

A Structural Model of Pakistan's Monetary Sector

by

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INTRODUCTION

The purpose of this study is to present an econometric model which is a formal representation of the structural relationships of the monetary sector of Pakistan. Two previous studies by Porter [15] and Snyder [16] should be noted in this regard. The study by Porter consists of an excellent survey of the portfolio behaviour of the scheduled banks¹ in Pakistan, yet it could hardly be categorized as a quantitative work in the sense of establishing formal empirical relationships. On the other hand, the study by Snyder constitutes a quantitative work in the above sense reflecting the behavioural responses of the scheduled banks with respect to their various assets and liabilities. The main limitations of the latter work, as admitted by the author himself, emerge from its lack of consideration of the process by which the State Bank², the scheduled banks, and the private sector determine money supply in Pakistan. The present study is intended as a modest attempt at filling both these caveats.

A particular feature of the model to be presented here will be its focus on the concept of money supply, the argument being that the scheduled banks' propensity to vary the levels of their excess and borrowed reserves in response to the demand for commercial loans by the public and private sectors provide an important reason for treating money supply, or at least a part of it, as endogenous. This is a departure from the traditional view of money supply as exogenously determined by the monetary authorities through the standard reserve-multiplier approach with its fixed-expansion multipliers and currency-drainage ratios. Similar results have already been established in case of the United States by Teigen [17] and Goldfeld [4, Chapter 5].

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¹Legal title of the commercial banks in Pakistan.

²Legal title of the central bank in Pakistan.

Another purpose of the present study is to examine how variations in the scheduled banks' portfolio behaviour transmit the effects of monetary-policy changes throughout the economy. For example, it has already been established that the flow of loans from the scheduled banks to the private sector plays a key role in determining private-investment activities [8, Chapter IV]. For this purpose a small aggregative model of income generation will be added to the structural relationships concerning the monetary sector so that the complete model will then embody both monetary and real sectors.

It would be fair to regard the study only as a prototype exercise to be expanded and refined as more institutional information and qualitatively better and longer economic time-series become available. Lack of more detailed institutional information necessitates that the behavioural equations, as embodied in the present model, may be regarded only as first approximations to the 'true' relationships. This together with the limitations of the data suggests that the actual numerical estimates to be presented here should be viewed with some caution if any policy conclusions are to follow from them. In addition, it must be noted that the model was estimated only in its linear form. This obviously presents the problem of misspecifying the relationships which comprise the present model. A direct result of such misspecification could be the problem of auto-correlation. It is well known that parameters of relationships which involve auto-correlation do not possess the property of least variance, *i.e.*, they are not the most efficient [9, Chapter 7]. As it will be seen later in subsection II.3 of this article, the usual Durbin-Watson test has been performed on all the estimated relationships on the evidence of which the problem of auto-correlation may be judged to be minimal in the present model. Unfortunately, many of the estimated relationships contain lagged dependent variable as an explanatory variable given which the Durbin-Watson test is biased towards rejecting the hypothesis of auto-correlation [2, Pp. 527-528]. This further adds to the need for caution in using the sampling predictions of the present model as the basis for policy decisions.

II. THE MODEL

II.1 Definitions of Variables of the Model

The present model comprises a system of twenty-two equations including the identities. The total number of variables in this model is forty-eight so that twenty-six variables are pre-determined including current exogenous variables and lagged endogenous variables. The endogenous variables are:

R^R = required (*i.e.*, statutory) reserves held by the scheduled banks

R^E = excess reserves (*i.e.*, in excess of R^R) held by the scheduled banks

- R^L = required liquid assets held by the scheduled banks
- R^{LB} = excess liquid assets (*i.e.*, in excess of R^L) held by the scheduled banks
- R^B = reserves borrowed by the scheduled banks from the State Bank
- D = total deposit liabilities of the scheduled banks
- D^D = total nonbank demand liabilities of the scheduled banks
- D^T = total nonbank time liabilities of the scheduled banks
- CL^P = private sector commercial loan portfolio of the scheduled banks
- S = total securities held by the scheduled banks
- ΔH = annual changes in the stock of 'high-powered money' (*i.e.*, cash-base)
- L = currency holdings of the private sector
- M' = stock of money defined as the sum of currency in circulation and total nonbank demand liabilities of the scheduled banks
- Y = gross national income at current factor cost
- Y^D = disposable income
- C = gross private consumption expenditure
- I^f = gross private fixed investment expenditure
- I^{df} = gross domestic private fixed investment expenditure
- G = government expenditure
- ΔI^v = gross private inventory investments
- Z = gross expenditure on imports
- r^L = weighted average commercial loan rate

The pre-determined variables are as follows:

- r^d = re-discount rate of the State Bank
- r^G = weighted average interest rate on government securities
- r^T = weighted average rate of interest paid by the scheduled banks on their various deposit liabilities

- X = export receipts
 T' = indirect taxes
 T'' = direct taxes
 NT = nontax receipts (*i.e.*, unless otherwise specified) of the government
 G^F = foreign-aid funds received by the government
 G^R = foreign-loan repayments on the government account
 DF'' = funds received from the State Bank against securities issued as well as withdrawals of US PL-480 counterpart funds net of change in government deposits held at the State Bank
 $\Delta S^{G'}$ = private sector's purchase of government securities
 ΔCL^G = funds obtained as loans by the government from the scheduled banks
 ΔA = annual changes in residual assets *minus* residual liabilities of the State Bank
 I'_{t-1} = stock of inventories lagged one period
 Dum = dummy variable indicating the shift (*i.e.*, for all periods after June 1960) in the borrowing behaviour of the scheduled banks from the State Bank
 $D^{D'}$ = Total interbank demand liabilities of the scheduled banks
 $D^{T'}$ = total interbank time liabilities of the scheduled banks
 I^F = Net foreign private-capital inflow.

