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Article

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Revisiting the causal nexus between savings and economic growth in India: An empirical analysis

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Abstract

This paper attempts to analyze the long run association between savings and growth; and investigates the causality issue in Indian context for the period 1950–51 to 2011–12. Firstly, the study identifies the structural break in the year 1980 by employing Bi-Perron test with unknown time. Further, it examines the association and the direction of causality between savings and real economic activity. The empirical evidence of the study suggests that savings boost the real activity both in the pre and post break period in the long run, while economic growth causes saving in the short run in the pre break period. Thus, the present study brings evidence in favour of the neoclassical exogenous and the post-neoclassical endogenous growth models and suggest that both the incentive-based measures and the productivity-based measures would be useful to generate higher savings and reinforce the acceleration of income and growth.

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Palavras-chave: Poupança; Ggrowth econômico; Ruptura estrutural

1. Introduction

Savings in an economy plays a pivotal role in achieving the growth targets. Economic growth attained with domestic savings is sustainable than the growth that is achieved through borrowed capital. In fact, it is the savings that determine the economic health of a country. Even an economic super power like U.S. and the industrialized nations in the Europe

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are resorting to the measures of austerity and making serious attempts to save more than what they did till the cropping up of global financial crisis in 2007 and the European sovereign debt crisis in 2010 respectively. The reason for this structural shift in their saving behaviour is that they spent more than what could afford to. Increasingly troublesome is the fact that the spending was driven by borrowed capital, instead of their domestic savings. The result of the savings indiscipline: U.S. and Euro zone is paying a heavy price in terms of lost output, high unemployment and increasing economic inequalities.

If this is the case of industrialized nations, a typical emerging economy like India need to be much more careful on its savings front in order to achieve the growth targets and cater to the needs of a billion plus population. However, there is an alarming development in the Indian economy since 2008 that the savings as a percentage of GDP is falling steadily for a variety of reasons like rising inflation and fall in incomes. During the same period, growth also faltered from its peak level and Indian economy registered lowest growth rate i.e. 4.3% of the decade during the first quarter of 2013–14. In this context an attempt is made to verify the causal nexus between savings and growth in Indian economy. To get a clear idea of the past trends, the post independent period is taken as the period of study.

There are theories aplenty that emphasizes the role of savings in achieving and maintaining high economic growth. Important among them is the Harrod-Domar growth theory that explains of how economic growth depends on the rate of saving or investment and the incremental capital-output ratio in the economy. The neo-classical growth theory due to Solow (1956) assigned a critical role to saving rate for facilitating a higher growth in per capita capital and per capita income in the transition to the steady state, and also implied that a high saving rate facilitates achieving a higher level of steady state per capita capital and income. On the other hand, there are fully endogenous growth models suggesting that, high savings rate and increased in the size of population contributes for the long-term growth rate. Consistent with theoretical underpinnings, empirical evidences also strongly support close inter-linkages between savings and economic growth in a cross-country perspective. It is observed that economies witnessing rapid economic growth such as China, India, Indonesia, Malaysia, Singapore, South Korea and Thailand, etc. also characterized by high saving rates during their developmental phase. Similarly, many countries in sub-Saharan Africa and Latin America typically save at a low rate and experience slow economic growth. Despite a large empirical evidence on the strong association between saving and growth, the direction of causality between saving and economic growth is highly debated both in the theoretical and empirical literature and the divergent views continue to persist.

From the theoretical prospective, two school of thoughts i.e. Mill–Marshall–Solow view versus Marx–Schumpeter–Keynes view emerged in line of the causality between saving and growth (Gutierrez and Solimano, 2007). In the Mill–Marshall–Solow approach, all savings is automatically invested and translated into output growth under wage–price flexibility and full employment. Thus, the first view posits that saving leads economic growth. Similarly, Jappelli and Pagano (1994) also claimed that saving contribute to higher investment and higher GDP growth in the short-run. In contrast, the Marx–Schumpeter–Keynes view depicts that investment (Keynes and some extent Marx) and innovation (Schumpeter) are the two important drivers of output. In this context, savings adjusts passively to meet the level of investment required to hold macroeconomic equilibrium and deliver a certain growth rate of output. In this view growth leads savings. In the same fashion, the Carroll–Weil hypothesis (Carroll and Weil, 1994) also states that it is economic growth that contributes to saving, not saving to growth.

Also, a strand of empirical results on the aforesaid issue for both the advanced and developing countries context do not reach at a settled conclusion. While a set of studies (Bacha, 1990; Otani and Villannueva, 1990; DeGregorio, 1992; Morande, 1998; Hebbel et al., 1992; Oladipo, 2010; Misztal, 2011) supports unidirectional causality from saving to economic activity, another set (Cullison, 1993; Mühleisen, 1997; Alguacil et al., 2004; Lorie, 2007) supports the reverse causality. A third set of studies (Singh, 2010) supports bi-directional causality between saving and economic growth.

