

# Revisiting Financial Development and Economic Growth Nexus After Incorporating Structural Breaks: Evidence from India

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## Abstract

The paper empirically investigates the co-integrating relationship between India's financial development and its economic growth. Whereas economic growth has been taken to be natural log of India's GDP; natural log of domestic credit to private sector has been considered as the proxy for financial development variable. The methodology employed has been autoregressive distributed lag (ARDL) bounds testing c-integration approach, and we have analysed log transformed yearly data for the 58-year period, i.e., 1960–2017. First the two time series were checked for unit root both at level and 1st difference and the test employed was Perron (1997) Unit root test with a single break. Then, the ARDL test was carried out with the two variables; Log GDP and Log Domestic Credit to Private Sector. Further model optimality model was tested using both AIC and SC criteria and model stability using CUSUM Plots. Also, ACF and PACF Plots along with 'Q' statistics results were used in the study for detection of serial correlation. The results of the study revealed positive co-integrating relation between India's economic growth and financial development when GDP was taken as dependent variable under ARDL Breakpoint Model. The 'F' statistics of this model was 39.02885 which was significantly higher than the upper bound limit as given in both Pesaran, M. H., Shin, Y., and Smith, R. J. (2001) and also Narayan (2004) tables. The ECM term was negative and statistically significant and time to achieve long-run equilibrium was approximately 17 ½ years. On the other hand, when dependent variable was domestic credit to private sector, no co-integration was detected in the results as the computed 'F' value of 2.917512 was less than the lower bound. Further, no serial correlation was noticed even at lag 10, when the same was checked by ACF and PACF Plots supported by 'Q' statistics. The model was found to be stable using CUSUM Stability plot and the long-term results of the ARDL model for both the variables were found to be quite robust.

**Keywords:** Co-Integration, ARDL, Structural Breaks, Serial Correlation, CUSUM

## Introduction

Is an efficient financial system a key to the fundamentals of a sound economy? The answer is probably yes; therefore, economies (especially the developed economies) have tuned their development strategies in line with the national financial development (Esso, L. J. 2010).

Empirical research has shown that development of the financial sector creates conditions which lead to the allocation of resources in an efficient manner thereby stimulating economic growth. Economists call this phenomenon as '*Supply Lending*' and the pioneering work in this direction was carried out by Schumpeter (1911). Since then, many researchers have gone ahead and tested the above phenomenon and these include Goldsmith (1969); Ghirmay (2004); Agbetsiafa (2004); Greenwood and Jovanovic (1990); Levine and Zervos (1993); Ross and Levine (1997); Abu-Bader and Abu-Qarn (2008); Seetanah (2008); and Anwar and Nguyen (2011). Most of these studies have emphasized the role of financial intermediaries who play a key role by mobilizing private savings and, in turn, fund the investment projects thereby contributing significantly to economic growth. On the other hand, some researchers have found that the above phenomenon of '*Supply Lending*' does not apply to all the economies, especially oil exporting countries. This, they say, because the oil exporting countries have comparatively less developed financial intermediaries, which actually means less credit to the private sector and, therefore, does not automatically translate to economic growth. Major work in this area has been done by Nili and Rastad (2007); Samargandi et al. (2014) and Nwani and Bassey Orié (2016).

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There is yet another group of researchers who have found the opposite view, i.e. their empirical work showed that financial development did not lead to economic growth; on the other hand, the opposite was found to exist, i.e. economic growth was found to be causing financial development, and this phenomenon was called ‘*demand following*’\*\*. These researchers argue that as real side of the economy improves, other macro indicators follow, leading to the overall growth in the financial sector (Shahani, Sharma & Akriti, 2018). The prominent research work in this category could be attributed to Robinson (1952) and Odhiambo (2004 & 2008).

Another group of researchers including Demetriades and Hussein (1996); Akinboade (1998), and Greenwood and Smith (1997) have empirically showed that there is a bilateral causal relation between economic growth and financial development, i.e. they could find a two-way relation between the two variables under study. There is still a fourth category of researchers such as Lucas (1988) and Atindéhou et al. (2005) who believe that the economists, while studying the relation between financial development and economic growth, have actually overstressed the role of financial factors and, therefore, they empirically conclude in their research that the two variables are actually not related to each other.

