Financial Liberalization, Savings, and Economic Development in Pakistan*

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I. Introduction

In recent years, many developing countries have implemented financial liberalization policies with the aim to improve the effectiveness of monetary policy through greater reliance on market forces. The main liberalization policies were aimed at liberalizing interest rates, reducing controls on credit, enhancing competition and efficiency in the financial system, strengthening the supervisory framework, and promoting the growth and deepening of financial markets.

Prior to implementing financial liberalization policies, the financial sector of developing countries shared many similar characteristics, which included direct controls on interest rate movements, domestic credit controls (bank-specific credit ceilings and selective credit allocations), high reserve requirements, and commercial banks serving in the role of captive institutions. In particular, the policies of imposing ceilings on interest rates accompanied by directed and rationed allocation of credit to priority sectors at low interest rates are seen to impede financial deepening and hence to intercept and weaken an important set of impulses that would foster economic development. The low interest rate policy pursued by many developing countries in the past was in accordance with Keynesian and neoclassical theories that predicted this practice would promote investment and economic growth.[1] Implicit in this policy was the assumption that the cost of capital and not the availability of loanable funds is the binding constraint for capital formation.

R. I. McKinnon and E. S. Shaw were the first to challenge seriously this conventional wisdom. In their separate works they argued that the pursuance of such policies (i.e., low and administered interest rates, selective credit control, and concessional credit practices) have led to widespread financial repression in developing countries.[2] The repressed financial markets discourage savings, retard the efficient allocation of re-

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sources, increase the segmentation of financial markets, and create financial disintermediation of the banking system.[3]

The McKinnon-Shaw thesis of ‘‘financial repression’’ became the new orthodoxy in the 1970s and 1980s and has brought a shift of emphasis in policy priorities as well. It has also influenced the thinking of the International Monetary Fund (IMF) and the World Bank. This influence is quite evident from the financial policies embodied in their stabilization packages. The essential message of the McKinnon-Shaw thesis is that a low or negative real rate of interest discourages savings and hence reduces the availability of loanable funds, constrains investment, and in turn lowers the rate of economic growth. On the contrary, an increase in the real interest rate may induce the savers to save more, which will enable more investment to take place. This suggests a basic complementarity between the accumulation of money balances (financial assets) and physical capital accumulation. The complementarity hypothesis rests on two key assumptions: (i) all economic agents are restricted to self-finance; and (ii) due to indivisibilities, investment requires the prior accumulation of money balances. Hence, the more attractive the process of money balances accumulation, the greater will be the inducement to invest.

As is the case in many other developing countries, Pakistan undertook an ambitious financial sector reform program at the end of 1989. The goal was (i) to liberalize interest rates by switching from an administered interest rate setting to a market-based interest rate determination; (ii) to reduce controls on credit by gradually eliminating directed and subsidized credit schemes; (iii) to create and encourage the development of a secondary market for government securities; (iv) to enhance competition and efficiency in the financial system by recapitalizing and restructuring the nationalized commercial banks and allowing private banks to enter the market; and (v) to improve prudential regulations.[4]

The key reforms that have already been implemented as part of the financial liberalization policies include (i) liberalizing interest rates by initiating a regular auction program of government debt; (ii) replacing the concept of a credit ceiling with open market operation; (iii) developing primary and secondary securities markets; (iv) enhancing competition and efficiency in the financial system by privatizing two nationalized commercial banks and allowing 10 new scheduled commercial banks and many other investment banks to operate in the private sector; and (v) strengthening the State Bank of Pakistan’s (SBP) supervisory role over the commercial banks and extending its supervisory responsibility for the first time to nonbank financial institutions.[5] Among the list of reforms introduced so far, the interest rate liberalization policy is central to this study. The main objectives of interest rate liberalization are to promote savings and investment and to deepen financial markets. The complementarity hypothesis of McKinnon provides useful formulation through which the success of the interest rate liberalization policy can be gauged.

In the past, several attempts were made to test the complementarity hypothesis for many developing countries, but the results were, at best, inconclusive. For example, a much-quoted empirical study by M. J. Fry for several Asian countries found little evidence to support McKinnon's complementarity hypothesis; Fry found instead a positive effect of the real interest rate on domestic saving and economic growth.[6] In a more recent study, P. K. Watson obtained results confirming the McKinnon-Shaw financial liberalization hypothesis but could not fully substantiate McKinnon's complementarity hypothesis for Trinidad and Tobago.[7] On the other hand, P. S. Laumas, J. Thornton, and J. Thornton and S. R. Poudyal found strong support for the complementarity hypothesis in the cases of India and Nepal, respectively.[8]

All of these studies suffer from a common defect; that is, all have ignored the stationary properties of the relevant variables. It has been widely accepted that most time-series data used in economic analysis are nonstationary in character. A regression of one nonstationary series on another can give rise to the so-called spurious regression problem and lead to incorrect statistical inferences.[9] The inconclusive nature of the findings on the one hand and statistical problems associated with ignoring the stationary properties of the relevant variables on the other prompted us to take a fresh look at the subject. Furthermore, since McKinnon's complementarity hypothesis provides a useful formulation through which one can judge the success of the interest rate liberalization policy under the broader financial sector reforms, it would be ideal to test this hypothesis with data from developing countries where financial liberalization is in progress. The present study is a step in that direction.

