

# **The Savings-Growth Puzzle in India: An Empirical Approach**

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## ***Abstract***

*The savings-growth nexus plays an important role in overall development of a fast-growing economy like India. The domestic savings in India has been used consistently to finance both domestic investment and further economic growth. However, in the recent years, a considerable slowdown in the economy had resulted in decreasing the rate of savings. The government of India argues that this slowdown is a short-term phenomenon rather than being long-term. Also, the debate amongst the economists is still going on whether the current economic slowdown is structural or cyclical. The savings-growth puzzle must be solved to understand whether this phenomenon is short-term or long-term and to anticipate its future consequences. This empirical study is based on different annual and quarterly time series data covering the period from 1990-91 to 2019-20(2<sup>nd</sup> quarter). The time series data on different macroeconomic variables are collected from the various issues of NAS published by CSO and the HSIE released by RBI. In this study, we used Engle-Granger causality test and ARIMA forecasting techniques to analyse the present and future relationship between savings and economic growth in order to solve the puzzle of savings-growth in India. We found that the savings-growth nexus, the key element of an economy, was not satisfactory in India. We also found that the phase of slowdown in the economy is neither short-term nor long-term, but it is a mid-term phenomenon. Moreover, we found the nature of slowdown as cyclical and it is driven by the demand crises in the economy but it is not similar to the economic crisis of 1991. Therefore, the fiscal and monetary policies of the government should be re-framed with the portfolio of short-term, mid-term and long-term objectives in order to avoid future instabilities in the economy.*

**Key Words:** *Savings-Growth Puzzle, Economic Slowdown, Engle-Granger Causality Test and ARIMA forecasting technique.*

## Introduction

The domestic savings is essential for rapid economic growth in any of the emerging economies of the world. Acceleration in the rate of savings can play a significant role in attaining a higher rate of investment, and it is implied that an increase in the rate of investment can make the target of achieving steady-state growth smooth<sup>1</sup>. However, the Indian economy had witnessed a downward fluctuation in macroeconomic variables during recent years. Also, the high savings and investment rate not reflected in the growth process of the economy. As a result, growth rate has decreased sharply over the past few quarters. Subramanian and Felman (2019) argues that the two engines of the economy-investment and exports are stalled which plummeted the overall economic growth in the recent years. They also mentioned that consumption is an important driver of the economy which is sluggish in the recent past. The macroeconomic key indicators like demand, private investment, GDP growth rate and other variables are slowing down (Kaul, 2019). Different institutions like Moody's, CRICIL, S & P and IMF are cutting India's growth projection in the recent years (Dhasmana, 2019). However, this slowdown is expected to be a short term phenomenon by the government. Upadhyay (2019) argues that there is a slowdown in the GDP growth rate but economy is not contracting. This slowdown is short-term phenomena but a natural revival process wouldn't be possible at all considering different key indicators of the economy.

On the other side Nagaraj (2020) argues that the current slowdown in India's economic growth rate is not a mere cyclical (or short-term) decline, as the Government would like us to believe. He also emphasizes the key role of savings and investment rate in the growth process of the economy. Nagaraj (2020) state that "to analyse the reasons for the slowdown, one needs to start with the boom of the 2000s when there was a steep rise in domestic saving and investment rates, rising bank credit growth and a flood of foreign capital inflows. As the boom went bust in the early 2010s, the un-fructified investments mounted, and new capital investment fell. Corporate bad debts turned into bank NPAs. It is reasonable to believe that a quick economic revival with public support could have melted way the NPAs earlier during the 2010s. But policymakers stuck to fiscal orthodoxy, inflation targeting and structural reforms to reduced policy-induced rigidities". It is clear that the savings and investments are not reflected in the economic growth of the country and the recent policy shocks were responsible for the economic slowdown.

The study examines the relationship between savings and economic growth in order to solve the puzzle of savings-growth in India. Also, the study aims to examine the nature of recent slowdown in the growth rate and to forecast the long-term trends of GDS, GCF and GDP growth rate. For this purpose, we used Engle & Granger causality test and ARIMA forecasting techniques in the study.

The study has been divided into five important sections; each section deals with a specific issue which is relevant to analyze the savings-growth relationships in India. The introductory