A handful of studies in Indian context also intensely debated the direction of causality between saving and economic activity since the economic crisis of late 80s and consequently financial reforms initiated in the early 90s. The empirical findings of such studies in connection to saving–growth causality in India are lopsided. 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. While Agrawal (2000), Jangili (2011) found causality runs from saving to growth but rejected causality from growth to saving, Mühleisen (1997), Sahoo et al. (2001), Verma and Wilson (2005), Sinha and Sinha (2008), and Verma (2007) from their study reached at the conclusion that saving does not cause growth, but growth causes saving. However, Singh (2010) found bidirectional causality between saving and growth.

Indian economy witnessed significant economic transformations, what Thomas Kuhn calls as a paradigm shift after 1991, which is generally called the post reform period. India's embrace of economic reforms was not a deliberate policy choice but an economic compulsion, given the deteriorating external and domestic economic conditions. Socialist model of development strategy was replaced by market friendly economic reforms. Insular economic model gave way to a globalized and integrated financial and real markets. As a result from the abysmally low growth rate, India jumped on to the high growth trajectory and became an one of the fastest growing emerging economies.

So far, no study has been attempted to identify the structural break with unknown time and to examine the causality in the pre and post break periods. In this backdrop, analysis of the causal nexus between savings and growth in Indian economy would expand the horizons of operating policy frame work. This study also adds to the to the existing saving-growth causality literature by explaining the pro-cyclicality story of saving; identifying the structural break with unknown timing utilizing the structural break tests of Bai-Perron, Brown's OLS-based CUSUM test, Resursive estimate test, F-test and supF-tests and examining the intensely debated causal nexus between saving and economic activity in the pre and post structural break periods. This study also utilizes the latest methodology (VECM approach) which is capable to address the endogeneity issue which is remain unresolved in the time series models and least addressed in the cross section and panel data approach.

The Section 2 analyses the data and methodology. Section 3 explains the pro-cyclicality story of saving. The empirical results dealing with identification of structural break and examining the direction of causality between economic growth and saving in the pre break and post break periods have been depicted in Section 4. Summary and conclusion of the study have been outlined in the Section 5.

2. Data and methodology

The present study is purely based on secondary data. The objectives of the present study are being analyzed and examined by using annual time series data for the period 1950–51 to 2011–12. Relevant data for the study has been obtained from RBI's Handbook of Statistics on the Indian Economy, 2011–12. The present study employs the Hodric–Prescott (HP) filter to analyse the pro-cyclicality story of saving. The study also utilizes the structural break tests of Bai-Perron, Brown's OLS-based CUSUM test, Resursive estimate test, F-test and supF-test. VEC Granger Causality/Block Exogeneity Wald Tests have been performed for both the periods of before and after the break date (one period: 1950–51 to 1979–1980; Second period: 1980–81 to 2011–12).

For assessing the direction of causality between saving and economic activity, the present study used causality tests. Particularly, the study used the test due to [Engle and Granger \(1987\)](#) based on the vector error correction mechanism (VECM) which is capable for testing causality even if the variables used for causality tests are non-stationary. Causality test under VECM framework also resolves the most debated endogeneity issue as it simultaneously determines the estimates of both the models. Before that we have used unit root tests to assess the stationarity of the time series and also used the technique of cointegration due to [Johansen and Juselius \(1990\)](#) and [Johansen \(1991\)](#) to examine long-run stability in the relation between saving and economic activity.

2.1. VEC Granger causality/block exogeneity wald tests

After carrying out the stationarity test of both ADF and PP, we confirm that both the variables i.e. LRGDP and LRGDS are stationary at first difference. If GDP has a long run relationship with GDS, the further step is to investigate causality, since if two or more variables are cointegrated: there is causality in at least one direction ([Engle and Granger, 1987](#)). We proceed to determine whether real GDP Granger cause real GDS, using Vector Error Correction Model (VECM) as the main advantage of this approach is that the causality can be carried out in a setting where variables are allowed to be determined simultaneously. The general VECM model can be represented as follows.

$$\Delta z_t = \mu + \alpha t + \lambda z_{t-1} + \sum_{i=1}^{p-i} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{p-1} \gamma_i \Delta x_{t-i} + \varepsilon_t \quad (1)$$

Where, Δ is the first-difference operator. The long-run multiplier matrix λ as:

$$\lambda = \begin{bmatrix} \lambda_{YY} & \lambda_{YX} \\ \lambda_{XY} & \lambda_{XX} \end{bmatrix}$$

The diagonal elements of the matrix are unrestricted, so the selected series can be either I(0) or I(1). If $\lambda_{YY} = 0$, then Y is I(1). In contrast, if $\lambda_{YY} < 0$, then Y is I(0). The VECM procedures described above are imperative in the testing of at most one cointegrating vector between dependent variable y_t and a set of regressors x_t .