The above discussion on relation between economic growth and financial development leaves few questions unanswered; firstly, whether financial development precedes economic growth or it is the other way round; second, even if we believe that the first model is correct or financial development does indeed result in economic growth, a question still needs to be answered, i.e. what shall be the mechanism of financial development impacting growth; and lastly, even if we leave out oil exporting countries, where the relation could not be seen due to ineffectiveness of financial system, can we still generalize the impact of financial development on growth on all other countries especially countries from the developing world?

Speaking of the mechanism or drawing a flowchart whereby financial development leads to economic

growth, two research studies carried out by Levine (1997) and Islam et al. (2004) have discussed this mechanism in detail. According to them, a healthy financial system induces information cost reduction and results in an increase in savings rate, which, in turn, promotes financial markets, financial institutions and payment mechanism resulting in overall efficient allocation of resources and, thus, achieving a sustained economic growth. However, on the other hand, it is also true that generalization of the impact of financial development on every country’s growth is actually not possible as each country differs from another on account of a unique set of factors, which greatly impact the strength of its financial system.

Keeping the above in mind, the present study makes an attempt to answer some of the questions listed above by focusing on India, a developing economy a growing at a reasonable pace. Few studies focusing on India economy include studies by Pradhan (2009) with findings that there exists a bilateral causality between financial development and economic growth. Another study by Sehrawat and Giri (2015) found that financial development did impact economic growth (one way relation). Ghildiyal et al. (2015) came out with similar results but with different proxy variable for financial development, i.e. financial deepening, their outcome was, however, positive. Sehrawat and Giri (2017) found the same result by using stock market proxies. Shahani, Sharma and Akriti (2018) using ARDL methodology again found a co-integrating relationship flowing from financial development to economic growth.

## Research Gap and Structure of the Paper

Although the relation between economic growth and financial development has been tested by a number of researchers by using various econometric techniques, only a handful of these studies have included the concept of structural break in time series of the variables included in their study. It is now clearly recognized that if the time series has a break and any study ignores this break, the result obtained might not give a correct picture with respect to long-term relation between the variables. The stationarity of the variables too is severely impacted in case one fails to include the break. Moreover, since the period under the present study is 58 years and with fairly large time period like this one, the chances of break are extremely high.

\*\* The work on twin hypothesis of ‘supply-leading’ (financial development → economic growth) and ‘demand following’ (economic growth → financial development) could be credited to Patrick (1966).

Therefore, in the current study, an attempt has been made to develop the long-term relation between variables after incorporating a structural break. The variables included in the study are economic growth and financial development and co-integration model used is autoregressive distributed lag (ARDL) co-integration approach. The data for the study includes log transformed yearly data for the 58-year period, i.e., 1960–2017 and has been taken from the website of the World Bank (World Development Indicators). Whereas economic growth has been taken to be Natural Log of India’s GDP. Natural Log of Domestic Credit to private sector has been considered as the proxy for financial development variable and signifies financial resources provided to the private sector by domestic financial institutions. The incorporation of a structural break makes the study unique and is expected to contribute positively to the knowledge domain in terms of testing the relation between the two variables.

The rest of the paper is structured as follows. Section 2 describes the research objectives of the study. Section 3 discusses the methodology employed including the model prerequisites and hypothesis to be tested. Section 4 provides empirical results in tabular format with their interpretation. Finally, Section 5 gives the conclusion and policy implications followed by references.

## Research Objectives

The following are the research objectives of the study:

- To establish a long-run relation among the variables; economic growth and financial development using the ARDL co-integration approach. Our ARDL model is a single equation which includes both long- and short-run variables along with a dummy variable reflecting structural break.
- To apply Partial ‘F’ test with critical levels as determined by two studies viz. Pesaran, M. H., Shin, Y., and Smith, R. J. (2001)) and Narayan (2004) to detect any long-run co-integration for the optimal model selected under the ARDL.
- To develop an error corrective mechanism (ECM) linking short-run dynamics to long-run stable equilibrium.
- To carry out diagnostics for the ARDL co-integration model in terms of (a) stationarity of the variables after including structural break, (b) serial correlation and (c) stability of the model parameters.

