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Saving and Investment Relationship in India: A Vector Error Correction Modelling

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ABSTRACT

The study of the relationship between saving and investment has a wide relevance for developed as well as developing nations. Economists often claim that higher savings contribute to increased investment and growth of Gross Domestic Product in an economy and thus, savings and investment are key factors for the sustainable development of a country. So, the objective of this paper is to investigate the relationship between savings and investment in the context of the Indian economy over the period 1950-51 to 2008-09. The use of the annual data in their natural logarithms in co integration test provides the evidence of existence of long-run equilibrium relationship between saving and investment. And, the vector error correction modelling suggests that there exists long-run unidirectional causality between the variables running from saving to investment. The Granger causality test supports the existence of short-run unidirectional causality running in the same direction too. This result disproves the classical theory, and establishes the Keynes view on saving-investment relationship. In addition, since higher economic growth warrants a balance between savings and investment, the policy makers should bring a trade off between monetary and fiscal policies.

KEYWORDS: Savings, Investment, Co- integration, VECM, Granger Causality

JEL CLASSIFICATION: C32, E21, E22

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INTRODUCTION

Since last few decades the investigation of the relationship between savings and investment has received a considerable attention of researchers, academicians and policy makers in developing countries like India. Saving and investment have been considered as two critical macro-economic variables with micro-economic foundations for achieving price stability and promoting employment opportunities thereby contributing to sustainable economic growth.

A long-standing view of the macro-economic dynamics of the growth process was that increasing savings when transformed into productive investment would help achieve an economic "take-off" (*Harrod, 1939; Domar, 1946; Lewis, 1954; Solow, 1956*). *Solow (1970),* argue 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. The endogenous growth theories since the mid-1980s, typified by *Romer (1986, 1990), Lucas (1988) and Barro (1990),* reconfirm the view that the accumulation of physical capital is the critical driver of long-run economic growth. *Bacha (1990) and Jappelli and Pagano (1994)*, also claim that savings contribute to higher investment and higher GDP growth in the short-run.

Since independence, Indian economy has moved from a moderate growth path of 1950-1980 to a higher growth trajectory from 1980s. Over the last three decades, Indian economy has emerged as one of the fastest growing economies of the world. Apart from registering impressive growth rate, India's growth process has been almost stable. Many empirical studies suggest the evidence that the year's variation in growth rate of Indian economy has been one of the lowest. In view of this fact, the role of saving and investment in proving the fundamental growth impulses in the economy cannot be overemphasised. It is a well established fact that the growth of income, output and employment of an economy depend on the volume of capital formation which in turn is determined by the rate of savings in the economy. Thus, real growth of an economy presumes not only a high rate of savings and investment but a high degree of positive correlation between them. Indian economy has been showing a steep increase in the domestic savings as a percentage of GDP, driven by increases in savings by the households, corporate and government sectors. This ratio has gone up by about four times, from a meagre 9.3% in 1950-51 to as high as 37.7% in 2007-08. Interestingly, the country's gross domestic savings has fallen to 32.5 per cent of GDP at market prices in 2008-09 as against 36.4 per cent in the previous year as per CSO estimates. But, in absolute numbers, the savings at current prices in 2008-09 had gone up to Rs 18, 11,585 crore from Rs 18, 01,469 crore in 2007-08. The fall in the rate of gross domestic savings has been mainly attributed to the fall in rates of savings of public sector (from 5 per cent in 2007-08 to 1.4 per cent in 2008-09) and private corporate sector (from 8.7 per cent in 2007-08 to 8.4 per cent in 2008-09). In respect of household sector, the rate of saving has remained at the same level of 22.6 per cent in 2007-08 and 2008-09.