Hence, the VEC model for the present study is as follows:

$$\begin{aligned} \Delta LRGDP_t &= \lambda_g(LRGDP_{t-1} - a_0 - a_1 LRGDS_{t-1}) \\ &+ \sum \Phi_{11}(i) \Delta LRGDP_{t-i} + \sum \Phi_{12}(i) \Delta LRGDS_{t-i} + \varepsilon_{gt} \end{aligned} \quad (2)$$

$$\begin{aligned} \Delta IFD_t &= \lambda_m(LRGDP_{t-1} - a_0 - a_1 LRGDS_{t-1}) \\ &+ \sum \Phi_{21}(i) \Delta LRGDP_{t-i} + \sum \Phi_{22}(i) \Delta LRGDS_{t-i} + \varepsilon_{mt} \end{aligned} \quad (3)$$

The above system is a two variables VAR model augmented by e_{t-1} . If l_s are zero, then it is a simple VAR model and there is no cointegration. Hence, cointegration and error correction are equivalent representation.

3. Pro-cyclicality of saving in India: preliminary evidences

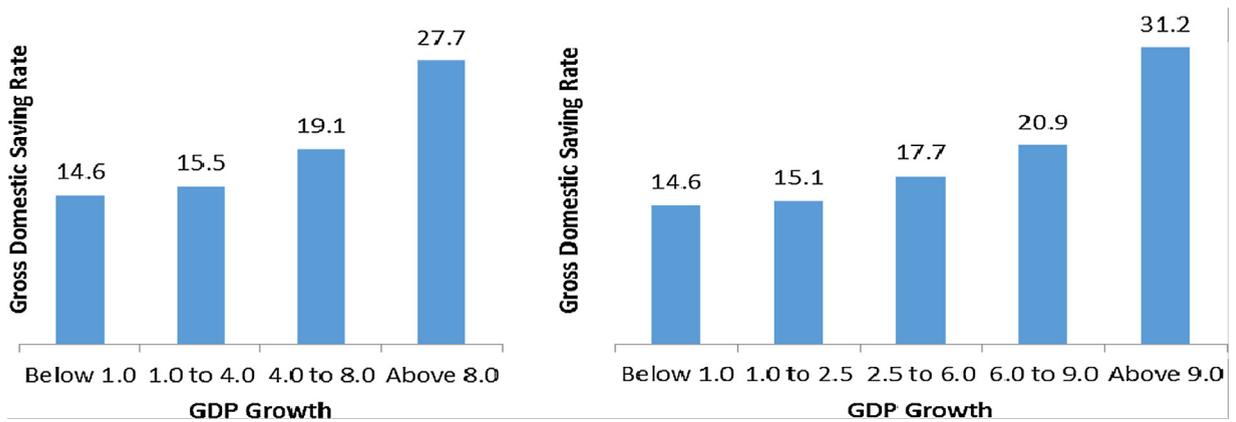
The most widely discussed concept i.e. business cycle, in the literature of macroeconomics, involves episodic reoccurrences of busts and booms of economic activity representing the simplest example of cyclicity in economics (Samantaraya, 2007).¹ In this section, we attempted to look at the association between gross domestic saving rates (GDS) and economic growth (GDP). In the Indian context, it was observed that the average economic growth during the first three decades since independence was around 3.5%. During this period, the average gross domestic savings as a percentage of GDP (GDS rate) was 13.5%. Average economic growth accelerated to 5.6% during the 1980s, when average GDS rate accentuated to 18.6%. The average economic growth during the post-reform period (1992–93 to 2011–12) further increased to 7%. During this period, the average GDS rate also rose to 27.6%. Particularly, with average economic growth leaping to the higher growth trajectory of 8.5% during 2003–12, average GDS rate also concomitantly soared to 33.0%.

Graphs 1 and 2 support the close association between savings and economic growth in India as discussed above. The average GDS rate² is plotted against different range of economic growth in Graph 1. Both the right and left panels depict that for lower economic growth rates, the average GDS rate is low, while for higher economic growth rates, the average GDS rate is high. Graph 2 portrays the strong pro-cyclicality of savings, where cyclical components of GDP and domestic savings were obtained by de-trending both the series using Hodrick–Prescott (HP) filter. Both GDP and GDS were taken in real terms.