In addition to the above, the set of pre-determined variables includes one-period lagged values of the following endogenous variables: R^B , S , r^L , CL^P , I^F , M' , $D^{D'}$ and $D^{T'}$. The sources and derivations of all the above sets of endogenous and pre-determined variables are given in the Appendix on Sources of Data.

II.2 The Identities

Required Reserves Identity

$$R^R = .05 (D_t^{D'} + D_t^{D''} + D_t^{T'} + D_t^{T''}) \dots \dots \dots (II.2.1)$$

Required Liquid Assets Identity

$$R^L = .20 (D_t^D + D_t^{D'} + D_t^T + D_t^{T'}) \dots\dots\dots (II.2.2)$$

Excess Liquid Assets Identity

$$R^{LB} = S + R^R + R^E - R^L \dots\dots\dots (II.2.3)$$

Scheduled Banks' Total Deposit Liabilities Identity

$$D = (D^D + D^T) + (D^{D'} + D^{T'}) \dots\dots\dots (II.2.4)$$

Changes in High-Powered Money Identity

$$\Delta H = (X - Z) + \Delta R^B + G^F + I^F + D^{F''} - G^R + \Delta A \dots\dots (II.2.5)$$

Demand for Currency Identity

$$L = M' - D^D \dots\dots\dots (II.2.6)$$

Government Budget Balance Identity

$$G = T' + T'' + NT + DF'' + \Delta S^{G'} + \Delta CL^G + G^F \dots\dots (II.2.7)$$

Gross National Income at Current Factor Cost Identity

$$Y = C + I^f + \Delta I^v + X - Z - T' \dots\dots\dots (II.2.8)$$

Disposable Income Identity

$$Y^D = Y - T'' \dots\dots\dots (II.2.9)$$

$$I^{df} = I^f - I^F \dots\dots\dots (II.2.10)$$

II.3 The Behavioural Relationships

Excess Reserves

$$\begin{aligned} R_t^B = & 15.0791 + 3.9140 r_t^T - .1287 \Delta (CL_t^F + CL_t^G) \\ & (1.7994) \quad (.0551) \\ & + .2315 \Delta H_t \dots\dots\dots (II.3.1) \\ & (.0916) \end{aligned}$$

$$\bar{R}^2 = .63; D-W \text{ statistic} = 1.91$$

Scheduled Banks' Borrowings from the State Bank

$$\begin{aligned} R_t^B = & -22.4587 + .5243 R_{t-1}^B + .2643 S_t \\ & (.2421) \quad (.1199) \\ & + 7.7902 (r_t^L - r_t^d) + \text{Dum } 33.6700 \dots\dots\dots (II.3.2) \\ & (3.2677) \quad (15.9194) \end{aligned}$$

$$\bar{R}^2 = .70; D-W \text{ statistic} = 1.88$$

Scheduled Banks' Holdings of Securities

$$\begin{aligned} S_t = & -13.2012 + .6943 S_{t-1} + .0921 D_t + 4.2157 r_t^G \\ & (.2010) \quad (.0425) \quad (1.9947) \\ & + .3239 \Delta S^{G'} \dots\dots\dots (II.3.3) \\ & (.1598) \end{aligned}$$

$$\bar{R}^2 = .90; D-W \text{ statistic} = 1.95$$

Scheduled Banks' Weighted Average Commercial-Loan Rate

$$r_t^L = 1.9821 + .2044 r_{t-1}^L - .0249 R_t^B + .9767 r_t^G \dots\dots (II.3.4)$$

(.0941) (.0087) (.4553)

$$\bar{R}^2 = .79; \text{D-W statistic} = 1.94$$

Private Demand for Currency and Demand Deposits

$$M_t' = -22.6014 + .6871 M_{t-1}' + .0921 Y_t - 14.3205 r_t^T \dots\dots (II.3.5)$$

(.3312) (.0416) (6.7179)

$$\bar{R}^2 = .79; \text{D-W statistic} = 1.92$$

Private Demand for Demand Deposits

$$D_t^D = -51.7019 + .6261 D_{t-1}^D + .0667 Y_t - 22.0226 r_t^T \dots\dots (II.3.6)$$

(.3100) (.0259) (10.1516)

$$\bar{R}^2 = .67; \text{D-W statistic} = 1.88$$

Private Demand for Time Deposits

$$D_t^T = -59.4017 + .8219 D_{t-1}^T + .0214 Y_t + 20.2097 r_t^T \dots\dots (II.3.7)$$

(.4051) (.0096) (9.7469)

$$\bar{R}^2 = .60; \text{D-W statistic} = 1.80$$

Private Sector's Demand for Commercial Loans from Scheduled Banks

$$CL_t^P = -194.2104 + .9423 CL_{t-1}^P + .0611 (Y_t - G_t) - 24.0116 r_t^L \dots\dots (II.3.8)$$

(.4021) (.0239) (11.5439)

$$\bar{R}^2 = .79; \text{D-W statistic} = 1.80$$

Gross Private Consumption Expenditure

$$C_t = 529.3109 + .6566 Y_t^D \dots\dots\dots (II.3.9)$$

(.1502)

$$\bar{R}^2 = .88; \text{D-W statistic} = 1.64$$

Gross Private Fixed Investment Expenditure

$$I_t^f = -287.1151 + .3437I_{t-1}^f + .0974Y_t + .1511CL_t^P \dots \dots (II.3.10)$$