The gross capital formation has also gone up sizeably since the 1950s, with significant jump ups during 2000s. The rate of gross capital formation has increased approximately by four fold, from around 10% in 1950-51 to 39.1% in 2007-08. According to CSO estimates, the gross domestic capital formation at current prices has increased from Rs. 18,65,899 crore in 2007-08 to Rs. 19,44,328 crore in 2008-09. But, the rate of gross capital formation at current prices has fallen to 34.9 per cent in 2008-09 from 37.7 per cent in 2007-08. This infers that the surge in India's saving ratio has continued to be matched by a commensurate increase in its investment ratio. The movements of gross domestic savings and capital formation in India over the period 1950-51 to 2008-09 are shown in Fig.1 which suggests that investment is greater than savings in almost all the periods. This inference contradicts the classical economists' view that planned savings are always equal to planned investment. It is with this backdrop, an attempt has been made in this paper to re-investigate the relationship between saving and investment in an emerging market economy like India. The rest of the paper is organised as follows: Section II reviews the empirical literature; Section III discusses the data and methodology of the study; Section IV makes the empirical analysis; and Section V summarizes and concludes.

REVIEW OF LITERATURE

The origin of the study of saving - investment relationship in the empirical literature can be traced back to a seminal study by *Fledstein and Horioka (1980)*. They examined the degree of the association between saving and investment rates across 16 OECD countries using data for the time period 1960-74, and found a high degree of correlation between domestic savings and investment that suggested the existence of limited capital mobility. Following this finding, the relationship between saving and investment has been the subject matter of intense research over the past three decades. In the cross-sectional framework, the findings of *Penati and Dooley (1984)* and *Dooley et al (1987)*, suggest a significant relationship between domestic saving and investment rates. *Obstfeld (1986)*, considering seven OECD countries found that saving-investment correlation differed significantly from one. *Frankel et al (1986)* using a sample of 64 countries (14 developed and 50 developing countries) in a study on savings-investment relationship found that in case of all the countries except a few less developed countries, savings and investment are highly correlated and shared a long-run equilibrium relationship. *Miller (1988)*, using the time series data for a period 1946 to 1987, found that in U.S both savings and investment were I(1) and shared a cointegrating relationship prior to the Second World War period and that the long-run relationship did not exist in the post-war period. The paper concluded that this phenomenon could be explained by the increased international mobility after the War. *Bayoumi (1990)*, argued that to a large extent the saving-investment correlation reflects endogenous inventory investment behaviour. *Arginon and Roldan (1994)*, investigated the observed correlation between domestic savings and investment in European countries using annual data for the period 1960–1988 and suggest the causality flowing from savings to investment without any feedback effect. *De Hann and Siermann (1994)*, found cointegration between savings and investment for some OECD countries. *Ghosh and Ostry (1995)*, used a current-account solvency model for some developing countries to explain the correlation of savings and investment co-movement in advanced and developing economies. Their approach takes into account demand-side factors. *Krol (1996)* examined the relationship between savings and investment using annual data pooled for 21 OECD countries over the period 1962-90 and found that the estimated impact of savings on investment is considerably smaller than the estimates of the earlier researcher that were used as averaged data (*Pelagidis and Mastroyiannis, 2003*). *Apergis and Tsoulfidis (1997)*, for 14 EU countries found that savings and investment are cointegrated which suggests that capital mobility is not as high even after the move towards economic integration in Europe has gained momentum. The study also finds that savings Granger-causes investment using Vector Error-Correction Model.

