Financial Development & Economic Growth Nexus: Empirical Investigation of three South Asian Economies

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Abstract

The paper investigates the co-integrating nexus between Financial Development & Economic Growth of three Prominent South Asian Economies namely India, Pakistan & Sri Lanka. Whereas Economic Growth has been represented by Per Capita GDP, the proxy for Financial Development Variable is Pvt. Sector Credit to GDP. The paper also includes two additional variables (as regressors) and these are Consumer Price Index (a proxy for inflation) & ratio of Trade to GDP (a proxy for Trade Openness). The co-integrating relation has been tested using Autoregressive Distributed Lag (ARDL) Bounds Testing Co-integration Approach .The pre-requisites for the ARDL model have also been tested in our study and these include the Variable Stationarity (using Augmented Dickey Fuller) , Stability of Parameters (using CUSUM plots) & Serial Correlation (using BG-LM test) To test the hypothesis of co-integration between variables, we have analysed log transformed yearly data for fifty years for the India and Sri Lanka & forty eight years for Pakistan. The period of study for all the three countries differs due to difference in availability of data. The ARDL test has been applied on Optimal Model and optimality has been checked using AIC & SC Criteria. The results of the study revealed positive co-integrating relation between Financial Development & its Economic Growth for two countries namely India and Sri Lanka as given by the partial F Statistics for which we have used Narayan (2004) tables. For Pakistan, the results showed presence of no co-integrating relation between these variables. The test also passed the model pre-requisite of Stationarity of Variables where we find that except Pvt. Credit to GDP of Pakistan, all other variables are stationary at I (1). Pvt Credit to GDP of Pakistan was found to be stationary at I (0) which in a way justifies the use of ARDL Methodology. The BG LM test for serial Correlation showed no serial correlation for all the three countries, further all the three countries had their parameters as stable using CUSUM Stability plots. The lagged Error term (ECM) coefficient was found to be negative for both India and Sri Lanka; it was significant at 5% and 10 % respectively for the two countries .The corrective mechanism linking short and long run equilibrium worked @ 47 % for India while it was at a much slower rate of 8.6 % for Sri Lanka.

Keywords: Co-integration, Partial 'F' test, ARDL, CUSUM, Serial Correlation

Introduction

The relation between financial development and economic growth has

received much of an attention after the seminal paper by Schumpeter (1911) where he empirically examined how financial development leads to economic growth. Thus when financial sector mobilizes savings and turns it to investment, it actually enables economic growth. The same viewpoint was later re-emphasized by Goldsmith (1969). Other Researchers coming to the same conclusion included Ghirmay (2004), Agbetsiafa (2004), Greenwood & Jovanovic(1990),Levine & Zervos (1993), Abu Bader & Abu Qarn (2008). The positive effect of financial development on economic growth is also termed by researchers as "supply-leading" On the other handthere is another group of researchers who are of the opinion that it is the economic growth which leads to financial development and this is what they call 'demand following'* . Thus as the real economy improves, the macro indicators show an upward trend which also leads to growth of financial services. The major contributors here include Robinson (1952) & Odhiambo (2004 & 2008).The third group of researchers including Demetriades & Hussein (1996) Akinboade (1998), Greenwood & Smith (1997) are of the view that the causal relation between financial develop-ment and economic growth run bilaterally. Lastly, there is yet another group of researchers who are of the view that there exists no relation between the two, the researchers like Lucas (1988) in his popular work argues that a lot of economists have overstressed the role played by financial factors when arriving at any kind of relation with economic growth. The same viewpoint of no relation has been supported by Atindehou et.al.(2005) in their study .

