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SAVINGS BEHAVIOUR IN SOUTH ASIA

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by

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ABSTRACT

Savings behaviour is important because of the close relation between savings and growth. Further, the direction of causality between savings and growth is of critical importance for development policy. Thus this paper presents individual country analysis of the savings behaviour in five main South Asian countries, namely India, Pakistan, Bangladesh, Sri Lanka and Nepal, using modern time series procedures. Our results show that savings in South Asia are mainly determined by income, access to banking institutions, foreign savings rate and dependency rate. The impact of the real interest rate on savings is minor and inconclusive in direction. Further, the direction of causality is primarily from income or growth to the savings rate in South Asia.

JEL Classification: E21, O16

Key Words: Savings, Growth, South Asia, Cointegraton, Causality

I. INTRODUCTION

Economic growth is among the most important factors affecting the quality of life that a people lead in a country. Given the close relation between savings and growth, the analysis of savings behaviour becomes naturally important in this context. Yet, a comprehensive analysis of the savings behaviour for many of the South Asian countries is missing. The present paper therefore, attempts to fill this gap by undertaking individual country analysis of the savings behaviour in five main South Asian countries, namely, India, Pakistan, Bangladesh, Sri Lanka and Nepal by using modern time series analysis. Further, the direction of causality between savings and growth in each of these South Asian countries is empirically examined as this has important implications for development policy.

The savings behaviour of a country has received considerable attention from previous authors as well. Among others, this includes the works of Edwards (1996), Lahiri (1989), Dayal and Thimann (1997), Schmidt-Hebbel et al. (1996; 1999), Lopez et al. (2000), Loayza et al. (2000), Baharumshah et al. (2003), Krieckhaus (2002), Ramajo et al. (2006) and Mohan, (2006). But the existing literature on savings is dominated by pooled time series cross-section or panel data on a large number of countries. However, savings behaviour shows considerable variation across countries depending upon the level of development and socio-economic structure and one cannot be sure whether the results of such pooled studies, which are applicable to the average country in the sample, apply to the particular country or region of interest. Thus, cross-country regression analysis based on the assumption of homogeneity cannot be used as a definitive study for any specific country of interest. For this reason, country studies have an importance of their own.

In the present study we have chosen to focus on the South Asia region as it is increasingly being recognized as an important emerging economic area. Furthermore, the South Asian countries (with the possible exception of India) remain relatively under-researched. Many of them (such as Nepal and Bangladesh) have had very limited research done on the savings behaviour, with even fewer studies that use modern time series analysis and undertake causality analysis. Thus, a modern time series analysis of savings behaviour in South Asia as is provided in this paper should be a useful contribution to the literature.

Further, some controversies still remain in the literature regarding the savings behaviour, an example of which is the impact that the raising of interest rates will have on the savings rate.

While some authors (see, for example, Fry 1995) have found the effect to be positive, many others have found it to be insignificant (see for example, Giovannini, 1983, 1985). On the other hand, the impact of factors such as financial development in the form of greater access to banking institutions in improving savings mobilization has hardly been analyzed except for a few countries. This factor is expected to be important for developing countries but has been largely ignored in most previous studies[i]. Also, most of the South Asian countries have comparatively low rates of savings (with the possible exception of India), so that a proper analysis of savings behaviour would help to better understand the determinants of savings in South Asia and thereby suggest ways to improve the savings rates.

The present paper takes into account a comprehensive set of relevant explanatory variables that can be expected to be the main determinants of savings behaviour. These include income, growth rate, dependency rate, foreign savings rate, share of agriculture in the GDP (to account for the possibility of a different savings rate for the agriculture sector), real interest rate, inflation rate, banking density (a measure of access to banking) and financial sector development. It also provides the estimation of both total and private savings rates over a relatively longer period than most previous studies of these countries. Thus we hope that our study might provide new insights into the savings behaviour in South Asia.

An examination of the ***direction of causality*** between the savings rate and GDP growth rate is also of considerable importance for development policy. For, if savings drive growth through an automatic translation of savings into capital formation, then the main goal of development policy should be to increase savings, while if growth results less from savings and capital formation and more from other factors such as policies relating to technological innovation, human capital, international trade or foreign direct investment, then they should be the main targets of development policy. The controversy about the savings-growth nexus can be grouped into two leading schools. The "growth theorists" (such as Harrod 1939, Domar 1946, Romer 1986 and Lucas 1988) assume that all savings is automatically invested and translated to growth. Thus, Savings leads to Growth. On the other hand, the consumption theorists (Modigliani 1970, 1986; Deaton and Paxson 1994, 2000; Carroll and Weil 1994) argue that income and its growth determines consumption and thence, savings. These two schools of thought are further explained below.

The theoretical underpinnings of the relationship between savings and growth can be traced to the early growth models of Harrod (1939) and Domar (1946) which assumed that output Y was proportional to the capital, $Y = A\ K$ where A is a constant and imply that growth rate of output would be proportional to the investment and savings rate. Formally,

$$dY/dt \;=\; A\,dK/dt \;=\; A\,sY \tag{1}$$

where $(dK/dt)/Y$ is the investment rate, assumed to equal savings rate, s. Thus,

$$\text{Growth} = (dY/dt)/Y \;=\; A\,s \tag{2}$$

In a two-factor growth model, labour per unit of output is added in a full employment economy with labour growing at an exogenous rate. Since labour requirement is not a binding factor in the context of developing countries of South Asia, which often have unlimited supplies of labour, growth would be proportional to the savings rate. Therefore, Lewis (1954) and Rostow (1960) emphasized that a higher rate of savings would lead to higher economic growth. On the other hand, Solow's (1956) celebrated growth model, which assumes decreasing marginal returns to capital and allows substitution between capital and labour, concludes that growth eventually stops but the economies with a higher savings rate enjoy a higher steady state income (though not growth). The endogenous growth models (Romer1986; Lucas 1988), which return to the Horrod-Domar assumptions of constant returns to capital implied in (1) (*albeit* with much better explanations for it), again come to the conclusion that higher savings and investment rates lead to a higher growth rate of output. Thus, growth theories imply that higher savings rates should lead to higher growth rates, at least if the economy is below the steady state rate of output.

On the other hand, consumption theories, such as the permanent income and life cycle hypotheses, imply the reverse direction of causality, i.e., they imply that people choose their consumption (and thence also savings) levels depending on current and (expected) future income levels. Modigliani (1970) has argued that the simple version of life-cycle hypothesis implies a positive relation between savings and income growth. He notes that if there were no income and no population growth across generations, the savings of the young would exactly balance the dis-saving of the old and the aggregate savings rate would be zero. Because income growth makes the young richer than the old, the young will be saving more than the old will be dis-saving, resulting in the positive association between savings and growth. However, Carroll and Weil (1994) have argued that, ceteris paribus, an exogenous increase in the aggregate growth will make forward looking consumers feel wealthier and thus consume more and save less - thus implying that the impact of income growth on savings could be negative. On the other hand, if consumption is habit based and changes slowly in response to changing income, a larger fraction of increases in income may be saved resulting in the savings rate increasing with income increases (Carroll and Weil 1994). The buffer stock model of savings (Deaton 1991; Carroll 1992) also yields a similar relation between savings and growth.

Thus the theoretical literature is unclear about both the direction of causality between the savings rate and income or growth and about whether the association between savings and growth should be positive or negative.

On the empirical side, while most of the studies (see those listed earlier) have the found the relation between the savings and growth to be positive, there is no clear conclusion about the direction of causality between the growth rate and savings rate. While some studies (Morande 1998; Muhleisea 1997; Cardenas and Andres 1998; and Sinha 1999; Krieckhaus 2002; Ramajo 2006) have found the causality running from savings to economic growth, others (Carroll and Weil 1994; Sethi 1999; Saltz 1999; and Chaudhri and Wilson 2000; Agrawal 2001; Mohan 2006) have found that growth determines savings. Moreover, most of the previous studies relating to savings behaviour have concentrated on specific regions like East Asia (Agrawal 2001; Fry 1995; Lahiri 1989), North Africa (Jbili et al. 1997), and Latin America (Melo and Tybout 1986). However, there is no existing study for South Asian countries together. This study fills the gap by doing a systematic study on savings behaviour and the direction of causality between savings and growth for South Asia.

The rest of the paper is structured as follows: In Section II, we report the determinants of savings in South Asia along with a brief review of the trends in savings in South Asia over the period 1960 to 2005; in Section III, we briefly explain the econometric procedures used in the paper; in Section IV, we present the results of our empirical analysis, and in Section V, we summarize the main conclusions and policy implications of our analysis.

