Short-Run and Long-Run Relationship between Savings and Economic Growth in India (1950-51 to 2008-09)

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Saving and Economic Growth are among the important macroeconomic variables, in this paper an attempt is being made to find out short-run and long-run relationship between saving and economic growth covering a long time period of 1950-51 to 2008-09. Cointegration test is done to see whether there exists a long run equilibrium relationship among the variables. Short-run relationship can be estimated through vector error correction model. Results of the study suggest that there is a long-run relationship between saving and economic growth as found from the cointegrated relationship. Cointegration results show that one per cent increase in GDP (economic growth) is accompanied by 1.186 per cent increase in GDS (saving). Cointegration results also show that one per cent increase in GDS (Saving) is accompanied by .84 per cent increase in GDP (economic growth). The negative coefficient of Zt-1 indicates that if the economic growth is above its long-run relationship with the saving, it will decrease to return to equilibrium. The coefficient of Zt-1 is found to be statistically insignificant. Thus, in the short-run the economic growth adjusts itself by decreasing in order to return to equilibrium whenever it is above the long-run relationship with saving but adjustment by saving to catch up with economic growth is not found to be statistically significant.

Keywords : Short Run, Long Run, Co-integration, Saving & Economic Growth.

Introduction

Saving and Economic Growth are among the important macroeconomic variables and have a major bearing on the well being of the economy. This is the reason that so much of importance is being given to these variables as is being reflected in the fact that a large number of studies have been undertaken in this area of economic research. In this paper an attempt is being made to find out short-run and long-run relationship between saving and economic growth covering a long time period of 1950-51 to 2008-09.

This paper is divided into seven sections. First section is the introductory one. Second section comprises of the objectives of the study. A discussion of various studies undertaken in this area of research has been done in the third section. The sources of data and the methodology adopted for the study is mentioned in section four. Theoretical aspect of the study is explained in the fifth section. Sixth section comprises of empirical analysis of the study. Conclusions of the study are mentioned in the final section of the paper.

Objectives of the Paper

The present paper is a modest attempt to study the relationship between saving and economic growth. The main objectives of this study are -

- Review of existing literature on the study of relationship between saving and economic growth.
- To find out the short-run and long-run relationship between saving and economic growth.
- To bring forth conclusions and policy implications of the present paper

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Review of Literature in Brief

Many studies have been undertaken so far in this area of research. A brief mention of these studies and their results is being made in this section. This will add to make the present study a more meaningful and fruitful. Some of these studies are as stated below -

The study by Pandit (1991) is the comprehensive one of the structure and growth of saving in India. He also found that the composition of household financial saving is driven by the rates of return on each type of financial saving and to some extent, by bank expansion. Muhleisen (1997) conducted Granger causality tests by running bivariate VARs on the growth in Real GDP and the levels of total, public and private saving rates. His study found causality from growth to saving and rejected causality from saving to growth for all forms of savings consistently.

Agrawal (2000) examined the savings rate and the growth rate of real GNP using VAR specifications. His study found causality from growth to the saving rate, not only for India but also for Sri Lanka. Mahambare and Balasubramanyam (2000) in their working paper carried out analysis about liberalisation and savings in developing countries with reference to India. They employed the long run vector autoregressive (VAR) model using the techniques of cointegration and error correction mechanism (ECM) with the time series data for the years 1960-61 to 1996-97. They concluded that in the long run, the level of income promotes savings rather than the other way round and Ricardian equivalence does not hold true in the Indian case. Their another important conclusion was that in the short run economic liberalisation appears to depress savings, but in the long run it promotes savings through its impact on growth.

The study by Athukorala and Sen (2002) is the comprehensive Indian case study of saving, investment and growth in India. The empirical analysis found strong empirical support for the view that the levels of investment as well as its efficiency are the proximate causes of growth. Saggar (2003) extended the period of Muhlesen (1997) to 2000-01 to analyse the consequences of India's financial reforms in the nineties. The result was similar to the one obtained in the study of Muhleisen wherein causality runs from output to savings and not in the opposite direction.

R.Verma and E.J. Wilson (2005) in their working paper considered per worker household, private corporate and public sector savings and investment, foreign capital inflows and economic growth for India in multivariate setting for the time period from 1950-51 to 2001-02. The estimates of long run cointegrating vector elasticities (without trend and with unrestricted intercepts) in the first cointegrating vector show that GDP per worker is determined by household savings per worker and private corporate savings per worker with respective long run elasticities of 0.65 and 0.15, which are significant at the one per cent level.