## Methodology Adopted

### ARDL Prerequisites

#### Prerequisite I: Stationarity of Variables

Most co-integration techniques require the variables to be integrated at same level. On the other hand, the ARDL co-integration model gives correct results if the variables are integrated either at level or first difference. This unique quality makes the ARDL technique not only superior but also one of the sought after co-integration techniques while performing econometric time series.

Since in our case too, we have applied the ARDL co-integration technique between the variables, we can go ahead with our model even if one of the time series is stationary at level and other at first difference. To test for the stationarity of variables, we have applied a modified unit root test that tries to incorporate one endogenous structural break based upon the innovative outlier approach of Perron (1997) in the popular ADF test. For the two variables namely, GDP and domestic credit, to private sector, we have developed two separate equations to test for the stationarity of variables and these are given as under (eqs. i and ii).

$$\Delta \text{GDP}_t = \lambda_1 + \lambda_1 * D_1 + (\lambda_2 - 1) \text{GDP}_{t-1} + \sum_{i=1}^m \lambda_{3i} \Delta \text{GDP}_{t-i} + \lambda_4 t + u_{1t} \quad \dots \dots \dots \text{(i)}$$

$$\Delta \text{Domestic Credit to Pvt Sector}_t = \delta_1 + \delta_1 * D_2 + (\delta_2 - 1) \text{Domestic Credit to Pvt Sector}_{t-1} + \sum_{i=1}^m \delta_{3i} \Delta \text{Domestic Credit to Pvt Sector}_{t-i} + \delta_4 t + u_{2t} \quad \dots \dots \dots \text{(ii)}$$

For the equation (i) ; The variable for which we are testing stationarity is GDP .

- $\Delta \text{GDP}_t$  is change in GDP in period t or  $\text{GDP}_t - \text{GDP}_{t-1}$
- $(\lambda_2 - 1)$  is the coefficient of the stationarity for variable GDP.
- $\sum_{i=1}^m \lambda_{3i} \Delta \text{GDP}_{t-i}$  denotes the change in GDP in period t-i and is the augmented variable which has been added to take care of serial - correlation and the term adds up ‘m’ times till the autocorrelation is removed.
- $\lambda_4 t$  is the trend variable and takes care of deterministic trend so that the equation focuses only on stochastic non-stationarity.

- $u_{1t}$  is random error term.
- $D_1$  is the intercept dummy which shows change in the intercept,  $D_1 = '1'$ , after break and including break date and  $D_1 = '0'$  (before break). As already stated we have applied Perron (1997) innovative outlier approach to determine the endogenous break date.

Note: For the second variable, domestic credit to private sector, we test the variable stationarity (see eq. ii above) by following a similar procedure as laid out above.

The testable hypothesis for stationarity test of our variables *GDP* and *Domestic Credit to Pvt Sector* (eq (i) and (ii)) would be:

( $H_{01}$ ):  $\lambda_2 - 1 = 0$  or  $\lambda_2 = 1$  (Variable *GDP* has a unit root with break).

( $H_{a1}$ ):  $\lambda_2 - 1 \neq 0$  (Variable *GDP* is stationary with break).

Acceptance of Null Hypothesis would mean that the variable has a unit root.

( $H_{02}$ ):  $\delta_2 - 1 = 0$  or  $\delta_2 = 1$  (Variable *Domestic Credit to Pvt Sector* has a unit root with break).

( $H_{a2}$ ):  $\delta_2 - 1 \neq 0$  (Variable *Domestic Credit to Pvt Sector* is stationary with break).

### Prerequisite II: Serial Correlation

Existence of serial correlation, i.e. Covariance ( $u_t, u_{t-1}$ )  $\neq 0$  among the residuals makes standard errors smaller than what they actually are, thus giving an inconsistent estimation of the parameters. Therefore, the absence of serial correlation is one of the prerequisites that must be checked before developing a co-integration model. We would be checking for the serial correlation by autocorrelation, partial autocorrelation plot and 'Q' statistics.