(1351) (.0401) (.0624)

$$\bar{R}^2 = .79; \text{D-W statistic} = 2.01$$

Private Inventory Investment Expenditures

$$\Delta I_t^v = -167.4534 - .3794I_{t-1}^v + .0615Y_t + .5317CL_t^P \dots \dots (II.3.11)$$

(1802) (.0211) (.2614)

$$\bar{R}^2 = .76; \text{D-W statistic} = 1.73$$

Expenditure on Imports

$$Z = 51.1756 + .6721(X + G^F + I^G) + .0148Y + .2129CL_t^P (II.3.12)$$

(2961) (.0067) (.0957)

$$\bar{R}^2 = .80; \text{D-W statistic} = 1.83$$

II.4 Discussion of the Model

The various identities and behavioural relationships that comprise the model, stated in the preceding section, will now be individually discussed. Let us proceed with the identities first.

II.4.1: Identities (II.2.1) to (II.2.3) govern the assets side of the scheduled banks' portfolio. Identity (II.2.1) shows the amount of statutory reserves that the scheduled banks must always hold in cash reserves at vault or at the State Bank. Identity (II.2.2) similarly shows the amount of liquid assets that the scheduled banks must hold. Identity (II.2.3) similarly shows the excess holdings of such liquid assets.

Identity (II.2.4), on the other hand, is only a balancing equation on the liabilities side of the scheduled banks' portfolio indicating that the sum of their demand and time deposits equals their total deposit liabilities.

Identity (II.2.5) is one of the central identities of the present model. It depicts the 'openness' of the economy and how such a factor affects the stock of 'high-powered money' within the economy and thus through it the credit-creating activities of the scheduled banks. First, any change in the current account of the balance of payments (e.g., $(X-Z)$) would affect the stock of 'high-powered money' (e.g., H). Similarly, net foreign-capital inflow on private (e.g., I^P) and government (e.g., $(G^F - G^R)$) accounts affects H . In addition, the identity also

shows the option open to the State Bank to affect the variable H by affecting the level of reserves borrowed by the scheduled banks (e.g., R^B). Again, this identity also shows how deficit financing activities of the government (e.g., DF'') affect the variable H .

Identity (II.2.6), on the other hand, is a fairly straightforward equation showing that the currency holding of the private sector (L) is equal to the demand for money (M') by the private sector net of the private sector's demand deposits. The variables which affect such demand for money as the aggregate of currency and demand deposit holdings of the private sector, and in the disaggregated form, only the demand deposits of the private sector would also, by inference, affect the private sector's currency holdings, the latter being the dependent variable in the identity in question. Such determining variables are the gross national income at current factor cost, weighted average rate of interest on time deposits, etc.

Identity (II.2.7) relates to government financing indicating how the various government financing items add up to equal total government expenditure. Such financing items have been assumed as exogenously determined by government policy decisions.

Identity (II.2.8) relates to gross national income at current factor cost showing how the endogenous flows, viz., private consumption (C), private investment (I' and $\Delta I'$), and import expenditures, and such exogenous flows as export receipts and indirect taxes, combine to define gross national income at current factor cost (Y)³. Identity (II.2.9) again is a simple accounting relation showing gross disposable income at current factor cost as equal to gross national income at current factor cost minus direct taxes.

Finally, identity (II.2.10) shows that gross private domestic fixed investment is gross private fixed investment minus net foreign investment.

II.4.2: The Behavioural Relationships: We would now discuss the various behavioural relationships. Consider, first, the excess-reserves function indicating that scheduled banks' excess reserves are related to changes in their commercial loans portfolio (i.e., $\Delta(CL^P + CL^G)$), changes in the stock of 'high-powered-money' (ΔH) and changes in the weighted average rate of interest (r^T). The interest rate effect here is the allocative effect on the stock of 'high-powered money' in the economy indicating that *ceteris paribus* a rise in

³Ideally, indirect taxes should be net of subsidies to express Y as gross national income at current factor cost. The necessary data on subsidies are, however, not available for the whole of the period under study, 1949/50 to 1965/66. The period for which the data are available suggests that it is not very significant (see Appendix) and the figures on private consumption which are obtained from the above identity as a residual are, thus, only slightly overestimated.

such interest rate would reallocate 'high-powered money' among bank deposits and currency in-circulation. The response, however, is fairly low, the elasticity at the mean being only 0.20.

Equation (II.3.2) relates to the borrowing behaviour of the scheduled banks. There are several interesting features about it. First, it takes account of the lags involved in the decision processes of the scheduled banks. Secondly, it suggests that if the interest rate differential (*i.e.*, $(r^L - r^G)$) widens, scheduled bank borrowings would increase. The scheduled banks in Pakistan would regard this as imperative since one of the ways in which they compensate for the relative unprofitability of government securities which are at subequilibrium yields and which the scheduled banks hold as a result of pressure from the State Bank [15, Pp. 13-29] is to use such borrowed funds in the commercial loans market. Finally, the use of the dummy variable indicates an institutional change since June 1960. From that date the scheduled banks have come to regard borrowing from the State Bank as a major source of liquid funds due to the withdrawal of the latter from the government-security market as the guarantor of the liquidity of government securities at subequilibrium yields in an 'inactive' market [15].