Mamingi (1997), estimated the relationship between saving and investment correlations for 58 developing countries by assessing the degree of capital mobility in the Feldstein -Horioka sense for these developing countries. They found that the relationship between savings and investment in case of middle-income countries tend to be lower than those that of low-income countries. *Levy (1998)*, examined the relationship in the short run as well in the long run and found the evidence in favour of long run and cyclical relationship between savings and investment. This study also found stronger relationship between savings and investment relationship in the post-war period than during pre-war period. Jansen (1998) suggests that correlation between savings and investment in the long run is determined by one or more of these factors - limited capital mobility, current account targeting by the Government and inter-temporal budget constraint and the short-run co-movements are due to capital mobility. In addition, the study also finds that the short-run correlation seems to vary across countries and is determined by country-specific business cycles (*Leachman, 1991; Jansen, 1996 and Taylor, 1996*). *Coakley, Hasan and Smith (1999)*, found that the correlation between savings and investment is low in less developed countries, which could be attributed to country-specific macro-economic policies and not high mobility. *Corbin (2001)*, recognized the importance of controlling for the heterogeneity of countries in a cross-section analysis of the savings and investment correlation for a group of countries using panel data. Thus, concluded that high saving and investment correlation is more due to country specific effect than to the existence of common factors affecting all the countries in his sample. *De Vita and Abott (2001)*, found that there is high correlation between saving and investment in the U.S.A by applying Autoregressive Distributive Lag (ARDL) bounds testing. This correlation however weakened during the more liberalized floating exchange rate period. *Sinha (2002)* ,found that savings and investment rates are cointegrated for Myanmar and Thailand indicating the growth of savings rate causes the growth of investment rate. Interestingly, reverse causality between savings rate and investment rate has been observed for Hong Kong, Malaysia, Myanmar and Singapore. *Kasuga (2004)*, employed cross sectional analysis and concluded that the impact of domestic savings on investment depends on financial systems and their development. Usually in developing countries with bank-based and/or relatively inefficient financial sectors, the lower saving and investment correlation is not unexpected. *Sinha and Sinha (2004),* used a huge sample of 123 countries to estimate the short run and long-run relationship between savings and investment rates in an Error Correction framework. And, the results suggest capital should be more mobile for the countries with high per capita income. They also found that the capital is mobile for 16 countries most with a low per-capita income. *Narayan (2005),* showed that low capital mobility also causes high saving and investment correlation in a study on China during the period of restricted capital mobility as indicated by low foreign direct investment. *Seshaiah and Sriyval (2005)* ,investigated the relationship between savings and investment in India. The results reveal that there is unidirectional causality from savings to investment in the country during the sample period 1970-71 to 2001-02.*Chinn and Ito (2007)*, found that increased financial liberalization may also encourage outflows of funds, resulting in fewer resources available to fund domestic investment projects, and thereby curtail the correlation between saving and investment. Moreover, the effect of financial liberalization on the relationship is further confounded by the theoretically ambiguous effect of financial liberalization on savings, although its effect on investment has generally been found to be positive. *Verma (2007)* ,considered savings, investment and economic growth for India using annual time series data for the period 1950-51 to 2003-04. The study finds that saving unambiguously determines investment in both the short-run and long-run. And, no evidence has been found to support the commonly accepted growth models in India, that investment is the engine of economic growth. *Wahid, Salahuddin and Noman (2008)*, using Fixed Effect, Random Effect and between or CS models, found that there is low correlation between saving and investment in Bangladesh, India, Pakistan, Srilanka and Nepal. But this result does not necessarily imply high capital mobility in these countries as capital mobility is influenced by other factors such as economic size, differences in financial structure across countries, fiscal policy coordination etc. *Ang (2009),* examined the dynamic relationship between the domestic savings and investment rates in India over the period 1950-2005 by controlling for the level of financial liberalization. The results indicate that greater financial liberalization enables more domestic resources to be channelled to investment activities. This literature review has made significant contributions to our understanding of the saving-investment relationship. It is well inferred that a number of factors have been emerged empirically to explain the savings and investment correlation in both developed and developing countries.The important among them are capital mobility, current account targeting by the government, inter-temporal budget constraint, and economic liberalisation.

It is also understandable that the literature lacks satisfactory studies on saving and investment relationship in an emerging market economy like India. Secondly, the literature is silent about a study on this relationship that takes into account the period of recent global financial crisis. The inclusion of the period of recent global financial crisis may provide an ideal testing ground for further analysis on the relationship between saving and investment. Finally, the database for India is considered relatively good by developing country standards. Therefore, this paper is an attempt to enrich the empirical literature by reinvestigating the saving and investment relationship covering the period of recent global crisis.

DATA AND METHODOLOGY

The objective of this paper is to investigate short-run and long-run relationship between saving and investment in India for the period 1950-51 to 2009-10. The study uses the annual data on select variables for the sample period. The variables of the study are Gross Domestic Savings (GDS) and Gross Domestic Capital Formation (GDCF) in India. All the variables are expressed in their natural logarithms to avoid the problems of heteroscedasticity, and denoted by LGDS and LGDCF respectively. The relevant annual data on domestic savings and investment for the sample period have been collected from the Handbook of Statistics on Indian Economy published by Reserve Bank of India. As an essential requirement of the time series based empirical analysis, the stationary properties of the time series have been tested by employing the Augmented Dickey-Fuller Unit Root Test (*Dickey and Fuller, 1979*). Then, the cointegration, i.e.

the existence of a long-run equilibrium relationship between savings and investment in India has been tested by applying Johansen's Cointegration Test. At last, the short-run and long-run dynamics of the relation between savings and investment has been examined by resorting to the Vector Error Correction Modelling.

