Saving and economic growth in India

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SAVING AND ECONOMIC GROWTH IN INDIA

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Abstract:

This paper studies the relationship between GDP and saving in India. During the last few years, the saving rate has fallen marginally raising concern that it might adversely affect economic growth. We take a long run view. We explore whether there is a long run relationship between GDP and saving. In doing so, we distinguish between gross domestic saving and gross domestic private saving. We posit that gross domestic private saving rather than gross domestic saving is more important in determining GDP. We find that both gross domestic saving and gross domestic private saving are cointegrated with GDP. However, causality tests between the growth of gross domestic saving/the growth of private domestic saving and the growth of GDP indicate that the causality does not run in any direction.

JEL Codes: C32, E21, O11

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I: INTRODUCTION

This paper critically examines the role of saving in Indian economic growth. India always has had a relatively high rate of saving compared with many other developing countries although the rate of saving is lower than many other faster developing Asian countries. Recently, concern has been raised regarding a fall in the saving rate in India.

In this paper, we do the following. First, we look at the trend in saving in India. Second, we test whether there is a long run relationship between saving and gross domestic product (GDP) in India. We distinguish between gross domestic saving (GDS) and gross domestic private saving (GDPS). It is expected that GDPS will have a stronger relationship with GDP than GDS. Third, we follow up our analysis of long run relationship by causality tests. Specifically, we look at the Granger causality between the growth of GDP and the growth of GDS as well as between the growth of GDP and the growth of GDPS.

Our comprehensive annual data are for the period, 1950-1993. GDS and GDP data are from the *Economic Survey* 1994-95 of the Government of India. All other data are from the *International Financial Statistics* (CDROM version, December 1995) of the International Monetary Fund. To derive the gross domestic private saving, we subtract government saving or dissaving from gross domestic saving. Government saving or dissaving is simply defined as government revenue minus government expenditure. All variables have been deflated so that we deal only with real variables.

II: TRENDS IN SAVING IN INDIA

Gross domestic saving as a percentage of gross domestic product rose from 10.41 per cent in 1950 to 23.61 per cent in 1990. Thereafter, saving rate has fallen marginally. Figure 1 looks at the gross domestic saving as a percentage of GDP during 1950-1993. Figure 2 looks at gross domestic private saving as a percentage of GDP during the same period. While saving rate in India has been around a little over 20 per cent, the newly industrializing countries in Asia such as Hong Kong, Republic of Korea, Singapore and Taiwan have achieved higher rates in the range of 30 to 40 per cent during 1981-90 (see Chandravarkar (1993)). Joshi (1970) takes a comprehensive look at the saving behavior in India during the 1950s and early 1960s. He finds that much of the increase in the saving rate can be attributed to the increase in the saving rate of the urban household sector. He attributes this phenomenon partly to the government's concentration on urban areas for saving drive. With the spread of banking and the television media in the rural areas, the situation has become more conducive to saving in the rural areas.

Of course, many factors affect the saving rate. Income is the most important determinant of the saving rate. Other important factors especially for private saving include population growth, life expectancy, socio-cultural factors such as political stability, value system, literacy rates, rate of return on saving, export earnings. A number of authors argue that Confucian ethic is one of the reasons for the high rate of private saving in some Asian countries. Tai (1989), for example, maintains that East Asians are generally known to be hard working and frugal because of the Confucian ethic. However, as Mackie (1992) notes, traditional values become less important as industrialization proceeds.

III: ECONOMETRIC METHODOLOGY

We perform two types of econometric analyses in the next section. The cointegration tests are followed by causality tests. Before studying the relationship between the variables, we will look into the issue of stationarity of the variables. A variable is said to be stationary or integrated of order zero (ie., I(0)) if it does not have a unit root. In many cases, a variable may be non-stationary in its level form but stationary in its first-difference form. We will use two different types of stationarity tests that are popular in the literature. First, we use the augmented Dickey-Fuller (ADF) test (See Dickey and Fuller (1979) and (1981)). The ADF test entails estimating the following regression equation (with an autoregressive process):

$$\Delta y_t = c_1 + \omega y_{t-1} + c_2\, t + \sum_{i=1}^{\rho} d_i\, \Delta y_{t-1} + \nu_t \qquad (1)$$

In the above equation, y is the relevant time series, Δ is a first-difference operator, t is a linear trend and ν_t is the error term. The above equation can also be estimated without including a trend term (by deleting the term $c_2\, t$ in the above equation). The null hypothesis of the presence of a unit root is $\omega = 0$.