Whereas a plot for autocorrelation function (ACF) measures how a residual time series is correlated with lags of itself, the partial auto correlation function (PACF) plot is the amount of correlation that is not explained by correlations at all lower-order-lags. Under 'Q' statistics, we test if correlation between residual return and residual lag returns (up to certain lag) is zero. The formula for 'Q' statistics is given as:

$$Q_m = n \sum_{l=1}^m \rho_l^2 .$$

Under 'Q' statistics, we add-up all the squares of autocorrelations (' $\rho$ ' is estimator of autocorrelation) and multiply the result by the number of observations (n), '1' is the lag with 'm' being the lag length used in the formula. The Q statistics follows Chi-Square distribution and the Null Hypothesis of No Serial Correlation gets rejected if  $Q_m > \chi^2$ .

### Prerequisite III: Stability of the Model

Stability of the model (and its parameters) is another important prerequisite under the ARDL framework and to check for model stability (after incorporation of break) we have applied a test of residuals called cumulative sum of recursive residuals (CUSUM), which is an 'xy' plot; 'x'-axis is time period of study and 'y'-axis shows the cumulative sum of normalized residuals. The model is accepted to be stable if the cumulative sum is within the limit  $\mu \pm 2$  SE i.e. (5 % level). It is important to note that the residuals are normalized before they can be cumulated and the formula for the same is given as under:

Normalizing the residuals:

$$z_{r_i} = \left( \frac{res_{r_i} - \overline{res_r}}{\tilde{A}_{res_i}} \right)$$

Cumulating the normalized residuals:

$$CUSUM(C_r) = \sum_{i=1}^{n-1} z_{r_i} ,$$

### ARDL Model Specification\*

Once we have satisfactorily checked for ARDL prerequisites, next step is to proceed with the development of the ARDL model. ARDL co-integration is a single representation equation which clubs long-term relation with short-run dynamic interaction between the variables. ARDL approach scores over traditional approaches of co-integration and there are a number of reasons to support this viewpoint; first, it is a single-equation model which includes lags of variables and the number of lags have been determined using appropriate lags-length criteria; second, it can work with both I(0) and I(1) variables; third, efficiency of the model is not impacted while working on

\* ARDL Model was originally developed by (Pesaran & Shin, 1999) and was later modified by (Perasan et al., 2001)

small samples; fourth it avoids the omitted variable bias; and lastly, the test can be applied even if regressors are lagged exogenous as well as endogenous (Srinivasan & Prakasam (2014), Sehrawat & Giri (2015), Shahani R, S. Sharma & G. Akriti (2018A)).

The ARDL co-integration model, as used under the present study, incorporates the long- and short-run along with dummy representing structural break whose value is '0' if time period falls before the break and '1' after the break (including the break date). Both the variables under study have been log transformed to lessen the impact of extreme values and also to take care of different units of measurement for our two variables. The ARDL Model equation(s) for our two variables are given as under:

$$\begin{aligned} \Delta LGDP_t = & \beta_1 + \beta_2 LGDP_{t-1} + \beta_3 LDCPS_{t-1} \\ & + \sum_{i=1}^n (\beta_{4,i} \Delta LGDP_{t-i}) + \sum_{i=1}^n (\beta_{5,i} \Delta LDCPS_{t-i}) \\ & + \beta_6 D_1 + u_t \quad \dots(iii) \end{aligned}$$

$$\begin{aligned} \Delta LDCPS_t = & \alpha_1 + \alpha_2 LDCPS_{t-1} + \alpha_3 LGDP_{t-1} \\ & + \sum_{i=1}^n (\beta_{5,i} \Delta LDCPS_{t-i}) + \sum_{i=1}^n (\alpha_{5,i} \Delta LGDP_{t-i}) \\ & + \alpha_6 D_2 + v_t \quad \dots(iv) \end{aligned}$$

where  $\Delta LGDP_t$  = Change in log of GDP in period 't'

$\Delta LDCPS_t$  = Change in log of Domestic Credit to Private Sector in period 't'

