NEXUS BETWEEN SAVINGS, INVESTMENT AND ECONOMIC GROWTH IN INDIA

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Sachin N. Mehta
Assistant Professor, D. R. Patel and R. B. Patel Commerce College, Bharthan (Vesu), Surat.
Gaurang D. Rami
Professor, Department Of Economics, Veer Narmad South Gujarat University, Surat.

Abstract

This paper examines the relationship between gross domestic product (GDP), gross domestic savings (GDS) and gross domestic investment (GDI) for India during the period 1951- 2012. Vector Error Correction Method and co-integration techniques are used for analyzing the relationship between gross domestic product (GDP), gross domestic savings (GDS) and gross domestic investment (GDI) in this study. The Johansen co-integration test indicates gross domestic product (GDP), gross domestic savings (GDS) and gross domestic investment (GDI) are co-integrated, and that a long-run equilibrium exists between them. The Vector Error Correction test reveals that there is unidirectional causality running from gross domestic savings (GDS) and gross domestic investment (GDI) to gross domestic product (GDP) in the short run as well as in the long run. It means gross domestic savings (GDS) and gross domestic investment (GDI) lead to gross domestic product (GDP) but gross domestic product (GDP) does not lead to gross domestic savings (GDS) and gross domestic investment (GDI).

Key words : *Economic Growth, Saving, Investment, Causality, Co-Integration. VECM*

JEL Classifications: C02, C22, E20, E21

Saving and investment are two key macro variables with micro foundations, which can play a significant role in economic growth, inflation stability and promotion of employment. National savings are critically important to help maintain a higher level of investment which is a key determinant for economic uplift' so it is necessary to analyse saving investment behavior for policy implications. The role of domestic saving and domestic investment is important for promoting economic growth. The central idea of Lewis's (1955) traditional theory was that increasing savings would accelerate growth, while the early Harrod-Domar (1939) models specified investment as the key to promoting economic growth. On the other hand, the neoclassical Solow (1970) model argues that the increase in the savings rate boosts steady-state output by more than its direct impact on investment because the induced rise in income raises savings, leading to a further rise in investment. Jappelli and Pagano (1994) also examined that saving contribute to higher investment and higher GDP growth in the short-run. The classical growth models support the hypothesis of saving promoting economic growth and Carroll-Weil hypothesis contradicts with the argument. The Carroll-Weil hypothesis (Carroll and Weil, 1994) states that economic growth that contributes to saving, not saving to growth. In the Indian context, though empirical studies exist on the role of saving and investment in promoting economic growth. Some empirical studies support the classical growth theory, some studies agree with the Carroll-Weil hypothesis and some do not support either of these. To illustrate, Sinha (1996) looked at the causality between the growth rates of gross domestic saving and economic growth, and found that there was no causality running in either direction. In a another study, Sinha and Sinha (2008) examined the relationships among growth rates of the GDP, household saving, public saving and corporate saving for the period 1950 to 2001 and found that economic growth produced higher saving in various forms and it was never the other way around. Ritu Verma (2007) employed the ARDL co-integration approach to determine the long run relationship of GDS, GDI and GDP for the period 1950-51 to 2003-04 and supported the Carroll-Weil hypothesis that saving does not cause growth, but growth causes saving. Ramesh Jangili (2011) examines the direction of the relationship between saving, investment and economic growth in India at both aggregate level and sectoral level for the period 1950-51 to 2007-08 by using Granger causality test. It is empirically evident that the direction of causality is from saving and investment to economic growth collectively as well as individually and there is no causality from economic growth to saving and investment. It appears that there is no comprehensive study available on the analysis of the interdependence between saving, investment and economic growth. Therefore, this study investigates the possibility of saving investment led growth and growth driven saving investment hypothesis, in detail, by testing for Granger causality between the logarithms of saving, nominal investment and nominal GDP in India.

Review of Literature : Sinha Dipendra (1996) in his paper "Savings and Economic Growth in India" found that both gross domestic saving and gross domestic private saving are co integrated 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. Agrawal (2001) examines the causality between GDP and saving for a number of Asian countries. He found evidence that higher savings rates cause higher growth rates in Bangladesh and Pakistan and higher growth rates cause higher savings rates in India and Sri Lanka. Reetu Verma (2007) in her paper "Savings, Investment and Growth in India" The study found that savings do not cause growth, but growth cause savings in India. Sinha, Dipendra and Sinha, Tapen (2007) worked on the relationship between per capita saving and per capita GDP for India using the Granger causality Data are for 1950-2004. The results show that there is no causality between per capita GDP and per capita household saving / per capita corporate saving in either direction. P. K. Mishra, J.R. Das and S.K. Mishra (2008) estimated the relationship between savings and investment for India. They found that the gross domestic investment causes gross domestic savings and gross domestic savings also causes gross domestic investment in India. That means there is bidirectional causality between gross domestic investment and

gross domestic savings. Ramesh Jangili (2011) in his paper "Causal Relationship between Saving, Investment and Economic Growth for India" examines the direction of the relationship between saving, investment and economic growth in India at both aggregate level and sectoral level for the period 1950-51 to 2007-08 by using Granger causality test. It is empirically evident that the direction of causality is from saving and investment to economic growth collectively as well as individually and there is no causality from economic growth to saving and investment.