The aim of the present study is to investigate whether Financial Development with respect to three South Asian Economies, namely India, Pakistan and Srilanka has any role in shaping country's economic growth& vice- versa. The three countries account for nearly 92 % of the GDP and 94 % of the exports arising out of the South Asian region. (www.imf.org). Moreover in all the three countries banks, stock markets and other financial institutions are fairly developed. There have been very few studies which have tested the relation between financial development and economic growth in the South Asian Context. Some of these include Pradhan (2009) who found the bilateral causality between financial development and economic growth of India. Sehrawat & Giri (2015) applied two models to study the impact of financial development upon economic growth in India and found the results to be positive for both the models Ghildiyal et.al. (2015) investigated the impact of financial deepening on GDP Per Capita & the results showed that financial deepening did cause the economic growth both in short as well as long run. Sehrawat&Giri (2017) tested the impact of sectoral stock indices on sector specific India's GDP & results showed both long and short term impact of sector's index on economy's sector specific GDP which in a way also proved that financial development causing economic growth.

Waqaset. al.(2011) tested for long run equilibrium between internal trade, economic growth & financial development in Pakistan & results showed long term relation between domestic credit, financial development, economic growth and international trade. Seetanah, B. (2008) tested using two models linkages between financial development and economic growth in Mauritius & found that long term relation existed in both the models. Coming to the present study, here attempt has been made to explore the empirical relation between financial development and economic growth using autoregressive distributed lag (ARDL) Co-integration approach with time series data for three South Asian Economies ; India, Pakistan &Srilanka. The rest of the paper is structured as follows: Section II: describes the research objectives of the study , Section III : gives the Data Description & a description on the variables used in the study. Section IV : discusses the methodology employed including the model pre-requisites along with hypothesis to be tested Section : V : provides empirical results of the study & its interpretation & finally Section VI: gives the conclusion & policy implications of the study.

Research Objectives

The following are the Research objectives of the Study

(i) To establish single long and short run equation for ARDL specification model between the variables:Per Capita GDP, Pvt. Sector Credit to GDP ,CPI and Trade to GDP for all the three countries namely India, Pakistan &SriLanka

(ii) To apply Partial 'F' test to detect any Long Run Co-integration

(iii) To carry out diagnostics for the ARDL Model in terms of (a) Serial Correlation (b) Stability of the Parameters& (c) Variable Stationarity

(iv) To identify the error correcting mechanism which establishes the long run and short run amongst the co-integrated variables

(v) To establish the causal relation between the variables

Description of Data & About the Variables

The study considers time series yearly log transformed data for all the three countries; namely India, Pakistan & Srilanka. However the period of study for all the three countries differ due to data availability i.e. India's period of study has been taken to be 1966 to 2015 (50 years), for SriLanka it is 1964-2013 (50 years) &for Pakistan it is

1967-2014 (48 years) The data has been taken from website of World Bank (World Development Indicators) (data. worldbank.org).Four Variables have been used in the study & these include Per Capita GDP(a proxy for economic growth), Pvt. Sector Credit to GDP (a Financial Development Variable & signifies financial resources provided to the private sector by financial institutions) Two additional regressors have been added and these include Consumer Price Index (a proxy for inflation) &ratio of Trade to GDP (a proxy for Trade Openness)

Methodology Adopted

(i) (a) ARDL Pre-requisite I: Variable Stationarity

ARDL model requires the variables to be integrated either at level or first difference. This pre-requisite makes the ARDL technique superior to other Co-integration techniques which require the variables to be integrated at same level and thus becomes the no. 1 choice when testing the variables for co-integration .

The stationary test applied here is ADF test (with intercept and trend) and all the four variables have separate equations which have been developed as under (i to iv).

$$\Delta \text{ Per Capita GDP}_t = \lambda_1 + (\lambda_2 - 1)\text{Per Capita GDP}_{t-1} + \sum_{i=1}^{m} \lambda_{3i} \Delta \text{ Per Capita GDP}_{t-i} + \lambda_4 t + u_{1t} \quad \text{..... eq.(i)}$$

$$\Delta \text{ Pvt Sector Credit to GDP}_t = \delta_1 + (\delta_2 - 1)\text{Pvt Sector Credit to GDP}_{-1} + \sum_{i=1}^{m} \delta_{3i} \Delta \text{ Pvt Sector Credit to GDP}_{t-i} + \delta_4 t + u_{4t} \quad \text{... eq.(ii)}$$