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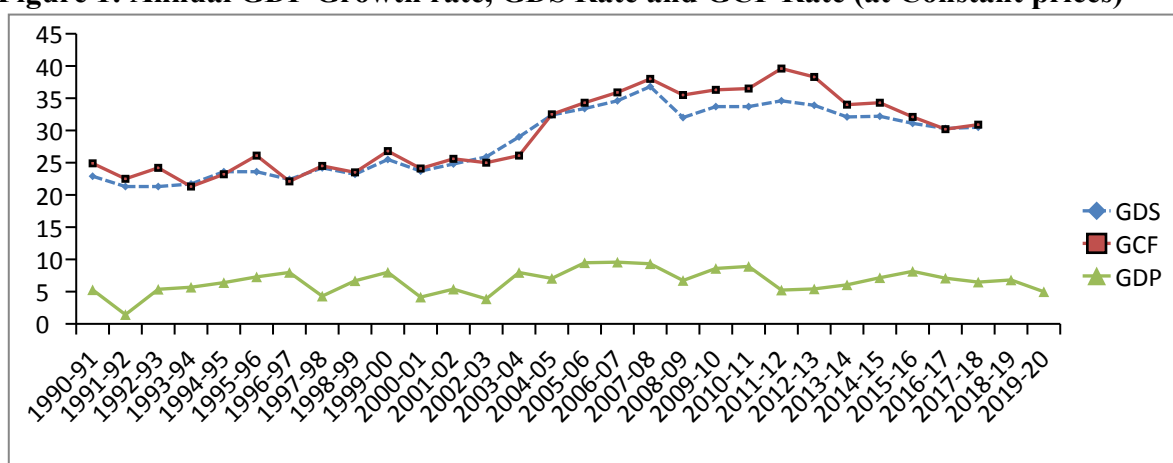
<sup>1</sup> Solow, R. M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. 70, No. 1 (Feb), 65-94.

section focuses mainly to decipher the importance of domestic savings and discusses the recent arguments related to growth performance of the economy. The second section is an overview of savings-growth performance in India. The third section deals with the empirical methodology and data base. The fourth section presents the empirical results of the study. The conclusion and suggestions are presented in the fifth section.

### Growth-Savings Performance in India

Since the new liberalization era, it has been observed that there is a steady increase in the savings and investment rate in India with some significant fluctuations from year to year. Savings and investment act as the engine of economic growth. Figure 1 show that the India's high economic growth has achieved on the basis of higher savings and thus higher investment.

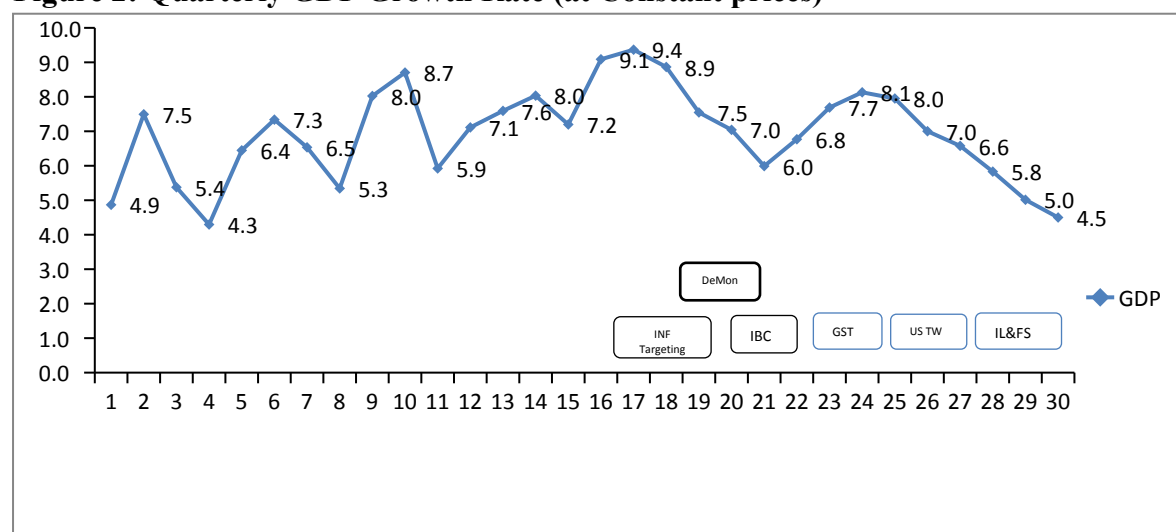
**Figure 1: Annual GDP Growth rate, GDS Rate and GCF Rate (at Constant prices)**



Sources: NAS, CSO, GoI.

The figure above clearly depicts the relationship among GDS, GCF and GDP. It is also seen that the GDP has constantly risen in the 2000s except for a few fluctuations and the dearth that came around 2008-09, where it can be seen that along with growth rate, the rate of savings and consequently investment has also fallen. In the late 2010s, a considerable slowdown in the growth rate had resulted in decreasing the rate of savings and investment as shown in figure 1.

**Figure 2: Quarterly GDP Growth Rate (at Constant prices)**



Sources: NAS, CSO, GoI.