The rest of the article is organized as follows: in Section II we discuss the McKinnon hypothesis and specify functions to test the complementarity hypothesis. Results are reported in Section III and some broad conclusions are presented in the final section.

II. The McKinnon Hypothesis

McKinnon's complementarity hypothesis can be represented by the following two equations:

$$M/P = f(y, I_p/Y, i - \dot{p}^e), \tag{1}$$

$$I_p/Y = g(y, i - \dot{p}^e, I_g/Y). \tag{2}$$

Equation (1) is the standard long-run real money demand function with real income (y) as a scale variable, real interest rate ($i - \dot{p}^e$) as an opportunity cost variable, and ratio of private sector investment to GNP (I_p/Y) as arguments. Equation (2) is a private investment function specified to depend on real income, real interest rate, and the ratio of public sector investment to GNP (I_g/Y). The last variable is included to shed light on the issue of complementarity and substitutability of public sector investment in the private investment function.[10] The complementarity hypothesis holds true if the following partial derivatives are positive:

$$\frac{\partial(M/P)}{\partial(I_p/Y)} > 0 \tag{3}$$

and

$$\frac{\partial(I_p/Y)}{\partial(i - \dot{p}^e)} > 0. \tag{4}$$

Equations (3) and (4) suggest that it is not the cost of capital but the availability of finance that constrains investment in financially repressed economies. When the real deposit rate increases, investment increases as well because the financial constraint is relaxed. However, the traditional theory suggests the reverse, that is, that an increase in interest rate reduces investment.

This is generally not the case in developing countries. As Fry points out, the effective limitation on the rate of real capital formation in developing countries is the supply of savings and not the inadequate willingness for investment.[11] Furthermore, investment financed by foreign savings (one-third of Pakistan's investment is financed by foreign savings) could hardly generate a finance motive demand for the domestic money stock. Accordingly, a savings function may be substituted for investment as the finance motive in the demand for money function. Equation (1) is, therefore, rewritten as

$$M/P = f(y, S/Y, i - \dot{p}^e). \tag{5}$$

Since complementarity works both ways in that the conditions of money supply have a first-order impact on decisions to save and to invest, we specify a savings function that must be determined simultaneously with the demand for money. The savings function is specified as

$$S/Y = g[y, \dot{y}, M/P, \text{DR}, (S_f/Y)], \tag{6}$$

where S/Y is the ratio of national savings to GNP (saving rate), y is real income and $\dot{y}$ is its growth rate, DR is the dependency ratio,[12] S_f/Y is the foreign saving to GNP ratio, and $i - \dot{p}^e$ is the real rate of interest. The savings function is similar to that used by Fry and by A. H. Khan, L. Hasan, and A. Malik except that we also include the dependency ratio (DR) and real money balances (M/P).[13] In the savings function the preferred variable would have been the private saving ratio, but data problems restricted our choice to the national saving ratio.

The rationale for including different variables in the savings function is briefly summarized. The inclusion of real income (*y;* or real per capita income, y/N) in the savings function hardly needs any explanation. Most studies on saving behavior in developing countries have included this variable. The intertemporal optimizing models, such as the life-cycle model, suggest a positive relation between the national saving rate and the growth rate of real income ($\dot{y}$). The higher the rate of economic growth, the richer the younger generation is compared to the older generation. Thus even a moderate effort by the younger generation to accumulate savings will outweigh the potential dissaving by the older generation. Hence, the higher the rate of economic growth, the higher the saving rate. Real money balances (M/P) are included in the savings function to test the complementarity hypothesis. Higher money balances increase the saving rate. The dependency ratio (DR) is included to test the influence of demographic variables on the saving rate. The rate of economic growth will have little or no effect on the saving rate if the population dependency ratio is higher. In the life-cycle model, households with more children are likely to consume more and save less at younger ages than households with few or no children. Hence, the higher the population dependency ratio, the lower the saving rate. The impact of foreign saving (S_f/Y) on the national saving rate in developing countries remains controversial. Overwhelming evidence has been found in favor of an inverse relationship between the two saving rates. Khan, Hasan, and Malik have argued that foreign savings relax the resource constraint in developing countries and may augment national savings with a time lag via increasing income.[14] In other words, the dynamic impact of foreign savings on the national saving rate may be positive.

The complementarity hypothesis holds true if the following partial derivatives are positive:

$$\frac{\partial(M/P)}{\partial(S/Y)} > 0 \tag{7}$$

and

$$\frac{\partial(S/Y)}{\partial(M/P)} > 0. \tag{8}$$

The real interest rate is defined in this article as a longer than 1-year but less than 2-year time deposit rate minus the expected rate of inflation ($\dot{p}^e$). It may be noted that the expected rate of inflation is unobservable. To overcome this problem we assume that expectations are formed according to the adaptive expectations model,[15] that is,

$$\dot{p}^e_t - \dot{p}^e_{t-1} = \lambda(\dot{p}^e_t - \dot{p}^e_{t-1}), \tag{9}$$

where λ is the coefficient of expectations such that $0 < \lambda < 1$.