$$\Delta \text{ CPI}_t = \alpha_1 + (\alpha_2 - 1)\text{CPI}_{-1} + \sum_{i=1}^{m} \alpha_{3i} \Delta \text{ CPI}_{t-i} + \alpha_4 t + u_{4t} \quad \text{... eq.(iii)}$$

$$\Delta \text{ Trade to GDP}_t = _1 + (\beta_2 - 1)\text{Trade to GDP}_{t-1} + \sum_{i=1}^{m} \beta_{3i} \Delta \text{ Trade to GDP}_{t-i} + \beta_4 t + u_{3t} \quad \text{..... eq.(iv)}$$

(For the equation (i) ; The variable for which we are testing stationarity is Per Capita GDP . Δ Per Capita GDP$_t$ is change in Per Capita GDP in period t, $(\lambda_2 - 1)$ is the coefficient of the Stationarity for variable , $\sum_{i=1}^{m} \lambda_{3i} \Delta$ Per Capita GDP$_{t-i}$ denotes change in Per Capita GDP in period t-i & is the augmented variable which has been added to take care of autocorrelation 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 in the variable so that only stochastic trend can be detected, the u_{1t} is random error term. Similarly we carry out stationarity tests (eq.(ii),(iii) &(iv)) for other variables namely Pvt Sector Credit to GDP, Trade to GDP & CPI)

The testable hypothesis for Stationarity test of our Variable Per Capita GDP (eq (i)) would be

(H_0) : $\lambda_2 - 1 = 0$ *0r* $\lambda_2 = 1$ *(the Per Capita GDP is not stationary)*

(H_a): $\lambda_2 - 1 \neq 0$, *(Per Capita GDP is stationary)*

(i) (b) ARDL Pre-requisite II : Error term Correlation

Error Term Correlation or Serial Correlation denoted as covariance(ut, ut-1) $\neq$ 0would result in smaller than true standard errors , thereby making the computed parameters more precise than what they actually thus impacting their efficiency. Thus before we go and develop an ARDL model it is important to test the variables for serial correlation. The test applied here is BG-LM test of residuals whereby the residuals are obtained from autoregressive equation of all the variables for all three countries and with residuals following the autocorrelation structure , the entire structure gets substituted in the autoregressive equation to get the final BG-LM equation. E.g. let us consider the variable Per Capita GDP for India , the BG-LM equation thus developed for this variable shall be :-

$$u_t = \beta_1 + \beta_2 \text{Per Capita GDP}_{t-1} + \beta_3 \text{Per Capita GDP}_{t-2} + \ldots\ldots\ldots + \beta_p \text{Per Capita GDP}_{t-(p-1)} + \psi_1 u_{t-1} + \psi_2 u_{t-2} + \psi_3 u_{t-3} + \ldots\ldots + \psi_n u_{t-n} + e_t \quad \text{.... eq.(v)}$$

R Square of the equation (v)follows a Chi Square Distribution , the criteria followed in our case shall be to accept the Null of No Error Term Correlation if $R2(n-p) < \chi 2n$

(i) (c) ARDL Pre-requisite III : CUSUM Parameter Stability

Cumulative Sum of Residuals are plots, of the

residuals(after normalizing) obtained from the recursive equations . The formula for CUSUM is developed as under

$$C_t = \sum_{t=k+1}^{n} \frac{w_t}{\sigma_{C_t}},$$

where C_t is the cumulative standardized residuals at period 't',

$$\sigma_{C_t} \text{ is defined as } \sqrt{\frac{\sum_{t=k+1}^{n}(w_t - \overline{w_t})}{n-k-1}} \quad \& \quad \overline{W_t} = \frac{\sum_{t=k+1}^{n}(w_t)}{n-k}$$