Unit Root Test

The time series econometric methodology, first examines the stationarity properties of each time series of consideration. The present study uses Augmented Dickey-Fuller (ADF) unit root test to examine the stationarity of the data series. It consists of running a regression of the first difference of the series against the series lagged once lagged difference terms and optionally, a constant and a time trend. This can be expressed as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \alpha_2 Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \varepsilon_t \text{ ....(1)}$$

The additional lagged terms are included to ensure that the errors are uncorrelated. In this ADF procedure, the test for a unit root is conducted on the coefficient of Y_{t-1} in the regression. If the coefficient is significantly different from zero, then the hypothesis that Y_t contains a unit root is rejected. Rejection of the null hypothesis implies stationarity. Precisely, the null hypothesis is that the variable is a non-stationary series ($H_0 : \alpha_2 = 0$) and is rejected when α_2 is significantly negative ($H_a : \alpha_2 < 0$). If the calculated value of ADF statistic is higher than McKinnon's critical values, then the null hypothesis (H_0) is not rejected and the series is non-stationary or not integrated of order zero, I(0). Alternatively, rejection of the null hypothesis implies stationarity. Failure to reject the null hypothesis leads to conducting the test on the difference of the series, so further differencing is conducted until stationarity is reached and the null hypothesis is rejected. If the time series (variables) are non-stationary in their levels, they can be integrated with I(1), when their first differences are stationary.

Co integration Test

Once a unit root has been confirmed for a data series, the next step is to examine whether there exists a long-run equilibrium relationship among variables. This is called cointegration analysis which is very significant to avoid the risk of spurious regression. Cointegration analysis is important because if two non-stationary variables are cointegrated, a VAR model in the first difference is misspecified due to the effects of a common trend. If cointegration relationship is identified, the model should include residuals from the vectors (lagged one period) in the dynamic VECM system. In this stage, Johansen's cointegration test is used to identify cointegrating relationship among the variables. The Johansen method applies the maximum likelihood procedure to determine the presence of cointegrated vectors in non-stationary time series. The testing hypothesis is the null of non-cointegration against the alternative of existence of cointegration using the Johansen maximum likelihood procedure.

In the Johansen framework, the first step is the estimation of an unrestricted, closed p^{th} order VAR in k variables. The VAR model as considered in this study is:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots.. + A_p Y_{t-p} + BX_t + \varepsilon_t \text{....... (2)}$$

Where Y_t is a k-vector of non-stationary I(1) endogenous variables, X_t is a d-vector of exogenous deterministic variables, A_1..........A_2.......... *and B* are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

Since most economic time series are non-stationary, the above stated VAR model is generally estimated in its first-difference form as:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + BX_t + \varepsilon_t \text{.......................(3)}$$

Where, $\Pi = \sum_{i=1}^{p} A_i - I, \quad and \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank, $r<k$ then there exist $k \times r$ matrices α *and* β each with rank r such that $\Pi = \alpha\beta'$ *and* $\beta' Y_t$ is I(0).r is the number of co-integrating relations (the *co-integrating rank*) and each column of β is the co-integrating vector. α is the matrix of error correction parameters that measure the speed of adjustments in ΔY_t.

The Johansen approach to cointegration test is based on two test statistics, viz., the trace test statistic, and the maximum eigenvalue test statistic *(Johansen, 1988, 1991)*.

Trace Test Statistic

The trace test statistic can be specified as: $\tau_{trace} = -T \sum_{i=r+1}^{k} \log(1-\lambda_i)$, where λ_i is the *ith* largest eigenvalue of matrix Π and T is the number of observations. In the trace test, the null hypothesis is that the number of distinct cointegrating vector(s) is less than or equal to the number of cointegration relations (r).

Maximum Eigenvalue Test

The maximum eigenvalue test examines the null hypothesis of exactly r cointegrating relations against the alternative of $r+1$ cointegrating relations with the test statistic: $\tau_{max} = -T \log(1-\lambda_{r+1})$, where λ_{r+1} is the $(r+1)^{th}$ largest squared eigenvalue. In the trace test, the null hypothesis of $r=0$ is tested against the alternative of $r+1$ cointegrating vectors.