Equation (II.3.3) explains the security holdings of the scheduled banks which are principally of government origin [15]. As suggested above, since government securities are at subequilibrium yields, the amounts of such securities issued to the scheduled banks are usually higher than the amounts demanded at such rates of interest. This excess is then subscribed by the scheduled banks on pressure from the State Bank. However, since rates of interest on government securities are not invariant and have marked a secular increase, there is, therefore, the possibility of a 'trade-off' between the pressure from the State Bank and the rate of interest on such securities. The variable which has been designed to capture this element of 'pressure' is ΔS^G , *i.e.*, total deficit financing of government expenditures by the private sector⁴. Apart from the interest rate (r^G) and the pressure variable (ΔS^G), as defined above, the other two explanatory variables are S_{t-1} and D . The first signifies the lags in the decision processes affecting scheduled banks' portfolio behaviour and the second indicates the hypothesis of a 'proportionality' between their holdings of securities and their total deposit liabilities [15, p. 27].

Equation (II.3.4) describes the variations in the scheduled banks' commercial-loan rates. The fact that their loan rate (*i.e.*, weighted average of loan rates on each type of collateral offered) r^L , will be related to their excess reserves (R^E), *i.e.*, loanable funds, is no surprise. However, its relations with the lagged loan-rate variable (r_{t-1}^L) and weighted average interest-rate on government securities (r^G) are not entirely obvious and need some additional comments. The loan activities of commercial banks are always constrained by some 'non-

⁴See Appendix.

price' considerations such as variations in the standards of credit-worthiness of borrowers and the vague notion of 'customer relationship'. To the extent such 'nonprice' considerations may be present, the link between the commercial banks' commercial loan rate and their commercial loan activities is weakened. However, commercial banks can always reduce some of these nonprice considerations into price considerations by quoting a set of interest rates and varying them according to the different type of collateral provided and repayment periods stipulated. Note in the present context that the variable r^L is a weighted average of the average loan rate on each type of collateral offered⁵. The 'nonprice' considerations may be further taken into consideration in the alleged link between commercial loan rate and the demand for commercial loans by arguing that because of such nonprice considerations, the scheduled banks would raise the price on their loanable funds only with a lag, thus showing a certain reluctance in raising interest rates. Such reluctance is to be explained in relation to the scheduled banks' probable fear of upsetting the 'customer relationship' because customers might take their commission elsewhere if interest rates are raised too quickly. Again, reductions of interest-rates may also occur with a lag in view of the well-known 'stickiness' of prices in the downward direction. More probably, however, this would occur because of the reluctance of the scheduled banks to lose their excess reserves too quickly if subsequent expansions in the demand for commercial loans are envisaged. Finally, government securities being the only remaining nonbank earning assets, the rate of interest on such securities constitutes the floor below which commercial loan rates will not fall. Hence, the link between the variables r^L and r^G .

Equations (II.3.5) to (II.3.7) explain the private-sector demand for money conventionally defined⁶, demand for demand deposits and demand for time deposits, respectively. All of them have lagged dependent variable, gross national product at current factor cost and the weighted average rate of interest on time deposits, as explanatory variables. One immediate question that could be asked is about the nature of the income variable, why current wealth or its surrogate, 'permanent income' has not been used as the constraint variable instead of current income. The decision in this regard was taken on the basis of Adekunle's work [1, Pp. 220-226] suggesting that in low-income regions current income is a very adequate approximation to 'permanent income'. Similarly, the equations lack any variable taking account of the effect of increasing monetization of the economy. The estimated Durbin-Watson coefficients, however, do not suggest any auto-correlation and thereby misspecification. One must, however, recognize that Durbin-Watson coefficients are biased towards the value of two, i.e., biased in favour of rejecting the null hypothesis of auto-correlation where the functional relationships contain lagged dependent variables as explanatory variables. The evidence, therefore, is a bit inconclusive.

⁵See Appendix for methodology and source.

⁶Currency in circulation plus nonbank demand deposits of commercial banks.

Equation (II.3.8) explains the borrowing behaviour of the private sector in terms of the levels of past flows, aggregate nongovernment expenditure and the weighted average commercial loan rate. While the first explanatory variable justifies the partial stock-adjustment hypothesis as constraining the portfolio behaviour of different investors, the relevance of the latter two explanatory variables is too obvious to necessitate any comment.

Finally, equations (II.3.9) to (II.3.12) are the real-sector equations of the present model. The major feature of this subset of equations is that the private-sector commercial loans portfolio (CL_t^P) of the scheduled banks appear in three of the above equations thereby establishing the link between the monetary and real sectors.

The structural form of the model, as presented in the preceding section, fulfilled two major objectives of the present study: demonstration of the endogenous characteristic of a part of money supply and the linkages between monetary and real sectors of the economy. Let us recount first the basis of the earlier statement.

Although no money-supply equation has been explicitly included in the model as presented here, this relationship is, however, easily demonstrated. To do this, let us define money supply as equal to currency in circulation plus the nonbank deposit liabilities of the scheduled banks, demand and time. The endogenous condition of money supply emanates from this deposit component of money supply the volume of which the scheduled banks can affect by varying the levels of their reserves through independent policy decisions. We have already seen from the 'high-powered money' identity, equation (II.2.5), that changes in the total amount of 'high-powered money' available within the economy are determined by, among other things, changes in reserves borrowed by the scheduled banks from the State Bank. Such funds are borrowed by the scheduled banks with regard to the profitability (e.g., variable r^L) of utilising them in the commercial loans market. Obviously, the effect of any change in the stock of 'high-powered money' on money supply can be offset by a compensating increase in the reserve-deposit ratio of the scheduled banks. However, since the present increment in the scheduled banks' reserves has been obtained at a 'cost' (i.e., the rediscount rate), it is unlikely that an offsetting change in the reserve-deposit ratio would occur. Therefore, *ceteris paribus*, money supply would increase if scheduled banks' reserves go up through their borrowings from the State Bank which can only affect the supply of such reserves by varying its 'cost' and quantitative controls but cannot affect the demand for them which is determined by the 'profitability' considerations of such borrowings.