Research Design

In this study, annual data is used from 1951 to 2012. All the data were collected from HAND BOOK OF INDIA (RBI) 2012-13. Variables used in this study and the definitions are GDS (log of Gross Domestic Savings), GDI (log of Gross Domestic Investment) and GDP (log of Gross Domestic Product) The data is analyzed to determine the causality between Saving, Investment and Growth. Before analyzing the causal relationship between Saving, Investment and Growth, data has been transformed in to natural logarithms, and then possible existence of unit roots in the data is examined. The stationarity of each series is investigated by employing Augmented Dickey-Fuller unit root test. The number of lagged differences included is determined by the Schwarz Information Criterion and Akaike Information criteria. Further proceed with the VAR lag order selection criteria to choose the best lag length for the VAR time series model to examine the Granger Causality test for all the series is performed. Johansen co-integration test is also applied to test for co-integration

The basic empirical investigation has two purposes. The first one is to examine the long-run relationship between Saving, Investment and Growth while the second is to examine the short-run dynamic causal relationship between Saving, Investment and Growth. The basic testing procedure requires three steps. The first step is to test whether the variables contain a unit root to confirm the stationarity of each variable. This is done by using the Augmented Dickey–Fuller tests (ADF). In the second step we test for the existence of a long-run co-integrating relationship between the variables. This is done by the use of the Johansen co-integration test. Finally, the last step, if all variables are integrated of same order and co-integrated then short run and long run causality test can be computed using the vector error correction model (VECM) method suggested by Engle and Granger (1987).

Results

Result of Stationarity Test : One of the most important attributes of a time series variable is its order of integration. Hence, we first perform unit root tests in levels and first differences in order to determine the order of integration of the series. To test the order of integration, we employ the conventional augmented Dickey-Fuller (ADF) test.

Table : 1

Result of Unit Root Test Using Augmented Dickey Fuller Test

Variable	At Level		At First Difference		Conclusion
	ADF	Prob.	ADF	Prob.	
Gross Domestic Product (GDP)	6.1989	1.0000	-4.3354	0.0000	I (1)
Gross Domestic Saving (GDS)	1.9065	0.9856	-2.2280	0.02312	I (1)
Gross Domestic Investment (GDI)	9.4162	1.0000	-8.0201	0.0000	I (1)

It is evident from the above table that the calculated ADF statistics for level variables are less than the critical values in all cases, suggesting that the variables are not level stationary. Table 1 also shows that the ADF statistics for all the variables imply first-difference stationary.

Result of Lag Order Selection Criteria for GDP, GDS and GDI: For getting optimal lag Length for co integration analysis, we have used five criteria namely, LR test statistic, Final prediction error, Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion. All the criteria have suggested a leg length of 1 as a optimal leg length.

Table 2

VAR Lag Order Selection Criteria for GDP, GDS and GDI

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-79.94951	NA	0.003686	2.910509	3.018038	2.952299
1	**161.0551**	**448.1840***	**1.08e-06***	**-5.230004***	**-4.799888***	**-5.062846***
2	168.8161	13.61583	1.13e-06	-5.186531	-4.433828	-4.894005
3	170.5996	2.941142	1.46e-06	-4.933319	-3.858029	-4.515425
4	179.4070	13.59739	1.49e-06	-4.926561	-3.528684	-4.383298
5	186.0706	9.586205	1.65e-06	-4.844581	-3.124117	-4.175950

*** indicates lag order selected by the criterion**

LR : sequential modified LR test statistic

HQ : Hannan-Quinn information criterion

FPE : Final prediction error

AIC : Akaike information criterion

SC : Schwarz information criterion

Result of Co-Integration Test Based on Johnson Juselius Method : Once we have the results of unit roots, the next step is to determine whether there exists co-integration, using the same order of integrated variables. To test for co-integration, the Johansen and Juselius (1990) procedure was used, which leads to two test statistics, trace test and maximum eigenvalue test, for cointegration.

