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The Demand for Money and the Term Structure of Interest Rates in Pakistan

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Using the term structure of interest rates, and treating measured income as a scale variable, the paper analyses the demand for money in Pakistan. It is found that replacement of simple average interest rate by the term structure of time deposit rates improves the estimates of money demand function. Money demand is found to be sensitive to changes in interest rates and income level. Furthermore, diseconomies of scale are observed in money holdings.

INTRODUCTION

Money plays an important role in determining the behaviour of the main macro-economic variables of the economy, e.g. the level of economic activity, the average rate of interest, price level, employment, etc. In developing countries, this role is expected to assume greater importance with increasing monetisation of their economies. However, this role is not invariant with respect to different institutional structures.

The demand for money has been a topic of interest in both the theoretical and empirical literatures. At the theoretical level, economists have been concerned with resolving various issues, such as determining the appropriate arguments of the money demand function, while at the empirical level, the analysis of money demand helps the policy makers to forecast money demand and determine the optimum growth rate of money supply which is crucial in the control of the rate of inflation. It is widely recognized by economists that money demand should be analysed with reference to a scale variable and an opportunity cost variable. Whether the scale variable

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is defined as the level of economic activity or permanent income remains a controversial issue.[1]

As in the cases of many other developing countries, the empirical evidence for the choice of interest rates is not unequivocal in the case of Pakistan also. In particular, some economists[2] argue that inflation rate reflects the true opportunity cost of holding money balances in less developed countries because interest rates are institutionally pegged in these economies. The PIDE Econometric Model [13][3] also supports this view. However, the studies carried out by Rao and Chaudhry [17], Akhtar [2], Abe *et al.* [1], Mangla [12] and Khan [8] conclude that interest rate variable does play an important role in the analysis of money demand in Pakistan.

Many of the studies just mentioned find the rate of return on government bonds, r_g, and the inter-bank call money rate, r_c, to be the relevant statistically significant variables. While Mangla emphasises the role of r_c in money holdings in Pakistan, Khan finds it statistically insignificant in explaining changes in money holdings. In the latter analysis, the rate of return on time deposits appears to be the most significant rate of interest in influencing the holding of money balances. However, the procedure, used by these authors, of including both r_c and r_t in the money demand function is open to question because the two interest rates are highly correlated, the correlation coefficient between these two variables being 0.994. Hence, the evidence used by these authors needs to be re-examined. To begin with, we must determine which of the two interest rates, taken one at a time in the conventional specification of money demand, is statistically significant.

Conventionally, the average of interest rates is used in estimating the money demand function. This procedure ignores that money holdings respond differently to different rates of interest and that the average interest rate conceals more than it reveals the 'true' variations among the 'components' of the average rate. Thus, instead of using an average of highly correlated interest rates, the present study uses the term structure of interest rates for analysing the demand for money. The term structure is defined as the continuum of the various interest rates in the money market. As such, rates of return on time deposits are ranked along the continuum according to the time to maturity.

The plan of the present study is as follows. The first section explains the specification of the model. The second section discusses the methodology and the data

[1]The level of economic activity is considered appropriate in transaction-based theories, while permanent income is treated with greater 'respect' in the portfolio analysis of money demand.

[2]See Wong [19], Cagans [4] and Khan [9].

[3]In the PIDE Macro-econometric Model [14], a money supply function has been estimated instead, where interest rate is not found as a relevant variable. It is interesting to note that interest rate variable does not appear anywhere in the 58-equation PIDE Macro-econometric Model.

used for estimating the specified relations. The results of the estimation are reported in the third section. The stability of the term structure and conventional money demand is tested in the fourth section, while the fifth section presents the policy implications and conclusions of the analysis.

I. MONEY DEMAND MODEL INCORPORATING THE TERM STRUCTURE OF INTEREST RATES

The conventional function for money demand is specified as:

$$M_t = A_t \; Y_t^{\alpha} \; R_t^{\beta} \quad . . \quad . . \quad . . \quad (1)$$

where

M = the demand for money;

Y = the scale variable denoted by either measured income or permanent income;

R = the variable for measuring the opportunity cost of holding money balances; and

t = time.