It is well known that Johansen's cointegration test is very sensitive to the choice of lag length. So first a VAR model is fitted to the time series data in order to find an appropriate lag structure. The Akaie Information Criterion (AIC), Schwarz Criterion (SC) and the Likelihood Ratio (LR) test are used to select the number of lags required in the cointegration test.

Vector Error Correction Model

Once the cointegration is confirmed to exist between variables, then the third step requires the construction of error correction mechanism to model dynamic relationship. The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state.

A Vector Error Correction Model (VECM) is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. Once the equilibrium conditions are imposed, the VECM describes how the examined model is adjusting in each time period towards its long-run equilibrium state. Since the variables are supposed to be cointegrated, then in the short-run, deviations from this long-run equilibrium will feedback on the changes in the dependent variables in order to force their movements towards the long-run equilibrium state. Hence, the cointegrated vectors from which the error correction terms are derived are each indicating an independent direction where a stable meaningful long-run equilibrium state exists.

The VECM has cointegration relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationship while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The dynamic specification of the VECM allows the deletion of the insignificant variables, while the error correction term is retained. The size of the error correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state.

In this study the error correction model as suggested by *Hendry (1986)*, has been used. The general form of the VECM is as follows:

$$\Delta X_t = \alpha_0 + \lambda_1 EC^1_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \sum_{j=1}^{n} \alpha_j \Delta Y_{t-j} + \varepsilon_{1t} \quad .....(4)$$

$$\Delta Y_t = \beta_0 + \lambda_2 EC^2_{t-1} + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{j=1}^{n} \beta_j \Delta X_{t-j} + \varepsilon_{2t} \quad .....(5)$$

Where Δ is the first difference operator; EC_{t-1} is the error correction term lagged one period; λ is the short-run coefficient of the error correction term $(-1 < \lambda < 0)$; and ε is the white noise. The error correction coefficient (λ) is very important in this error correction estimation as greater the co-efficient indicates higher speed of adjustment of the model from the short-run to the long-run.

The error correction term represents the long-run relationship. A negative and significant coefficient of the error correction term indicates the presence of long-run causal relationship. If both the coefficients of error correction terms in both the equations are significant, this will suggest the bi-directional causality. If only λ_1 is negative and significant, this will suggest a unidirectional causality from Y to X, implying that Y drives X towards long-run equilibrium but not the other way around. Similarly, if λ_2 is negative and significant, this will suggest a unidirectional causality from X to Y, implying that X drives Y towards long-run equilibrium but not the other way around.

On the other hand, the lagged terms of ΔX_t and ΔY_t appeared as explanatory variables, indicate short-run cause and effect relationship between the two variables. Thus, if the lagged coefficients of ΔX_t appear to be significant in the regression of ΔY_t, this will mean that X causes Y. Similarly, if the lagged coefficients of ΔY_t appear to be significant in the regression of ΔX_t, this will mean that Y causes X.

EMPIRICAL FINDINGS

At the outset, the correlation between savings and investment in India is examined by calculating Pearson's correlation coefficient. The correlation coefficient between the variables is 0.99 with the t-statistic of 53.9 at 59 degrees of freedom. Since the computed t-value is greater than the critical t-value at 1% level of significance, the Pearson's correlation coefficient is very significant. It is also clear from the Figure 1 that the savings and investment moves in the same direction. This is the indication of high degree of positive correlation between the two time series. Correlation, however, does not say anything about long-run relationship and thus, leaves unsettled the debate concerning the long-run relationship between savings and investment.