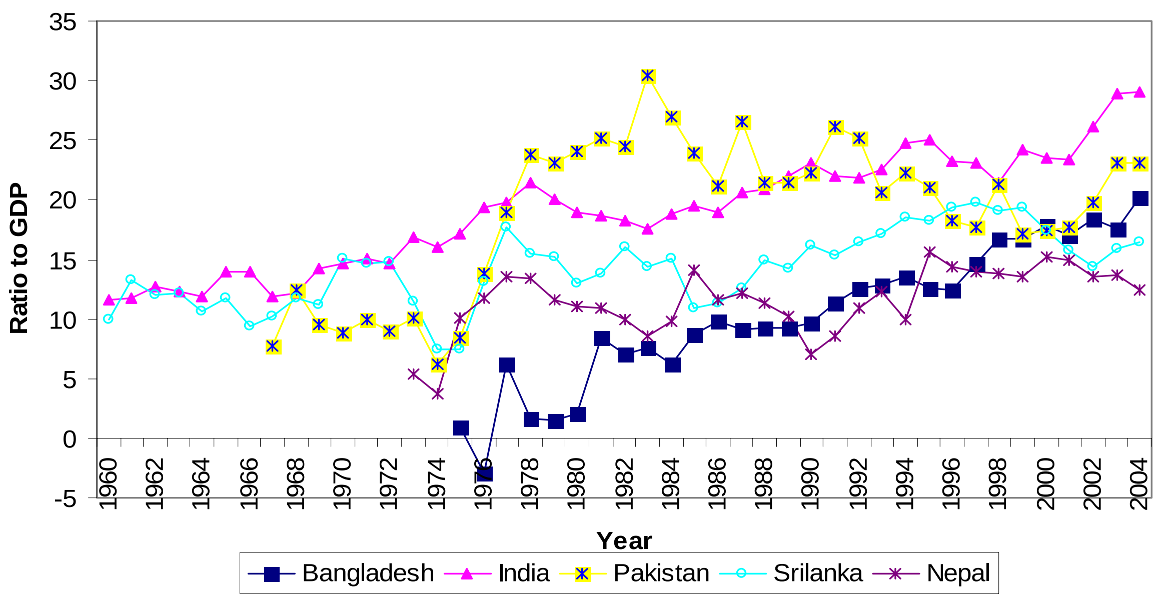
II. DETERMINANTS OF SAVINGS IN SOUTH ASIA

In this section, we briefly consider the trends in savings and various determinants of savings for South Asian countries and specify the savings functions for total and private savings rates.

II.1 Trends in Savings in South Asia

Trends in the total savings ratio for South Asian countries are presented in Figure 1. It is seen that generally, the savings rate in South Asia lies in the low to medium range and is comparatively lower than in some other developing countries, particularly China and in countries of East/ South East Asia where the savings rates are in the range of 30 to 40 %. The figure shows that among the South Asian countries, the total savings rate is highest for India for which it increased from 12 % in 1960 to 23% in 1990 and further increased to 29% by the end of 2004-05.

Figure 1: Trends in Total Savings Ratio in India, Pakistan, Bangladesh, Sri Lanka and Nepal.



Source: Authors Chart based on data from WDI 2006 CD-ROM.

The savings rate of Pakistan was among the highest in South Asia[ii] in the 1970s but has had a declining trend from 1983 to about 2000. It shows some recovery since 2000 and by 2004 it was the second highest in South Asia. For Sri Lanka, the savings rate was almost equal to that of India during the 1960s, but since the mid 1970s, it has come down and been close to the average or middle range (about 15 %) among the South Asian countries. It has dipped further over the last 10 years and is now the second lowest in South Asia.

It is seen that while Bangladesh had the lowest savings rate in South Asia over the 1970s, its savings rate has risen rapidly since then and was the third highest in South Asia (after India and Pakistan) over the years 1999 to 2004. Nepal's savings rate was relatively high in comparison to Bangladesh during 1970s, but the rate has remained stagnant over the 1980s and shows a declining trend for the last 5-6 years, when it also had serious political disturbances. As a result, it now stands at the lowest in South Asia. Overall, the savings rate in South Asia is seen to be in the low to medium range.

II.2 Determinants of Savings Rate in South Asia

A proper estimation of the savings function for South Asian countries and the investigation of the direction of causation between savings and growth require that other major factors affecting the savings rate also be taken into account. Since, the time series of a length sufficient to permit a proper econometric analysis has become available only recently for countries like Bangladesh, Nepal and Pakistan, it should be of interest to estimate the savings function for these countries taking all the relevant factors into account. The various factors affecting the savings rate and how these factors are measured and used for the purpose of undertaking econometric estimations and the likely signs of their coefficients[iii] are described below. This is followed by a specification of the savings function to be estimated.

Savings Rate (GDSY)

The savings rate is measured as the ratio of Gross Domestic Savings[iv] (GDSY) in current prices to Gross Domestic Product (Y) in current prices. Similarly, the private savings rate is measured as the ratio of private Gross Domestic Savings (GDSpvt) to Gross Domestic Product. Gross Dmestic Private savings (GDSpvt) is calculated by deducting Gross Domestic Public savings (GDSpb) from Gross Domestic Savings**.** Finally, Gross Domestic Public Savings (GDSpb) is calculated as total government revenue less current government expenditure.

Real Income per Capita (RYPC) and GROWTH Rate:

As discussed previously in the introduction, the neoclassical growth models (Solow, 1956) imply that higher savings rate will lead to higher steady state levels of income (or output) per capita, while the endogenous growth theory models imply that higher savings rates would lead to higher levels of growth of income per capita. Thus in general, both the variables should be considered. The real (in constant domestic prices) Gross Domestic Product (GDP) per capita is used as a measure of real income. The growth rate of GDP per capita is used as a measure of the growth rate (denoted by GROWTH). As discussed previously, the expected sign of the coefficient of income per capita, YPC, is positive, that of GROWTH is analytically ambiguous, though more likely to be positive.

Demographics (DEPEND)

Aggregate savings is affected by the age distribution of the population if the share of inactive or dependent population is high, the savings ratio will be low. According to the life-cycle hypothesis a larger working population relative to the older population contributes to raise the savings rate. We use the age dependency ratio (*DEPEND*), the share of dependent age population (aged below 15 or over 64 years) to the working age population (aged 15 to 64 years), as a reasonable proxy to capture this effect. The expected sign of the coefficient of DEPEND is negative (Lahiri 1989; Bosworth 1993; Loayza 2000; Ramajo, 2006).

Foreign Savings as Share of GDP (FSY)

Greater availability of foreign savings may encourage more consumption, and reduce savings. Thus in case of foreign borrowing constraints, additional foreign savings is likely to lead to higher consumption and lower domestic savings. That is, foreign and domestic savings are likely to be substitutes (see Fry 1995; Schmidt-Hebbel and Serven 1999). The variable FSY used in the relation to be estimated is the negative of the current account balance as a proportion of the GDP. The expected sign of its co-efficient is negative.

Share of Agriculture in GDP (AGRY):

The rural or agricultural sector of the economy can display different savings behaviour than the urban/industrial sector, especially in the case of developing countries like the South Asian countries, with large agricultural sectors. The agricultural sector could have a different savings rate due to a lower access to the banking system and because of lower and unstable incomes in the agricultural sector. While the first two facts should lower the savings rate, the greater instability of income could increase the savings rate to cope with the greater instability. Thus, the overall effect of this variable could be either negative or positive.

Financial variables and Savings Rate:

The previous literature on savings functions (Dayal and Thimann 1997; Edwards 1996; Johansson 1996) has found a positive impact of financial sector reforms on savings. Deeper financial markets and prudential regulations of financial institutions improve the savings rate by offering a wider variety of financial instruments to channel savings and also by providing more security to savers. In this context, we have included some analysis of the impact of financial sector development on the savings rate using variables like bank density (bank branches per million of population) and ratio of broad money to GDP. We also consider the real interest rates and inflation rates.

Bank Branch Density (BOPM):

In order to enable a person to save the full amount he wants to save, access to appropriate financial instruments, such as bank time deposits at reasonable interest rates, is obviously important. Such access is not always available in developing countries such as the South Asian countries, especially in the rural areas. Here the access to banking is proxied by the number of bank offices per million inhabitants. *A priori* we expect this variable to have a positive co-efficient and to be more important in determining the private rather than the total savings rate.

Financial Sector Development (M2Y):

The savings ratio could depend on the level of financial sector development since that affects the access to appropriate savings instruments. Since bank deposits are the principal financial instruments in developing countries of South Asia, we use the ratio of broad money M2 to GDP (M2Y) as an alternative measure of financial development, somewhat similar to the number of banking density variable (BOPM).

Real Interest Rates (RD):

Analytically, an increase in interest rates will have an ambiguous effect on savings because of a positive substitution effect towards future consumption and a negative income effect due to increased real returns on saved wealth. Empirically, Fry (1995) has found a small but positive interest rate elasticity of savings while Giovannini (1985) has found savings to be insignificantly related to real interest rates. The empirical evidence on the effects of interest rates on savings has proven to be inconclusive (see Schmidt-Hebbel and Serven 1999). In view of this controversy in the literature, it is of interest to evaluate the interest elasticity of savings in South Asia. We have proxied the real expected interest rate on savings by the real interest rate on one-year time deposits with banks. The real interest rate on bank deposits is the relevant rate of real return for most households and even firms in developing countries.

Inflation Rate (INFY):

An increase in the inflation rate can impact income or wealth negatively, which can lower savings. It can also lower the real interest rate, which can have an ambiguous effect on the savings rate. Further, an increase in variability of inflation rate (which usually accompanies a higher level of inflation) is often treated as a proxy for macroeconomic uncertainty. The increased macro uncertainly due to increase in inflation rate may induce people to save more for precautionary motives. Therefore, analytically, the overall impact of an increase in inflation on the savings rate is ambiguous. We include the expected inflation rate as an explanatory variable to empirically examine its impact on the savings rate.

Other variables not included here:

The basic life cycle model suggests that the *net wealth* per capita of the private sector (and variations in its value due to capital gains and losses) should be a determinant of savings. However, data on proper measures of wealth were not available for South Asian countries. Another variable that is often considered relevant in savings functions is the ratio of *expenditure on social security and welfare* as a proportion of GDP (higher social security and welfare expenditures of the government reduce the private savings due to reduced need to save for old age, etc.). However, in case of South Asian countries, the social security and welfare system are poorly developed and cover a very small fraction of the population. Further, systematic data is generally not available. Hence this variable was not included in our analysis.