For ease of estimation, equation (1) may be transformed into log-linear form.

$$ln\, M_t = A_t + \alpha ln\, Y_t + \beta\, ln\, R_t \quad . . \quad . . \quad (2)$$

It is assumed that $\alpha > 0$ and $\beta < 0$. If interest rates are classified on the basis of their maturity period, then equation (2) can be rewritten as:

$$ln\, M_t = A_t + \alpha ln\, Y_t + \beta \sum_{i=1}^{\eta} ln\, R_{it} \quad . . \quad . . \quad (3)$$

where R_{it} is the opportunity cost of holding money balances at time t and interest rates *(i)* are allowed to range from maturity period 1 to η.

In view of the collinearity among interest rates of different maturities, the term structure of interest rates in the demand for money function, following Heller and

Khan [6],[4] is replaced by two parameters which are obtained by regressing commercial bank deposit rates, (R_i)s, for every year against different maturities.[5]

$$R_{it} = a_t T_i^{\gamma_t} \quad \ldots \quad (4)$$

Taking log of both sides

$$\ln R_{it} = a_t + \gamma_t \ln T_i \quad \ldots \quad (4')$$

where a_t is a constant which is the intercept of the term structure of time deposit rates for the year t; and γ_t is the slope of the yield curve and measures the marginal proportionate change in the interest rates due to the change in maturity period for the year t, denoted by T_i, where i ranges from three to six months, one to two years, two to three years, three to four years, and from four to more than four years.

Equation (4) is used to get the following relation.

$$\ln M_t = A_t + \alpha \ln Y_t + \beta_1 (\hat{a}_t) + \beta_2 (\hat{\gamma}_t) \quad \ldots \quad (5)$$

It is argued that in less developed countries, expected inflation rate should be used as a proxy for the opportunity cost of holding money balances. In order to test its effect on money demand a term for inflation rate is added to equation 5. Thus

$$\ln M_t = A_t + \alpha \ln Y_t + \beta_1 (\hat{a}_t) + \beta_2 (\hat{\gamma}_t) + \beta_3 \ln \dot{P} \quad \ldots \quad (6)$$

Yet another specification which includes inter-bank call money rate, γ_c, but not $\dot{P}$, along with the term structure of interest rates is also estimated.

$$\ln M_t = A_t + \alpha \ln Y_t + \beta_1 (\hat{a}_t) + \beta_2 (\hat{\gamma}_t) + \beta_4 \ln r_c \quad \ldots \quad (7)$$

A priori, on theoretical grounds it is expected that the income elasticity is positive and the coefficients β_1, β_2 and β_4 are negative because they are considered the opportunity cost of holding money balances. β_1 measures the effect of change in the intercept of the term structure of money demand while β_2 measures the response of money demand to intertemporal change in the term structure.

[4]The paper by Heller and Khan [6] is based on M Friedman's article [5].

[5]In order to account for the different shapes of the yield curve, the following function was also estimated.

$$R_{it} = a \exp(\gamma T_i + \delta_i T_i^2) \quad (4'')$$

Transforming into log form,

$$\ln R_{it} = a_t + \gamma T_i + \delta T_i^2 \quad (4''')$$

with a_t and $r_t > 0$ and $\delta_t < 0$ for most of the years. However, δ_t turned out to be insignificant in eight out of twenty observations. Moreover, the inclusion of T^2 in equation 4 rendered T_i insignificant in some cases.

II. METHODOLOGY AND DATA

The analysis of money demand is based on time-series data for the period from 1959-60 to 1978-79.

The annual data on money stock, constructed for the present Pakistan, have been taken from [7] and those on GNP from the *Pakistan Economic Survey 1980*. GNP is taken as a proxy for the measured income, which acts as scale variable. The data on the rates of return on commercial bank deposits are taken from the various issues of the *Bulletin* of the State Bank of Pakistan. The rate of return on time deposits, r_t, has been calculated by taking the average of commercial banks deposit rates for various maturities. The deposits are categorised into five groups of maturities, ranging from 3 months to 6 months, one to two years, two to three years, three to four years, and from four years to more than four years. The data on inter-bank call money rate, r_c, have been obtained from the Research Department of the State Bank of Pakistan. The series on inflation rate has been calculated from the implicit GNP deflator. The actual rate of inflation is taken as a proxy for the expected inflation rate, on the assumption of static expectations.