(ii) ARDL Model Specification

After checking for ARDL Pre-requisites, next we proceed to the development of ARDL Model. ARDL Co-integration Model incorporates the long and short run relation amongst the variables in a single VAR equation. The Model was originally developed by (Pesaran&Shin 1999)& was later modified by (Perasan et.al 2001)All the variables have been log transformed with the intention to lessen the impact of extreme values and also to free ourselves from the worry of problems associated with different units of measurement for our variables. Thus basic relationship that we would be testing shall beLPGDP = f(LCGDP, LCPI, LTGDP) where LPGDP is Log of Per Capita Gross Domestic Product,LCGDP is Log of Pvt. Sector Credit to GDP, LCPI is Log of Consumer Price Index, & LTGDP is the Log of Trade as a percentage of GDP. The ARDL equation is given as under :-

$$\Delta LPGDP_{,t} = \beta_1 + \beta_2 LPGDP_{t-1} + \beta_3 LCGDP_{t-1} + \beta_4 LCPI_{t-1} + \beta_5 LTGDP_{t-1} + \sum_{i=1}^{n}(\beta_{6,i}\Delta LPGDP_{t-i}) + \sum_{i=1}^{n}(\beta_{7i}\Delta LCGDP_{t-i}) + \sum_{i=1}^{n}(\beta_{8,i}\Delta LTGDP_{t-i}) + + \sum_{i=1}^{n}(\beta_{9,i}\Delta LCPI_{t-i})u_t \ldots\ldots(vi)$$

(iii) Partial 'F' Bounds test :

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001)) developed Partial 'F' test to determine if the results of the ARDL Model revealed any long term co-integration or not .

Null for the Partial 'F' test isHo1 :β2= β3= β4= β5 = 0 (from eq. (vi) above)

i .e .Long run Co -integration between variables is not established

The following shall be Accept /Reject Criteria for our Null Hypothesis :

Accept the Null , if ' F ' computed < Lower Bound critical or (3 .79)

Reject the null if 'F 'computed > Upper Bound critical or (4 .85)

No Inference : If F Computed is between the two bounds or (between 3 .79 - 4 .85)

(iv) The ECM and Short Run Dynamics

To obtain the short term variables we run the following regression , the ECM term shall specify the speed of adjustment to equilibrium .

$$LPGDP_{,t} = \delta_1 + \delta_2 v_{t-1} + \sum_{i=1}^{n}(\delta_{3,i}\Delta LPGDP_{t-i}) + \sum_{i=1}^{n}(\delta_{4i,}\Delta LCGDP_{t-i}) + \sum_{i=1}^{n}(\delta_{5,i}\Delta LCPI_{t-i}) + \sum_{i=1}^{n}(\delta_{6,i}\Delta LTGDP_{t-i}) + u_t \ldots\ldots\ldots(vii)$$

(Where δ3,δ4, δ5&δ6 are the short run parameters to be estimated &δ2 is the parameter of error correction term(ECM) term lagged is obtained from the static equation (viii) given below)

$$LPGDP_{,t} = \beta_1 + \beta_2 LTGDP_t + \beta_3 LCPI_t + \beta_4 LCGDP_t + \beta_5 + v_t \ldots\ldots\ldots(viii)$$

V. Empirical Results and Investigation

To begin with we discuss the results of the three pre-requisites for our ARDL Model and the first pre-requisite is the variable stationarity which as per the model must be either stationary at level or first difference { I(0) or I(1)} . As we see from Table 1 below shows where the stationarity has been computed at levels and also at 1st difference for all the variables under study &for all the three countries we find that except Pvt Credit to GDP all other variables are stationary at 1stdifference. Pvt Credit to GDP of Pakistan was found to be stationary at level and therefore since there is a mix of I(0) & I (1) variables , after testing the stationarity we proceeded with ARDL Co-integration approach.