The Proposed Savings Functions:

The relation between the total domestic savings rate, growth and other relevant variables[v] is proposed to be as follows:

$$GDSY = a_0 + a_1\,RYPC + a_2 GROWTH + a_3\,RD + a_4\,DEPEND + a_5\,FSY + a_6\,BOPM + a_7\,M2Y + + a_8\,AGRY + a_9\,INFY + e \qquad (1)$$

In the case of private savings function also, the above variables are important. In addition, the public savings rate is also included and is expected to have a negative coefficient (for example, an increase in government tax revenue would increase public savings but decrease private savings). Also of interest here is whether an increase in public savings leads to an equal, larger or smaller decrease in private savings. Thus, the proposed private savings function is:

$$GDSpvtY = a_0 + a_1\,RYPC + a_2 GROWTH + a_3\,RD + a_4\,DEPEND + a_5\,FSY + a_6\,BOPM + + a_7\,M2Y + a_8\,AGRY + a_9\,INFY + a_{10}\,GDSpY + e \qquad (2)$$

III. ECONOMETRIC ISSUES

The empirical analysis being undertaken here has two goals. The first objective is to estimate the savings functions for South Asian countries. The second is to investigate the direction of causality between the savings rate and growth or income level. It is well known by now (see Engle and Granger, 1987; Banerjee et al. 1993) that when the variables of interest exhibit unit roots, the procedures of classical econometrics break down. Thus, in order to decide on the appropriate procedure of estimating the savings function and testing the direction of causality, one needs to first consider the order of integration of the relevant variables and then decide on the appropriate procedure to use.

III.1 Order of integration of the variables

We use the Augmented Dickey Fuller (ADF) test (see Dickey and Fuller 1981) to examine whether there exists unit root in each variable. The results of our testing are shown in Table 1. It is seen that all savings rates (the dependent variables in various estimations) are integrated of order 1 {denoted, I (1)} except in the case of Bangladesh. Most of the explanatory variables are also I (1) variables, with a few stationary or I (0) variables mixed in. However, in the case of Bangladesh, practically all the variables are stationary in levels.

III.2 The Estimation Procedures

Given this dominance of I (1) variables, at least in the case of India, Pakistan, Sri Lanka and Nepal, the cointegration procedures are appropriate. For more reliable results we have used two separate estimation procedures: (i) The ECM co-integration procedure recently proposed by Banerjee, Dolado and Mestre, 1998, and (ii) the Dynamic OLS (DOLS) procedure of Stock and Watson, 1993. The ECM procedure provides a more reliable test of co-integration as well as an unbiased estimate of the long-run relation when the explanatory variables are weakly exogenous for the parameters of interest. The Dynamic OLS procedure has been shown to provide unbiased and asymptotically efficient estimates of the long-run relation, even in the presence of endogenous regressors. Further, comparing the estimates obtained by the above two procedures would provide some information about whether any explanatory variables are actually endogenous or not. Since GROWTH is essentially the first difference of income per capita, and the lags and leads of the first difference variables are already included in the ECM and DOLS procedures, we did not include GROWTH as a separate variable in the estimation of savings functions in these countries.

However, in the case of Bangladesh, the dependent variables, both total and private savings rates, are stationary at level. Thus in this case, both these econometric procedures could not be applied to estimate savings behaviour of Bangladesh as they are applicable only for non-stationary dependent variables. Instead, we have employed the Autoregressive Distributed Lag Model (ARDL) in the case of Bangladesh and as practically all the variables are stationary while income is not, income seems unlikely to form a long-run equilibrium with the other variables. Thus we only included GROWTH in the estimation in this case.

A brief description of the ECM & DOLS procedures follows. The description of the ARDL procedure, used for only one country, is relegated to Appendix A.

***The ECM procedure*:**

It provides a more reliable test of co-integration (than the static OLS procedure) and simultaneously yields less biased estimates of the long run relationship among the variables – weak exogeneity of the regressors for the parameters of interest being a sufficient condition for OLS to provide asymptotically efficient estimates. Let Y (a scalar) and X (a k-dimensional vector in general) be I (1) processes that are co-integrated. Then in the static OLS (first step of Engle and Granger 1987), the Dickey- Fuller test of co-integration is based on the t-statistic of the coefficient of β in the regression:

$$\Delta Y - \lambda^{s\prime} \Delta X = \beta (Y_{-1} - \lambda^{s\prime} X_{-1}) + e_1 \qquad (3)$$

where λ^s is a k-dimensional vector of coefficients of X, estimated by the static OLS and a prime ($\prime$) on a vector denotes its transpose. Banerjee et al. (1998) point out that the ECM regression,

$$\Delta Y = \alpha' \Delta X + \beta (Y_{-1} - \lambda' X_{-1}) + e_2 \qquad (4)$$

is the more general form of equation 3 that does not impose the potentially invalid *common factor restriction,* $\alpha = \lambda$, and is therefore likely to yield more accurate results. More generally, when X may be only weakly exogenous to the parameters of interest, Banerjee et al. suggest estimating the following (unrestricted) ECM regression by OLS (inclusion of ΔX_{t+j} terms take care of the possibility of endogeneity of X, i.e., feedback from Y to future values of X (see Banerjee et al.1998):

$$\gamma(L)\Delta Y_t = \alpha(L)' \Delta X_t + \beta Y_{t-1} + \theta' X_{t-1} + \sum_1^s a'_j \Delta X_{t+j} + \varepsilon_t \qquad (5)$$

where $\gamma(L)$ and $\alpha(L)$ are polynomials in the lag operator, L. When β exceeds the critical values (which depend upon the number of I(1) variables and deterministic components but is independent of the number of dynamic terms), the null hypothesis of non-co-integration is rejected. In this procedure, the long-run relationship, $Y = \lambda^{e\prime} X$, is also simultaneously estimated. The vector of coefficients ($\lambda^{e\prime}$) of X by this ECM procedure are given by,

$$\lambda^e = \theta^e / \beta. \qquad (6)$$

In finite samples, the long-run estimates, λ^e, obtained by this method often has considerably less bias than the estimates, λ^s, obtained by static OLS (see Banerjee et al. 1998). Further, inference on the significance of the coefficients is facilitated by the fact that (unlike the case of static OLS coefficients, λ^s) the t-statistic of the coefficients λ^e have asymptotic normal distribution, if the explanatory variables are weakly exogenous.

***The Dynamic OLS (or DOLS) procedure*:**

This procedure, developed by Saikonnen (1991) and Stock and Watson (1993), has the advantage that the endogeneity of any of the regressors has no effect, asymptotically, on the robustness of the estimates. Further, statistical inference on the parameters of the co-integrating vector is facilitated by the fact that the t-statistics of the estimated co-efficient have asymptotic normal distribution, even with endogenous regressors (Stock and Watson 1993). This procedure also allows for direct estimation of a mixture of I (1) and I (0) variables. It is asymptotically equivalent to the maximum likelihood estimator of Johansen (1988) and has been shown to perform well in finite samples (Stock and Watson 1993); this is important for us given the limited data availability for each country. One limitation of this procedure is that, so far, there is no direct test of co-integration while using the DOLS procedure. Thus, the procedure is often supplemented by some alternative procedure to test for co-integration among the variables, such as the ECM procedure used in this paper. The DOLS procedure incorporates the lags and leads of the first differences of the I(1) variables. Thus estimation of the long-run relation between Y and X is carried out with a regression of the type:

$$Y = \lambda^{d\prime} X + \Sigma_{-n}^{n} a_i \Delta X_{t-i} \tag{7}$$

where λ^d denotes the vector of long run coefficients of X using the DOLS procedure. The inclusion of ΔX_{t+j} terms take care of the possibility of endogeneity of X, i.e., feedback from Y to future values of X (see Stock and Watson 1993).

III.3 The Causality Analysis

It is seen from Table 1 that all the savings rates are integrated of order 1 expect Bangladesh. The, real income per capita is also I (1), while growth of income per capita is I (0). Econometric theory suggests that causal relations are likely between variables that are integrated of the same order. On the other hand, as discussed earlier, the theoretical literature suggests that the causal relation could be between savings rate and either growth or income per capita. Thus, we will carry out the causality analysis between the savings rates and income per capita. The causality testing procedure that is appropriate when both variables of interest are I (1) is the vector error correction (VECM) procedure.