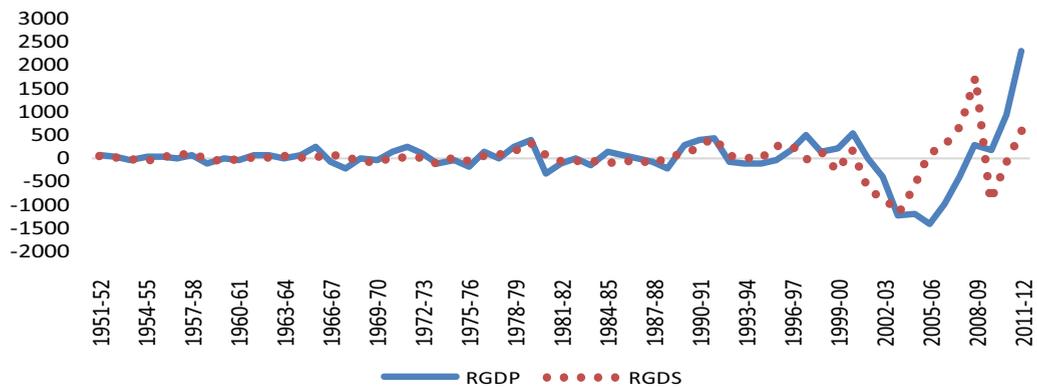
It may be noted that the post-reform period in India witnessed impressive macroeconomic performance in terms of sustaining high economic growth with stable prices, integration of the Indian economy with the rest of the world, and significant improvement in savings and investment in the economy. Average economic growth accelerated to 6.9% during the post-reform period (1992–2013) as compared to around 4.0% in the pre-reform period (1951–1991). Average saving rate nearly doubled to 27.8% from 14.9% during the comparable period. The ratio of foreign trade to GDP increased nearly three-fold from around 15% in early 1990s to close to 44% in recent years. The structure of the economy got transformed with larger space for the market and private sector in the real economic activity, overwhelming dominance of services sector in overall GDP at the expense of agriculture and industry, and there has

¹ Samantaraya (2007) highlighted about the pro-cyclicality behaviour of bank credit and economic growth in Indian context in which he observed that during the periods of boom, the growth of bank credit accelerates and decelerates during economic slowdown.

² GDS as a percentage of GDP.



Graph 1. Growth of GDP and gross domestic saving rate.



Graph 2. Cyclicity of RGDP and RGDS (HP Filter).

been significant broadening and deepening of the financial sector.³ No comprehensive study has been carried out yet, to the best of our knowledge, to examine the causality between saving and real activity in the different phases of economic growth in Indian context.

4. Empirical results

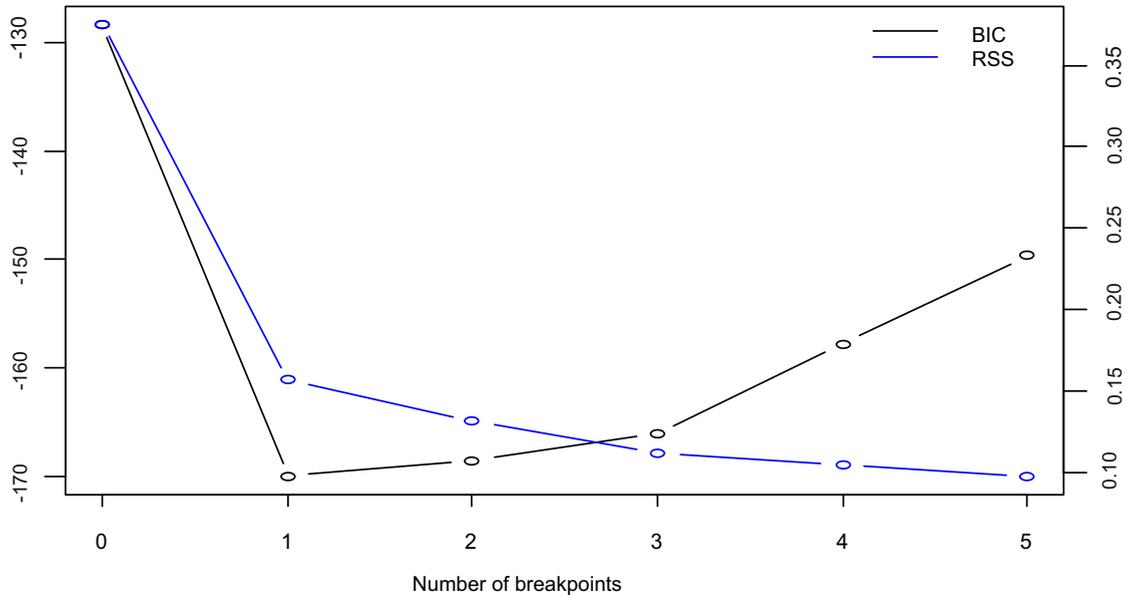
4.1. Identifying the structural break points

The main credit for developing the classical test of structural change for the first time goes to [Chow \(1960\)](#). In the conventional Chow test, we divide samples into two sub periods; estimate the parameters for each sub period and finally, by using F-statistics, test the equality of two sets of parameters. Thus, in Chow test, we can get only one break point and not more than that simultaneously with a priori data. Due to this drawback, we have employed [Bai and Perron \(2003\)](#) test to check the structural change of unknown timing. Thereafter, F-test, supF-test, OLS-based CUSUM test and Recursive Estimate tests have been performed. RGDP and RGDS have taken into account for the period 1950–51 to 2011–12 and are transformed into log form.

Table 1
Structural break points.