$LGDP_{t-1}$  = 1<sup>st</sup> lag Prices of Log of GDP

$LDCPS_{t-1}$  = 1<sup>st</sup> lag Prices of Log of Domestic Credit to Private Sector

$\sum_{i=1}^n \Delta LGDP_{t-i}$  = Change in log of Gross Domestic Product in period 't-i'; i denotes the no. of lags and goes from '1' to 'n' in eq. (iii) and from '0' to 'n' in eq. (iv)

$\sum_{i=1}^n \Delta LDCPS_{t-i}$  = Change in log of Domestic Credit to Private Sector in period 't-i'; i denotes the no. of lags and goes from '1' to 'n' in eq. (iv) and from '0' to 'n' in eq. (iii)

$D_1$  = Dummy Variable introduced to incorporate structural break in time series of LGDP (eq. iii)

$D_2$  = Dummy Variable introduced to incorporate structural break in time series of LDCPS (eq. iv)

## Partial 'F' Bounds Co-Integration Test

The decision of whether or not long-term co-integration is established is taken under the ARDL co-integration model with the help of partial 'F' test. Here, we establish our Null Hypothesis as long-run co-integration between variables is not established, i.e.  $H_{01} : \beta_2 = \beta_3 = 0$  (from eq. iii) and  $H_{01} : \alpha_2 = \alpha_3 = 0$  (from eq. iv). To test this hypothesis, we follow accept/reject criteria given by Pesaran, M. H., Shin, Y., and Smith, R. J. (2001) and cross check the same with Narayan (2004) tables. The lower and upper bound critical values for two tables are as under:

- Accept  $H_{01}$ , if 'F'<sub>computed</sub> < Lower Bound critical (3.79 Pesaran or 3.116 Narayan level)
- Reject  $H_{01}$  if 'F'<sub>computed</sub> > Upper Bound critical (4.85 Pesaran or 4.094 Narayan level)
- No Inference about  $H_{01}$ : If  $F_{\text{Computed}}$  is between the two bounds Pesaran (3.79 - 4.85) or Narayan (3.116 - 4.094)

## The Error Correction Model (ECM)

Existence of long-term relation duly confirmed by Partial 'F' bounds test would lead to the development of an error correction representation (eq. v) reflecting the speed of adjustment to long-run equilibrium. As seen in eq. (v), we develop this equation only for LGDP where co-integration was proved from Partial 'F' Bounds results.

$$\begin{aligned} \Delta LGDP_t = & \beta_1 + \beta_2 ECM_{t-1} + \sum_{i=1}^n (\beta_{3,i} \Delta LDCPS_{t-i}) \\ & + \sum_{i=1}^n (\beta_{4,i} \Delta LGDP_{t-i}) + \beta_4 D_1 + u_{1t} \quad \dots(v) \end{aligned}$$

(In the ECM model(v) given above, the coefficients;  $\beta_{3,i}$  and  $\beta_{4,i}$  represent the short run parameters to be estimated for variables  $\Delta LDCPS$  and  $\Delta LGDP$  respectively.  $\beta_2$  is the parameter of error correction term (ECM) and  $\beta_1$  is the constant. Also 'n' which denotes number of lags shall be defined by the best model as given by AIC and SIC. We also have  $D_1$  as dummy variable reflecting structural break in variable LGDP with coefficient  $\beta_4$ . Note: We have developed only one equation for variable GDP, based upon empirical results obtained where only one ECM model was required).

### Empirical Results and Interpretation

Our discussion on empirical results begin with the results of the stationarity of our variables. We have applied the unit root stationary test, which incorporates one structural break in the popular ADF unit root test of Perron (1997) and the stationary test results of our two variables are given in Table 1.