Upender et. al. (2007) examined savings behaviour in the Indian Economy in terms of shift in the growth rates of domestic savings, and in magnitude of income elasticity of the domestic savings at the aggregate and disaggregated levels during post economic reform period. Some of the findings of their study are - (i) there is no shift in the growth rate of the domestic savings both at aggregate and disaggregated levels during post economic reform period; (ii) there is no shift in the magnitude of income elasticity of savings of household, private and public sectors during post economic reform period showing homogeneity in the size of the income elasticity of domestic savings; and (iii) an acceleration in the growth rate of domestic savings of household and private sectors was found to exist during the time period 1950-2002, but at the same time a deceleration in public sector saving was observed

during the same time period.

Sources of Data and Methodology Adopted

Time series data on saving and economic growth covering the time period of 1950-51 to 2008-09 have been used for analysis in this paper. The data for the present study have been taken from Economic Survey, Ministry of Finance, and Government of India. In order to avoid the problem of heteroscedasticity, these data have been converted into logarithmic form and thereafter the econometric analysis has been carried out. The data on saving have been taken in terms of Gross Domestic Saving (GDS) at current prices and data on economic growth have been taken in terms of Gross Domestic Product (GDP) at current market prices. Since the data on saving are estimated only at current prices and not at constant prices so far, so data on economic growth have also been considered at current market prices only. Therefore, the present study has been undertaken only at current prices.

Most of the macroeconomic time series are non-stationary which make the analysis spurious if the ordinary least squares (OLS) method is employed. In such a situation the pioneering work of Engle and Granger (1987) provides a very useful tool of analysis. Hence the techniques of cointegration and error correction mechanism (ECM) have been employed in this paper.

Theoretical Aspect of the Study

Following steps are involved in the estimating the short-run and long-run relationship between the variables -

(1) Variables are to be converted into its log natural form to avoid the problem of heteroscedasticity.
(2) Unit root tests on time series data are to be carried out to ascertain the integration properties of the variables.
(3) If the variables are of same order, cointegration test is to be carried out to find out the long-run relationship.
(4) If the variables are cointegrated, then the vector error correction model (VECM) is to be estimated. In case of no cointegration between the series, then the Vector Autoregression (VAR) is to be estimated.
(5) Results of the VECM or VAR are to be interpreted.

Unit Root Test - The order of integration of the series is ascertained by means of unit root test. Unit root test involves estimating Dicky-Fuller (DF) test in following three forms depending upon suitability according to the nature of the time series -

Yt is a random walk:

$$\Delta Y_t = \delta Y_{t-1} + u_t \qquad (1.1)$$

Yt is a random walk with drift:

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + u_t \qquad (1.2)$$

Yt is a random walk with drift around a stochastic trend:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + u_t \qquad (1.3)$$

Here, t is the time or trend variable. = -1 or alternatively, = + 1. It implies that for to be less than unity, the value of should be negative. The null hypothesis is that is zero which means that = 1 and it indicates the presence of unit root, implying that the series is non-stationary. The alternative hypothesis is that there is absence of unit root and the series is stationary. The null hypothesis is rejected if the calculated statistics is more negative than the critical value. Rejection of the null hypothesis indicates that the series is stationary. In case of the series being found to be non-stationary, the series is tested for stationarity in the first difference form. A series is said to be stationary, integrated of order zero, i.e., I (0) when it is found to be stationary at levels. If series becomes

stationary after first differencing, then the series is said to be integrated of order 1, i.e., I (1). In other words, a series is said to be integrated of order d, i.e., I (d) if the series has to be differenced d times to yield a stationary series.

Cointegration Test - Cointegration test is done to see whether there exists a long run equilibrium relationship among the variables. If there is a vector (set of variables) Xt consisting of n variables, all of which are integrated of order 1, wherein stationarity is achieved by first differencing; this set of variables are said to be cointegrated if these variables form a linear combination, Zt = a Xt such that Zt is I (0), where a is called as cointegrating vector.