Breakpoints at observation number					Corresponding to break dates						
m = 1				30	m = 1				1980		
m = 2			17	30	m = 2			1967	1980		
m = 3		17	30	53	m = 3		1967	1980	2003		
m = 4	9	18	30	53	m = 4	1959	1968	1980	2003		
m = 5	9	18	30	41	53	m = 5	1959	1968	1980	1991	2003

BIC and Residual Sum of Squares



Graph 3. BIC and residual sum of squares.

4.1.1. Bai–Perron structural break point with unknown time

Table 1 below presents results of Bai–Perron test indicating break points with unknown time. The BIC and the residual sum of square of the above model can be plotted in the following figure (Graph 3).

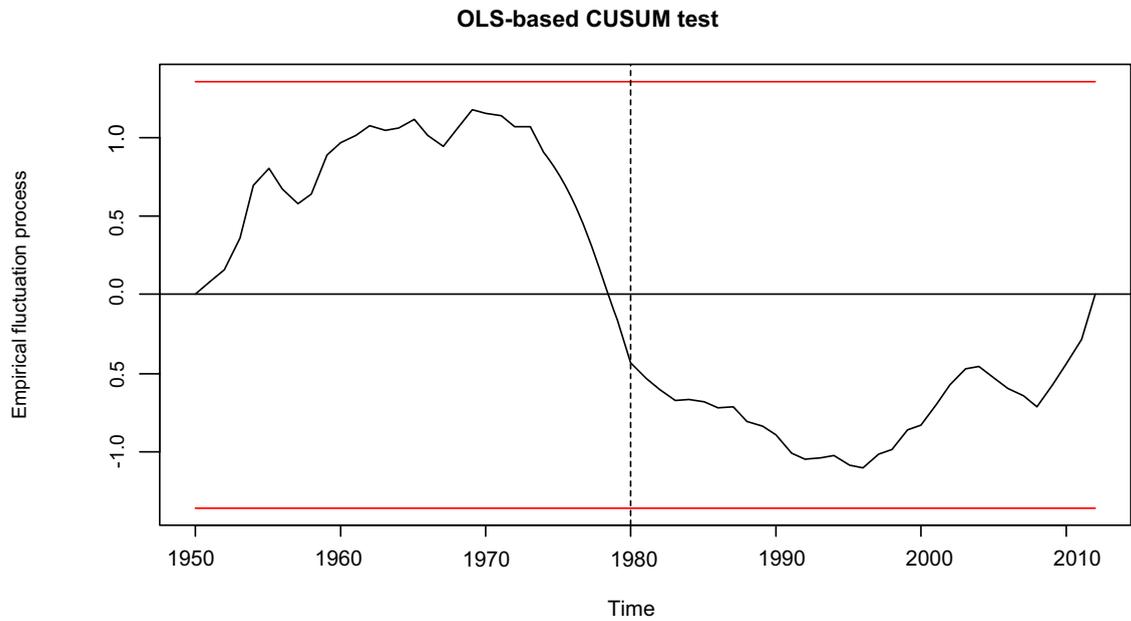
The BIC plot in the above graph clearly detects the break point at the observation number 30 which is the year 1980. India experienced the ‘Hindu Rate’ of economic growth in the aftermath of the three decades of the independence. Since 1980s, India’s decadal growth never comes below 5% and the saving growth during these decades was more than 25%, which clearly depicts the break in the year 1980. The different points of break can also be observed through different tests such as RE test, supF test, F-test and CUSUM tests in following figures (Graphs 4–7).

Figures presented above like the break points presented in the Table 2 clearly indicates different peaks along with the pick particularly at 1980 confirming a break at that particular point. Hence, the study now divides the entire time period into two periods i.e. from 1950–1980 and from 1981–2012.

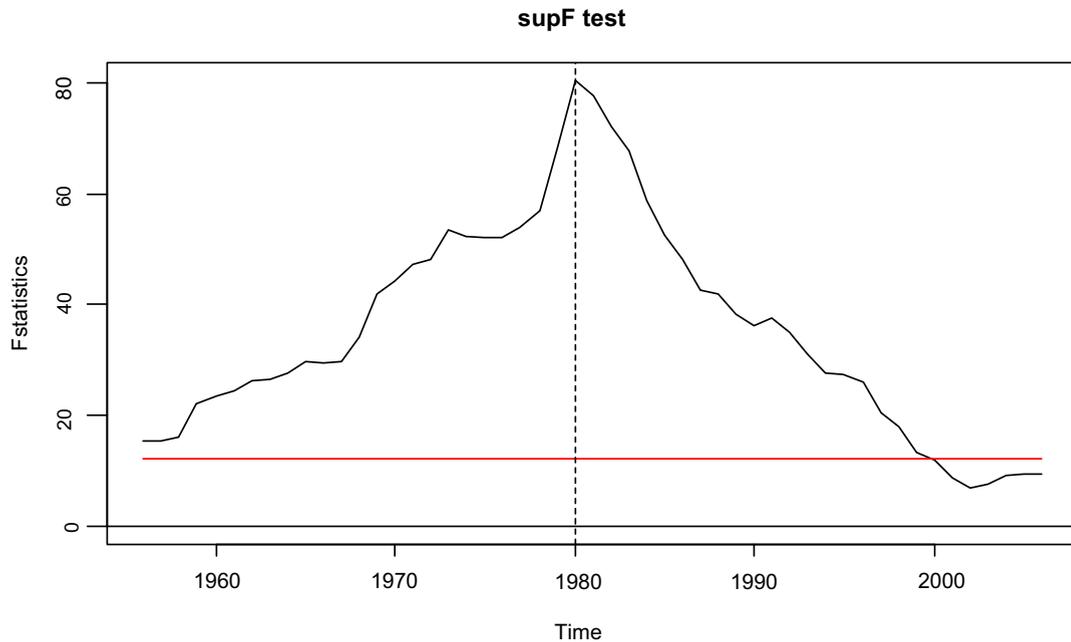
4.2. Direction of causality in pre-break period (1951–1980)