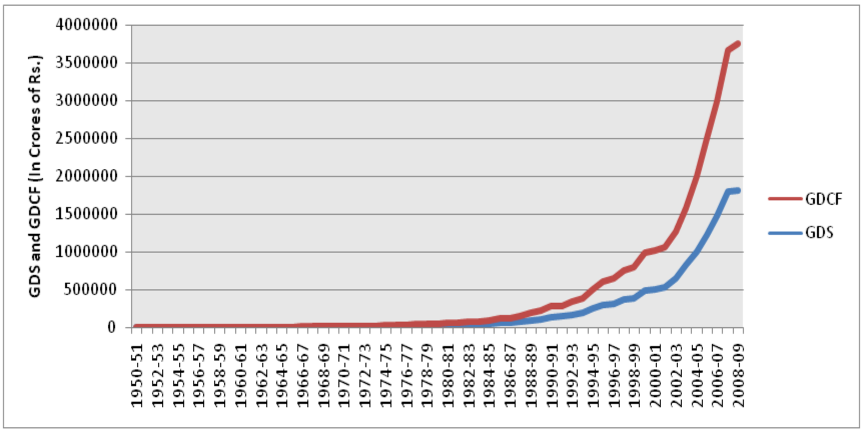

Figure 1: Co-Movement of Savings and Investment in India

Source: Author's Own Calculation

Before proceeding with the empirical analysis, it is required to determine the order of integration for each of the two variables used in the analysis. The Augmented Dickey-Fuller unit root test has been used for this purpose. And, the results of such test are reported in Table 1.

It is clear from the Table1 that the hull hypothesis of no unit roots for both the time series are rejected at their first differences since the ADF test statistic values are less than the critical values at 10%, 5% and 1% levels of significances. Thus, the variables are stationary and integrated of same order, i.e., I(1).

Table 1: Results of Augmented Dickey-Fuller Unit Root Test

Variables in their First Differences with intercept & Linear Trend	ADF Statistic	Critical Values	Decision
LGDS	-6.86	At 1% : -4.12 At 5% : -3.49 At 10% : -3.17	Reject Null hypothesis of no unit root
LGDCF	-4.48	At 1% : -4.12 At 5% : -3.49 At 10% : -3.17	Reject Null hypothesis of no unit root

Source: Author's Own Calculation

In the next step, the cointegration between the stationary variables has been tested by the Johansen's Trace and Maximum Eigenvalue tests. The results of these tests are shown in Table2.

Table 2: Cointegration Test of Variables

Hypothesized Number of Cointegrating Equations	Eigen Value	Trace Statistics	Critical Value at 5% (p-value)	Maximum Eigen statistics	Critical Value at 5% (p-value)
None*	0.2539	20.1507	15.494(0.009)	16.407	14.264(0.022)
At Most 1	0.0646	3.7428	3.841(0.053)	3.7428	3.841(0.053)

* denotes rejection of the hypothesis at the 0.05 level
Source: Author's Own Calculation

The null hypothesis of no Cointegration between savings and investment $(r = 0)$ based on both the maximum eigenvalue test and the trace test is rejected at the (5%) level of significance. However, the null hypothesis that $(r \leq 1)$ could not be rejected which indicates the existence of only one cointegration equation between the two time series at 5% level of significance. Thus, the two variables of the study have long-run equilibrium relationship between them. But in the short-run there may be deviations from this equilibrium and we have to verify that whether such disequilibrium converges to the long-run equilibrium or not. And, Vector Error Correction Model can be used to generate this short-run dynamics.

The estimation of a Vector Error Correction Model (VECM) requires selection of an appropriate lag length. The number of lags in the model has been determined according to Akaike Information Criterion (AIC). The lag length that minimizes the AIC is 2. Then an error correction model with the computed t-values of the regression coefficients is estimated and the results are reported in Table3.

The estimated coefficient of error-correction term in the LGDCF equation is statistically significant and has a negative sign, which confirms that there is not only any problem in the long-run equilibrium relation between the independent and dependent variables in 5% level of significance, but its relative value (-0.3611) for India shows the rate of convergence to the equilibrium state per year. Precisely, the speed of adjustment of any disequilibrium towards a long-run equilibrium is that about 36.11% of the disequilibrium in gross domestic capital formation is corrected each year. Furthermore, the negative and statistically significant value of error correction coefficient indicates the existence of a long-run causality between the variables of the study. And, this causality is unidirectional in our model being running from savings to investment. In other words, the changes in GDCF can be explained by GDS. However, the coefficient of the error term in the LGDS equation is negative, but statistically insignificant which means that the error term does not contribute in explaining the changes in GDS. Therefore, it confirms the unidirectional causality running from the GDS to GDCF.