Following Granger (1969), an economic time series Y_t is said to be "caused" by another series X_t if the information in the past and present values of X_t helps to improve the forecasts of the Y_t variable, i.e. if,

$$MSE(Y_t \mid \Omega_t) < MSE(Y_t \mid \Omega_t')$$

where MSE is the conditional mean square error of the forecast of Y_t, Ω_t denotes the set of all (relevant) information up to time t, whilst Ω_t' excludes the information in the past and present X_t. The conventional Granger causality test involves specifying a bi-variate pth order VAR. The procedure for testing the direction causality becomes more complex when the variables X_t and Y_t have unit roots. In such cases, it is useful to re-parameterize the model in the equivalent error correction (ECM) form as follows (see Engle and Granger 1987; Johansen 1988):

$$\Delta Y_t = \eta + \sum_{i=1}^{p-1} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{p-1} \beta_j \Delta X_{t-j} + \Theta(Y - \kappa X)_{t-1} + U_t \qquad (8)$$

$$\Delta X_t = \eta' + \sum_{i=1}^{p-1} \gamma_i \Delta Y_{t-i} + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \Phi(Y - \kappa X)_{t-1} + U_t' \qquad (9)$$

where the lagged ECM term $(Y\text{-}\kappa X)_{t\text{-}1}$ are the lagged residuals from the co-integrating relation between Y and X (this term is not included in case the variables are not co-integrated). As Engle and Granger (1987) and Toda and Phillips (1993) have argued, failure to include the ECM term will lead to mis-specified models which can lead to erroneous conclusions about the direction of causality. Thus if Y_t and X_t are I (1) and co-integrated, causality tests can be carried out using (8) and (9). However, there are two sources of causation of Y_t by X_t, either through the lagged dynamic terms ΔX_t if all the β_i are not equal to zero, or through the lagged ECM term if θ is non-zero (the latter is also the test of weak exogeneity of Y, see Engle et al. 1983). Similarly, X_t is caused by Y_t either through the lagged dynamic terms ΔX_t (if all the γ_i are not equal to zero), or through the lagged ECM term (if Φ is non-zero). Thus this procedure has the additional advantage that the source of causation can be identified in the form of either short-run dynamics or long term dis-equilibrium adjustment.

III.4 Data Considerations:

The data on Gross Domestic Savings (GDSY), Real Per Capita Income (RYPC), Foreign Savings (Current Account Balance, rate of inflation (INFY), Age Dependency Ratio (Depend) and the share of agriculture (AGRY) are taken from the World Bank's World Development Indicators (CD version, 2005 and 2006). However, the data on Gross Domestic Savings (GDSY), Gross Private Domestic Savings (GDSpvtY) and Gross Public Domestic Savings (GDSpbY) for India is taken from the Economic Survey of India 2005-06. Similarly, data on Gross Private Domestic Savings (GDSpvtY) and Gross Public Domestic Savings (GDSpbY) for Bangladesh, Pakistan, Sri Lanka, and Nepal is taken from their respective National Statistics.

The data on real interest rates (RD), bank branches per million (BRANCH), and fiscal variables are taken from their respective Central Bank publications.

IV. EMPIRICAL RESULTS

We first present the estimated savings functions for the five South Asian countries under consideration and then the results of the tests of the direction of causality between savings rate (both total and private) and income per capita or its growth rate.

IV.1 Estimation of Savings Rate Functions

As noted in the previous section we have used different procedures for estimating the savings functions depending on whether the savings rate is integrated of order one or zero. The estimation has been carried out using the Error Correction Model (ECM) procedure of Banerjee et al (1998) and the dynamic OLS (DOLS) of Stock and Watson (1993) where most of the variables are non-stationary as is the case with all countries except Bangladesh for which the Auto Regressive Distributed Lag (ARDL) procedure of Pesaran and Shin (1998) has been used. It was found that the ECM test for co-integration rejects the null hypothesis of non-cointegration and suggests the presence of a long-term relation among the variables for each of the four South Asian countries, viz., India, Pakistan, Sri Lanka and Nepal. Further, various diagnostic tests of the full estimations, including the Lagrange multiplier test of residual serial correlation, the Ramsey RESET test for functional form mis-specification, the Jarque-Bera test for the normality of residuals and Engle's autoregressive conditional heteroscedasticity (ARCH) test were also carried out. These tests (reported in Appendix B) suggest that we had robust and reliable estimations.

The long-run relations obtained using these procedures are shown in Table 2 and 3 while the details of full ECM, DOLS and ARDL estimations are reported in Appendix B. The ECM procedure involved up to second order lags of the dynamic terms and first order in leads of dynamic terms:- a higher order was usually not feasible given that we usually had 30 to 45 annual observations available for each country. Similarly, the Dynamic OLS was carried out with up to second order of lags and leads in dynamic terms. Though we began the estimation procedure by including all the relevant variables for estimating the savings functions, the insignificant terms were dropped. Thus, some of the variables dropped out in the final estimations.

In the case of Bangladesh, we used the ARDL procedure because practically all the variables were stationary. In this procedure, the F-test statistic is used to examine the existence of stable long-run relationship. The estimated F-statistic for the appropriate parsimonious form in the case of the total savings function, denoted, $F_{GDSY,}$ was found to be 82.36, which is much higher than the upper bound critical value at 1 % level (see Pesaran and Shin, 1998). Thus the null hypothesis of non-existence of a stable long-run relationship was rejected. The optimum order of ARDL was found to be (1, 1, 1, 1, 2), selected on the basis of Akaike Information Criteria (AIC). Similarly for the private savings relation, the order of ARDL for private savings was found to be (1, 1, 1, 1, 2, 0) on the basis of the AIC criterion and the estimated F-statistics $F_{GDSpvtY}$ = 74.97 is significant at the 1 % level, which rejects the null hypothesis of the non-existence of a stable long-run relationship.

The long-run relations obtained for total and private savings rates for each of the five South Asian countries are reported in Tables 2 and 3, respectively. A brief discussion of the impact of the main variables found to have a considerable role in determining the savings rate is provided below.

The coefficient of Real Per Capita Income (RYPC in constant US dollars, the base year being 2000) is significantly positive for all the five countries[vi]. Though the coefficients are small for India, Pakistan, and Sri Lanka, they are relatively large for Nepal but it needs to be remembered that the corresponding increases in per capita income are rather small in the case of Nepal. As discussed earlier, in the case of Bangladesh. We have used Growth of per capita income instead of income itself. The coefficient of Growth is rather large (0.92), positive and significant, suggesting a 1 % increase in the growth rate is likely to increase savings by about 0.92 %. Overall, we find that the increase in real per capita income increase savings rate in South Asian countries supporting consumption theories and previous studies for example Schmidt-Hebbel and Serven (1999) and Carroll and Weil (1994). Whether the direction of causality is from income to savings rate or vice versa is an issue we explore in the latter part of this section.

As mentioned earlier, the theoretical and empirical literature is not clear about the impact of the real interest rate on the savings rate. We too find mixed results for South Asian countries. The real interest rate, R_d, has a negative and significant coefficient for India and Pakistan; insignificant coefficients for Sri Lanka and positive and significant coefficients for Bangladesh and Nepal. The coefficients are relatively small for South Asian countries except Bangladesh (a 1 % increase in real interest rate will increase the savings rate by about 0.2 to 0.3 % of GDP). The fact that the coefficient of interest rates are so small suggests that the interest rates are not likely to be a significant influence on the savings rates since it is rarely possible for the government or central bank to change them by more than 1 or 2 %.

We have also analyzed the effect of improved access to banking facilities. This provides an important instrument for savings to a population a good part of which previously had no safe savings instrument (except "stuffing the money in your mattress"). While access to banking may also increase access to credit and may induce some to borrow, but on the whole, households, are the major net savers in the economy and will be the main beneficiaries of increased access to banking. Thus, the net result of increased access to banking on the savings rate should be positive. This argument finds empirical support from our results as the coefficients of banking density (BOPM): a measure of the access to banking facilities is positive and significant for all the countries (except Nepal, for which the coefficient is insignificant). Thus it can be said that a well developed banking system throughout the country improves the savings rate in South Asian countries.

Foreign savings rate (FSY) is seen to have a significant negative impact on each of savings rates for both procedures as expected. This is probably due to larger availability of foreign savings leading to greater consumption, especially of imported goods. Many developing countries of South Asia have foreign credit constraints to manage their macroeconomic stability and continued reforms. Thus, additional foreign savings lead to higher consumption and, ceteris paribus, lower domestic savings.

Though demographic or age structure of the population, as captured by the dependency ratio is generally found to be an important determinant of savings in cross section or panel studies, it often presents unreliable results in time series analysis because of its strong and negative correlation with income per capita. We too found the dependency ratio (DEPEND) to be strongly correlated with income per capita in the case of India, Pakistan and Sri Lanka. We therefore dropped this variable from our estimations in the case of these countries, but given its strong and negative correlation with income per capita, its co-efficient can be assumed to be negative. Further, in the case of Bangladesh and Nepal, where it was NOT highly correlated with real per capita income, we did include it in our estimations and found the coefficient to be negative. Thus the long-run coefficients of the dependency ratio can be thought to be negative for all countries of South Asia implying that a decline in the dependency rate increases both the total and private savings rates. Indeed the sharp increase in the savings rate in Bangladesh is largely due to the rapid decline in the dependency rate there.

Other variables like Share of agriculture in GDP, Inflation, and the ratio (M2Y) of broad money to GDP were included in the estimations of each of the countries. However, they were found to be insignificant and were dropped from the final estimations.

A similar exercise was also carried out for private savings and the results are reported in Table 3. It is seen that the results of the impact of various variables are essentially the same as in the case of total savings. The only difference is that in this case we also include public savings rate as an additional determinant of the private savings rate. This is sensible since policy relating to taxation and expenditure (especially on social security, health and education), which affect public savings, also affects the level of private savings. As expected, we find that the public savings rate has a negative and statistically significant relationship with private savings for all the countries (except Nepal where it is insignificant). The coefficients are quite large for India, Pakistan, Sri Lanka and Bangladesh. This is expected because higher tax collections and lower expenditure on social sectors, which will increase public savings will have an opposite effect on the private savings by reducing the disposable income per capita and increasing the need to save for old age, sickness and children's education, etc.

IV.2 Direction of Causality between Savings Rate and Income

So far we have seen that the savings rates are strongly correlated with income per capita or its growth rate. In this section, we present the empirical evidence on the direction of Granger causality between savings and growth or income per capita.