A few words regarding the estimation technique are in order. In this article we use time-series data for the period 1959–60 to 1994–95. It is now well known that most macroeconomic time series are nonstationary. When both the dependent and the independent variables in a time-series regression are nonstationary, spurious correlations are likely to occur.[16] This means that the regression equations, which include nonstationary time series, have a high R^2 combined with a low Durbin-Watson statistic and, as a consequence, it is likely that the variables appear to be statistically significant when they are not. In order to avoid obtaining misleading statistical inferences we perform appropriate tests for stationarity of all the variables employed in various equations.

Some of the methods currently employed to evaluate the time-series characteristics of macrovariables are the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests. The DF test is based on the regression $\Delta X_t = \mu + \beta X_{t-1} + \epsilon_t$ where X_t denotes the variable of interest and Δ is the difference operator; μ and β are parameters to be estimated. The null hypothesis (H_0) is X_t is $I(0)$. The ADF test is based on the regression $\Delta X_t = \mu + \beta X_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta X_{t-i} + \epsilon_t$, where n is selected such that ϵ_t is white noise, and μ, β, γ_i are parameters to be estimated. The cumulative distribution of the DF and ADF statistics are provided by W. A. Fuller.[17] If the calculated t-ratio of coefficient β with negative sign is less than its critical value from Fuller's table, then X_t is said to be stationary or integrated of order 1, that is, $X_t \sim I(1)$.[18] If the variables in equations (1)–(2) and (5)–(6) are individually $I(1)$ but some linear combination of a subset of these variables is $I(0)$, in other words, if they constitute a cointegrated set, this would suggest the following two-stage estimation strategy. In the first stage, static long-run equations (1)–(2) and (5)–(6) are estimated for cointegration regression with variables of the same order of integration. The residuals from the cointegration regressions are recovered to perform stationary tests based on the following equations:

$$\Delta\epsilon_t = \phi_0 + \phi_1\epsilon_{t-1} + V_t, \tag{10}$$

$$\Delta\epsilon_t = \phi_0 + \phi_1\epsilon_{t-1} + \sum_{i=1}^{K} \phi_i \Delta\epsilon_{t-i} + V_t, \tag{11}$$

where ϵ_t represents the residuals from the cointegration regressions. The null hypothesis of nonstationarity stands rejected if ϕ is negative and the calculated DF and ADF statistics are less than the critical values from Fuller's table.

An important correspondence exists between cointegration and the error-correction (EC) mechanism. For any set of cointegrated variables there exists a valid error-correction representation of the data.[19] In the second stage another set of regressions is carried out in which the set of variables includes variables in equations (1)–(2) and (5)–(6), but expressed in first difference (to avoid nonstationarity) and lagged difference terms to capture short-run dynamics. In addition, lagged residuals from the cointegration regressions are also included in the set of explanatory variables—this term is referred to as an EC term. The statistical significance of the EC term is that it measures the deviation of the dependent variable from its long-run trend. In other words, it represents the self-correcting mechanism of the system for deviation from its long-run trend. The general form of the EC model is as follows:

$$(1 - L)y_t = \alpha_0 + \alpha_1(1 - L)X_{t-i} + \alpha_2(1 - L)y_{t-i} + \alpha_3 \text{EC}_{t-1} + \eta_t, \tag{12}$$

where L is the lag operator, y_t is the dependent variable, X_t is the set of independent variables, and EC is the error-correction term.

Before we close this section a few words regarding data and their sources are in order. The data corresponding to money supply (M_2 definition) for the period 1959–60 to 1970–71 are taken from A. R. Kemal, F. Bilquees, and A. H. Khan.[20] Thereafter data are taken from the various issues of the *Pakistan Economic Survey* (*PES*). The data pertaining to real income (gross national product, or GNP) and various components of national income accounts, which have been used to derive national savings, such as investment and current account deficit, are taken from the *PES*, 1994–95. The data for the more than 1-year but less than 2-year time deposit rate are taken from various issues of the *Monthly Bulletin* of the SBP. The rate of change in the GNP deflator is used as a rate of inflation and is taken from the *PES*, 1994–95. The data pertaining to variables used to measure the dependency ratio are also taken from the *PES*, 1994–95. Finally, the data for foreign savings, as measured by the current account deficit, are taken from various issues of the *PES*. These are reported in U.S. dollars but are converted to rupees by multiplying by the average exchange rate of the respective years.

III. Results

The first step toward testing the complementarity hypothesis of McKinnon is to determine the order of integration of all the variables used in the analysis. To this end, the DF and ADF class of unit root tests are applied to the first difference of each variable for the period 1959–60 to

TABLE 1

UNIT ROOT TESTS FOR RELEVANT VARIABLES (First Difference), 1959– TO 1994–95

Variable	Dickey-Fuller (DF)		Augmented Dickey-Fuller (ADF)	
	Without Trend	With Trend	Without Trend	With Trend
Real income (y)*	−5.55	−5.97	−4.13	−4.70
Real per capita income (y/N)*	−5.43	−5.92	−3.88	−4.48
Real money demand (M/P)*	−4.51	−4.53	−4.68	−4.69
Real money demand per capita (m/N)*	−4.43	−4.46	−4.61	−4.64
Saving rate (S/Y)	−6.30	−6.27	−4.64	−4.63
Foreign saving rate (S_f/Y)	−7.52	−7.51	−6.23	−6.26
Real deposit rate ($i - \dot{p}^e$)	−5.32	−5.28	−4.20	−4.17
Dependency ratio (DR)	−5.76	−5.71	−4.90	−4.89
Private investment rate (I_p/Y)	−6.61	−6.52	−5.21	−5.14
Public investment rate (I_g/Y)	−5.12	−5.18	−3.97	−3.88
Real lending rate ($I_l - \dot{p}^e$)	−5.21	−5.11	−4.53	−4.43

NOTE.—Critical 5% values of DF and ADF without trend and with trend are −2.95 and −3.55, respectively.