The term-structure analysis is conducted in two steps. First, the yield curve is derived and then the parameters so obtained are substituted in the equation on money demand. Aggregate money-demand is estimated by using both the definitions of money, M_1 and M_2, to conform to the general practice of estimations of money demand.[6] Money stock has been treated as a proxy for the demand for money. One-way causation from interest rates to money demand is assumed and single equations are estimated by applying the method of OLS. It is also postulated that the actual level of money holdings adjusts itself to the desired level within a period of one year. Money demand functions are estimated in real terms, because people are interested in the services that money provides and not in the absolute sum of money. Therefore, the nominal quantities of measured income and money stock are deflated by the implicit GNP deflator for estimating money demand in real terms.

III. EMPIRICAL ESTIMATES

a. Estimation of Conventional Money Demand

On theoretical grounds, it is the rate of return on time deposits which should form the true opportunity cost of holding money balances, because it is the return

[6]The issue of the appropriateness of the definition of money is not as yet resolved. See Laidler [10].

on money balances held by the public, whereas inter-bank call money rate is the rate which commercial banks have to pay to each other to obtain additional finances. As such, inter-bank call money rate does not really represent market rate of interest. However, in view of the very high correlation between these two rates (the correlation coefficient is 0.994), r_c can be used as a proxy for r_t in the absence of reliable data for the latter. Thus r_c is also expected to influence money demand significantly. In the conventional estimation of money demand, r_t and r_c are entered separately in the money demand functions. Table 1 presents the results of the present study and those of Mangla [12] and Khan [8] in which r_c is used as the opportunity cost variable. The estimated coefficients, with both M_1 and M_2 definitions of money, turn out to be significant with expected signs.

The results reported in this study differ from those reported by Khan [8] in the sense that r_c is found to be a significant explanatory variable. The difference is mainly due to the fact that data on call money rate relating to the period from 1959-60 to 1965-66 were not available in the published form, and Khan assumed the rates prevailing at Karachi to be representative for Pakistan.

b. Money Demand Functions incorporating the Term Structure of Interest Rates

The two parameters of the term structure of time deposit rates, $\hat{\alpha}$ and $\hat{\gamma}$, are estimated by employing relation (4) in which the time deposit rates for every year are regressed against the maturity period. In this way, the yield curve is derived in which $\hat{\alpha}$ captures the effect of the intercept of the term structure and $\hat{\gamma}$ refers to the slope of the yield curve that implies the return on deposits of different maturity periods. The estimated values of $\hat{\alpha}$ and $\hat{\gamma}$ for all the years are reported in Appendix Table I. The positive signs of the two estimated coefficients are in conformity with the *a priori* hypothesis made, which is that as the maturity period extends, the yield on commercial bank deposits increases. In eighteen out of twenty observations, $\hat{\gamma}$ is significantly different from zero at the 5-percent level of significance.

In the term-structure analysis, the estimated values, $\hat{\alpha}$ and $\hat{\gamma}$, form the arguments in the money demand function. As mentioned earlier, they are good proxies for the interest rates, R_{it}, and incorporate the effects of short- and long-term yields on time deposits in one equation, without engendering multicollinearity which exists among interest rates of different maturities.

Equations (5), (6) and (7) of the model are estimated by employing the M_1 and M_2 definitions of money. The estimated values with M_1 and M_2 definitions are presented in Table 2.

Table 2 shows that the income elasticity of M_1 balances is greater than unity and statistically significant in all the estimated equations. The two parameters of the term structure of interest rates, $\hat{\alpha}$ and $\hat{\gamma}$, have the anticipated signs and are significant