Second, we use the Phillips-Perron (1988) test (PP test) which is well suited for analysing time series whose differences may follow mixed ARMA (p,q) processes of unknown order in that the test statistic incorporates a nonparametric allowance for serial correlation in testing the regression. It involves estimating the following equation:

$$y_t = \tilde{c}_0 + \tilde{c}_1 y_{t-1} + \tilde{c}_2 (t - T/2) + \nu_t \qquad (2)$$

where T is the number of observations and ν_t is the error term. The null hypothesis of the presence of a unit root is $\tilde{c}_1 = 1$. As in the ADF test, we can drop the trend term to test the stationarity of a variable without the trend.

The concept of cointegration is developed by Granger (1981). Engle and Granger (1987) provide a comprehensive look at the methodology. If a variable has a unit root, but its first difference is stationary, then it is said to be integrated of order one, denoted by I(1). Two I(1) variables are said to be cointegrated if there exists a linear combination of them that is stationary. Engle and Granger show that if the variables are cointegrated, then the OLS method gives super-consistent estimates. However, there are important shortcomings of the Engle-Granger cointegration methodology. One of the most important problems with the methodology is that it does not give us the number of cointegrating vectors (see Hall (1989)).

We will use the Johansen-Juselius (see Johansen (1988) and Johansen and Juselius (1990) for details) cointegration methodology. The method in its basic form can be shown by the error correction representation of the VAR(p) model with Gaussian errors:

$$\Delta Z_t = a_0 + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \dots\dots\dots \Gamma_{p-1} \Delta Z_{t-p+1} + \Pi Z_{t-p} + BX_t + u_t \qquad (3)$$

where Z_t is a an m x 1 vector of I(1) variables, X_t is an sx1 vector of I(0) variables, Γ_1, Γ_2, Γ_{p-1}, Π are m x m matrices of unknown parameters, B is an m x s matrix and $u_t \sim N(0, \Sigma)$. The maximum likelihood method is used to estimate (3) subject to the hypothesis that Π has a reduced rank, $r < m$. The hypothesis, therefore, is as follows:

$$H(r): \ \Pi = \alpha\beta^{/} \tag{4}$$

where α and β are m x r matrices. If certain conditions are fulfilled, equation (4) implies that the process ΔZ_t is stationary, Z_t is non-stationary, and that βZ_t is stationary. βZ_t are known as the cointegrating relations.

When the variables are stationary or they are cointegrated, then causality tests can be conducted (See Granger (1988)) . We will perform the Granger (1969) causality tests. The methodology is as follows. Let x and y be two time series. To test the null hypothesis "x does not cause y", we run the following two regressions:

$$y = \sum_{i=1}^{m} \alpha_i y_{t-i} + \sum_{i=1}^{m} \beta_i x_{t-i} + \varepsilon_t \tag{5}$$

$$y = \sum_{i=1}^{m} \alpha_i y_{t-i} + \varepsilon_t \tag{6}$$

Regressions (5) and (6) are the unrestricted and restricted regressions respectively. We use the sum of squared residuals from each regression to calculate an F statistic and test whether $\beta_1 = \beta_2 .... = \beta_m$. To test this joint hypothesis, the F statistic is calculated as follows:

$$F = (n\text{-}k\text{-}1)\ \frac{(ESSR - ESSU)}{q(ESSU)} \tag{7}$$

where ESSR is the error sum of squares in the restricted regression, ESSU is the error sum of squares in the unrestricted regression, n-k-1 is the number of degrees of freedom in the unrestricted regression and q is the number of parameter restrictions. The statistic is distributed as F(q, n-k-1). To test "y does not cause x", we can run the same regression after switching x and y.

The choice of lags is somewhat arbitrary but a number of criteria are available. We use Akaike's Final Prediction Error (FPE) criterion to decide the number of lags in (5) and (6).

IV: RESULTS OF ECONOMETRIC ANALYSES

As pointed out earlier, we perform two types of stationarity tests before proceeding with the cointegration tests. The results of ADF tests on the levels and first differences of gross domestic product (GDP), gross domestic saving (GDS) and gross domestic private saving (GDPS) are given in table 1. It is clear from table that all three variables have unit roots in their levels but are stationary in their first differences. Although the results of the PP tests are not shown here, these tests also show that all three variables are non-stationary in their levels but stationary in their first differences[1].

Since all variables are stationary after first differencing, it is appropriate to test whether the variables are cointegrated. The first step in the Johansen-Juselius procedure is to determine the lag order. Since we have annual data and

the variables achieve stationarity after first differencing, we use a lag of one. The maximum number of lags used by applied researchers for annual data is two. Although we report the results of only one lag, we have also tested with two lags. However, we get the same results. Table 2 give the results of the cointegration tests with GDP and GDS in the non-trended case. Both the maximal eigenvalue and trace tests indicate that there is one cointegrating

[1]The data and the results of the PP tests are available from the author upon request.

vector. In the trended case, while the trace test gives evidence of one cointegrating vector, the maximal eigenvalue test does not (not shown here). The long run cointegrating vector in the non-trended case is given in (8).

$$.0080294\ GDP - .054843\ GDS = \omega_t \tag{8}$$

where ω_t is white noise.