* Variables were transformed into natural logarithms.

1994–95 with and without trends.[21] As shown in table 1, both the DF and the ADF tests applied to the first difference of the data series reject the null hypothesis of nonstationarity for all the variables used in the analysis. The calculated values for both the DF and the ADF tests are found to be less than the critical values at the 5% level, which suggests that the order of integration for all the variables is unity ($I[1]$); that is, that all series are stationary in first difference with the exception of the growth rate of real income and the growth rate of real per capita income, which are indeed $I(0)$.

Having found the variables to be integrated of the same order, it is possible to test for cointegration. The cointegration regressions of equations (1)–(2) and (5)–(6) are estimated with ordinary least squares (OLS), and the results are reported in the appendix. A cursory look at the cointegration regression for the savings function in the appendix is sufficient to see that the DF, the ADF, and the CRDW statistics reject the null hypothesis of no cointegration at the 5% level of significance for all four equations.[22]

The multivariate regressions of real money demand (real per capita money demand) with real income (real per capita income), real interest rate, and saving rate (savings to income ratio) as arguments are found to be cointegrated (see eqq. [A1] and [A3] in the appendix). This suggests that there exists a stable long-run equilibrium relationship between these variables. Similar results are obtained in the case of savings functions (see eqq. [A2] and [A4]). The saving rate with growth rate of real income (growth rate of real per capita income), real income (real per capita income), real money balances (real per capita money balances), and dependency ratio as arguments are found to be cointegrated. In other words, there exists a stable long-run equilibrium (or observed) relationship between these variables.[23]

The coefficients of (S/Y) in the money demand functions and of real money balances (M/P) in the savings functions are both positive and statistically significant at the 5% level. These results provide abundant support for McKinnon's complementarity hypothesis in the case of Pakistan. The above findings are not simply an artifact of the choice of variables; that is, they remain whether we use real money balances and real income in per capita form or in level form.[24]

The income elasticity of money demand is found to be close to unity (1.02 and 1.03), which suggests that the demand for money has been rising at a rate that is proportional to income growth. This finding is consistent with Khan and S. S. Ali.[25] The coefficient of the real deposit rate, although it bears a positive sign, did not reach the traditional level of significance. The positive sign of the real interest rate confirms the existence of financial repression in the economy during the sample period. This again is consistent with Khan and Ali as well as with Khan.[26]

The mobilization of savings appears to have taken place independent of movements in real income or real per capita income. The growth rate of real income or real per capita income has very little effect on the national saving rate. Although the coefficients bear a positive sign, they failed to reach the traditional level of significance. This finding is not surprising because Fry has pointed out that the acceleration in the growth rate of real income or real per capita income will raise the saving rate by a smaller amount if the dependency ratio is higher.[27] In the case of Pakistan, one earning member is taking care of six to seven nonearning members of the household. In such an environment, the insignificant effect of the growth rate of real income or real per capita income on the saving rate is hardly surprising.

The dependency ratio is found to have a strong effect on the saving rate. The coefficient bears a negative sign and is statistically significant. The estimated coefficient suggests that a one percentage point increase in the dependency ratio would reduce the national saving rate by eight-tenths of a percentage point. This finding is consistent with Fry and with Khan, Hasan, and Malik.[28]

The battery of tests reported for each estimated equation suggests that these equations do not suffer from serial correlation, nor is the model misspecified nor the choice of functional form incorrect; the normality of the residuals is not rejected, and therefore, the reliability of the t-values is ascertained; the residuals are homoscedastic.[29]

In the final stage, the EC model (eq. [12]) is estimated with the help of OLS. Given the number of observations and the fact that all the variables are in first difference form, we restricted the lag structure in the dynamic formulation to a maximum of one period (i.e., $i = 1$ in eq. [12]).[30] The results of the EC model are documented in equations (A9)–(A12). Like cointegration regressions (see eqq. [A1]–[A4]), coefficients of (S/Y) in the money demand functions and of the real money balances in the saving functions are both positive and statistically significant at the 5% level. Once again, abundant support for McKinnon's complementarity hypothesis is found, even in the dynamic formulation. The coefficients of the EC term in the money demand functions and the savings functions are fairly stable (0.55–0.56 and 0.62–0.64, respectively) and statistically significant. This suggests that 55%–64% of the previous year's discrepancy between the actual and the equilibrium values of the dependent variables are corrected each year. The statistical significance of this coefficient indicates that market forces are in operation to restore long-run equilibrium following a short-run disturbance due to the introduction of recent financial-sector reforms. The battery of tests reported for each estimated equation suggests that these equations do not suffer from serial correlation, the choice of functional form is correct, and residuals are normally distributed and homoscedastic.