Table 1

Determinants of Demand for Money

Study	Period	Equations	R^2	*SE*	*D.W.*	*F*-statistic
		(a) Corresponding to Real M_1 Balances				
Mangla	1958–71	$\log M_1 = -4.66 - 1.53 \log y - 0.18 \log r_c$ (−4.10) (7.34) (−2.06)	0.94		1.34	44.8
Khan	1959–78	$\log M_1 = -6.48 - 1.06 \log y - 0.03 \log r_c$ (12.1) (19.4) (−1.34)	0.96		1.39	263.35
Present Study	1959–79	$\log M_2 = -5.95 + 1.51 \log y - 0.34 \log r_c$ (3.58) (8.21) (−2.42)	0.945	0.095	1.53	143.68
		(b) Corresponding to Real M_2 Balances				
Khan	1959–78	$\log M_2 = -8.43 + 1.28 \log y - 0.03 \log r_c$ (−12.87) (19.28) (−1.14)	0.97		1.37	234.04
Present Study	1959–79	$\log M_2 = -7.08 + 1.64 \log y - 0.31 \log r_c$ (−4.88) (10.28) (−2.52)	0.97	0.083	1.11	253.22

(*t*-statistics are reported in the parenthesis.)

Table 2

Estimations of Real M_1 and M_2 with Term Structure of Interest Rates: 1959-60 to 1978-79

Equation No.	Money Definition	Co-efficients: Constant	Measured income	Reflection of the average interest rate	The effect of interest rate changes due to maturity - time difference	Inflation rate	Inter-Bank call money rate	R^2	*S.E.*	*D.W.* statistic	*F*-statistic
		C	Y	$\hat{a}$	$\hat{\gamma}$	$\dot{P}$	r_c				
(5)	M_1	−9.17	1.896	−.75	−3.53			.9471	0.095	1.44	95.43
		(−2.86)	(5.31)	(−2.52)	(−2.19)						
(5′)	M_2	−11.59	2.15	−.73	−2.05			.9715	0.079	1.645	181.65
		(−4.32)	(7.19)	(−2.92)	(−1.52)						
(6)	M_1	−9.23	1.90	−.76	−3.57	−.002		.9471	0.098	1.43	67.14
		(−2.88)	(5.24)	(−2.41)	(−2.06)	(−.085)					
(6′)	M_2	−11.63	2.14	−.72	−2.01	.0017		.9720	0.082	1.56	127.81
		(−4.06)	(6.75)	(−2.76)	(−1.39)	(.10)					
(7)	M_1	−9.13	1.88	−.52	−2.46		−.19	.9513	0.094	1.56	73.20
		(−2.88)	(5.33)	(−1.45)	(−1.32)		(−1.14)				
(7′)	M_2	−11.66	2.14	−.51	−1.02		−.19	0.9745	0.078	1.522	143.171
		(−4.41)	(7.32)	(−1.71)	(−1.71)		(−1.33)				

(*t*-statistics are reported in the parenthesis.)

at the 5-percent level of significance. The overall fit is good. The D.W. statistic is in the inconclusive range.[7]

Comparing the results of M_1 and M_2 it is seen that the income elasticity of M_2 balances is greater than that of M_1 balances. The coefficients of $\hat{\alpha}$ and $\hat{\gamma}$ turn out to be negative with the M_2 definition of money as well. However, the interpretation of the response of money demand to the term structure of time deposit rates differs with the two definitions of money. When the M_1 definition of money is employed, it represents the return on an alternative asset. As such, its effect on the holdings of M_1 balances (composed of currency in circulation plus demand deposits) is expected to be negative. In the second case with the M_2 definition (when money balances are defined to include currency plus demand deposits plus time deposits), the rates of return on time deposits represent 'own' rates of return to a component of M_2, i.e. time deposits. As such, $\tilde{\alpha}$ and $\tilde{\gamma}$ exert a positive effect on time deposits as compared to a negative effect on currency plus demand deposits. In view of the relatively close substitution between time and demand deposits, it is expected that an increase in one will come about partly at the expense of the other. However, the positive impact of an increase in $\tilde{\alpha}$ and $\tilde{\gamma}$ on time deposits could be more than offset by the negative effect of $\hat{\alpha}$ and $\hat{\gamma}$ on holdings of demand deposits plus currency. This phenomenon is observed when the coefficients of $\hat{\alpha}$ and $\hat{\gamma}$ remain negative. However, the coefficient of $\hat{\gamma}$ no longer remains significant at the 5-percent level of significance. The overall specification of the term-structure equations is improved by using the M_2 definition of money demand. The D.W. Statistic is improved, yet it remains in the indeterminate range. Inflation rate is not only insignificant but also has a positive effect on money demand which is contrary to theoretical argument. Inter-bank call money rate has the correct sign but it is statistically insignificant.