Table 3 gives the results of cointegration tests for GDP and GDPS in the non-trended case. Both the maximal eigenvalue and trace tests indicate that there is one cointegrating vector. Although the results are not shown here, the results of both maximal eigenvalue and trace tests in the trended case also indicate that there is one cointegrating vector[2]. Thus, we find that the long run relationship between GDP and GDPS is stronger than the relationship between GDP and GDS. This is probably as expected because GDPS is one of the major driving forces behind the economy. The long run cointegrating vectors for GDP and GDPS in the non-trended and trended cases are in (9) and (10) respectively.

$$-.012765\ GDP + .065073\ GDPS = \varphi_t \tag{9}$$

$$-.041249\ GDP + .17576\ GDPS = \omega_t \tag{10}$$

where φ_t and ω_t are white noise.

[2]The results of the cointegration tests in the trended cases are available from the author upon request.

Therefore, we find that there is a positive long run relationship between GDP and GDPS. The cointegrating vectors tell us that the AR(1) process holds. Although we have not reported here, we find cointegration with two lags as well. Thus, there is a long run relationship between GDP and GDS as well as between GDP and GDPS with a two-year lag as well. However, we need to proceed with causality tests to see if there is any causal relationship between the growth of GDP and GDS and between the growth of GDP and GDPS.

We use the Granger causality tests. Although the results are not reported here, we find that the growth rates of GDP, GDS and GDPS are all stationary according to both the ADF and the PP tests. First, we test the null hypothesis: the growth rate of GDS does not Granger cause the growth rate of GDP. Our calculated F test statistic is 0.2129 and the relevant table value ($F(4,30)$) at the 5% level of significance is 2.69. Thus, we cannot reject the null hypothesis. For the reverse causality, the calculated F statistic is 1.40716 but the table value for $F(3,36)$ at the 5% level of significance is around 2.84. Thus, we cannot reject the null hypothesis in this case also. Next, the same tests are done with the growth of GDP and the growth of GDPS. Here also, we cannot reject the null hypothesis: the growth of private saving does not cause the growth of GDP. The test statistic is 0.4518 and it does not exceed the table value for $F(4,30)$. For the reverse causality, the test statistic is 1.5706 but again, it does not exceed the table value for $F(4,30)$. Therefore, in our case, causality does not run in any direction.

V: SUMMARY AND CONCLUSIONS

In this paper, we look at the relationship between gross domestic product and saving in India. First, we look at the trends in gross domestic saving and gross domestic private saving. Some economists have raised concerns over the fall in the saving rate in India in recent years. However, this may not be a cause for concern. For a very long time, consumers in India had access to a limited range of consumer goods. However, with the launch of economic liberalization programs of the government of India, Indian consumers are now able to enjoy a wide variety of goods that were not previously available to them. The marginal fall in the saving rate, therefore, reflects an increase in consumption. It is expected that the saving rate will stabilize again at a sustainable level. Second, we look at the long run relationship between gross domestic saving and gross domestic product. We find that gross domestic product is cointegrated with gross domestic saving as well as with gross domestic private saving. Third, we test for the causality between the growth rates of gross domestic product and gross domestic saving as well as between the growth rates of gross domestic product and gross domestic private saving. We do not find any causality in any direction. We must note that here that the relationship between saving and GDP is not a direct one. If saving are not channelled into productive investment, then the link between saving and GDP may be tenuous when we look at the causal relationships. However, data on investment are far less reliable for developing countries like India.

Figure 1. Gross Domestic Saving as a Percentage of GDP, 1950-93

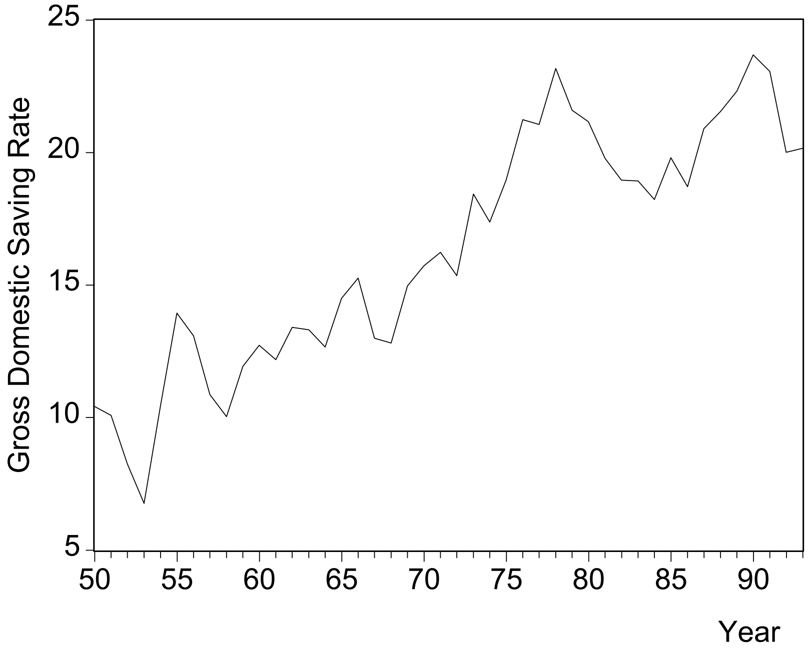

Figure 2. Gross Domestic Private Saving as a Percentage of GDP, 1950-93.