Table: 3

Result Of the Co-integration Test based on Johnson Juselius method

Johansen Test for Co-integration (Trace Test)					
Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	0.01 Critical Value	Prob.	Conclusion
None	41.34210	29.79707	35.65	0.0015	One Co integrating Relationship
At most 1	4.751758	15.49471	20.04	0.8346	
At most 2	0.639225	3.841466	6.65	0.4240	
Johansen Test for Co-integration (Maximum Eigen value Test)					
Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value	0.01Critical Value	Prob.	Conclusion
None	36.59034	21.13162	25.52	0.0002	One Co integrating Relationship
At most 1	4.112533	14.26460	18.63	0.8473	
At most 2	0.639225	3.841466	6.65	0.4240	

Table3 express the results of the co-integration test. There are two test statistics for co-integration, the Trace test and Maximum Eigen value test. The Trace-Statistic value is shown to be greater than the critical values at both 1% and 5% levels. Therefore, we reject the null hypothesis of no co-integrated equation among the variables. Thus, we conclude that there is at most one co-integrated equation among the variables. The results of Maximum Eigen value test statistics also express

same here. Finally, we can say that there is a long run relationship between gross domestic product (GDP), gross domestic saving (GDS) and gross domestic investment (GDI).

Result of Granger Causality Test Based on VECM:

Long run Causality Test Based on VECM: The VECM long run causality result presented in Table 4 revealed the causal relationship among gross domestic product (GDP), gross domestic saving (GDS) and gross domestic investment (GDI). The result showed that the error correction term for co-integrating equation with gross domestic product (GDP) as a dependent variable is negative and significant at one percent, implying that there exists a strong long run relationship running from gross domestic saving (GDS) and gross domestic investment (GDI) to economic growth (GDP). The coefficient of error correction term with gross domestic saving (GDS) as a dependent variable was observed to be insignificant, implying that no existence of long run causality was observed from gross domestic product (GDP) and gross domestic investment (GDI) to gross domestic savings (GDS). The coefficient of error correction term with gross domestic investment (GDI) as a dependent variable was observed to be insignificant, implying that no existence of long run causality was observed from gross domestic product (GDP) and gross domestic saving (GDS) to gross domestic investment (GDI).

Table : 4

Long run Causality Test Based on VECM:

Causality	ECM_{t-1}	T-Statistic	Prob.	Result
Long run causality from GDS and GDI to GDP	-0.271273	-5.996765	0.0000	Causality exist
Long run causality from GDP and GDI to GDS	-0.001265	-0.201070	0.8414	No Causality
Long run causality from GDP and GDS to GDI	-0.087222	-0.858891	0.3941	No Causality

Short run Causality Test Based on VECM / Block Exogeneity Wald Tests: Multivariate Short run Causality Test Based on VECM/Block Exogeneity Wald Tests present in Table 5 revealed the short run causal relationship among gross domestic product (GDP), gross domestic saving (GDS) and gross domestic investment (GDI). The result showed that the short run unidirectional causality running from GDS and GDI to GDP. Result also expressed that the short run unidirectional causality running from GDS to GDI.

Table: 5

Shortrun Causality Test Based on VECM / Block Exogeneity Wald Tests

Causality	Coefficient	T-Statistic	Result
Short run causality from GDP to GDS	-0.606238	-0.6188	Uni directional Causality
Short run causality from GDS to GDP	0.166866	2.0743**	
Short run causality from GDP to GDI	0.439189	-0.8588	Uni directional Causality
Short run causality from GDI to GDP	-0.207630	-2.8559***	
Short run causality from GDS and GDI	0.795127	3.886470***	Uni directional Causality
Short run causality from GDI to GDS	-0.385994	-0.6173	

**** and *** denotes significant at 5% and 1% respectively.**

Conclusion : In this paper, we have examined the relationship between gross domestic product (GDP), gross domestic saving (GDS) and gross domestic investment (GDI) in India using time series data from 1951 to 2012. This study uses the ADF unit root test, Johansen co-integration and Vector Error Correction techniques to investigate the long run and short run causality between gross domestic products (GDP), gross domestic saving (GDS) and gross domestic investment (GDI) in India. . From the above study, it can be concluded that the Augmendented Dickey Fuller unit root tests show that GDP, GDS and GDI series become stationary when first difference are considered. The empirical result reveals a long run co-integrating relationship between gross domestic products (GDP), gross domestic saving (GDS) and gross domestic investment (GDI) in India. We also found evidence of unidirectional causality running from GDS and GDI to GDP in the short run as well as in the long run. It means GDS and GDI lead to GDP in the short run as well as in the long run. However, GDP does not lead to GDS and GDI in the short run as well as in the long run.

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