Error Correction Mechanism - Error correction mechanism provides a means to reconcile the short-run (dynamic) and long-run (static) relationship between the variables. Short-run relationship can be estimated through vector error correction model. The following equations have been estimated -

$$DLNGDP = \alpha_0 + \sum_{i=1}^{2} \alpha_1 DLNGDP_{t-i} + \sum_{i=1}^{2} \alpha_2 DLNGDS_{t-i} + \alpha_3 Z_{t-1} + e_t \quad (1.4)$$

$$DLNGDS = b_0 + \sum_{i=1}^{2} b_1 DLNGDS_{t-i} + \sum_{i=1}^{2} b_2 DLNGDP_{t-i} + b_3 Z_{t-1} + e_t \quad (1.5)$$

Empirical Analysis Of The Study

After converting the data series on Gross Domestic Saving and Gross Domestic Product into their logarithmic form, the unit root test has been carried out and the results have been shown in table 1. Both the series LNGDP and LNGDS in levels are found to be integrated of order 1 because the Augmented Dicky-Fuller (ADF) test statistics are found to be lesser negative than the McKinnon critical values at all levels of significance (1 per cent, 5 per cent and 10 per cent). It means that the null hypothesis of unit root can not be rejected, indicating thereby that the series are non-stationary. On the other hand, both these series in their first difference are found to be stationary, i.e., I (0) because the ADF test statistics are found to be more negative than the McKinnon critical values at all levels of significance (1 per cent, 5 per cent and 10 per cent). It means that the null hypothesis can be rejected in favour of the alternative hypothesis that there is no unit root, indicating that these series are stationary. This means that both the series are integrated of same order and become stationary after first differencing. This permits carrying out cointegration test between the two series.

Table 1: Unit Root Tests of Stationarity of Variables under Study

Variables	ADF Test Statistic (Intercept) (Trend and Intercept)	ADF Test Statistic Statistics	Durbin-Watson	Level of Integration
LNGDP	_	-3.165765	1.896398	I (1)
	(-4.1383)*			
	(-3.4952)**			
	(-3.1762)***			

LNGDS	-2.214216 (-4.1383)* (-3.4952)** (-3.1762)***	_	2.151381	I (1)
DLNGDP	-3.918298 (-3.5625)* (-2.9190)** (-2.5970)***	_	2.108563	I (0)
DLNGDS	-6.506003 (-4.1420)* (-3.4969)** (-3.1772)***	_	1.976941	I (0)

* McKinnon Critical value at 1 per cent level of significance

** McKinnon Critical value at 5 per cent level of significance

*** McKinnon critical value at 10 per cent level of significance

Notations:

LNGDP	-	Natural Log of Gross Domestic Product
LNGDS	-	Natural Log of Gross Domestic Saving
DLNGDP	-	First Difference of LNGDP
DLNGDS	-	First Difference of LNGDS

Cointegration results have been shown in table 2. It is observed from the augmented Dicky-Fuller test that the residuals of the cointegrated regression between natural logarithm of GDS and GDP is integrated of order zero with Durbin-Watson statistics being just above 2 and hence the residuals are stationary. Residuals are found to be stationary because the obtained statistics is -2.944126 which is more negative than the McKinnon critical values at all levels of significance (1 per cent, 5 per cent and 10 per cent). It means that there is a long run relationship between the two variables.

Both the dependent and independent variables in the cointegrating regression models are in the natural logarithmic form which means that this kind of regression is of double-log or log-linear form. Accordingly, the coefficients in the cointegrating regression model 1 suggest that one per cent increase in GDP (economic growth) is accompanied by 1.186 per cent increase in GDS (saving). Alternatively, the coefficients in the cointegrating regression model 2 suggest that one per cent increase in GDS (Saving) is accompanied by .84 per cent increase in GDP (economic growth). (table on next page)

Short-run relationship between saving and economic growth has been estimated in terms of error correction model. These estimates have been shown in table 3. It is observed from the results in table 3 that in equation 1.8 all the coefficients except for the constant and the lagged Zt term are found to be statistically insignificant

Table 2. Cointegration Test Results

Cointegrating Regression Output

Cointegrating Regression Model 1.: LNGDSt = a1 + a2 LNGDPt + ut (1.6)

Variable	**Coefficient**	**t-statistics**	**Probability**	**Adjusted R2**	**D.W**
C	-4.009 (0.102)	-39.128	0	0.997	0.598
LNGDP	1.186 (0.009)	138.399	0		

Dependent Variable: LNGDS

Figures in parenthesis are the standard errors of the coefficients.