In order to avoid spurious analysis, it is necessary to go for stationarity tests for time series variables before going for any estimation. Hence, in the present study, we have conducted both the Augmented Dickey Fuller (ADF) and

³ Particularly, the India’s average economic growth was phenomenally high at around 8.5% during 2003–11 varying within a range of 6.7–9.6%. The GDS–GDP ratio was around 33.3% during this period as compared around 23.0% during the 1990s.



Graph 4. OLS-based CUSUM test.

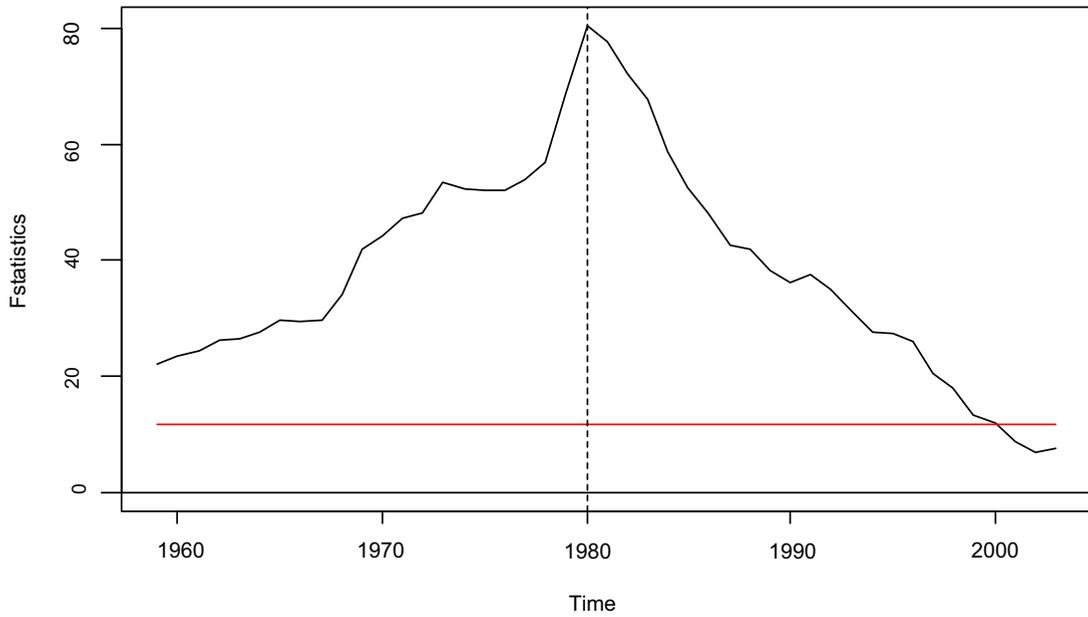


Graph 5. Sup-F test.

Table 2
Results of unit root tests.