For most of the South Asian countries, namely India, Pakistan, Sri Lanka and Nepal, the savings rate is integrated of order one. In this case, we use the income per capita (and not growth, as explained earlier) as an explanatory variable. In Tables 2 and 3, we have seen that the savings rate is co-integrated with the real income per capita along with other variables. When two or more variables Y and X (X represents either one or a vector of explanatory variables) are co-integrated, there necessarily exists causality in at least one direction (Granger 1987). The direction of causality can be tested using the VECM procedure described in Section III. For the purpose of this causality analysis we have focused only on the I(1) variables in each country, and dropped the I(0) variables. The cointegrating vector was estimated using the static OLS and the ADF test on residuals showed cointegration among the variables[vii]. The results of the causality analysis using the vector error correction mechanism (VECM) are shown in Table 4 for both total and private savings rates. We have used the Akaike Information criterion to select the lag length of the VECM. It is seen that for all four countries and for both total and private savings rates, there is evidence of increasing income leading to increasing savings rate, mainly through the disequilibrium mechanism, that is, through the lagged ECM term.

[Insert Table 4]

For the remaining country, Bangladesh, for which the VECM approach was not applicable as all the variables are stationary, we used the VAR approach to analyze the direction of Granger causality (see Section III). The results are shown in Table 5. The lag length for the VAR was chosen by minimizing the Akaike information criterion (AIC). It is seen that the direction of Granger causality is bi-directional, both from growth of income per capita to the savings rate and from savings to growth.

To summarize, we found evidence that the high growth rate or increasing real income per capita did Granger cause the savings rates in all 5 South Asian countries considered here. In one country, namely Bangladesh, we also found evidence of simultaneous reverse causality from savings rate to growth. Thus, while the causality runs primarily from high growth to high savings rate, occasionally, there also exists a feedback effect with high savings rates leading to high growth or high income per capita as well. We did not find any South Asian country exhibit causality running from savings rate to growth. This suggests that there is no need to be overly concerned with the savings rates in South Asia as the savings rates do not determine the growth rate but are in fact determined by it. The recent increase in the savings rates in India from the usual 23-24 % to about 30 % following an approximate 5 year period of over 8 % growth of real GDP only illustrates this phenomenon.

V. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, we have analyzed the behaviour of the savings rate in five South Asian countries. First we find that the savings rates and relevant determinants have a long-run co-integrating relationship. Our econometric analysis shows that the main factors positively affecting the total savings rate in these countries are income per capita or its growth rate and access to banking facilities. We also find that dependency ratio and availability of foreign savings have a statistically significant negative effect on savings. Thus the recent increase in savings rates in South Asia is largely explained by the increasing per capita income or growth, declining dependency rates (fewer children per couple) and improved availability of banking facilities. The real interest rate affects the savings rate positively but negligibly in Bangladesh and Nepal but negatively in India, Pakistan and Sri Lanka. Our analysis suggests that trying to influence the savings rates by manipulating interest rates is not likely to be a practical policy option in these countries as interest rate changes have only a minor impact on the savings rates. However, greater use of foreign savings (capital account deficits) can reduce domestic savings and do need to be controlled, especially if it is due to increases in imports of consumption goods. Results are also similar for private savings with an added variable, public savings rate, which is found to have a negative and significant impact on private savings in all South Asian countries except Nepal.

An important focus of this paper was on the Granger causality analysis to test whether the higher savings rates cause higher growth rates or vice versa in the countries under consideration. We found strong evidence that increasing the direction of causality was mainly from income to savings, i.e., higher real income per capita Granger caused higher savings rates in all five South Asian countries (with bi-directional causality between savings and growth in the case of Bangladesh). These results suggest that governments or central banks need not be excessively concerned with the savings rates.

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Table-1: Results of ADF test for Unit Roots in Various Variables

Variables	India		Pakistan		Sri Lanka		Bangladesh		Nepal	
	ADF Test	Order of Integration	ADF Test	Order of Integration	ADF Test	Order of Integration	ADF Test	Order of Integration	ADF Test	Order of Integration
GDSY	-0.50	I(1)	-2.34	I(1)	-2.18	I(1)	-4.85*(t)	I(0)	-2.53	I(1)
DGDSY	-5.30*		-6.37*		-5.74*				-6.33*	
GDSpvtY	-3.11(t)	I(1)	-2.15	I(1)	-1.78	I(1)	-3.27***	I(0)	-2.75	I(1)
DGDSpvtY	-5.89*		-5.46*		-5.58*				-5.54*	
GDSpbY	-1.11(t)	I(1)	-1.81	I(1)	-3.17*	I(0)	-0.98	I(1)	-1.69	I(1)
DGDSpbY	-4.54*		-8.09*				-4.31*		-3.54*	
RD	-4.14*	I(0)	-3.18*	I(0)	-4.48*	I(0)	-4.14*	I(0)	-6.00*	I(0)
RYPC	4.99	I(1)	0.41	I(1)	3.55	I(1)	-	-	1.03	I(1)
DRYPC	-5.13		-4.55*		-4.50*		-	-	-5.23*	
Growth	-6.46*	I(0)	-5.68*	I(0)	-5.67*	I(0)	-4.26*	I(0)	-5.44*	I(0)
FSY	-1.83	I(1)	-2.25	I(1)	-3.55*	I(0)	-4.83*(t)	I(0)	-1.55	I(1)
DFSY	-4.76*		-5.37*						-6.04*	
BOPM	-9.43*	I(0)	-1.05	I(1)	-0.94	I(1)	-5.71*	I(0)	-1.85	I(1)
DBOPM			-3.82*		-4.89*				-3.61*	
Depend	-5.87#	I(0)	-7.25*	I(0)	-6.73*	I(0)	-7.34#	I(0)	-3.83#	I(0)
AGRY	-4.12*	I(0)	-1.35	I(1)	-0.73	I(1)	0.69	I(1)	-1.91	I(1)
DAGRY			-5.13*		-4.52*		-4.73*		-6.57*	
INF	-4.05*	I(0)	-3.62*	I(0)	-3.63*	I(0)	-3.32*	I(0)	-3.78*	I(0)
M2Y	0.59	I(1)	-4.13*	I(0)	-0.63	I(1)	1.06	I(1)	-3.67*	I(0)
DM2Y	-3.37*				-3.96*		-4.18*			

Notes:

1. * denotes that ADF test statistic rejects the null hypothesis of non-stationarity of the variable at the 5 percent confidence level (5% critical value for ADF test is -2.86),.

2. # denotes that The Perron (1997) test statistic rejects the null hypothesis of non-stationarity of the variable at the 5 percent confidence level We have used Perron endogenous unit root test (Perron 1997) in the case of this variable as it has a structural break in the series

3. A series DX denotes the first difference of series X. If the variable itself is non-stationary but its fist difference is stationary, it is integrated of order one, denoted, I(1)..

Table 2: Co integration and Long Run Coefficients of Total Savings

Variable	India		Pakistan		Sri Lanka		Nepal		Bangladesh
	ECM	*DOLS*	*ECM*	*DOLS*	*ECM*	*DOLS*	*ECM*	*DOLS*	*ARDL*
Constant	11.55** (10.20)	11.43** (11.63)	-0.67 (-0.33)	-1.03 (-0.43)	11.22** (6.72)	11.29** (10.36)	233.01 (1.79)	252.2** (3.11)	38.59** (5.30)
RYPC	0.006** (2.97)	0.0053** (3.40)	0.007* (2.31)	0.01* (2.17)	0.003* (2.78)	0.004* (2.11)	0.24* (2.15)	0.19* (2.63)	-
GROWTH	-	-	-	-	-	-	-	-	0.299* (2.38)
RD	-0.26* (-2.54)	-0.19* (-2.64)	-0.16* (-2.12)	-0.31* (1.98)	-0.08 (-0.78)	-0.12 (-1.64)	0.25* (2.34)	0.57* (2.74)	0.92* (3.08)
BOPM	0.13** (11.12)	0.129** (9.36)	0.19** (6.10)	0.21** (6.87)	0.09* (1.99)	0.074* (2.23)	-0.16 (-0.92)	-.014 (-0.09)	0.089* (2.21)
FSY	-1.45** (-7.85)	-1.36** (-7.42)	-0.27 (-1.74)	-0.13 (-0.74)	-0.53* (-2.08)	-0.47** (-3.58)	-1.10* (2.79)	-0.59* (2.56)	-0.078 (-0.38)
DEPEND	-	-	-	-	-	-	-3.12* (-2.18)	-3.31** (-3.04)	-0.409** (-5.93)
R^2	0.78	0.95	0.84	0.92	0.66	0.99	0.88	0.93	0.93
SE of Reg.	0.74	1.00	1.54	1.73	1.45	0.49	1.16	1.49	
DW Stats.	2.09	1.87	2.29	1.85	1.92	2.35	2.18	1.84	1.96
ECM Test of Cointegration	-6.70**	-	-8.11**	-	-4.33*	-	-4.50**	-	F_{GDSY}=82.36*
Sample (Annual)	1960-2005	1960-2005	1967-2005	1967-2005	1960-2005	1960-2005	1973-2005	1971-2005	1975-2005

Notes 1. ** Denotes significant 1% level and * denotes significance at 5% level. Critical Values are 2.57 and 1.96 respectively for the t-statistics and 5.04 and 4.30 respectively for the ECM test (critical values for the case of 2 I(1) and 3 deterministic or I(0) variables from Ericsson and MacKinnon, 2002).