IV. Concluding Remarks

The purpose of this article is to provide empirical evidence concerning McKinnon's complementarity hypothesis for Pakistan. Using annual time-series data for the period 1959–60 to 1994–95 we found strong support for McKinnon's hypothesis. The coefficients of the saving ratio in the money demand function and of real money balances in the savings function are both positive and statistically significant. This result holds true when money demand and savings functions are estimated in static long-run formulations (cointegration regressions) as well as in the dynamic formulation (EC models). The financial liberalization policies currently being pursued in Pakistan are likely to result in financial deepening. An increase in the real interest rate (either by increasing the nominal interest rate or by reducing the inflation rate) would lead to the accumulation of money balances (financial assets), which would improve the availability of loanable funds for investment. Our findings are in line with Laumas, Thornton, and Thornton and Poudyal but are in sharp contrast with Fry.[31]

The income elasticity of money demand is found to be close to unity, which suggests that the demand for money has been rising at a rate that is in proportion to income growth. Savings mobilization in Pakistan appears to have taken place independent of movements in the income variables. The growth rate of real per capita income has very little effect on the saving rate. This is primarily due to the higher dependency ratio, which exerts a negative influence on the saving rate. Contrary to common findings, domestic and foreign savings are found to be complementary in nature. The positive effect of foreign savings on national savings is realized after a lag of 1 year.

Appendix
Modeling Results from the Error-Correction Model

This appendix contains equations that give explicit information about the cointegration regressions for savings and investment and for the EC model. The numbers in parentheses are *t*-statistics. An asterisk indicates significance at the 5% level.

Cointegration Regression, Savings Function

Demand for Money Function

$$\ln M/P_t = \underset{(5.64)^*}{-1.40} + \underset{(36.95)^*}{1.02} \ln y_t + \underset{(2.93)^*}{1.97}(S/Y)_t + \underset{(0.52)}{0.0015}(i - \dot{p}^e). \quad \text{(A1)}$$

$\bar{R}^2 = 0.99$; CRDW = 1.08; SER = 0.066; DF = −5.83*; ADF = −5.43*.

AR: LM(1) = T.R^2: $\chi^2(1) = 8.80$; *F*-statistics = 10.17.
RESET: $\chi^2(1) = 0.507$; *F*-statistics = 0.437.
Normality: $\chi^2(2) = 3.37$.
HT(1): $\chi^2(1) = 0.036$; *F*-statistics = 0.034.

Savings Function

$$(S/Y)_t = \underset{(2.14)^*}{0.42} + \underset{(1.26)}{0.002}\, \dot{y}_t - \underset{(2.57)^*}{0.12} \ln y_t + \underset{(3.84)^*}{0.16} \ln M/P_t - \underset{(1.96)^*}{0.82}\, \text{DR}. \quad \text{(A2)}$$

$\bar{R}^2 = 0.71$; CRDW = 1.29; SER = 0.017; DF = −5.38*; ADF = −5.25*.

AR: LM(1) = T.R^2: $\chi^2(1) = 6.80$; *F*-statistics = 6.79.
RESET: $\chi^2(1) = 2.43$; *F*-statistics = 2.13.
Normality: $\chi^2(2) = 1.63$.
HT(1): $\chi^2(1) = 0.175$; *F*-statistics = 0.163.

Demand for Money Function

$$\ln(m/N)_t = \underset{(4.41)^*}{-1.44} + \underset{(17.74)^*}{1.03} \ln(y/N)_t + \underset{(3.00)^*}{2.00}(S/Y)_t + \underset{(0.58)}{0.0016}(i - \dot{p}^e). \quad \text{(A3)}$$

$\bar{R}^2 = 0.95$; CRDW = 1.09; SER = 0.066; DF = −5.78*; ADF = −5.41*.

AR: LM(1) = T.R^2: $\chi^2(1) = 8.56$; *F*-statistics = 9.81.
RESET: $\chi^2(1) = 0.046$; *F*-statistics = 0.039.
Normality: $\chi^2(2) = 3.43$.
HT(1): $\chi^2(1) = 0.12$; *F*-statistics = 0.11.

Savings Function

$$(S/Y) = \underset{(1.70)}{0.30} + \underset{(1.29)}{0.002}\,(\dot{y}/N) - \underset{(2.48)^*}{0.08}\ln(y/N) + \underset{(3.88)^*}{0.16}\ln(m/N) - \underset{(2.45)^*}{0.79}\,\text{DR}. \quad \text{(A4)}$$

$\bar{R}^2 = 0.71$; CRDW = 1.26; SER = 0.017; DF = −5.34*; ADF = −5.13*.

AR: LM(1) = T.R^2: $\chi^2(1) = 6.66$; F-statistics = 6.59.
RESET: $\chi^2(1) = 1.63$; F-statistics = 1.34.
Normality: $\chi^2(2) = 1.63$.
HT(1): $\chi^2(1) = 0.41$; F-statistics = 0.40.