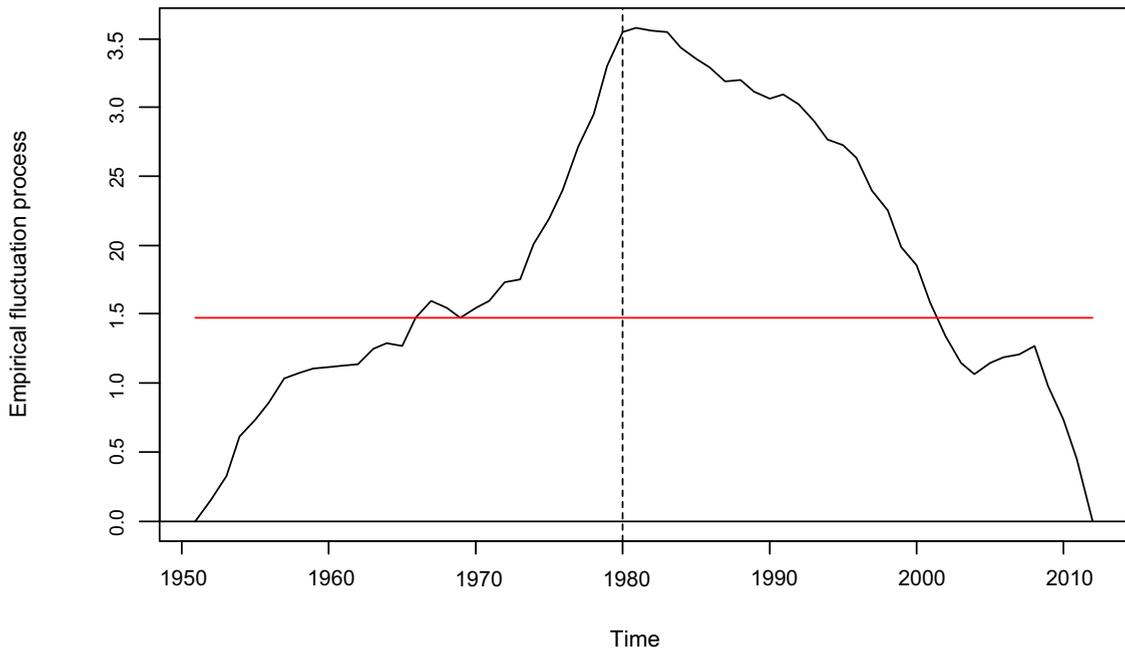
Variables	ADF test		PP test	
	Level	First diff.	Level	First diff.
LRGDP	-0.78	-6.71*	-1.29	-10.33*
LRGDS	-0.32	-6.43*	0.28	-6.05*

Notes: * denotes the statistical significance and the rejection of null at 1% level.



Graph 6. F test.

RE test (recursive estimates test)



Graph 7. Recursive estimate test.

Phillips Perron (PP) tests to determine the stationarity of variables. Both the variables such as LRGDP and LRGDS are integrated of order one i.e. $I(1)$. The table presents the results of both the ADF and PP tests.

After confirming that both our time series are $I(1)$, we proceed to apply Johansen–Juselius co integration test and Engle–Granger procedure to test causality for non-stationary variables. For this purpose, we have chosen a lag order of 1 for VAR analysis, based on Akaike Information Criteria and Schwartz Information Criteria.

Table 3
Johansen's ML estimates for the long run relationship between LRGDP and LRGDS.

Johansen test statistics					
Testing hypothesis		Critical value		Critical value	
H ₀	H _A	λ_{trace}	5%	$\lambda_{\text{maxeigen}}$	5%
$r \leq 0$	$r > 0$	20.01	15.49	19.56	14.26
$r \leq 1$	$r > 1$	0.45	3.84	0.44	3.84

Notes: Both Trace test and Maxeigen tests indicate 1 cointegrating eqn(s) at the 0.05 level.

Table 4
Results of vector error correction model.

Error correction:	D(LRGDP)	D(LRGDS)
Ecm _{t-1}	-0.33*[-3.21]	0.38 [1.29]
D(LRGDP(-1))	0.16 [0.81]	1.45 [2.64]
D(LRGDS(-1))	-0.10 [-1.31]	0.22 [0.98]

Notes: t-statistics in [] and * denotes the rejection of null hypothesis at 1% level.

Table 5
VEC granger causality/block exogeneity wald tests.

Sample: 1950-1980, Lag:1			
Null hypothesis	χ^2	P-value	Causal relation
LRGDS does not Granger cause LRGDP	1.72	0.19	LRGDP → LRGDS
LRGDP does not Granger cause LRGDS	6.96*	0.00	

Notes: * Denotes the rejection of null hypothesis at 1% level.

The VEC granger causality/block exogeneity wald tests establishes the short run causality between saving and real activity in Table 5. It reveals that in the short run, there is uni-directional causality that runs from economic growth to saving but not the reverse causality

Guided by both the estimated trace statistic and eigen values, we reject the null of 'no co-integration' and could not reject the null of 'at most 1 co-integrating vector'. Thus, Johansen-Juselius co-integration test established long-term stable relation between saving and economic growth in India. The results of Johansen–Juselius co-integration test is depicted in Table 3.

However, co-integration does not reflect the direction of causality between the variables. Given that our variables were non-stationary, we applied Engle and Granger (1987) procedure to test causality between saving and economic growth and economic activity in India. Such a framework takes into account the causality both directly from the causal variable as well as indirectly through the lagged value of the stochastic error term of the estimated co-integrating relation (e_{t-1}). The VECM results are reported in Table 3.

The causality test performed under VECM framework (Table 4) suggests that there is a unidirectional causality that runs from saving to growth in the long run as the error correction term is negative and significant at 1% level but not vice-versa.

Now, the study proceeds towards VEC Granger Causality or Block Exogeneity Wald test to know the short run causality between saving and economic growth which is presented in Table 5.

The VEC granger causality/block exogeneity wald tests establishes the short run causality between saving and real activity in Table 5. It reveals that in the short run, there is uni-directional causality that runs from economic growth to saving but not the reverse causality.