2. t-statistics of coefficients are given in parentheses

3. DOLS refers to estimation by the dynamic OLS procedure and ECM refers to estimation by error correction mechanism procedure. The long-term for explanatory variables in the ECM procedure are obtained from solving full ECM estimations using eq. (5). The t-statistics for these are provided by the Microfit program using a non-linear procedure.

Table 3: Co integration and Long Run Coefficients of Private Savings

Variable	India		Pakistan		Sri Lanka		Nepal		Bangladesh
	ECM	*DOLS*	*ECM*	*DOLS*	*ECM*	*DOLS*	*ECM*	*DOLS*	*ARDL*
Constant	8.03** (5.11)	7.58** (5.10)	-3.69 (-0.81)	-4.52 (-0.64)	10.25** (8.59)	11.08** (11.47)	419.66* (2.65)	218.20* (2.21)	39.60** (5.43)
RYPC	0.0076** (3.45)	0.007** (3.37)	0.01* (2.64)	0.013* (2.80)	0.067* (2.17)	0.005* (2.71)	0.26* (2.38)	0.22** (2.92)	-
GROWTH	-	-	-	-	-	-	-	-	0.273* (2.15)
RD	-0.18 (-1.88)	-0.24** (-3.36)	-0.027 (-1.22)	-0.38 (0.80)	-0.03 (-0.49)	-0.012 (-0.19)	0.29* (2.52)	0.52* (2.38)	0.088** (2.94)
BOPM	0.118** (10.86)	0.12** (8.87)	0.29** (6.42)	0.26** (3.76)	0.066* (1.97)	0.053* (1.72)	-0.15 (0.83)	-0.04 (-0.25)	0.086* (2.17)
FSY	-1.41** (-6.37)	-1.33** (-5.44)	-0.49* (-2.04)	-0.38 (-1.28)	-0.49* (-2.14)	-0.50** (-4.94)	-1.32* (-2.29)	-0.55* (-2.08)	-0.083 (-0.38)
GDSpbY	-1.23* (-2.25)	-1.35* (-2.37)	-1.05* (-2.27)	-0.93* (-2.90)	-0.87** (-3.60)	-0.69** (-4.13)	-1.02 (-0.90)	-0.39 (-0.69)	-0.686* (-2.43)
DEPEND	-	-	-	-	-	-	-5.48* (-2.65)	-2.93* (-2.24)	-0.426** (-6.06)
R^2	0.76	0.98	0.81	0.89	0.86	0.81	0.86	0.93	0.94
SE of Reg.	0.78	0.90	2.00	1.83	1.14	1.80	1.41	1.49	
DW Stats.	2.06	1.81	2.16	1.86	2.36	1.91	2.28	1.84	2.04
ECM Test of Cointegration	-5.64**	-	-6.48**	-	-5.44**	-	-3.93*	-	$F_{GDSpvtY}$=74.97*
Sample (Annual)	1960-2005	1960-2005	1967-2005	1967-2005	1960-2005	1960-2005	1973-2005	1973-2005	1975-2005

Notes 1. ** Denotes significant 1% level and * denotes significance at 5% level. Critical Values are 2.57 and 1.96 respectively for the t-statistics and 5.04 and 4.30 respectively for the ECM test (critical values for the case of 2 I(1) and 3 deterministic or I(0) variables from Ericsson and MacKinnon, 2002).

2. t-statistics of coefficients are given in parentheses. 3. DOLS refers to estimation by the dynamic OLS procedure and ECM refers to estimation by error correction mechanism procedure. The long-term for explanatory variables in the ECM procedure are obtained from solving full ECM estimations using eq. (5). The t-statistics for these are provided by the Microfit program using a non-linear procedure.

Table 4: **Granger Causality Between Savings Rate and Income per Capita**

Using VECM Approach

Direction of Causality	No. of Lags	Θ =0: t-statistic (P-value)	$\Sigma\beta_i$ =0: F-statistic (P-value)
India			
RYPC→GDSY	1	-3.53* (0.00)	1.16 (3) (0.46)
GDSY→RYPC	3	-0.91 (0.36)	0.82 (0.45)
RYPC→GDSpvtY	1	-3.93* (0.00)	0.10 (0.91)
GDSpvtY→RYPC	3	0.30 (0.76)	1.46 (0.24)
Pakistan			
RYPC→GDSY	3	-2.46* (0.02)	1.88 (0.15)
GDSY→RYPC	1	-1.17 (0.25)	0.78 (0.51)
RYPC→GDSpvtY	3	-2.22* (0.04)	2.50 (0.08)
GDSpvtY→RYPC	3	-1.34 (0.19)	0.89 (0.46)
Sri Lanka			
RYPC→GDSY	2	-4.70* (0.00)	2.03 (0.15)
GDSY→RYPC	3	0.32 (0.75)	0.22 (0.88)
RYPC→GDSpvtY	1	-3.67* (0.00)	1.19 (0.28)
RYPC→GDSpvtY	2	-0.51 (0.61)	0.14 (0.91)
Nepal			
RYPC→GDSY	3	-2.24* (0.04)	1.47 (0.25)
GDSY→RYPC	3	-0.38 (0.69)	2.55 (0.08)
RYPC→GDSpvtY	2	-2.27* (0.03)	1.99 (0.17)
GDSpvtY→RYPC	2	-1.38 (0.18)	2.29 (0.11)

Notes: 1. See Equation (8) and (9) in the text for details of the test.
2. Figures in the bracket are p-values. * indicates rejection of null hypothesis at 5% level.
3. Lag length selected on the basis of Akaike Information criterion (AIC).

Table 5: Granger Causality Test between Growth and Savings rate for Bangladesh

Null Hypothesis, H_0	No. of Lags	F-statistics for Rejection of H_0	P-value for Rejection of H_0
Growth does not granger cause GDSY	4	3.52*	0.02
GDSY does not granger cause Growth	4	4.15*	0.01

Notes 1. Lag length is chosen on the basis of Akaike Information criterion (AIC).
2. * indicates rejection of null hypothesis at 5% level

APPENDIX-A

The ARDL Estimation Procedure: For determining the long-run relationship, Pesaron and Shin (1998) have developed the ARDL method. This procedure is valid for stationary variables as well as for a mixture of I (0) and I (1) variables. The existence of the long run relationship is confirmed with the help of an F-test that tests that the coefficients of all explanatory variables are jointly different from zero (see Pesaron and Shin 1998).

The augmented ADRL model can be written as follows

$$\alpha(L)y_t = \mu_0 + \sum_{i=1}^{k} \beta_i(L)x_{it} + u_t \text{ -----------------------------(3)}$$

where $\alpha(L) = \alpha_0 + \alpha_1 L + \alpha_2 L^2 + - - - - - - - \alpha_t L^t$

and $\beta(L) = \beta_0 + \beta_1 L + \beta_2 L^2 + - - - - - - - \beta_t L^t$

where μ_0 is a constant; y_t is the dependent variable; L is the lag operator such that $L^i x_t = x_{t-i}$. In the long-run equilibrium $y_t = y_{t-1} = y_{t-2} = - - - y_0$ and $x_{it} = x_{it-1} = x_{it-2} = - - - x_{i0}$. Solving for y we get the following long run relation:

$$y = a + \sum_{i=1}^{k} b_i x_i + \gamma_t \cdots\cdots\cdots\cdots\cdots \qquad (4)$$

where

$$a = \frac{\mu_0}{\alpha_0 + \alpha_1 + - - \alpha_t}$$

$$b_i = \frac{\beta_{i0} + \beta_{i1} + \beta_{i2} + - - \beta_{it}}{\alpha_0 + \alpha_1 + \alpha_2 + - - - \alpha_t}$$

$$\gamma_t = \frac{u_t}{\alpha_0 + \alpha_1 + \alpha_2 + - - - \alpha_n}$$

The error correction (EC) representation of the ARDL method can be written as follows:

$$\Delta y_t = \Delta\hat{\alpha}_0 - \sum_{j=2}^{p} \hat{\alpha}_j \Delta y_{t-j} + \sum_{i=1}^{k} \hat{\beta}_{i0}\Delta x_{it} - \sum_{i=1}^{k} \sum_{j=2}^{q} \beta_{i,t-j} \Delta x_{i,t-j} - \alpha(1, p)ECM_{t-1} + \mu_t \qquad \text{..........} .(5)$$

$$where \quad ECM_t = y_t - \hat{\alpha} - \sum_{i=1}^{k} \hat{\beta}_{i0}\Delta x_{it} \qquad \text{..........} (6)$$

where Δ is the first difference operator; $\alpha_{j,\ t-j}$ and $\beta_{ij,\ t-j}$ are the coefficients estimated from Equation-3 and α (1,p) measures the speed of adjustment.