Cointegrating Regression Model 2.: LNGDPt = a1 + a2 LNGDSt + ut (1.7)

Variable	**Coefficient**	**t-statistics**	**Probability**	**Adjusted R2**	**D.W**
C	3.403 (0.062)	54.719	0	0.997	0.597
LNGDS	0.840 (0.006)	138.399	0		

Dependent Variable: LNGDP

Figures in parenthesis are the standard errors of the coefficients.

ADF Unit Root Tests of Residuals of Cointegrated Estimates

Variable	Obtained Statistics	McKinnon Critical Value	Durbin-Watson Statistics	Level of Integration
	-2.944126	-2.6064 *	2.049432	I (0)
		-1.9468 **		
		-1.6190 ***		

* McKinnon Critical value at 1 per cent level of significance

** McKinnon Critical value at 5 per cent level of significance

*** McKinnon critical value at 10 per cent level of significance

as the value of probability is more than 0.10. It means that lagged values of these endogenous variables do not impact the dependent variable ? LNGDP. Here, coefficient of lagged Zt term is found to be statistically significant because the probability value is 0.048 and the t statistics is -2.032. The negative coefficient of Zt-1 indicates that if the economic growth is above its long-run relationship with the saving, it will decrease to return to equilibrium. The results of the other equation 1.9 show that all the coefficients are statistically insignificant at 5 per cent level of significance except the constant term because the t statistics value is lesser than 2 and the probability value is more than 0.05. Here, the lagged Zt term is also statistically insignificant as t statistics is 1.159 and probability value is 0.252.

Table 3 Estimated Error Correction Model Equations For Gross Domestic Product and Gross Domestic Saving

? LNGDPt = 0.68 + 0.136 ? LNGDPt-1 + 0.179 ? LNGDPt-2 + 0.066 ? LNGDSt-1

(3.554) (1.010) (1.397) (0.839)

(0.001) (0.318) (0.169) (0.406)

-0.001 ? LNGDSt-2 - 0.155 Zt-1

(1.8)

(-0.008) (-2.032)

(0.994) (0.048)

? LNGDSt = 0.119 - 0.193 ? LNGDPt-1 + 0.401 ? LNGDPt-2 + 0.253 ? LNGDSt-1

(3.425) (-0.785) (1.707) (1.754)

(0.001) (0.436) (0.094) (0.086)

-0.282 LNGDSt-2 + 1.63 Zt-1

(1.9)

(-1.962) (1.159)

(0.056) (0.252)

Figures in parenthesis corresponding to each coefficient are t statistics and the probability value.

Notations:

? LNGDPt	-	First Difference of Natural Log of Gross Domestic Product
? LNGDPt-1	-	One year lagged value of First Difference of Natural Log of Gross Domestic Product
? LNGDPt-2	-	Two year lagged value of First Difference of Natural Log of Gross Domestic Product
? LNGDS	-	First Difference of Natural Log of Gross Domestic Saving
? LNGDSt-1	-	One year lagged value of First Difference of Natural Log of Gross Domestic Saving
? LNGDSt-2	-	Two year lagged value of First Difference of Natural Log of Gross Domestic Saving
Zt-1	-	One year lagged value of the residual of the cointegrating regression of LNGDP and LNGDS

Conclusions of the Study

In this paper an attempt has been made to find out the short-run and long-run relationship between saving and economic growth covering a period of 1950-51 to 2008-09. Gross domestic saving at current prices has been considered to represent saving and gross domestic product at current market prices has been considered to represent economic growth. Results of the study suggest that there is a long-run relationship between saving and economic growth as found from the cointegrated relationship. Cointegration results show that one per cent increase in GDP (economic growth) is accompanied by 1.186 per cent increase in GDS (saving). Cointegration results also show that one per cent increase in GDS (Saving) is accompanied by .84 per cent increase in GDP (economic growth). The negative coefficient of Zt-1 in equation 1.8 is found to be statistically significant which indicates that if the

economic growth is above its long-run relationship with the saving, it will decrease to return to equilibrium. The coefficient of Zt-1 in the equation 1.9 is found to be statistically insignificant. Thus, in the short-run the economic growth adjusts itself by decreasing in order to return to equilibrium whenever it is above the long-run relationship with saving but adjustment by saving to catch up with economic growth is not found to be statistically significant.

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