Again, barring any compensating leakage of scheduled banks' reserves into currency in circulation, the scheduled banks can also lower their reserve-deposit ratio by lowering the ratio of their excess reserves to total deposits and

thus increase money supply. The effect of such an action would be an increase in their commercial loans portfolio and other noncash asset portfolios. If the whole of such decumulation of excess reserves does not leak into currency in circulation, an expansion of deposits is inevitable, and hence an increase in money supply.

The second objective of demonstrating the linkages between monetary and real sectors of the economy can now be discussed. We have seen from equations (II.3.4) and (II.3.8) that the scheduled banks use their commercial-loan rates to affect their private sector commercial loan portfolio and that the private sector demand for such loans is inversely related to the former. We have also seen from equations (II.3.10) to (II.3.12) that this commercial-loan funds variable is an important constraint variable affecting the expenditure variables; a relation from the monetary to the real sector is, thus, established.

The question now is the link from the real sector to the monetary sector. This can be expounded in several ways. As seen from the national-income identity, equation (II.2.8), one of the expenditure components of gross national income is government expenditure. However, from equation (II.2.7) we know that the level of government expenditure is also determined by the foreign-capital inflow on the government account. Such inflow of foreign capital also increases the stock of the 'high-powered money', equation (II.2.5), which, through equation (II.3.1), affects the portfolio behaviour of the scheduled banks. Again, apart from the interest rates on commercial loans, the private-sector demand for such loans is also affected by the volume of demand within the economy, as shown by equation (II.3.8). Therefore, any change in such demand conditions, as measured by the composite variable $(Y-G)$, would affect the volume of commercial loans which, through equation (II.3.1), would again cause the scheduled banks to adjust their portfolios.

The structural form of the model as presented in the preceding section fulfils a further objective not stated before. It consists of the linkages that have been established between the policy-controlled pre-determined variables and the endogenous variables of both the real and financial sectors. For example, in equation (II.3.2) the effect of changes in the rediscount rate (*i.e.*, r^d) on scheduled-bank borrowings from the State Bank is noted. It has already been stated that such effects would cause adjustments in the scheduled banks' portfolio behaviour and through that variables in the real sector (*e.g.*, I^r , ΔI^r , and Z) will be affected. Again, effects of changes in indirect taxes, a policy-controlled variable in the present context, would be felt on the income variable (*i.e.*, Y) which would further affect the private sector's demand for commercial loans. Since, as already noted, such changes in the demand for commercial loans causes adjustments in the scheduled banks' portfolio behaviour, a chain of causation from a policy-controlled variable such as indirect taxes to the real and monetary sectors is, thus, established.

II. 5 Some Technical Considerations

II.5.1: Simultaneous Equations Bias: The preceding estimates of the behavioural relations were obtained by the two-stage least-squares (TSLS) methods. Single-stage estimates in a simultaneous equations system are 'biased', *i.e.*, inconsistent; on the other hand, TSLS procedure yields consistent estimates of each behavioural relationship in such a system. However, the estimates, as obtained from the TSLS procedure, are one of a set of 'modified' TSLS estimates that could be obtained from the present model. Usually, all the pre-determined variables are used as instrument variables in the first-stage of the TSLS estimation method. However, in the present study the data sample consists of only sixteen observations in most cases as compared to twenty-six pre-determined variables so that a modified first-stage procedure was imperative. A set of pre-determined variables usually around ten to twelve to each behavioural equation was selected with the aid of the criteria suggested by Liu [10]. First, the pre-determined variables appearing as explanatory variables in any equation or the 'inside' [10] predetermined variables for that equation were included among the pre-determined variables for that equation. The other instrument variables were then chosen from the remaining pre-determined variables of the model on the criterion that they should be relatively less correlated with the 'inside' pre-determined variables than with the endogenous variables appearing as explanatory variables in the equation concerned.

II.5.2: Indentification: The necessary or the 'order' condition for the 'identification' of a linear structural equation is that the number of pre-determined variables excluded from the equation but within the model must be equal to the number of endogenous variables in the equation minus one [2, Pp. 314-331]. All the equations appearing in the model are 'overidentified' by this 'order' condition.

II.5.3: Test of Significance: The interpretation of point estimates, or more particularly, hypothesis testing with respect to parameters of equations under the TSLS procedure is complicated by several factors. Very little is currently known about the small-sample properties of the TSLS estimation method [5]. This means that the standard *t*—, *f*—, and Durbin-Watson tests are now suspect. What little evidence there is, suggests that the TSLS procedure tends to yield somewhat conservative *t*-values, *i.e.*, tends to understate the significance of a particular coefficient. This suggests that, if anything, greater emphasis can be laid on the *a priori* specification such as the appropriate sign of a coefficient, and to be somewhat liberal with respect to the notion of significance.

III. THE 'REDUCED-FORM' OF THE MODEL

The structural form of the present model, as presented in the preceding section, is, however, not suitable for giving a complete simultaneous view of the effect of any policy-controlled variable on the whole set of endogenous variables

appearing in the present model. For this purpose, we need the 'reduced form' of the model, expressing all the endogenous variables as explicit functions of the pre-determined variables only. Hence, we turn to the derivation of the 'reduced form' of the model [3, Chapter III].