Cointegration Regression, Investment Function
Demand for Money Function

$$\ln M/P_t = \underset{(7.29)^*}{-1.78} + \underset{(48.21)^*}{1.07}\ln y_t + \underset{(2.39)^*}{1.39}(I_p/Y)_t + \underset{(1.37)}{0.003}(i - \dot{p}^e)_t. \quad \text{(A5)}$$

$\bar{R}^2 = 0.99$; CRDW = 0.85; SER = 0.07; DF = −4.74*; ADF = −4.98*.

AR: LM(1) = T.R^2: $\chi^2(1) = 14.2$; F-statistics = 21.12.
RESET: $\chi^2(1) = 0.024$; F-statistics = 0.02.
Normality: $\chi^2(2) = 5.99$.
HT(1): $\chi^2(1) = 0.63$; F-statistics = 0.60.

Investment Function

$$(I_p/Y)_t = \underset{(2.09)^*}{0.24} - \underset{(1.80)^*}{0.11}\ln y_t + \underset{(1.81)^*}{0.10}\ln M/P_t + \underset{(0.51)}{0.0005}(i - \dot{p}^e)_t + \underset{(0.40)}{0.06}(I_g/Y)_t. \quad \text{(A6)}$$

$\bar{R}^2 = 0.05$; CRDW = 0.45; SER = 0.02; DF = −1.90; ADF = −2.76.

AR: LM(1) = T.R^2: $\chi^2(1) = 21.10$; F-statistics = 47.85.
RESET: $\chi^2(1) = 0.84$; F-statistics = 0.71.
Normality: $\chi^2(2) = 1.42$.
HT(1): $\chi^2(1) = 1.10$; F-statistics = 1.07.

Demand for Money Function

$$\ln M/P_t = \underset{(4.92)^*}{-1.33} + \underset{(48.70)^*}{1.06}\ln y_t + \underset{(2.58)^*}{0.12}\ln(I_p/Y)_t + \underset{(1.21)}{0.003}(i - \dot{p}^e)_t. \quad \text{(A7)}$$

$\bar{R}^2 = 0.99$; CRDW = 0.85; SER = 0.067; DF = −4.74*; ADF = −4.98*.

AR: LM(1) = T.R^2: $\chi^2(1) = 14.2$; F-statistics = 21.18.
RESET: $\chi^2(1) = 0.19$; F-statistics = 0.71.
Normality: $\chi^2(2) = 6.10$.
HT(1): $\chi^2(1) = 0.53$; F-statistics = 0.50.

Investment Function

$$\ln(I_p/Y)_t = \underset{(0.14)}{-0.24} - \underset{(1.92)^*}{1.39} \ln y_t + \underset{(1.95)^*}{1.32} \ln M/P_t + \underset{(0.83)}{0.0009}(i - \dot{p}^e)_t + \underset{(0.47)}{0.12} \ln(I_g/Y)_t. \quad \text{(A8)}$$

$\bar{R}^2 = 0.12$; CRDW = 0.43; SER = 0.24; DF = −1.82; ADF = −2.39.

AR: LM(1) = T.R^2: $\chi^2(1) = 21.8$; *F*-statistics = 52.70.
RESET: $\chi^2(1) = 1.01$; *F*-statistics = 0.86.
Normality: $\chi^2(2) = 1.51$.
HT(1): $\chi^2(1) = 1.24$; *F*-statistics = 1.21.

Error-Correction Model

Demand for Money Function

$$\Delta \ln M/P_t = \underset{(1.35)}{0.04} + \underset{(5.72)^*}{0.46} \Delta \ln y_t + \underset{(2.14)^*}{0.85} \Delta(S/Y)_{t-1} + \underset{(1.66)}{0.004}(i - \dot{p}^e)_t + \underset{(1.68)^*}{0.006}(i - \dot{p}^e)_{t-1} + \underset{(3.97)^*}{0.55} \Delta \ln M/P_{t-1} - \underset{(2.75)^*}{0.56} EC_{t-1} \quad \text{(A9)}$$

$\bar{R}^2 = 0.80$; CRDW = 1.46; SER = 0.051.

AR: LM(2) = T.R^2: $\chi^2(2) = 4.99$; *F*-statistics = 4.41.
RESET: $\chi^2(2) = 1.07$; *F*-statistics = 1.03.
Normality: $\chi^2(2) = 0.36$.
HT(2): $\chi^2(2) = 1.94$; *F*-statistics = 1.95.

Savings Function

$$\Delta(S/Y)_t = \underset{(1.52)}{-0.012} + \underset{(0.49)}{0.0005} \Delta\dot{y}_{t-1} - \underset{(1.89)^*}{0.06} \Delta \ln y_{t-1} + \underset{(4.15)^*}{0.20} \Delta \ln M/P_t - \underset{(1.85)^*}{0.50} \Delta DR_{t-1} + \underset{(1.53)}{0.20} \Delta(S_f/Y)_{t-1} + \underset{(2.33)^*}{0.42} \Delta(S/Y)_{t-1} - \underset{(3.44)^*}{0.64} EC_{t-1}. \quad \text{(A10)}$$

$\bar{R}^2 = 0.70$; CRDW = 2.04; SER = 0.015.