**Table 1: Results of Unit Root Stationary Test with Single Break**

Variable	Year of Break	Computed 't' at Level and ('p' values)	Computed 't' at 1st Difference and ('p' values)
Domestic Credit to Pvt. Sector	1996	-1.412512 (0.9404)	-6.045714 ( $< 0.01$ )
GDP	1990	-3.800148 ( $< 0.05$ )	-6.813413 ( $< 0.01$ )

As the Table 1 clearly shows, one of our variables; GDP is stationary at level (has a 'p' values  $< 0.05$ ) while the second variable; Domestic Credit to Pvt Sector is stationary at first difference (has a 'p' values  $< 0.01$ ). Further, Table 1 also shows that the two variables have different breakpoint levels; whereas Domestic Credit to Private Sector has a Break Point in the year 1996, GDP has the breakpoint in the year 1990.

Having established the stationarity of our variables, we now proceed towards optimal lag length for our ARDL model. It is to be noted that while developing the optimal model, we have placed the restriction of maximum lags for both dependent and independent variables at '3'. This fixing the maximum number of lags is based upon a study done by Narayan (2005), where it was concluded that the number of lags should be sufficient so as to take care of autocorrelation, but low enough so that error correction term is not highly over parametrized. Further, we have adopted both AIC and SC Lag specification Criteria and have identified the following combinations as being optimal (see Table 2 below).

**Table 2: Optimal Lag Determination for Our ARDL Model**

Model with Optimal Lags	AIC	SC
Dependent: GDP	(1,1)	(1,1)
Dependent: Domestic Credit to Pvt Sector	(3,1)	(3,1)

(figures in parenthesis are no. of lags of dependent variable followed by lags of regressor).

The next part of our results relates to checking of the long-term co-integration between the variables using ARDL Partial 'F' Bounds approach. The results which are reproduced in Table 3 below clearly show that long-term co-integrating relationship is established among the variables when GDP is taken as a function of domestic credit as the computed 'F' Statistic value of 39.02885 is greater than the critical values of both Pesaran\* and Narayan\*\* (See Table 4 below for details). On the other hand, no co-integration was seen when Domestic Credit to Pvt Sector is considered (*Computed F* = 2.917512).

**Table 3: ARDL Co-Integration Partial 'F' Test Results**

Model Specification	'F' Bounds Value Computed	Inference
GDP = f (Domestic Credit to Pvt Sector)	Computed F = 39.02885	Co-integration is Established
Domestic Credit to Pvt Sector = f (GDP)	Computed F = 2.917512	Co-integration is Not Established

**Table 4: Critical Tables for ARDL 'F' Bounds Test**

	Pesaran* Critical Values	Narayan** Critical Values
Lower Bound	3.79	3.116
Upper Bound	4.85	4.094
No Inference	Between 3.79 and 4.85	Between 3.116 and 4.094

How each variable has performed in the long run is displayed in Tables 5 and 6; whereas Table 5 gives the results of model for GDP, Table 6 displays the results for the variable Domestic Credit to Pvt. Sector. The table results pertain only to the optimal lag model as given by AIC and SC. The results of Table 5 clearly show that the independent variable, Domestic Credit to Pvt Sector and its first lag have significant 't' values and 'p' values at 5% level of significance. The dummy variable reflecting break is also statistically significant. Further, the model is also an excellent fit as given by adjusted R Square and over all 'F' Statistics. Coming to results Table 6, we find that the independent variable Domestic Credit to Pvt Sector and its lag is not statistically significant, while Dummy Variable for BREAK is highly significant.

**Table 5: ARDL Model Long Run Results for Optimal Model Dependent Variable: Log GDP**

Independent Variable	Coefficient	t-Statistic	Prob.
LOG_GDP(-1)	0.793638	10.30354	0.0000
LOG_DOMESTIC	0.878233	14.10766	0.0000
LOG_DOMESTIC(-1)	-0.757356	-9.839309	0.0000
BREAK_2	-0.052321	-2.685489	0.0097
Robustness Indicators			
R-squared		0.999106	
Adjusted R-squared		0.999018	
F-statistic		11394.35	

**Table 6: ARDL Model Long Run Results for Optimal Model AIC (3,1) and SC (3,1) Dependent Variable: Log Domestic Credit to Pvt Sector**