Let us consider a system of structural relations such as in the preceding section containing a set of endogenous variables (y) and a set of exogenous variables (q) so that we write

$$F(y, q) = 0 \dots\dots\dots(III.1)$$

where F is a matrix of functional operators. Taking total differentials, we have

$$dF = \left(\frac{\partial F}{\partial y} \right) dy + \left(\frac{\partial F}{\partial q} \right) dq = 0 \dots\dots\dots(III.2)$$

$$i.e., dy = -\left(\frac{\partial F}{\partial y} \right)^{-1} \left(\frac{\partial F}{\partial q} \right) dq = \pi q.$$

For a linear structural system, as the present model, the matrix will be a constant matrix [3, Chapter III] and the typical element of π , i.e., π_{ij} ⁷, represents the change in any given endogenous variable y_i as determined by a unit change in any given q_j with all other pre-determined variables held constant. The complete 'reduced form' (i.e., π matrix) was computed, but for the purpose of showing only the impact of the monetary-policy variables, we would be concerned with what can be termed as policy sub-matrix as contained in the following table:

THE 'REDUCED FORM': POLICY SUB-MATRIX OF IMPACT MULTIPLIERS

Endogenous variables	Exogenous variables				
	r_d	r_T	r_G	$\Delta SG'$	DF'
RE	-3.42	3.94	2.19	-.20	.03
RR	-.69	.20	-.71	.04	.04
RL	-2.76	.82	-2.86	.14	.15
RLE	-6.87	4.18	2.02	.37	.02
rL	.12	-.16	.99	...	-.01
S	-.74	.43	3.97	.50	.10
RB	-6.60	-4.22	1.51	.06	.02
CLP	-8.51	8.20	-23.54	.15	.17
DD	-9.42	-3.41	-11.60	.20	.22
DT	-4.40	11.24	-4.82	.10	.51
L	-.35	-1.01	-.34	.16	.15
M'	-9.78	-4.40	-10.96	.37	.37
C	-4.57	5.02	-12.22	2.74	2.76
If	-3.24	2.61	-8.96	.53	.54
ΔI^v	-6.24	4.39	-11.70	.27	.28
Y	-11.26	4.84	-20.65	4.11	4.14
Z	-3.04	7.18	-12.24	.43	.43

Note: (...) means insignificant value.

⁷Also described as impact multipliers.

As seen from the above table 'impact multipliers' of five different exogenous policy-variables have been shown. Let us consider first the impact multipliers of the rediscount rate. These are uniformly negative except with respect to the commercial-loan rate variable, r^L . This is what should be expected. The effect of a rise in the rediscount rate is to affect negatively the scheduled banks' borrowings from the State Bank which also affect their reserves negatively. Given this, a rise in their loan rate is likely; this reduces the private sector demand for commercial loans as a consequence of which the private-sector consumption, investment and import demand fall. The sizes of the 'impact multipliers' about the real-sector variables (e.g., C , I^P , ΔI^V , etc.) are, however, not very large. Another important point to note is the effect of a rediscount-rate policy on money supply. If we define the total supply of money as the sum of currency in circulation and total nonbank deposits of the scheduled banks, it seems that a change of one percentage point in the rediscount rate leads to an inverse change in money supply to the extent of 14.18 crore rupees, i.e.,

$$\frac{\partial D^D}{\partial r^d} + \frac{\partial L}{\partial r^d} + \frac{\partial D^T}{\partial r^d} = -14.18$$

In terms of the figures for 1965/66, this would have meant slightly more than 1-per-cent change in money supply. This has implications with respect to the State Bank's reluctance with regard to using the rediscount rate as a policy of controlling that part of money supply which is created by the scheduled banks. Only thrice in the history of commercial banking in Pakistan has the State Bank resorted to raising the rediscount rate as the price of borrowing by the scheduled banks and has periodically resorted to direct restrictions on borrowing through quota system. Applications of such direct measures are, however, fraught with danger since the liquidity of the whole stock of government securities is dependent on allowing such borrowing. The column vector of coefficients appearing in the table above under the variable r^d suggests empirical evidence regarding the effectiveness of any pricing policy (i.e., varying the level of r^d) that can be pursued by the State Bank. Direct restrictions need not be resorted to for this could only undermine the willingness of the scheduled banks to accept government securities as facilities for borrowing is a prop for the rather suspect liquidity of such securities. More important, while the State Bank can, by using direct measures, prevent the scheduled banks from borrowing, relaxation of such measures would not compel the scheduled banks to expand their loans and deposits. Scheduled banks, however, would borrow if the spread between their loan rate and the rediscount rate (equation (II.3.2)) alters in favour of the former and herein lies a key argument in favour of the rediscount-rate policy. Unlike direct restrictions, it can affect deposit-creating activities of the scheduled banks in both upward and downward directions, and not just in the downward direction.

We can now consider the role that the weighted average of rate of interest on time deposits has played as one of the policy instruments at the disposal of the State Bank. The relevance of this policy instrument arises from its effect on the allocation of the stock of 'high-powered money' or any change thereof among currency in circulation and the reserves of the scheduled banks. The scheduled banks do not favour the use of this variable as an instrument of credit-control since it tends to reallocate some demand deposits into time deposits⁸ and is, thus, a cost from the scheduled banks' viewpoint that they could dispense with because even without such an incentive of interest payment the private sector would hold part of their deposits in the form of demand deposits on which no interests need be paid. However, apart from the reallocative effect, the interest rates on time deposits (*i.e.*, their weighted average) also has a substitution effect against currency holdings in favour of time deposits. Consequently, reserves of the scheduled banks vary positively with respect to the interest rates on time deposits which allow the scheduled banks to lower their commercial-loan rates and, thus, expand their commercial loans portfolio⁹. The net result is, thus, an expansion of money supply. In terms of the relevant 'impact multipliers'

$$\frac{\partial D^D}{\partial r^T} + \frac{\partial L}{\partial r^T} + \frac{\partial D^T}{\partial r^T} = 6.82.$$

As regards the effect of the interest rates on time deposits (*i.e.*, their weighted average) on the real-sector variables, we note that the multipliers, although not of very large magnitude, are yet positive and this effect follows from the positive effect of the weighted average rate of interest on time deposits (r^T) on the excess reserves of the scheduled banks which negatively affects their commercial loan rates. As we have already seen (equation (II.3.8)), the scheduled-bank commercial loan rates affect the size of their private-sector commercial-loan portfolio which in turn affect the real-sector variables positively; hence the positive effects of the weighted average interest rate on time deposits on these variables.