APPENDIX-B

Full Equations and Diagnostic Tests for ECM, DOLS and ARDL Estimations for Table 2 and 3

Brief Description of the Diagnostic Tests Reported Below: R^2 is the fraction of the variance of the dependent variable explained by the model, F is the F-statistics for the joint significance of the explanatory variables, SE is the standard error of the regression, *DW* is the Durbin Watson statistics, *LM* = Lagrange multiplier test of residual serial correlation, *RESET* = Ramsey test for functional form mis-specification (square terms only); *Normality* = Jarque-Bera test for the normality of residuals: *ARCH* = Engle's autoregressive conditional heteroscedasticity test;

B1. The detailed ECM Estimations and Diagnostic Tests

India

Total Savings Rate (GDSY)

ΔGDSY = 11.28C – 0.97 GDSY (-1) + 0.5251E-2 RYpc (-1) – 0.257 RD (-1) + 0.129 BOPM (-1)
(5.77) (-6.70) (2.80) (-2.53) (5.68)
– 1.422 FSY (-1) + 0.408 ΔGDSY (-1) + 0.33 ΔGDSY (-2) – 0.16 ΔRD +
(-5.97) (2.98) (2.50) (-2.82)
0.31 ΔRD (-1) – 0.53 ΔDFSY – 0.203 ΔBOPM (-1) +0.592ΔFSY (+1)
(3.97) (-2.36) (-1.78) (2.31)

R^2=0.78, F(12,24) = 6.31*, SE = .75, DW= 2.09, LM1 –F(1,28) = 0.32, ARCH–(χ^2(1)) = 2.01, RESET –F(1,18)= 0.15, NORMALITY – (χ^2(2)) = 3.22.

Private Savings Rate, GDSpvtY

ΔGDSpvtY = 9.01C – 1.12 GDSpvtY (-1) + 0.862E-3 RYpc (-1) – 0.20 RD (-1) + 0.132 BOPM (-1)
(5.07) (-5.64) (2.52) (-1.76) (5.53)
– 1.58 FSY (-1) - 1.38 GDSpbY + 0.45 ΔGDSpvtY (-1) + 0.35 ΔGDSpvtY (-2) –
(-5.37) (-2.49) (2.61) (2.21)
0.20ΔRD + 0.19 ΔRD (-1) +0.69ΔGDSpbY (-1) + 0.69ΔGDSpbY (-2) – 0.64
(-3.14) (2.45) (1.77) (2.21) (-2.50)
ΔDFSY – 0.35 ΔBOPM (-1) - 0.28 ΔBOPM (-2) +0.001 ΔRYpc (-2)
(-2.52) (-2.11) (1-96)

R^2=.76, F(12,29) = 3.81, SE = .78, DW= 2.06, LM1 –F(1,28) = 0.19, ARCH–(χ^2(1)) = 0.12, RESET –F(1,18)= 0.16, NORMALITY – (χ^2(2)) = 0.72.

Pakistan

Totoal Savings Rate (GDSY)

ΔGDSY = -1.03C – 0. 79 GDSY (-1) + 0.007 RYpc (-1) – 0.17 RD (-1) + 0.197 BOPM (-1)
(-0.43) (-8.11) (1.96) (-2.21) (6.14)
– 0.26 FSY (-1) + 0.06 ΔRYpc– 0.22 ΔBOPM (-1) + 0.62 ΔDFSY (+1) +0.12ΔRYpc (+1)
(-1.80) (1.98) (-2.88) (4.75) (3.09)

R^2=0.83, F(12,24) = 12.48*, SE = 1.54, DW= 2.41, LM1 –F(1,28) = 2.31, ARCH–(χ^2(1)) = 1.84, RESET –F(1,18)= 0.005, NORMALITY – (χ^2(2)) = 0.33.

Private Savings Rate, GDSpvtY

ΔGDSpvtY = -3.18C – 0. 86 GDSpvtY(-1) + 0.010 RYpc (-1) – 0.023 RD(-1) + 0.254 BOPM (-1)
(-0.82) (-6.48) (2.61) (-1.01) (5.22)
– 0.426 FSY(-1) – 0.91GDSpbY + 0.10 ΔRYpc + – 1.11 ΔGDSpbY +
(-1.96) (-2.05) (1.77) (-3.13)

+ 0.65 ΔDFSY(+1) – 0.25 ΔGDSpbY(+1)
(3.84) (-1.98)

R^2=.81, F(12,29) = 8.93, SE = 2.00, DW= 2.16, LM1 –F(1,28) = 0.93, ARCH–(χ^2(1)) = 0.70,
RESET –F(1,18)= 0.14, NORMALITY – (χ^2(2)) = 0.40.

Sri Lanka

Totoal Savings Rate (GDSY)

ΔGDSY = 6.61C – 0.58 GDSY (-1) + 0.002 RYpc (-1) – 0.047 RD (-1) + 0.053 BOPM (-1)
(4.48) (-4.33) (2.71) (-0.76) (2.02)
– 0.312 FSY (-1) + 0.45 ΔGDSY (-1) - 0.40 ΔFSY + 0.20 ΔFSY (-1) +
(-2.21) (2.85) (-3.71) (1.88)
0.047 ΔRYpc (-1) – 0.25 ΔBOPM (-1) -0.592ΔRD (+1)
(1.91) (-2.52) (-2.01)

R^2=0.66, F(12,24) = 4.82*, SE = 1.45, DW= 1.92, LM1 –F(1,28) = 0.31, ARCH–(χ^2(1)) = 0.63,
RESET –F(1,18)= 0.11, NORMALITY – (χ^2(2)) =0.52.

Private Savings Rate, GDSpvtY

ΔGDSpvtY = 7.84C – 0.76 GDSpvtY (-1) + 0.005 RYpc (-1) – 0.027 RD (-1) + 0.052 BOPM (-1)
(4.97) (-5.44) (1.89) (-0.49) (1.99)
– 0.37 FSY (-1) - 0.67 GDSpbY + 0.79 ΔGDSpvtY (-1) -0.48 ΔFSY +0.59 ΔFSY (-1)
(-2.41) (-3.61) (4.93) (-4.43) (4.74)
-0.33ΔBOPM (-1) - 0.33 ΔGDSpbY + 1.04 ΔGDSpbY (-1) – 0.11 ΔRD
(-3.58) (-3.58) (5.51) (-2.62)

R^2=.86, F(12,29) = 10.35, SE = 1.14, DW= 2.36, LM1 –F(1,28) = 0.33, ARCH–(χ^2(1)) = 0.13,
RESET –F(1,18)= 0.19, NORMALITY – (χ^2(2)) = 0.05.

Nepal

Totoal Savings Rate (GDSY)

ΔGDSY = 204.46C – 0.87 GDSY (-1) + 0.21 RYpc (-1) + 0.22 RD (-1) - 0.14 BOPM (-1)
(2.10) (-4.55) (2.39) (2.01) (-1.00)
– 0.96 FSY (-1) – 2.74DEPEND (-1) - 0.45 ΔRD (-1) - 0.69 ΔFSY + 0.32 ΔRYpc +
(-2.79) (-2.13) (-1.76) (-2.72) (2.96)
0.24 ΔRYpc (-1) – 173.1 ΔDEPEND + 123.3 ΔDEPEND (-1) + 0.24ΔRYpc (+1)
(2.93) (-3.04) (3.39) (2.41)

R^2=0.66, F(12,24) = 4.40*, SE = 1.45, DW= 1.92, LM1 –F(1,28) = 0.04, ARCH–(χ^2(1)) = 0.94,
RESET –F(1,18)= 0.31, NORMALITY – (χ^2(2)) =0.22.

Private Savings Rate, GDSpvtY

ΔGDSpvtY = 465.1C – 1.10 GDSpvtY (-1) + 0.28 RYpc (-1) + 0.32 RD (-1) - 0.16 BOPM (-1)
(3.82) (-3.93) (2.34) (1.76) (-0.99)
–1.47 FSY (-1) - 1.13 GDSpbY - 0.14 ΔRD (-1) -1.08 ΔFSY +0.40 ΔRYpc
(-3.03) (-1.10) (-1.88) (-3.03) (2.97)
+-0.343ΔRYpc (-1) - 0.33 ΔGDSpbY – 303.39 ΔDEPEND+ 212.24ΔDEPEND(-1)
(3.13) (-3.58) (-3.63) (3.87)
-0.56 ΔFSY(+1) + 0.33ΔRYpc (+1)
(-2.26) (2.69)

R^2=.88, F(12,29) = 4.16, SE = 1.41, DW= 2.28, LM1 –F(1,28) = 2.10, ARCH–(χ^2(1)) = 0.27,
RESET –F(1,18)= 0.89, NORMALITY – (χ^2(2)) = 1.24.

B2. The Detailed Dynamic OLS (DOLS) Estimations

India

GDSY = 11.43C + 0.5345E-3 RYpc – 0.19 RD + 0.13 BOPM – 1.36FSY +0.14 ΔRD (-1)
(10.68) (3.40) (-2.64) (9.36) (-7.42) (1.87)
+ 0.92 ΔFSY - 0.32 ΔBOPM (-2)
(3.31) (-2.30)

R^2=0.95 S.E = 1.00, F(7,33) = 95.72*, DW= 1.87, LM1 –F(1,19) = 2.50, ARCH–($\chi^2(1)$) = 0.72, RESET –F(1,18)= 0.76, NORMALITY – ($\chi^2(2)$) = 0.98.

GDSpvtY = 7.58C + 0.7606-3 RYpc – 0.24 RD + 0.12 BOPM – 1.36GDSpbY - 1.33 FSY+ 0.14 ΔRD (-1)
(5.10) (3.37) -3.36) (8.87) (-2.37) (-5.44) (1.77)
+ 0.58 ΔDFSY - 0.36ΔBOPM - 0.31 ΔBOPM (-1) - 0.68 ΔFSY(-2) +1.37 ΔGDSpbY – 0.49 ΔFSY(+1)
(1.98) (-2.41) (-2.24) (- 2.72) (3.04) (-1.78)

R^2=0.98, S.E = 0.90, F(7,20) = 90.24, DW= 1.81, LM1 –F(1,24) = 0.78, ARCH–($\chi^2(1)$) = 0.03, RESET –F(1, 38)= 0.48, NORMALITY – ($\chi^2(2)$) = 0.55.