The income elasticity of money demand turns out to be greater than unity[8] in this analysis, implying diseconomies of scale in money holdings; but such a conclusion would be unwarranted without capturing the effect of monetisation on money holdings. Khan [8] has used the number of bank branches in the economy as a proxy for the monetisation variable in the money demand function. However, the number of bank branches inadequately captures the effect of monetisation in the economy. An attempt[9] has been made in this study to account for monetisation in

[7] The indeterminacy of the D.W. Statistic does not necessarily bias the OLS estimates. See Pindyck and Rubinfeld [15].

[8] Baumol [3] and Tobin [18] introduced this concept in the demand-for-money function in their Inventory Theoretic Approach. They showed that transaction demand for money is sensitive to interest rates and income elasticity is less than unity.

[9] By assuming that 30 percent of the GNP generated in agriculture is marketed for the year 1959-60, the annual growth rates over the sample years were calculated. This series was used as a proxy for monetisation along with permanent income as the scale variable. However, owing to non-improvement in the results, this analysis is not reported in this study.

the absence of data on the share of the GNP marketed, but that has not helped either in inferring anything about economies of scale. However, it may be mentioned that there is some degree of monetisation in the economy, and in this transitional stage people may be adjusting their habits accordingly. The non-inclusion of the proper variable that could have captured the extent of monetisation in the economy may have introduced a specification bias that may explain the finding regarding the diseconomies of scale observed in the money demand function.

The comparison between conventional specification of demand for money and term-structure specification of demand for money reveals that the standard error of the money demand function incorporating term structure of interest rates is smaller than that of conventional money demand function. For M_1 balances, standard error of the regression falls from 0.095 to 0.094 and for M_2 balances from 0.083 to 0.078. These results provide support to the claim that term-structure specification of demand for money is better than the conventional specification of money demand.

IV. STABILITY OF THE MONEY DEMAND FUNCTION

The covariance analysis technique is used to investigate the stability of coefficient estimates of money demand function over time. In order to determine if events which occurred during the Seventies have changed the structure of the relationship of the money demand with independent variables specified in the above analysis, differential slope and intercept dummies are introduced into the money demand function with both term-structure and conventional specifications. The detailed results of the analysis of structural shift are reported in Appendix Tables II, III and IV.

The value of F-statistic, which shows the significance of incremental explained variance due to introduction of dummies for intercept and slope is less than the critical value of F-statistic for all the equations of the term-structure specification of demand for money (Table 3). For conventional specification of demand for money with the M_1 definition also the incremental explained variance turns out to be insignificant, whereas for the M_2 definition of money, the value of F-statistic denoting the significance of incremental explained variance exceeds the critical value of F-statistic at the five-percent level of significance.

These results show that the term-structure specification of demand-for-money equations remains stable over the whole sample period, while the conventional money demand equation for the M_2 balances does not pass the stability test.

Table 3

Summary Statistics of Covariance Analysis

Equation	Money Definition	R^2	$R^{2'}$	F_c
	M_1 and M_2 with Term Structure Specification			
(5)	M_1	0.947	0.950	0.82
(5′)	M_2	0.971	0.980	2.62
(6)	M_1	0.947	0.951	0.60
(6′)	M_2	0.972	0.980	2.00
(7)	M_1	0.951	0.969	0.56
(7′)	M_2	0.974	0.980	1.81
	M_1 and M_2 with Conventional Specification			
(2)	M_1	0.945	0.950	0.66
(2′)	M_2	0.970	0.988	3.68*

R^2 corresponds to original equations and is based on Tables 1 and 2.
$R^{2'}$ corresponds to equations employing covariance analysis technique and is based on Appendix Tables II, III and IV.
F_c is calculated F-statistic which shows the significance of incremental explained variance and is based on Appendix Tables, II, III and IV.
* = Statistically significant at the five-percent level.

V. POLICY IMPLICATIONS

The analysis of the demand for money should help monetary authorities to determine the desired amount of monetary expansion to match money demand. The income and interest rate elasticities determine the total money demand in the economy.