Independent Variable	Coefficient	t-Statistic	Prob.
LOG_DOMESTIC (-1)	1.040572	11.83805	0.0000
LOG_DOMESTIC (-2)	-0.122357	-2.234996	0.0252
LOG_DOMESTIC (-3)	-0.137442	-2.226145	0.0308
LOG_GDP	0.790794	0.313284	0.4387
LOG_GDP (-1)	-0.750739	-0.551269	0.3911
BREAK_1	-0.078964	-2.845689	0.0065
Robustness Indicators			
R-squared		0.999555	
Adjusted R-squared		0.999489	
F-statistic		15080.25	

In the next table (Table 7), we report the results of our Error Correction Model. The ECM Model is required only for those variables which are proved to be co-integrated. In our case, we have ECM Model for our variable LGDP. The results reveal that our ECM term is negative and statistically significant. Further coefficient of ECM (-1) is 0.057, which shows that it would take approximately 17 ½ years to achieve long-run equilibrium.

**Table 7: Error Correction Results for Model with Long Run Co-Integration Established**

Dependent Variable	Beta Coefficient of ECM(-1)	Corresponding 'p' value
LGDP	-0.057	0.006

The results of the next table (Table 8a and b) relate to the test of Serial Correlation. The table gives 'Q' statistics for

each lag (Lag1 to Lag 10) of our variables along with the respective 'p' values. The plots of ACF and PACF are also displayed as (\*) for each of the two variables. For both the variables, the results clearly depict that there is absence of serial correlation even at Lag 10. (*p' value at Lag 10 is 0.635 showing Null of No Co-integration is accepted*)

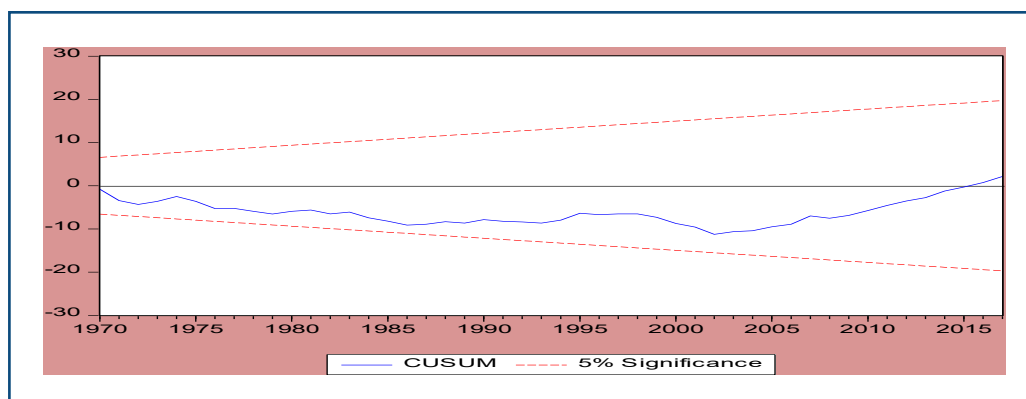
**Table 8(a): Serial Correlation Results (ACF, PACF and Q Statistics) for GDP**

Autocorrelation	Partial Correlation	Lag	Q-Stat	'P'
.*.	.*.	1	0.4859	0.486
. .	. .	2	0.4928	0.782
. .	. .	3	0.5032	0.918
.*.	.*.	4	1.3638	0.850
** .	** .	5	4.3957	0.494
. .	.*.	6	4.4096	0.621
. .	.*.	7	4.5828	0.711
. *.	. *.	8	6.8051	0.558
.*.	.*.	9	7.7820	0.556
. .	. .	10	7.9407	0.635