The coefficients of the first difference of GDS lagged

Table 3: Estimates for VECM Regression

Independent Variable	$LGDCF_t$	$LGDS_t$
EC_{t-1}	-0.3611	-0.0147
[t-statistic]	[-2.1515]	[-0.0921]
(p-value)	(0.0338)	(0.9268)
$LGDCF_{t-1}$	-0.2818	-0.3693
[t-statistic]	[-1.1993]	[-1.6429]
(p-value)	(0.2332)	(0.1035)
$LGDCF_{t-2}$	0.2103	0.0098
[t-statistic]	[0.9784]	[0.0476]
(p-value)	(0.3302)	(0.9621)
$LGDS_{t-1}$	0.7097	0.5310
[t-statistic]	[2.6360]	[2.0623]
(p-value)	(0.0097)	(0.0418)
$LGDS_{t-2}$	-0.3618	-0.2326
[t-statistic]	[-1.262]	[-0.8485]
(p-value)	(0.2098)	(0.3982)
Constant	0.1006	0.1438
[t-statistic]	[3.7765]	[5.6441]
(p-value)	(0.003)	(0.0000)

Source: Author's Own Calculation

Table 4: Results of Granger Causality TestNull Hypothesis

	F-Statistic	Probability	Decision
ΔLGDS does not Granger Cause ΔLGDCF	6.5854	0.0028	Reject
ΔLGDCF does not Granger Cause ΔLGDS	1.9048	0.1592	Accept

(Number of lags = 2)

Source: Author's Own Calculation

one period in LGDCF equation in Table-3 is statistically significant which indicate the presence of short-run causality from GDS to GDCF based on VECM estimates. In order to confirm the result of the short-run causality between the ÄLGDS and the ÄLGDCF based on VECM estimates, a standard Granger causality test has been performed based on F-statistics *(Granger, 1988)*. The results of Granger causality test are reported in Table4.

The result in Table4 indicates that the null hypothesis that Gross Domestic Savings does not Granger cause the Gross Domestic Capital Formation is rejected at 5% level of significance. This result supports the previous result obtained from VECM that there exists a short-run causality from savings to investment at the 5% level of significance. Based on this causality test it can be said that change in savings cause changes in investment in the short- and long-run as well.

CONCLUSION

This paper examined the dynamics of short- and long-run relationships between savings and investment in India over the period 1950-51 to 2008-09. As an essential pre-requisite of the analysis, both the time series of the study have been tested for the stationarity by the ADF unit root test and it is found that both the variables are stationary at their logarithmic first difference forms. Then, the Johansen's cointegration test has been performed to investigate the long-run equilibrium relationship between the variables, and it is found that there exists one cointegrating equation thereby indicating the presence of long-run equilibrium relationship, although they may be in disequilibrium in the short-run. The vector error correction model based on VAR indicates that about 36.11% of disequilibrium is corrected each year. In addition, the negative and significant error correction term in LGDCF equation supports the existence of a long-run equilibrium relationship between GDS and GDCF.

Furthermore, the estimates of the VECM indicate the existence of a unidirectional causality running from GDS to GDCF. The Granger causality test indicates that there exists a causal relationship running from GDS to GDCF in the short- and long-run. Precisely, the empirical evidence put forward is that savings drive investment in both the short- and long-run. Such finding is in line with *Seshaiah and Sriyval (2005) and Verma (2007)*, and supports the arguments of *Bacha (1990) and Jappelli and Pagano (1994)*, that savings contribute to higher investment and higher GDP growth in the short-run. Thus, the classical theory of savings-investment relationship fails to hold, but the Keynes' view holds good for India over the sample period. Such finding also corroborates the neoclassical argument 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 *(Solow, 1970)*. The outlook may be that the Banks and other financial institutions should target at mobilizing small savings of people by introducing innovative but secured financial products. In this direction interest rate and price stability would go a long way. An optimal trade off between the monetary and fiscal policies is warranted. However, this paper does not suggest that Indian planners and policy makers should de-emphasize investment, but rather equal attention should be paid to the view which considers savings and investment as the consequence of higher growth, not the primary cause. In this context, further research is warranted to establish a relation between savings, investment and real economic growth of the country.

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