We would now consider the effect of the weighted average interest rate on government securities (r^G) on the endogenous variables as shown in the preceding table. As apparent from the relevant column vector, holdings of securities by the scheduled banks move positively with variable r^G . On the other hand, since the variable r^G also affects the commercial loan rates or their weighted average (*i.e.*, r^L) positively, the scheduled banks' private-sector commercial loan portfolio goes down. An interesting result to note is that the variable r^G causes scheduled banks' borrowings from State Bank to go up. This is, however, a result that should be expected. As shown in Equation (II.3.2), apart from profitability and other conditions affecting scheduled banks' borrowings from the State Bank, such

⁸The relevant impact multipliers for the variables D^D and L with respect to variable r^T are -3.41 and -1.01 , respectively.

⁹See equations (II.3.4) and (II.3.8) and the Table 'impact multipliers'.

borrowings are also positively dependent on the size of the 'securities' portfolio of the scheduled banks. Since the majority of the securities portfolio of the scheduled banks are of government origin which are held subject to State Bank's pressure due to their low yield and 'suspect' liquidity, the State Bank therefore, permits easy borrowings on such collateral [15, Chapter IV]. The scheduled banks, thus, compensate their loss of potential profitability through holding government securities of sub-equilibrium yield by trying to borrow on the collateral of their holdings of such securities and utilizing such funds in the commercial loan market. As regards the effects on the money-supply variable *e.g.*, $(M' + D^T)$ as well as the real-sector variables (*e.g.*, $C, I^r, \Delta I^r, Y$, *etc.*) the impact multipliers are not very large, although they possess correct signs. For the purpose of illustration,

$$\frac{Y}{r^G} = -20.65$$

Since the gross national income at current factor cost of 1965/66 is 4968.90 crore rupees [11, December 1968] the effect of a rise of one percentage point in the weighted average rate of interest on government securities on the former is a negative change of only 0.42 per cent. The present pattern of impact multipliers of the variable r^G is, however, entirely what should be expected. While the variable r^G performs as a credit-contraction variable in the present model and hence the observed negative impacts on the variables as noted above, its effect, however, is severely limited by the re-entry of the sale proceeds of government securities into the expenditure stream¹⁰. Presumably, the impact multipliers would have been higher without such re-entry.

We can now consider the effect of the two deficit-financing variables, ΔS^G and DF^r . Let us consider the impact multipliers of the variable ΔS^G first. As apparent from the relevant column vector in the preceding table, this variable shows positive entries against all 'real-sector' variables (*e.g.*, $C, I^r, \Delta I^r$, *etc.*). Again such deficit-financed government expenditures are an addition to the current income stream of the economy and thus tend to increase the private-sector demand for scheduled banks' deposits and commercial loans. Hence, we have positive entries for all scheduled bank portfolio variables except for excess reserves, thus, suggesting a net drainage of scheduled-bank reserves into currency in circulation. In terms of the relevant impact multipliers, we have

$$\frac{\partial R^B}{\partial (\Delta S^G)} + \frac{\partial R^R}{\partial (\Delta S^G)} + \frac{\partial L}{\partial (\Delta S^G)} = 0$$

We can now consider the effect of the variable DF^r , *e.g.*, government deficit as financed by the State Bank. Here, again, we have positive entries against all 'real-sector' variables as well as against the private sector demand variables for

¹⁰See Equation (II.2.7).

scheduled-bank deposits and commercial loans. However, since DF'' causes a net addition to the stock of 'high-powered money', it tends to increase the reserves of the scheduled banks. Thus, we have

$$\partial R^E / \partial DF'' = .03$$

However, since the weighted average commercial loan rate of the scheduled banks is related to the latter's excess reserves¹¹, we also have a resultant negative influence on the weighted average commercial-loan rate. We write,

$$\partial r^L / \partial DF'' < 0, \text{ because } R^E / DF'' > 0$$

This sums up our discussion of the reduced form of the model. Quite clearly, the reduced-form of the model and its sub-matrix, as shown in the preceding table, provide an opportunity of looking at the effects of any given exogenous variable *in isolation*, on the whole set of endogenous variables of the system. The structural form of the model, as presented in Section II, is unsuitable for this purpose. Again, the policy sub-matrix, as presented in the preceding table, highlights certain aspects of the monetary policy in Pakistan, especially with respect to the use of certain policy instruments. First, the impact multipliers of the rediscount rate with respect to the scheduled bank portfolio variables (e.g., R^E , S , R^B , etc.) as well as with respect to money supply (e.g., the sum of currency in circulation plus nonbank demand and time deposits of the scheduled banks) indicate fairly large negative impacts so that the effectiveness of a rediscount-rate policy need not be suspect. Although the sizes of these impact multipliers are not such as to permit the use of a rediscount-rate policy to cause a very substantial change in the money supply but its use in association with other relevant policy measures need not be overlooked if such an objective is desired.