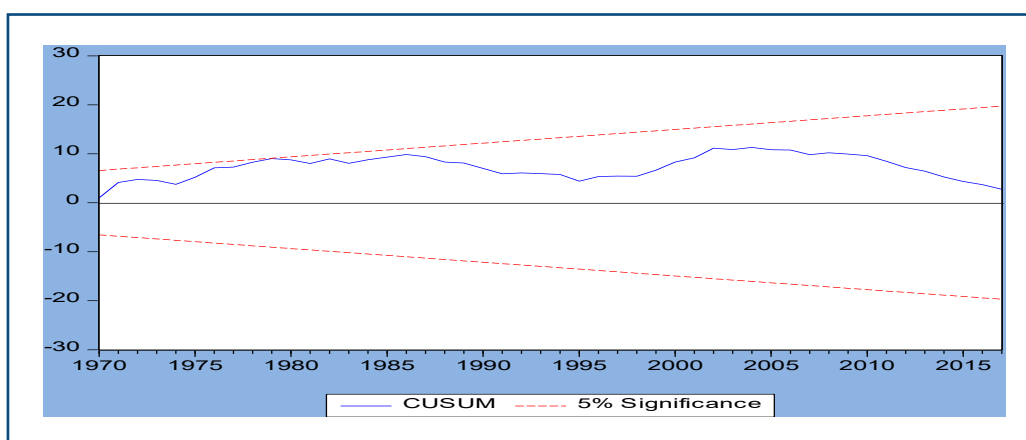
**Table 8(b): Serial Correlation Results (ACF, PACF and Q Statistics) for Domestic Credit to GDP**

Autocorrelation	Partial Correlation	Lag	Q-Stat	Prob*
. .	. .	1	0.0412	0.839
.*.	.*.	2	1.0627	0.588
. .	. .	3	1.1000	0.777
.*.	.*.	4	2.0093	0.734
** .	** .	5	4.9089	0.427
. .	. .	6	5.1703	0.522
. *.	. *.	7	7.8242	0.348
. **	. **	8	10.860	0.210
.*.	.*.	9	13.072	0.159
. .	. .	10	13.204	0.212

The next set of results are the two plots of CUSUM (Figs. 1 and 2) for two variables: GDP and Domestic Credit to Pvt Sector. These two plots have been drawn after incorporation of break in the ARDL Model. The stability of the Models is thus proved as both the curves lie between the two lines, i.e.  $\mu \pm 2$  SE (5 % level).



**Fig. 1: Cusum Plot for GDP**



**Fig. 2: Cusum Plot for Domestic Credit to Pvt Sector**

## Conclusion and Policy Implications

The present study empirically investigated the co-integrating relationship between India's financial development (Natural Log of Domestic Credit to private sector as its proxy) and economic growth (Natural Log of India's GDP as its proxy). The methodology employed was the ARDL Bounds Testing Co-integration Approach and the analysis was carried out on for the 58-year period, i.e., 1960–2017. An important point of this study was to include a single structural breakeven point in the ARDL Model for which a modified ADF test of Perron (1997), which could detect the break while testing for unit root, was employed under the study. The results of the study revealed positive co-integrating relation between India's economic growth and financial development when GDP was taken as dependent variable under ARDL as reflected by computed 'F' statistics which was 39.02885. This value was significantly higher than

the upper bound critical limit. Since the co-integration was established, the ECM Model was also established to determine the process whereby we could achieve long-run equilibrium. The ECM results showed that the coefficient was highly significant and negative, hence stable and that it would take approximately 17 ½ years to achieve long-run equilibrium. On the other hand, no co-integration was detected when financial development was the dependent variable. The diagnostics were, however, satisfactory with no serial correlation noticed even at lag 10 and model being stable using CUSUM plot after incorporation of break.

The study throws to light a few policy implications; first, having proved that India's GDP does have a co-integrating relation with the financial development, there is a need to take this story further whereby the government can give a further boost to the lending by banks and institutions. This can be developing an atmosphere whereby banks and institutions are able to lend at even lower rates than

existing rates. Second, an attempt can be made to create an atmosphere whereby one is able to sustain the lower rates and this could be achieved by further reformative policies of the government and the Central Bank. Adding to this, certain bold steps are also needed in terms of taking fresh challenges for further deepening of the entire financial system. Steps are also needed which shall give the necessary boost to sectors which contribute positively to economic growth; these steps include availability of infrastructure, reduction in taxes or tax holidays, incentives, subsidies, etc. Third, the government must also learn a lesson from past mistakes and ensure that complex process of economic growth is not derailed by allowing slippage of other macroeconomic indicators such as inflation, fiscal deficit, balance of payments position, etc., as the financial development cannot work in an isolation but has strong linkages with the real sector.

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