Figure 2 shows the quarterly GDP growth rate during the period of 2012-13 (Q1) to 2019-20 (Q2), where it has been observed that a major fluctuations from quarter to quarter. During the period, the Indian economy has faced several reforms and challenges. Some of these include the adoption of inflation targeting framework by the RBI, demonetisation (Nov 2016), implementation of GST (July 2017), US-China trade war and the Infrastructure Leasing and Financial Services (IL & FS) failure, those were responsible for the deterioration in overall demand and other macroeconomic indicators in the economy. Therefore, the growth rate continued its downward spiral for the 7<sup>th</sup> successive quarter, falling to 4.5 % in the second quarter (July-September) of the year 2019-20.

**Table1: India's Growth Forecast by Different Agencies**

Agencies	Earlier (FY 2019-20)	Revised (FY 2019-20)
CRISIL	6.9	6.3
WB	7.5	6.0
IMF	7.0	6.1
RBI	7.2	6.1
UN	7.4	7.1
Fitch's	6.8	6.6
OECD	7.2	5.9
ADB	7.0	6.5
Moody's	6.2	5.8
S & P	7.1	6.3
NCAER	6.0	4.9
FICCI	7.1	6.9
ES 2018-19	7.0	5.0

Also, the GDP growth rate has been revised downward for the FY 2019-20 by the different agencies as shown in Table 1. It implies that the slowdown is deeply rooted in the economy and it can create a serious problem in the future.

### Empirical Methodology and Data Base

This empirical study is based on annual time series data covering the period from 1990-91 to 2019-20 and quarterly time series data for the period of 2012-13 (Q1) to 2019-20 (Q2). The time series data of GDS, GCF and GDP are collected from various issues of the National Accounts Statistics (NAS) published by Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation, Government of India.

### Stationarity Test/ Unit Root Test

Before the selection of appropriate model, we must know the nature of time series variables whether they are stationary or not. A time series will be stationary if its mean and variance are constant over a period. If a time series is not stationary, then it will be non-stationary series. In the study, we used ADF test to test the stationarity of the series. The null hypothesis of the ADF test is that the series is non-stationarity or contains a unit root (i.e.,  $H_0: \delta = 0$ ). The following equations were prescribed for ADF test: -

- .....(1) Random Walk Model without Drift
- .....(2) Random Walk Model with Drift
- .....(3) Random Walk Model with Time Trend

### Engle-Granger Co-integrated Approach

In the study, we used Engle-Granger (1987) approach to analyze the co-integration relationship between the variables. The condition for the approach is that all variables must be in the same order of integration. The standard Granger-causality test equation can be written as follows.

$$GDP_t = \alpha_0 + \alpha_1 GDS_{t-1} + \alpha_2 GDP_{t-1} + \alpha_3 GCF_{t-1} + u_1 t \dots \dots \dots (4)$$

$$GDS_t = \beta_0 + \beta_1 GDS_{t-1} + \beta_2 GDP_{t-1} + \beta_3 GCF_{t-1} + u_2 t \dots \dots \dots (5)$$

$$GCF_t = \gamma_0 + \gamma_1 GDS_{t-1} + \gamma_2 GDP_{t-1} + \gamma_3 GCF_{t-1} + u_3 t \dots \dots \dots (6)$$

Where the null hypothesis ( $H_0$ ) is that there is no co-integration relationship between the variables.

### Auto Regressive Integrated Moving Average (ARIMA) Model

In the study, we used ARIMA (p,d,q) model to forecast the macroeconomics series. The model forecast a given time series based on its own past values and the lagged forecast errors. This can be expressed as follows:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 \epsilon_{t-1} + e_t \dots \dots \dots (4)$$

Or

Predicted  $Y_t$  = Constant + Linear Combination of Lags of Y (AR term) + Linear Combination of Lagged forecast errors (MA term)

Where  $Y_t$  is GDS/GCF/GDP at the time period.  $Y_{t-1}$  is lagged value of GDS/GCF/GDP.  $\epsilon_{t-1}$  is the lagged forecast errors term.  $\beta_i$  is the moving average parameter,  $\alpha_i$  is the autoregressive parameter.

### Empirical Results and Discussions

This section is the core part of the study where we are discussing the estimated results in detail. The objective of the study is not only to estimate the relationship between the domestic savings and economic growth but also to forecast the future trends of GDP, GDS and GCF. To estimate the cause-effect relationship between the domestic savings and economic growth, we used the co-integration test developed by Engle & Granger (1987). Before the estimation of co-integration model, the empirical analysis requires to test the order of integration of each variable. The unit root test results are given below:

**Table 2: Results of ADF Test**

Variables	Level			1 <sup>st</sup> Difference			Order of Integrati on
	Model 1 (Intercept )	Model 2 (Trend & Intercept)	Model 3 (None)	Model 1 (Intercep t)	Model 2 (Trend & Intercept)	Model 3 (None)	
GDS	-1.147	-1.200	0.835	-5.799*	-5.980*	-2.750*	I(1)
GCF	-1.282	-1.805	0.378	-6.894*	-6.934*	-6.891*	I(1)
GDP	1.497	-2.908	17.771	-4.525*	-4.348*	-0.288	I(1)

*Note:* \* and \*\* denotes the rejection of null hypothesis ( $H_0$ ) at 1% and 5% significance level, respectively.