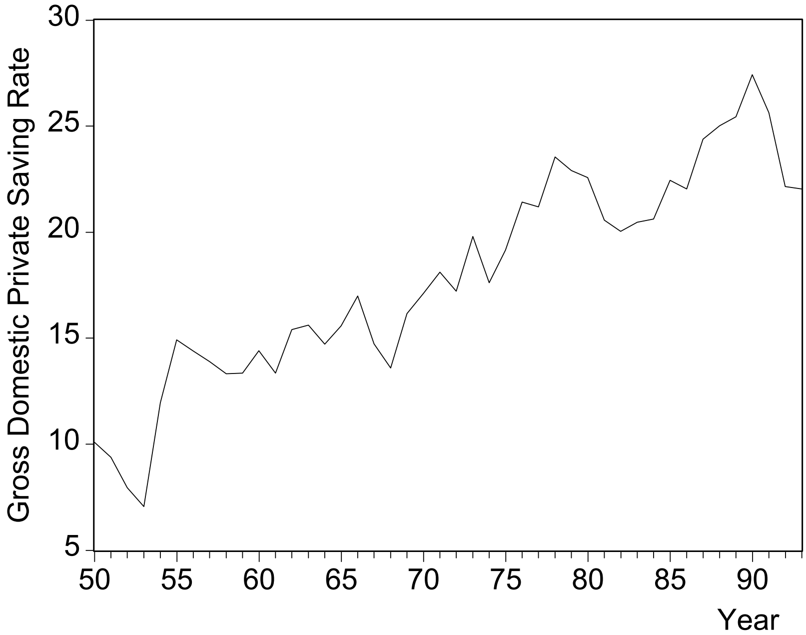

Table 1. Augmented Dickey Fuller (ADF) Unit Root Tests

Variable	ADF Test Statistic[*]	Lag Order[**]	Critical Value
GDP	$T_\mu =$ 4.1427	2	-2.60
GDP	$T_\tau =$ -0.6791	0	-3.18
ΔGDP	$T_\mu =$ -5.3181	0	-2.60
ΔGDP	$T_\tau =$ -6.5457	0	-3.18
GDS	$T_\mu =$ 0.6177	0	-2.60
GDS	$T_\tau =$ -1.7422	0	-3.18
ΔGDS	$T_\mu =$ -5.8476	0	-2.60
ΔGDS	$T_\tau =$ -6.0046	0	-3.18
GDPS	$T_\mu =$ 0.4693	0	-2.60
GDPS	$T_\tau =$ -1.6406	0	-3.18
ΔGDPS	$T_\mu =$ -5.4785	0	-2.60
ΔGDPS	$T_\tau =$ -4.2568	3	-3.18

[*] T_μ and T_τ and are test statistics (1) with drift and no trend and (2) with drift and trend respectively. Critical values are from Fuller ((1976), table 8.5.2, p. 373) have been used.

[**]Akaike Information Criterion (AIC) is used to determine the lag order.

Note: First differenced variables are denoted with Δ in front.

Table 2. Maximal Eigenvalue and Trace Tests using Johansen-Juselius Maximum Likelihood Procedure (Non-trended case) for GDP and GDS

Maximal Eigenvalue Tests			
Null	Alternative	Test Statistic	Critical Value*
r =0	r=1	31.2233**	13.7520
r <=1	r=2	7.2525	7.5250
Trace Tests			
r =0	r>=1	38.4758**	17.8520
r <=1	r=2	7.2525	7.5250

[*] Critical values are for the 90% quantile are from Osterwald-Lenum (1992).
[**] Significant at the 10% level.

Table 3. Maximal Eigenvalue and Trace Tests using Johansen-Juselius Maximum Likelihood Procedure (Non-trended case) for GDP and GDPS

Maximal Eigenvalue Tests			
Null	Alternative	Test Statistic	Critical Value*
r =0	r=1	32.2552**	13.7520
r <=1	r=2	6.7015	7.5250
Trace Tests			
r =0	r>=1	38.9567**	17.8520
r <=1	r=2	6.7015	7.5250

*Critical values are for the 90% quantile are from Osterwald-Lenum (1992).
**Significant at the 10% level.

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