Diseconomies of scale are observed in money holdings as the elasticity of money demand with both narrow and broad definitions of money with respect to (real) GNP is greater than unity. Our study also finds that when the average rate of interest on time deposits increases by one percent, the demand for demand deposits plus currency in circulation decreases by 0.75 percent while the demand for demand deposits plus currency in circulation plus time deposits decreases by 0.73 percent. The increase in the long-term interest rate by one percent leads to the reduction in money demand with the M_1 definition of money by 3.53 percent and with the M_2 definition of money by 2.05 percent. The sensitivity of money demand

to interest rates implies that the objectives of monetary policy like controlling money supply can be achieved to some extent by manipulating the structure of these rates. At present the State Bank influences the rates on time deposits by fixing the inter-bank call money rate. However, it may be noted that the monetary policy in our economy is limited to the extent of being able to manipulate the rates of return on time deposits only. Owing to the less developed and narrow security markets [16], the rate of return on government bonds has only a narrow role to play in the framework of monetary analysis.

The desired growth rates of money demand, which are useful in determining the safe limits of money supply expansion, are calculated by assuming the inter-bank call money rate and, hence, the time deposit rates to be constant for the 1976–1981 period. However, these growth rates may be overstated because it is implicitly assumed that increasing monetisation of the economy will continue corresponding to the positive rate of change in the money supply.

The desired growth rates of money demand calculated for the 1976–81 period are 13.08 percent and 14.84 percent with the M_1 and M_2 definitions of money, respectively (Table 4). As already mentioned, these growth rates are biased upwards because of our inability to capture the effect of monetisation in the economy on money demand.

Table 4

Desired Growth Rates (M_d) *of Money Demand (1976–81 and 1980-81) with* M_1 *and* M_2 *Definitions of Money*

(Percentages)

Money Definition	1976–81	1980-81
M_1	13.08	10.43
M_2	14.84	11.83

VI. CONCLUSIONS

The objective of the paper has been to study the demand for money, employing term structure of interest rates as opportunity cost variable instead of an average of highly correlated interest rates. In view of the multicollinearity among the term structure of interest rates, it has been replaced by two parameters which represent the intercept and slope of the yield curve respectively and have been obtained by regressing commercial bank deposit rates for every year against different maturity

periods. Money demand is found to be highly sensitive to both the intercept and slope of the yield curve, reaffirming the results of earlier studies about the significant role of interest rate in determining the size of money holdings in Pakistan.

Measured income has been used as a scale variable and diseconomies of scale are observed in money holdings. However, this finding should be viewed with reservation because of our inability to capture the effect of monetisation on money holdings.

Appendix Table I

Estimated Values of Average Yield and the Yield with Different Maturity Periods on Time Deposits: 1959-60 to 1978-79

Financial Year	$\hat{a}$	$\hat{\gamma}$
1959-60	.82 (25.4)	.08 (5.76)
1960-61	.92 (87.29)	.08 (19.21)
1961-62	.91 (37.54)	.12 (11.84)
1962-63	.91 (29.68)	.12 (9.33)
1963-64	.92 (25.49)	.11 (7.65)
1964-65	1.02 (63.35)	.11 (16.86)
1965-66	1.13 (70.22)	.11 (16.83)
1966-67	1.20 (74.94)	.13 (15.82)
1967-68	1.34 (128.45)	.08 (19.06)
1968-69	1.44 (43.80)	.09 (6.32)
1969-70	1.46 (26.52)	.09 (4.17)
1970-71	1.49 (17.56)	.08 (2.36)

Continued –

Appendix Table I – *(Continued)*

Financial Year	$\hat{a}$	$\hat{\gamma}$
1971-72	1.56 (19.75)	.07 (2.24)
1972-73	1.59 (30.02)	.06 (2.74)
1973-74	1.86 (25.73)	.06 (2.03)
1974-75	2.01 (30.85)	.02 (2.23)
1975-76	2.08 (37.71)	.05 (2.35)
1976-77	2.15 (44.63)	.04 (2.07)
1977-78	2.20 (58.02)	.03 (1.64)*
1978-79	2.22 (73.9)	.02 (1.60)*

* indicates that the coefficient is insignificant at the 5-percent level.