We used Augmented Dickey-Fuller (ADF) test to identify whether the variables are stationary or not. Table 2 shows that the  $H_0$  (there is a unit root) is rejected for all the variables at 1<sup>st</sup> difference. In other words, all the variables are stationary at I(1). Hence, the

Engle-Granger causality test is the most suitable for estimating the co-integration between the variables.

In this study, we used Engle-Granger (1987) co-integrated approach which is based on two-step residual procedure and the reduced-rank regression approach (Johansen, 1991; Johansen, 1995). If two or more series are themselves non-stationary, but the linear combination between them is found to be stationary, then the series is called co-integrated. The Granger Causality test results are given below:

**Table 3: Granger Causality Test Results**

<b>(a)</b>		
<b>Null Hypothesis</b>	<b>F-Statistic</b>	<b>Prob.</b>
GDS does not Granger Cause GDP	2.40036	0.1344
GDP does not Granger Cause GDS	0.17041	0.6834
GCF does not Granger Cause GDP	0.38751	0.5395
GDP does not Granger Cause GCF	1.32483	0.2611
GCF does not Granger Cause GDS	7.72695	0.0104
GDS does not Granger Cause GCF	22.5864	8.E-05
<b>(b)</b>		
<b>Null Hypothesis</b>	<b>F-Statistic</b>	<b>Prob.</b>
GDS does not Granger Cause GDP_G	3.40372	0.0774
GDP_G does not Granger Cause GDS	0.14958	0.7023
GCF does not Granger Cause GDP_G	1.66929	0.2087
GDP_G does not Granger Cause GCF	0.34759	0.5610
GCF does not Granger Cause GDS	7.72695	0.0104
GDS does not Granger Cause GCF	22.5864	8.E-05

Table 3(a) shows that the co-integration relationship between GDS, GCF & level of GDP and Table 3(b) shows that the co-integration relationship between GDS, GCF & GDP growth rate. The null hypothesis is that there is no co-integration relationship among the variables. In Table 3(a), we cannot reject the hypothesis that GDS does not Granger cause GDP and the other way also. We do reject the hypothesis that GCF does not Granger cause GDS and GDS does not Granger cause GCF at the 1% level of significance. Therefore it appears that Granger causality runs two-way from GCF to GDS and the other way. Table 3(b) reveals that there is a bi-directional relationship between GDS and GCF. Also, we cannot accept the hypothesis that GDS does not Granger cause GDP Growth but at the low level of significance (at 10 % level of significance). Therefore it appears that Granger causality runs one-way from GDS to GDP Growth and not the other way.

In the study, we used Auto Regressive Integrated Moving Average (ARIMA) models to forecast the macroeconomics series. Before the forecasting, we select an appropriate ARIMA model for each variable which are given below:

**Table 4: Selected ARIMA Model**

Variable	No. of Estimated ARIMA Model	Selected Model	AIC Value (Min.)
GDS	25	ARIMA(2,1,1)	-2.419
GCF	25	ARIMA(2,1,1)	4.923
GDP (Annually)	25	ARIMA(1,1,0)	3.993
GDP (Quarterly)	25	ARIMA(2,0,4)	3.201

The Akaike Information Criterion (AIC) has been referred for selecting the ARIMA models. Comparing 25 models, for each variable, the model with the lowest value of the AIC is preferred (see Appendix 2). Table 4 shows that the ARIMA(2,1,1) model for GDS and GCF, ARIMA(1,1,0) model for GDP (Annually) and ARIMA(2,0,4) model for GDP (Quarterly) is selected by using lowest AIC values -2.419, 4.923, 3.993 and 3.20 respectively.

The ARIMA forecasting results are given in Table 5. The variable AR (1) and AR (2) are found to have a significant impact on the gross domestic savings (GDS) and gross capital formation (GCF) functions, while the MA (1) is not statistically significant on the both GDS and GCF functions. It implies that the GDS and GCF rate is determined by its own lagged values. The value of R bar squared is 0.774 for the GDS function and 0.780 for the GCF function, which indicates the fitness of the models.