Pakistan

GDSY = -1.05C + 0.01 RYpc – 0.31RD + 0.21 BOPM – 0.13FSY +0.12 ΔRD (-1) + 0.14ΔRYpc
(-0.33) (2.17) (-1.98) (6.87) (-0.74) (1.67) (3.03)
- 0.23 ΔRD (+1) + 0.54 ΔFSY (+1) + 0.18 ΔRYpc -0.34 ΔBOPM (+1)
(-2.57) (3.09) (4.07) (-3.27)

R^2=0.92 S.E = 1.73, F(11,23) = 25.30*, DW= 1.85, LM1 –F(1,19) = 0.08, ARCH–($\chi^2(1)$) = 1.69,
RESET –F(1,22)= 0.70, NORMALITY – ($\chi^2(2)$) = 0.82.

GDSpvtY = -4.51C + 0.013 RYpc – 0.01 RD + 0.29 BOPM – 0.93GDSpbY - 0.39 FSY+ 0.48 ΔFSY
(-0.64) (2.80) (-0.80) (3.78) (-2.90) (-1.28) (2.55)
+ 0.09 ΔRYpc - 0.34ΔBOPM + 0.59 ΔFSY (+1)
(1.78) (-2.51) (2.57)

R^2=0.89, S.E = 1.83, F(10,20) = 17.44, DW= 1.86, LM1 –F(1,24) = 0.06, ARCH–($\chi^2(1)$) = 0.24,
RESET –F(1, 19)= 2.01, NORMALITY – ($\chi^2(2)$) = 0.84.

Sri Lanka

GDSY = 11.29C + 0.004 RYpc – 0.12RD + 0.07 BOPM – 0.47FSY + 0.07ΔRYpc (-1)
(10.36) (2.11) (-1.64) (2.23) (-3.59) (2.39)
- 0.20 ΔBOPM - 0.284 ΔBOPM (-1) - 0.18 ΔBOPM (+1)
(-1.97) (-2.99) (-1.79)

R^2=0.68 S.E = 1.45, F(8,33) = 9.02*, DW= 1.84, LM1 –F(1,19) = 19.45, ARCH–($\chi^2(1)$) = 2.05, RESET –F(1,32)= 3.53, NORMALITY – ($\chi^2(2)$) = 1.41.

GDSpvtY = 11.08C + 0.005 RYpc – 0.01 RD + 0.05 BOPM – 0.68GDSpbY - 0.50 FSY+ 0.48 ΔFSY

(11.47) (2.71) (-0.80) (1.78) (-4.13) (-4.94) (2.55)
+ 0.05 ΔRYpc (-1) - 0.14ΔBOPM - 0.59 ΔBOPM (-1)
(1.65) (-1.71) (-2.44)

R^2=0.81, S.E = 1.80, F(8,34) = 17.86, DW= 1.91, LM1 –F(1,24) = 9.34, ARCH–(χ^2(1)) = 1.96, RESET –F(1, 33)= 0.04, NORMALITY – (χ^2(2)) = 1.79.

Nepal

GDSY = 252.59C + 0.19 RYpc + 0.12RD - 0.014 BOPM – 0.59FSY - 3.31 DEPEND -0.21ΔRD
(3.11) (2.63) (-1.64) (-0.09) (-2.54) (-3.04) (-3.32)
- 0.11 ΔRD (-1) -0.23 ΔFSY (-1) + 0.24 ΔRYpc (-1) -171.64 ΔDEPEND + 120.14 ΔDEPEND (-1)
(-2.22) (-1.99) (3.27) (-3.63) (4.03)

+81.07 ΔDEPEND (+1) + 0.19 ΔRYpc (+1)
(3.11) (2.44)

R^2=0.93 S.E = 1.49, F(14,26) = 6.26*, DW= 1.84, LM1 –F(1,19) = 0.05, ARCH–(χ^2(1)) = 0.77, RESET –F(1,32)= 2.56, NORMALITY – (χ^2(2)) = 0.57.

GDSpvtY = 218.20C + 0.22 RYpc + 0.53 RD - 0.04 BOPM – 0.39GDSpbY - 0.55 FSY- 0.20 ΔRD
(2.21) (2.92) (2.38) (-0.24) (-0.64) (-2.09) (2.74)
- 181.15 ΔDEPEND + 126.40 ΔDEPEND (-1) -+0.16 ΔRYpc (-1) + 84.40 ΔDEPEND (+1) +0.13 ΔRYpc
(-3.75) (3.87) (2.58) (2.93) (1.78)

R^2=0.88, S.E = 1.18, F(8,30) = 5.28, DW= 2.00, LM1 –F(1,24) = 0.07, ARCH–(χ^2(1)) = 0.48, RESET –F(1, 33)= 2.15, NORMALITY – (χ^2(2)) = 0.23.

B.3 The ARDL Estimations and Diagnostic Tests for Bangladesh

National Savings Rate:

$GDSY_t = 38.59^{***} + 0.29^{**}GROWTH_{t-1} - 0.40^{***}DEPEND_{t-1} + 0.08BOPM_{t-2} - 0.07FSY_{t-1} + 0.09^{***}RD_{t-1}$
(5.30) (2.38) (-5.93) (2.21) (-0.36) (3.08)

$\overline{R}^2$ = 0.93, DW = 1.96, SE of regression = 1.43, AIC = -54.26, RSS = 47.36, F-stat= 82.36(0.000***)***, LM-χ^2 (1) for serial correlation = 0.03 (0.85), LM (RESET)- χ^2 (1) for functional form = 0.23 (0.62), Normality LM-χ^2 (2) = 0.21 (0.90) and H-LM-χ^2 (1) = 4.01(0.04).

Private Savings Rate:

$GDSpvtY_t = 39.60^{***} + 0.27^{**}GROWTH_{t-1} - 0.42^{**}DEPEND_{t-1} + 0.08^{**}BOPM_{t-2}$
(5.43) (2.15) (-6.06) (2.17)

$- 0.68^{**}GDSpbY - 0.08FSY_{t-1} + 0.08^{***}RD_{t-1}$
(-2.43) (4.327) (2.94)

$\overline{R}^2$ = 0.94, DW = 2.04, SE of regression = 1.42, AIC = -54.46, RSS = 44.83, F-stat= 74.97 (0.000), LM-χ^2 (1) for serial correlation = 0.17 (0.67), LM (RESET)- χ^2 (1) for functional form = 1.31 (0.25), Normality LM-χ^2 (2) = 0.01 (0.99) and H-LM-χ^2 (1) = 4.26 (0.04).

ECM for Total Savings Rate

$$\Delta GDSY_t = \underset{(-0.01)}{-0.01} + \underset{(3.82)}{0.27^{***}}\ \Delta GROWTH_{t-1} + \underset{(4.50)}{0.11^{***}}\ \Delta RD_{t-1} + \underset{(-0.74)}{0.12}\Delta BOPM_{t-2} - \underset{(-1.07)}{0.66}\ \Delta DEPEND_{t-1} - \underset{(0.69)}{0.11}\ \Delta FSY - \underset{(-5.10)}{1.15^{***}}\ ECM_{t-1}$$

R-Bar Square = 0.73, DW = 1.97, SE of Regression = 1.32, AIC = -50.57, RSS = 36.85, F-stat 13.78(0.00), LM-χ^2 (1) for Serial Correlation = 0.19 (0.66), LM (RESET)- χ^2 (1) for functional form = 0.88(0.34), Normality LM-χ^2 (2) = 6.03(0.04) and H-LM- χ^2 (1) 0.009(0.92).

ECM for Private Savings Rate

$$\Delta GDSPvtY_t = \underset{(-0.08)}{-0.07} + \underset{(3.53)}{0.25^{***}}\ \Delta GROWTH + \underset{(4.58)}{11^{***}}\ \Delta RD - \underset{(-0.72)}{0.12}\ \Delta BRANCH - \underset{(-1.18)}{0.72}\ \Delta DEPEND_{t-1} - \underset{(-0.56)}{0.09}\ \Delta FSY - \underset{(-2.43)}{0.66^{**}}\ \Delta GDSpbY - \underset{(-5.16)}{1.15^{***}}\ ECM_{t-1}$$

Notes

[i] Fry (1995) has considered it previously in the context of some Asian countries, but there are hardly any previous studies that use this variable for the South Asian countries.

[ii] The savings rate of Pakistan is measured as gross national savings divided by GDP while that of all other countries is domestic savings divided by GDP. This means that the numbers for Pakistan are not completely comparable with other South Asian countries. This was done due to our perception that the domestic savings series for Pakistan was not fully reliable.

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[iii] There is by now an abundant literature on the determinants of savings rate - see for example, Edwards (1996), Fry (1995) and Schmidt-Hebbel *et al*. (1996 and 1999).

[iv] Only in the case of Pakistan we have used gross national savings instead of the groess domestic savings as the latter appeared to have some problems and did not seem reliable.

[v] We also considered the possibility of using logarithmic version of the above variables but decided against it primarily because the foreign savings (as well as real interest rates and growth rates of real income per capita) can take negative values.

[vi] We have also included variable GDP growth as one of the explanatory variables. However, GDP growth and real per capita Income are strongly correlated and GDP growth has turned out to be insignificant.

vii. Using the Johansen procedure we were able to confirm that the number of co-integrating vectors does not exceed one for any of the three countries.

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