Appendix Table II

Estimation of Real M_1 *Balances with Term Structure of Interest by Analysis of Covariance*

Eq. No.	Dependent Variable	*C*	*Log y*	$\hat{a}$	$\hat{\gamma}$	*Log P*	$\log r_c$	*D*	*D log y*	*Da*	$D_{\hat{\gamma}}$	*D log P*	*D log* r_c	R^2	*SE*	*D.W.*	F_c
(i)	$\log M_1$	−6.55	1.59	−.43	−3.07			23.45	−2.14	−0.96	12.58			.95	0.101	1.557	0.809
		(−1.16)	(2.48)*	(−.69)	(−1.39)			(.95)	(−.90)	(−.099)	(.09)						
(ii)	$\log M_1$	−6.63	1.60	−.43	−3.10	−.0004		26.73	−2.50	.18	15.43	−.004		.95	0.110	1.56	0.607
		(−0.911)	(1.91)	(.55)	(−1.06)	(−.017)		(.43)	(−.42)	(.11)	(.34)	(−.07)					
(iii)	$\log M_1$	−6.84	1.62	−.23	−2.34		.19	24.47	−2.27	−.16	−14.36		−.24				
		(−1.14)	(2.38)*	(−.34)	(−.34)		(.85)	(.85)	(−.80)	(.12)	(−.80)		(−.35)	.969	0.106	1.66	0.563

Notes: t−values are given in parentheses.
F_c is calculated *F*-statistic which shows the significance of incremental explained variance.
* indicates that the coefficient is significant at the 5-percent level.

Appendix Table III

Estimation of M_2 *Balances with Term Structure of Interest Rates by Analysis of Covariance*

Eq. No.	Dependent Variable	*C*	*log y*	$\hat{a}$	$\hat{\gamma}$	*log P*	$\log r_c$	*D*	*D log y*	*Da*	$D_{\hat{\gamma}}$	*D log P*	*D log* r_c	R^2	*S.E.*	*D.W.*	F_c
(v)	$\log M_2$	−7.36	1.66	−.22	−1.09			28.06	−2.56	−.05	−17.06			.98	0.072	2.11	2.62
		(−1.83)	(3.64)*	(−.49)	(−.61)			(1.62)	(−1.51)	(−.07)	(−2.09)						
(vi)	$\log M_2$	−6.02	1.51	−.07	−.51	.009		25.23	−2.26	−.224	−16.46	−.027		.98	0.077	2.14	2.00
		(−1.78)	(2.57)*	(−.14)	(−.21)	(.50)		(1.62)	(0.54)	(−.20)	(−.51)	(.06)					
(vii)	$\log M_2$	−7.57	1.68	−.07	−.54		−.14	28.9	−2.65	−.23	−18.22		−.17	.98	0.075	1.88	1.81
		(−1.78)	(3.64)	(−.14)	(−.30)		(−.90)	(1.39)	(−1.32)	(−.25)	(−1.44)		(−.35)				

Notes: t-values are given in parentheses.
F_c is calculated *F*-statistic which shows the significance of incremental explained variance.
* indicates that the coefficient is significant at the 5-percent level.

Appendix Table IV

Estimation of M_1 and M_2 Balances with conventional Specification by Analysis of Covariance

Dependent Variable	Constant	log y	log y r_c	D	D log y	D log r_c	R^2	S.E.	D.W.	F_c
log M_1	–5.98	1.49	–0.24	0.65	–0.03	–0.21	0.95	0.099	1.55	0.658
		(5.93)	(–1.29)	(0.14)	(–0.05)	(–0.69)				
log M_2	–7.21	1.63	–0.15	1.37	–0.072	–0.34	0.98	0.071	1.75	3.68
		(9.04)	(–1.13)	(0.397)	(–0.20)	(–1.56)				
log M_2	–6.89	1.60	–0.13		0.068	–0.39	0.98	0.069	1.77	3.20
		(10.37)	(–1.09)		(2.08)	(–2.42)				

Notes: t-values are given in parentheses.
F_c is calculated F-statistic which shows the significance of incremental explained variance.

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