**Table 5: Forecasting Results of Different ARIMA Models**

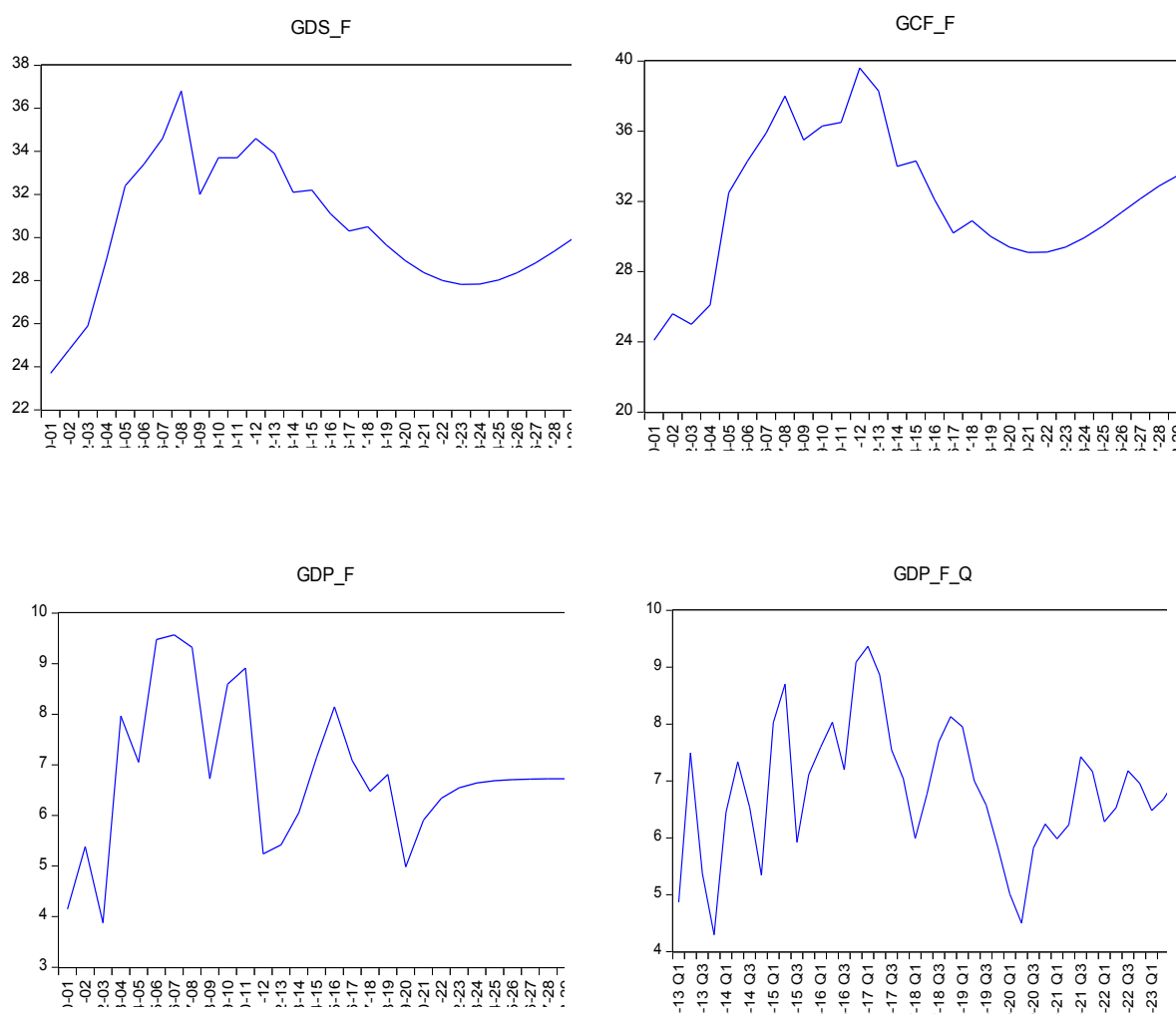
Gross Domestic Savings								
Variable	Coefficient	S.E.	T-Stat	Prob.	Ad. R²	F-Stat	Prob.(F)	DW-Stat
C	3.410	0.062	54.791	0.000	0.774	15.582	0.000	2.331
AR(1)	1.854	0.099	18.641	0.000				
AR(2)	-0.928	0.087	-10.649	0.000				
MA(1)	-0.999	22277.89	0.0001	0.999				
SIGMASQ	0.002	1.468	0.001	0.998				
Gross Capital Formation								
C	32.284	1.705	18.933	0.000	0.780	16.107	0.000	2.193
AR(1)	1.820	0.138	13.121	0.000				
AR(2)	-0.908	0.112	-8.067	0.000				
MA(1)	-0.999	33509.58	0.0001	0.999				
SIGMASQ	3.697	4237.75	0.0008	0.999				
Gross Domestic Product (Annually)								
C	6.727	0.588	11.425	0.000	0.197	2.089	0.104	1.968
AR(1)	0.470	0.202	2.324	0.032				
SIGMASQ	2.324	1.076	2.158	0.045				
Gross Domestic Product (Quarterly)								
C	6.786	0.369	18.380	0.000	0.652	5.892	0.0006	1.721
AR(1)	-0.059	0.173	-0.341	0.736				
AR(2)	-0.753	0.194	-3.867	0.0008				
MA(1)	0.650	1509.45	0.0004	0.999				
MA(2)	1.365	4069.66	0.0003	0.999				
MA(3)	0.650	2377.23	0.0002	0.999				
MA(4)	0.999	5958.57	0.0001	0.999				
SIGMASQ	0.623	309.27	0.002	0.998				

Table 5 reveals that the variable AR (1) is found to have a significant positive impact on annual GDP function. It implies that the GDP growth rate is determined by its own recent past value. The value of R bar squared is 0.197 and the value of DW test statistic is 1.968 for the annual GDP function.