AR: LM(2) = T.R^2: $\chi^2(2) = 0.25$; *F*-statistics = 0.19.
RESET: $\chi^2(2) = 0.009$; *F*-statistics = 0.007.
Normality: $\chi^2(2) = 3.28$.
HT(2): $\chi^2(2) = 0.51$; *F*-statistics = 0.48.

Demand for Money Function

$$\Delta \ln(m/N)_t = \underset{(1.40)}{0.22} + \underset{(5.42)^*}{0.40}\, \Delta \ln(y/N)_t + \underset{(2.17)^*}{0.82}\, \Delta(S/Y)_{t-1}$$
$$+ \underset{(1.68)}{0.004}(i - \dot{p}^e)_t + \underset{(1.69)}{0.005}\, \Delta(i - p^e)_{t-1} \qquad \text{(A11)}$$
$$+ \underset{(3.64)^*}{0.5}\, \Delta \ln(m/N)_{t-1} - \underset{(2.71)^*}{0.55}\, EC_{t-1}.$$

$\bar{R}^2 = 0.79$; CRDW = 1.47; SER = 0.051.

AR: LM(2) = T.R^2: $\chi^2(2) = 4.98$; F-statistics = 4.44.
RESET: $\chi^2(2) = 1.10$; F-statistics = 1.02.
Normality: $\chi^2(2) = 0.36$.
HT(2): $\chi^2(2) = 1.94$; F-statistics = 1.90.

Savings Function

$$\Delta(S/Y)_t = \underset{(0.56)}{-0.003} + \underset{(0.68)}{0.0008}\, \Delta(\dot{y}/N)_{t-1} - \underset{(1.93)^*}{0.05}\, \Delta \ln(y/N)_{t-1}$$
$$+\underset{(4.35)^*}{0.15}\, \Delta \ln(m/N)_t - \underset{(1.90)^*}{0.74}\, \Delta DR_{t-1} + \underset{(1.45)}{0.19}\, \Delta(S_f/Y)_{t-1} \qquad \text{(A12)}$$
$$+\underset{(2.32)^*}{0.40}\, \Delta(S/Y)_{t-1} - \underset{(3.23)^*}{0.62}\, EC_{t-1}.$$

$\bar{R}^2 = 0.68$; CRDW = 1.96; SER = 0.015.

AR: LM(2) = T.R^2: $\chi^2(2) = 0.34$; F-statistics = 0.14.
RESET: $\chi^2(2) = 0.08$; F-statistics = 0.05.
Normality: $\chi^2(2) = 3.24$.
HT(2): $\chi^2(2) = 0.43$; F-statistics = 0.45.

Notes

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1. In the Keynesian view, saving rates, which are mainly dependent on the level of income, could be raised indirectly; adopting a low interest rate policy would sustain investment and income, leading to higher savings. See Deena R. Khatkhate, ‘‘Assessing the Impact of Interest Rates in Less Developed Countries,’’ *World Development* 16 (May 1988): 577–88.

2. See Ronald I. McKinnon, *Money and Capital in Economic Development* (Washington, D.C.: Brookings Institution, 1973); and Edward S. Shaw, *Financial Deepening in Economic Development* (New York: Oxford University Press, 1973).

3. For further details, see Ashfaque H. Khan and Syed Sajid Ali, ''The Demand for Money in Pakistan: An Application of Cointegration and Error-Correction Modeling,'' *Savings and Development* 21 (1997): 49–62.

4. For a detailed discussion of financial sector reforms in Pakistan, see Ashfaque H. Khan, ''Need and Scope for Further Reforms in the Financial Sector in Pakistan,'' *Journal of Institute of Bankers in Pakistan* 61 (June 1995): 41–58.

5. Ibid.

6. See Maxwell J. Fry, ''Money and Capital or Financial Deepening in Economic Development,'' *Journal of Money, Credit and Banking* 10 (November 1978): 464–75.

7. See Patrick K. Watson, ''Savings, the Rate of Interest and Growth in a Small Open Economy: The Trinidad and Tobago Experience,'' *Social and Economic Studies* 41 (December 1992): 1–24.

8. See Prem S. Laumas, ''Monetization, Financial Liberalization, and Economic Development,'' *Economic Development and Cultural Change* 38 (January 1990): 377–90; J. Thornton, ''The Demand for Money in India: A Test of McKinnon's Complementarity Hypothesis,'' *Savings and Development* 14 (1990): 153–58; and J. Thornton and S. R. Poudyal, ''Money and Capital in Economic Development: A Test of the McKinnon Hypothesis for Nepal,'' *Journal of Money, Credit and Banking* 22 (August 1990): 395–99. For a detailed survey of empirical findings on the complementarity hypothesis, see Maxwell J. Fry, *Money, Interest, and Banking in Economic Development* (Baltimore: Johns Hopkins University Press, 1988).

9. See Keith Cuthbertson, S. G. Hall, and Mark P. Taylor, *Applied Econometric Techniques* (London: Harvester Wheatsheaf, 1992).

10. For more on this issue, see Ashfaque H. Khan, ''Macroeconomic Policy and Private Investment in Pakistan,'' *Pakistan Development Review* 26 (Autumn 1988): 277–91.

11. See Fry, ''Money and Capital.''

12. This is defined as the ratio of the difference between the total population and the employed labor force to the total population. For further details, see Ashfaque H. Khan, Lubna Hasan, and Afia Malik, ''Determinants of National Saving Rate in Pakistan,'' *Economia Internazionale* 47 (November 1994): 365–82.