4.3. Direction of causality in post-break period (1981–2012)

Both the series such as LRGDP and LRGDS in the post break period are also integrated of order one i.e. I (1). The Table 6 presents the results of both the ADF and PP tests.

Table 6
Unit root test results.

Variables	ADF test		PP test	
	Level	First diff.	Level	First diff.
LRGDP	−0.43	−4.18*	0.04	−4.14*
LRGDS	−2.53	−6.28*	−2.52	−6.28*

Notes: * denotes the statistical significance and the rejection of null at 1% level.

Table 7
Johansen's ML estimates for the long run relationship between LRGDP and LRGDS.

Johansen test statistics					
Testing hypothesis		Critical value		Critical value	
H ₀	H _A	λ_{trace}	5%	$\lambda_{\text{maxeigen}}$	5%
$r \leq 0$	$r > 0$	28.69	20.26	24.99	15.89
$r \leq 1$	$r > 1$	3.69	9.16	3.69	9.16

Notes: Both Trace test and Maxeigen tests indicate 1 cointegrating eqn(s) at the 0.05 level

Table 8
Results of vector error correction model.

Error correction:	D(LRGDP)	D(LRGDS)
Ecm_{t-1}	−0.16* [−3.06]	0.08 [0.39]
D(LRGDP(−1))	−0.09 [−0.45]	0.46 [0.56]
D(LRGDS(−1))	−0.03 [−0.57]	−0.22 [−0.93]
C	0.07* [5.42]	0.07 [1.34]

Notes: t-statistics in [] and * denotes the rejection of null hypothesis at 1% level.

Table 9
VEC Granger causality/block exogeneity wald tests.

Sample: 1981–2012, Lag: 1.

Null hypothesis	χ^2	P-value	Causal relation
LRGDS does not Granger cause LRGDP	0.33	0.56	No causality
LRGDP does not Granger cause LRGDS	0.32	0.57	

Notes: * denotes the rejection of null hypothesis at 1% level.

As both the variables follow I (1) order of integration, then, we should move forward for johansen and Juselius cointegration. The lag of $m = 1$ has been taken as per the AIC and SBC criterion both for the Johansen's cointegration as well as for VECM. The results of the Johansen's cointegration test presented in Table 6 confirm that there is 1 cointegration between two variables in the long run which means that the null hypothesis of no cointegration is rejected at 5% level as both the trace and the Max–Eigen statistics are less than 5% Critical value. Therefore, the study proceeds for Granger Causality approach using VECM approach (Table 7).

The causality test under VECM frame work presented in Table 8 explains that in the long run saving causes to growth as the error correction term is negative and significant.

Now, the study proceeds towards VEC Granger Causality or Block Exogeneity Wald test to know the short run causality between saving and economic growth which is depicted in Table 9. It reveals that in the short run there is no causality between saving and economic growth.

5. Summary and conclusion

Indian economy since its independence till the late 1980s was a completely different economy relative to post 1991 period. The policy framework, economic functioning and the way the country and economy was managed has been altogether different during these two periods. Hence, the present study firstly discussed the pro-cyclicality behaviour of saving rate in India for the period 1950–51 to 2011–12 and thereafter, divided the entire study period into two i.e. 1950–51 to 1979–80 and another from 1980–81 to 2011–12 applying the Bai–Perron structural break test as well as F-test, supF-test, OLS-based CUSUM test and Recursive Estimate tests with unknown time.

Johansen's cointegration approach has been performed for both the periods; as it establishes the long run relationship when the variables are non-stationary; to examine whether in the long run, saving and growth are cointegrated. The cointegrating approach confirms that saving and real economic activity have long run relationship in both the pre and post break period.

In the pre break period i.e. the period from 1950–51 to 1979–80, the causality results obtained under the VECM framework reveals that in the long run, saving causes economic growth while in the short run economic growth causes saving. The empirical results for the first period supports the Mill–Marshall–Solow view of saving causes growth in the long run and also does not refute the Marx–Schumpeter–Keynes views in the short run.

In the post break period i.e. the period from 1980–81 to 2011–12, it is empirically verified that saving causes real economic activity in the long run but not vice-versa, while in the short run, there is no causality between saving and growth, supporting the Mill–Marshall–Solow view.

The long run causality based on the VECM framework both for pre and post break periods supports the prediction of both the neoclassical exogenous and the post-neoclassical endogenous growth models and suggest the long run causality that runs from saving to economic growth. The stylized empirical evidence for the steady state effects of saving on economic growth suggests the need to accelerate domestic saving to finance domestic investment and promote higher income and growth. Therefore, a two pronged approach with the incentive-based measures to induce the motivation to save and the productivity-based measures to increase income and strengthen the capacity to save, would be useful to generate higher saving and reinforce the acceleration of income and growth.

However, the results may not be generalized and applied to other economies similar to India as every country differs in its structural and institutional factors from the other. Thus, further systematic empirical investigations covering a variety of individual country situations are needed before valid generalizations on the policy relevance. After all, one size doesn't fits all.

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