The ARIMA (2, 0, 4) model is select for the quarterly GDP growth rate function which indicates that only the variable AR (2) is statistically significant at 1 percent level of significance. The coefficient of AR (2) is -0.753 in the function. This implies that the quarterly GDP growth rate determined by its own two period lagged value. The value of R bar squared is 0.652 and the value of DW test statistic is 1.721 for the quarterly GDP function, which indicates the fitness of the model.

In order to long-term forecasting, we calculate forecast data for the period of 2018-19 to 2029-30 for GDS and GCF series which is based on previous observations (see Appendix 3). Figure 3 shows that the long-term showdown in the forecasted data of GDS and GCF. The GDS and GCF rate was 30.5 and 30.9 percent respectively during 2017-18 and it decreased up to 29.7 and 30.0 percent respectively in the next year as forecasted data shown in Figure 3(GDS\_F).The declining trend in GDS rate has been forecasted during 2018-19 to 2023-24. After that, it is slightly increasing.

**Figure 3: Actual and Forecast Data**





In order to identify whether the slowdown in the growth rate is short-term or long-term, we forecast annual GDP growth rate for the period 2020-21 to 2029-30 and quarterly GDP growth rate for the period 2019-20 (Q3) to 2022-23 (Q4). Figure 3(GDP\_F) shows that the actual and forecast data for annual GDP Growth rate, which reveals that the GDP growth rate increased from 4.982 percent (in 2019-20) to 5.906 percent (in 2020-21). After that, the GDP growth rate slightly increasing with the range of 6.34-6.72 percent as forecasted data shown in Figure 3. Also, the forecasted data of quarterly GDP growth rate is increasing but it exhibited a cyclical trend (see 4<sup>th</sup> part of Figure 3).

### **Conclusion and Suggestions**

The empirical study found that there is a bi-directional causality relationship between GDS and GCF. On the other hand, the Granger causality runs one-way from GDS to GDP Growth at low level of significance and not the other way. Therefore, the savings-growth nexus as a key element of an economy was not satisfactory in India.

In order to identify whether the slowdown in the growth rate is short-term or long-term, we forecast quarterly GDP growth rate for the period 2019-20 (Q3) to 2022-23 (Q4). We found that the forecast data of quarterly GDP growth rate is increasing but it exhibited a cyclical trend. Therefore, the phase of slowdown in the economy is neither short-term nor long-term, but it is a mid-term phenomenon. Moreover, we found the nature of slowdown as cyclical and it is driven by the demand crises in the economy but it is not similar to the economic crisis of 1991.

Finally, we can conclude that the savings and investment rates are not reflected in the path of overall economic development of the country and the recent policy shocks were responsible for the economic slowdown.

The government must simplify and rationalise the fiscal policy that will help to generate demand in the economy. Also, the monetary policy of the government should be liberalized so that it would help to mobilize domestic savings to investment and to the further economic growth. Therefore, the fiscal and monetary policies of the government should be re-framed with the portfolio of short-term, mid-term and long-term objectives in order to avoid future instabilities in the economy.

### **References**

- Agarwal, P., Sahoo, P., and Dash, R. K. (2010), "Savings Behaviour in India: Co-integration and Causality Evidence", *The Singapore Economic Review*, Vol.55, No.2, pp.273-295.
- Agrawal, P. (2001), "the Relation between Saving and Growth: Co-integration and Causality Evidence from Asia", *Applied Economics*, 33, pp 499-513.
- Athukorala, P and Sen, K. (2003), "Saving, Investment and Growth in India", Oxford University Press, New Delhi.
- Athukorala, P. (1998), "Interest Rates, Saving and Investment: Evidence from India", *Oxford Development Studies*, Vol.26, No.2, pp.153-169.

Athukorala, P. and Sen, K. (1995), "Economic Reforms and Rate of Saving in India", *Economic and Political Weekly*, Vol. 30, No. 35, pp. 2184-2190.

Dhasmana, I. (2019), "Moody's cuts India's GDP growth to 6.2% for 2019 amid economic slowdown", *Business Standard*, August 24, 2019. [https://www.business-standard.com/article/economy-policy/moody-s-cuts-india-s-gdp-growth-to-6-2-for-2019-amid-economic-slowdown-119082400027\\_1.html](https://www.business-standard.com/article/economy-policy/moody-s-cuts-india-s-gdp-growth-to-6-2-for-2019-amid-economic-slowdown-119082400027_1.html)

Engle, Robert F., and Granger, C. W. J. (1987), "Co-integration and Error Correction: Representation, Estimation, and Testing", *Econometrica*, Vol.55, No.2, pp.251-276.