Again, the policy sub-matrix, as contained in the preceding table, reveals the apparent inconsistency in the effects of the two policy variables, r^G and $\Delta S^{G'}$, on the endogenous variables of the present model such that they tend to be mutually compensating in their effects on most of the endogenous variables. While both raise the 'securities' holdings of scheduled banks and their borrowings from the State Bank, unlike $\Delta S^{G'}$, the variable r^G also affects their commercial loan rates positively. Hence, the negative effect of the variable r^G on such variables as CL^P , DP , DT , C , I , etc. The effects of r^G on these variables are contrasted with the effects of the variable $\Delta S^{G'}$ on such variables. This contrast arises due to the fact that unlike a country like the United States, the variables r^G and $\Delta S^{G'}$ are not consistent open market variables for controlling the reserves of the economy and, thus, money supply. The inconsistency results from the fact that the proceeds from the sales of government securities are spent to finance government expenditures and not retained as 'idle deposits' to affect money supply.

¹¹See Equation (II.3.4).

Thus, the variable r^G can be effective only if it is not compensated by the supply variable for government securities, ΔS^G , and that the latter does not have any connotation with respect to the financing of government expenditures and was instead an open-market variable designed to affect the levels of the stock of high-powered money and money supply. However, since ΔS^G is not an open-market variable in the normal sense, changes in the variable r^G need to be greater to attain a desired objective with respect to money supply than it would need to be if the variable ΔS^G was indeed an open-market variable for controlling the stock of high-powered money and money supply within the economy.

IV. CONCLUSIONS

The preceding estimates offer some preliminary guidance towards formulation of monetary policy in Pakistan. The estimated monetary policy-parameters, *i.e.*, 'impact multipliers', are not very large yet are by no means inconsequential. And certainly, when viewed not in isolation but as a set of policy options available to the 'authorities', they could be of some discernible effect on money supply.

It is an usual presumption that an underdeveloped economy such as Pakistan is particularly insensitive to changes in interest rates because rates of return on the investments made possible by bank loans are probably higher in underdeveloped than in developed countries. This, as Porter suggests [15, Section XV], rather misses the point since the purpose of changes in the interest-rate is to influence the bankers as lenders, not their customers as borrowers. As seen from the table containing the 'impact multipliers' in the preceding section, the influence of changes in the various interest rates on the scheduledbank portfolio behaviour are, by no means, inconsequential.

Another argument against an active monetary policy as an instrument of public policy is that only a small part of the economy is affected by changes in bank credit. Consequently, very little can be done to affect movements in national income through monetary-policy changes. The table containing the 'impact multipliers' suggests a quantitative measure of the impact of some of the monetary-policy variables. Whether or not these 'impact multipliers' constitute significantly large influences of the monetary-policy alternatives is a matter of judgment. It is important, however, that such possibilities for control are recognised.

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Appendix

SOURCES OF DATA

The time-series used in this study covers a span of seventeen years, *i.e.*, 1949/50 to 1965/66, the annual periods being July to June. The basic source for all the various monetary time-series used in the study was *Report on Currency and Finance* [14, 1955/56 through 1965/66]. The time-series on the various interest rates except the rediscount rate were not, however, directly available and the procedures for their derivation using basic data published in [14] are delineated as follows.

The weighted average interest rate on government securities (*i.e.*, r^G) was calculated by multiplying the nominal interest rates, *i.e.*, coupon rates, on each maturity class of government securities by the corresponding amount of government securities outstanding [14].

The weighted average commercial loan rate (*i.e.*, r^L) was calculated using the volume of loans extended under each type of collateral as weights to multiply the corresponding average loan rate [14].

The weighted average interest rate paid on time deposits (*i.e.*, r^T) was also obtained by multiplying the various interest rates on time deposits by the following set of weights: 0.30 for savings deposits, 0.20 for 3-month fixed deposits, 0.20 for 6-month fixed deposits and 0.30 for one-year fixed deposits [15, p. 44].

The basic source for the figures on government budgetary data was *Pakistan Budgets* [12]. The figures on government expenditures are the sum of the expenditures of central and provincial governments net of any transfer payments between them. The figures on the variables ΔS^G , ΔCL^G , and DF'' were obtained in a rather involved manner and, therefore, need to be stated in detail. The above source, (*i.e.*, [12]), provides figures for only total deficit financing (*e.g.*, sum of ΔS^G , ΔCL^G , and DF''). Deducting from it the figures on DF'' (*see*, quarterly statements of the Issue and Banking Departments of the State Bank) and the figures on ΔCL^G [14, chapters on Money and Banking], figures on ΔS^G were then obtained as a residual.

The last group of variables are the real sector ones. The figures on gross national income at current factor cost are available from the *CSO Statistical Bulletins* [11]. The figures on total private investment expenditure (*viz.*, fixed

and inventory) are available for 1949/50 to 1958/59 in [6, Statistical Appendix, Table A-7]. After that date, figures were obtained from [13]. The figures on exports, imports and net foreign-capital inflow are available from the quarterly balance-of-payments statements in [14]. Finally, figures on private consumption expenditure were obtained as a residual after deducting from gross national product the figures on government expenditure, total private investment expenditure, current-account receipts in the balance of payments (e.g., X), and adding to it the figures on current-account payments in the balance of payments (e.g., Z) and indirect taxes. It must be noted that the figures on government subsidies were not deducted from indirect taxes for the above purpose so that the figures on private-consumption expenditure are somewhat overestimated. The reason for this procedure is the nonavailability of any figures on subsidy payments for the sample period of the study except 1965/66 for which date the figure is 290 million rupees. This is less than 1 per cent of the estimated private consumption expenditure for that year so that such overestimation can be judged to be fairly negligible.