13. See Fry, ''Money and Capital''; and Khan, Hasan, and Malik.

14. See Khan, Hasan, and Malik.

15. An earlier study by Khan found that the results were insensitive to alternative expectations schemes, such as perfect foresight ($\lambda = 1$), static expectations ($\lambda = 0$), and adaptive expectations scheme ($0 < \lambda < 1$). See Ashfaque H. Khan, ''Financial Repression, Financial Development and the Structure of Savings in Pakistan,'' *Pakistan Development Review* 27 (Winter 1988): 701–11.

16. See C. W. J. Granger and P. Newbold, ''Spurious Regression in Econometrics,'' *Journal of Econometrics* 2 (July 1974): 111–20.

17. See Wayne A. Fuller, *Introduction to Statistical Time Series* (New York: Wiley, 1976).

18. As described by R. F. Engle and C. W. J. Granger (''Cointegration and Error Correction: Representation, Estimation and Testing,'' *Econometrica* 55 [March 1987]: 251–76), a nonstationary time series, X_t, is said to be integrated of the order d if it achieves stationarity after being differenced d times. This is usually denoted by $X_t \sim I(d)$.

19. See ibid.

20. See A. R. Kemal, F. Bilquees and Ashfaque H. Khan, ''Estimates of

Money Supply in Pakistan: 1959–60 to 1978–79,'' *Statistical Paper Series no. 1* (Pakistan Institute of Development Economics, Islamabad, 1980).

21. The DF and ADF tests applied to the level form of the variables suggest that all of the variables are nonstationary and, hence, that the estimation of eqq. (1)–(2) and (5)–(6) with variables in levels will be inappropriate. These results are not reported here, but can be obtained from us. Furthermore, we started the unit root tests on third differences and worked back through second and first differences to their levels to ensure that the variables are indeed $I(1)$.

22. The Durbin-Watson from the cointegration regression (CRDW) is yet another quick way to test the stationarity of the residual. If CRDW approaches zero, then two or more variables are not cointegrated. Under the null hypothesis of noncointegration, CRDW should be close to zero; therefore, we seek a value of CRDW that is high enough to reject the null hypothesis.

23. While the growth rates of real income and real per capita income are $I(0)$ we have kept these variables in the savings functions (b) and (d) in table 2 for their theoretical and empirical relevance for developing countries. Although these two variables are statistically insignificant in the respective savings functions, they convey a very important message for developing countries as outlined in the text. Both savings functions with all their arguments, including real income and real per capita income, are found to be cointegrated. This cointegration is shown by the DF, ADF, and CRDW statistics. At the suggestion of a referee we dropped real income and real per capita income from the respective savings functions but the overall results remained almost unchanged.

24. At the suggestion of a referee we estimated an investment function instead of the savings function along with the money demand function. Before doing so, we determined the order of integration of all the variables used in the investment function, the results of which are documented in table 1. Having found the variables to be integrated of the same order, we estimated the cointegration regressions (see [A5]–[A8] in appendix table A1). As shown in the appendix, real money demand with real income, real interest rate, and investment to GNP ratio as arguments was found to be cointegrated, but the same was not true for investment function. Private investment with real income, real money balances, real interest rate, and public investment were not cointegrated; i.e., no long-run equilibrium relationship exists between these variables. We did not pursue further for the EC model.

25. See Khan and Ali (n. 3 above).

26. See ibid.; see also Ashfaque H. Khan, ''Analysis of Saving Behaviour in Pakistan,'' *Savings and Development* 16 (1993): 209–25.

27. See Maxwell J. Fry, ''Domestic Resources Mobilization in Developing Asia: Four Policy Issues,'' *Asian Development Review* 9 (1991): 15–39.

28. See Fry, ''Domestic Resources''; and Khan, Hasan, and Malik (n. 12 above).

29. A Lagrange multiplier (LM) test is used to check for serial correlation. See Cuthbertson, Hall, and Taylor (n. 9 above) for a detailed discussion. Ramsey's RESET (regression specification error test) is used to test for the choice of functional form. See G. S. Maddala, *Introduction to Econometrics* (New York: Macmillan, 1989), p. 408, for further details on RESET. A Jarque and Bera test is used to check the normality of residuals. The test statistics follow a χ^2 distribution under the null hypothesis of a normal distribution. For details see C. M. Jarque and A. K. Bera, ''Efficient Tests of Normality, Homoscedasticity and Serial Independence of Regression Residuals,'' *Economic Letters* 6 (1980): 255–59. A White test is used to test for residual heteroscedasticity. It follows an *F*-

distribution under the null hypothesis of homoscedasticity. For details, see H. White, ‘‘A Heteroskedasticity Consistent Covariance Matrix Estimator and a Direct Test of Heteroskedasticity,’’ *Econometrica* 48 (May 1980): 817–38.

30. We started with current and more than one period lag variables, but we dropped those that had very low *t*-values.

31. Laumas (n. 8 above); Thornton (n. 8 above); Thornton and Poudyal (n. 8 above); and Fry, ‘‘Money and Capital’’ (n. 6 above).