Government of India (2020), "Economic Survey 2019-20", Ministry of Finance, New Delhi, pp. 1-20.

Kapoor, A. (2019), "The dynamics of India's growth slowdown", *The Economic Times*, Sep 09, 2019.

Kaul, V. (2019), "15 ways to define India's slowdown", *livemint*, August 14, 2019. <https://www.livemint.com/news/india/15-ways-to-define-india-s-slowdown-1565715613762.html>

Nagaraj, R.(2020), "Understanding India's Economic Slowdown", *The India Forum*, February 7, 2020.

Santosh Kumar, M. V. S., "Household savings hit 21-year low" *The Hindu Business Line*, August, 24, (2012). <https://www.thehindubusinessline.com/economy/household-savings-hit-21-year-low/article20489228.ece1>

Subramanian, A. and Felman, J.(2019), "India's Great Slowdown: What Happened? What's the Way Out?", Centre for International Development at Harvard University, CID Faculty Working Paper No. 370, December 2019.

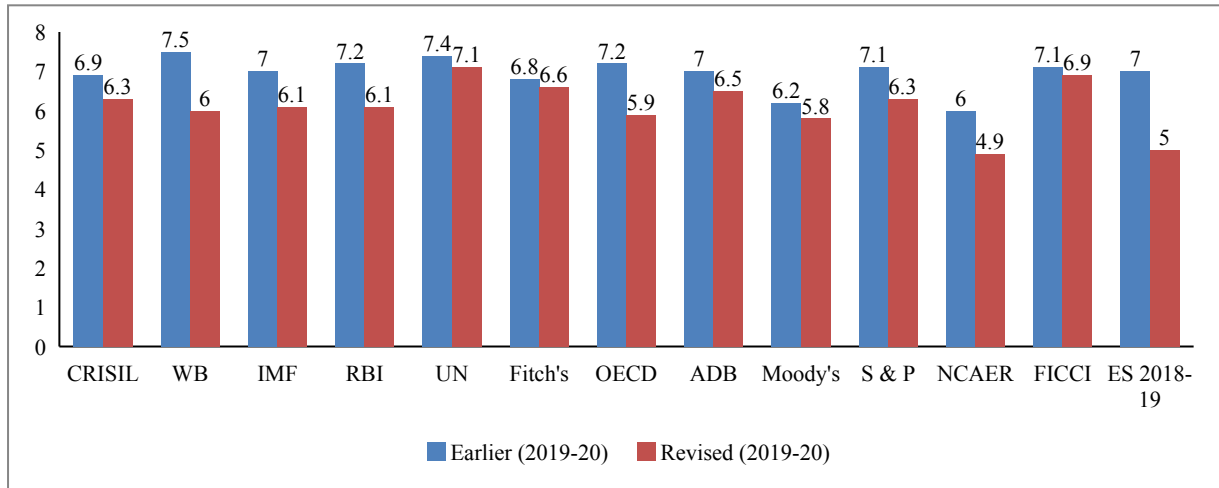
Upadhyay, R.K.(2019), "Cause and the Nature of the Slowdown in the Indian Economy", *SSRN Electronic Journal*, October 2019.

Upadhyay, R.K.(2019), "Slowdown Creeps in Indian Economy", *SSRN Electronic Journal*, January 2019.

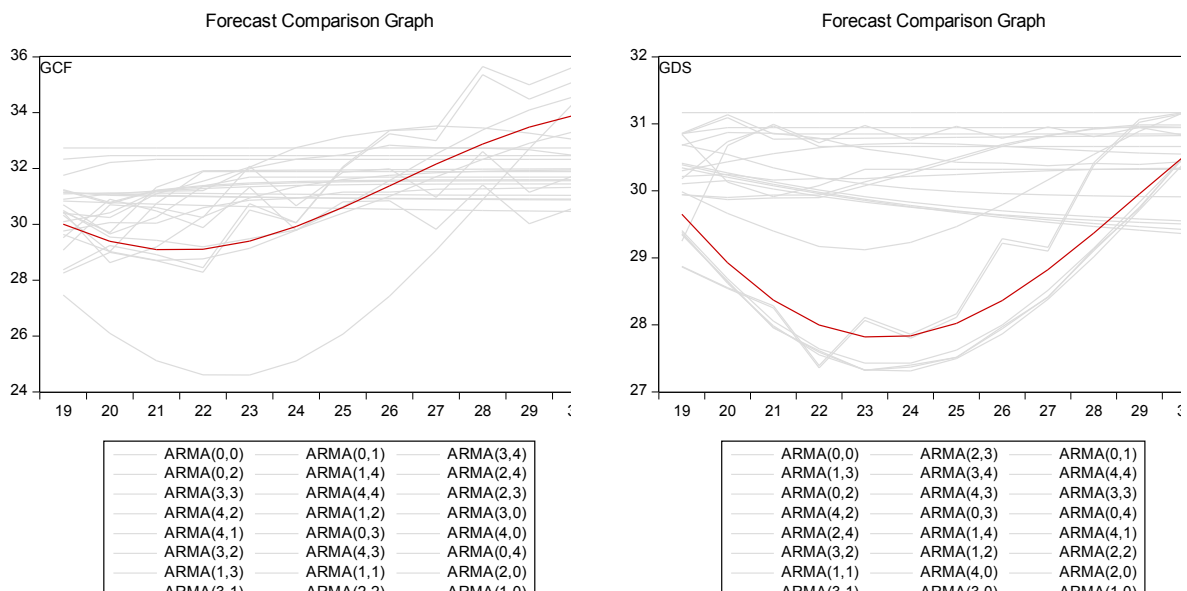
Yamini, S. and Deokar, B. (2012), "Declining Household Savings" *Economic and Political Weekly*, Vol.XLVII, No.50, pp.75-77.

## Appendices

### Appendix 1: India's Growth Forecast by Different Agencies

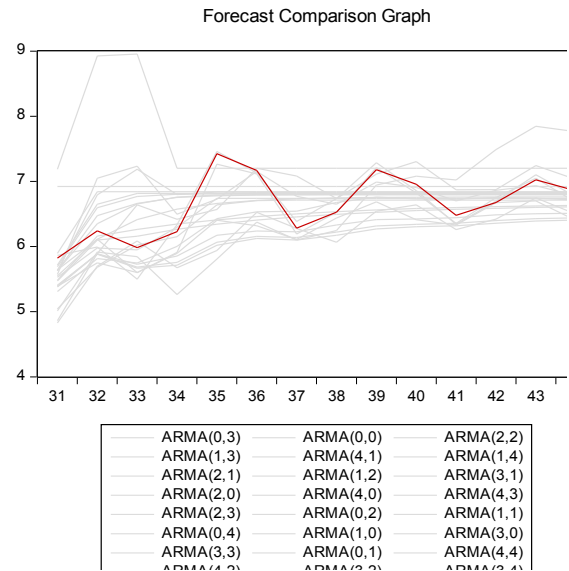
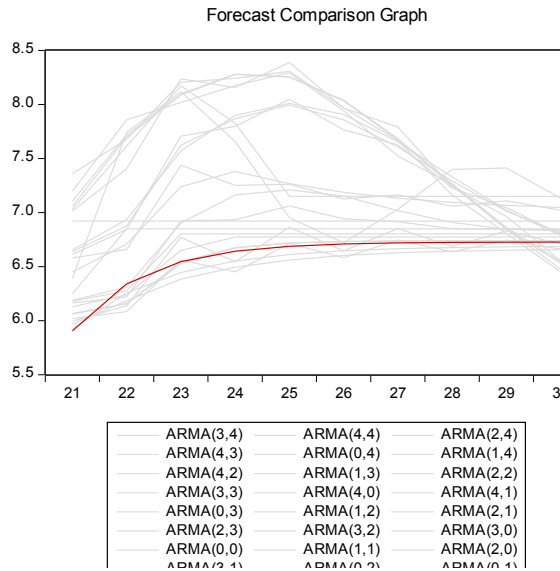


### Appendix 2: Forecast Comparison with Estimated ARMA Models



GDP (Annually)

GDP (Quarterly)



### Appendix 3: Forecasted Data

Quarter	GDP_G		Year	GDS	GCF	GDP_G
2019-20 Q3	5.821		2018-19	29.649	30.005	6.810*
2019-20 Q4	6.241		2019-20	28.927	29.395	4.982*
2020-21 Q1	5.982		2020-21	28.370	29.096	5.906
2020-21 Q2	6.229		2021-22	27.998	29.108	6.340
2020-21 Q3	7.424		2022-23	27.821	29.401	6.545
2020-21 Q4	7.167		2023-24	27.834	29.923	6.641
2021-22 Q1	6.283		2024-25	28.022	30.606	6.687
2021-22 Q2	6.528		2025-26	28.363	31.377	6.708
2021-22 Q3	7.180		2026-27	28.825	32.157	6.718
2021-22 Q4	6.956		2027-28	29.369	32.878	6.723
2022-23 Q	6.479		2028-29	29.953	33.480	6.725
2022-23 Q2	6.676		2029-30	30.531	33.921	6.726
2022-23 Q3	7.023					
2022-23 Q4	7.023					

\*Given data (not forecasted)