Table 1 : ADF (Unit Root) test of all the variables under study

	India		Pakistan		SriLanka	
	'P' value at Level	**'p' value at 1st Diff**	**'P' value at Level**	**'p' value at 1st Diff**	**'P' value at Level**	**'p' value at 1st Diff**
Per Capita GDP	**0.9989**	**0.0000**	**0.9949**	**0.0001**	**0.9900**	**0.0002**
CPI	**3.563185**	**0.0138**	**1.0000**	**0.0019**	**0.9890**	**0.0089**
Pvt. Credit to GDP	**0.3368**	**0.0238**	**0.0418**	**0.0002**	**0.1266**	**0.0000**
Trade to GDP	**0.6477**	**0.0002**	**0.3510**	**0.0000**	**0.9501**	**0.0000**

Having established the stationarity of our variables & also convinced that ARDL procedure must be applied to test the co-integrating relation amongst the variables ,next we proceed to check the optimal model which we shall be using to establish the long and short term relation amongst the variables viz. GDP per capita and Pvt. Credit to GDP. The optimal model shall be determined on the basis of lag length criteria for our regression. We have chosen two statistics AIC & SC for this purpose and shall be choosing the model with the lowest AIC or SC .Table IIshows the values obtained for AIC & SC for all our models for all the three countries. As the results clearly show the AIC as well as the SC are lowest for India and Pakistan at Lag 3 while for Sri Lanka it was Lag 1 where AIC & SC were lowest.

Table II : ***Optimal Lag determination for our ARDL Model***

	AIC			*SC*		
No. of Lags→	*Lag 1*	*Lag 2*	*Lag 3*	*Lag 1*	*Lag 2*	*Lag 3*
India	-0.36128	-1.29913	**-1.535269**	-0.010430	-0.787391	**-0.859467**
Pakistan	-1.52267	-1.48650	**-1.530421**	-0.164889	-0.964580	**-0.991075**
SriLanka	**4.538470**	4.721697	4.818906	**4.889321**	5.233440	5.494708

Table IIIgiven below discusses the results of the computed 'F' values under ARDL methodology for determining the Long term Co-integration between the variables for all the three countries under consideration. The results show that computed F Statistics for India was 4.135896 , for Pakistan it was 2.250736 & for Sri Lanka5.514792.

Table III :ARDL Co-integration Partial 'F' test Results
(for model with Lag 3 for India , Pakistan & for Sri Lanka at Lag 1)

	Relation	*'F' Bounds Value Computed*	*Inference*
India	*LPGDP as a function of LTGDP , LCPI , & LCGDP*	4.135896	**Null Rejected, Co-integration established**
Pakistan	*LPGDP as a function of LTGDP , LCPI , & LCGDP*	2.250736	**Null Accepted, Co-integration not established**
SriLanka	*LPGDP as a function of LTGDP , LCPI , & LCGDP*	5.514792	**Null Rejected, Co-integration established**

Two types of Tables are available for determining whether Long term co-integration exists or not(see Table IV below) , first set of tables belong to Pesaran et.al. (2001) and second set are the Narayan(2004) tables giving critical values for our F Computations. Upon comparing the results with Narayan (2004) tables , we find that for both India and SriLankawe get long term co-integrating relation amongst the variables as the values obtained are above the upper bound critical of 4.094. However if we use the Pesaran et.al. (2001)tables then the critical value for the upper bound is 4.85 and therefore only in case of Sri Lanka we see a long term co-integrating relation. An important point to be mentioned here is that most researchers have been using Narayan(2004) if the data frequency is annual and since we are also working on yearly data we stick to Narayan (2004) tables and therefore conclude that both for India and Sri Lanka there appears to be a long term co-integrating relation amongst its variables.

Table IV : 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 & 4.85	Between 3.116 & 4.094

Table V gives the test results of our BG LM Serial Correlation test for each of our sampled countries . The Null for this is no serial correlation amongst the variables and we analyse our results as 'p' value of Chi Square Distribution where we accept the Null in all the cases as the Prob. of Chi-Square is greater than 0.05. Model & Parameter Stability for all the three optimal models established for three countries has been tested using CUSUM plots (See: Fig 1, 2 & 3. The plots show that all the models are stable as the CUSUM plotted line is within upper and lower limits of 5 %.

Table V : ***Results of the Serial Correlation BG-LM Test***

	India	***Pakistan***	***SriLanka***
Observed R- square	4.167757	3.718094	0.003065
'p' value (Chi Square)	0.2439	0.2936	0.9559

Figure 1 : CUSUM Plot for India

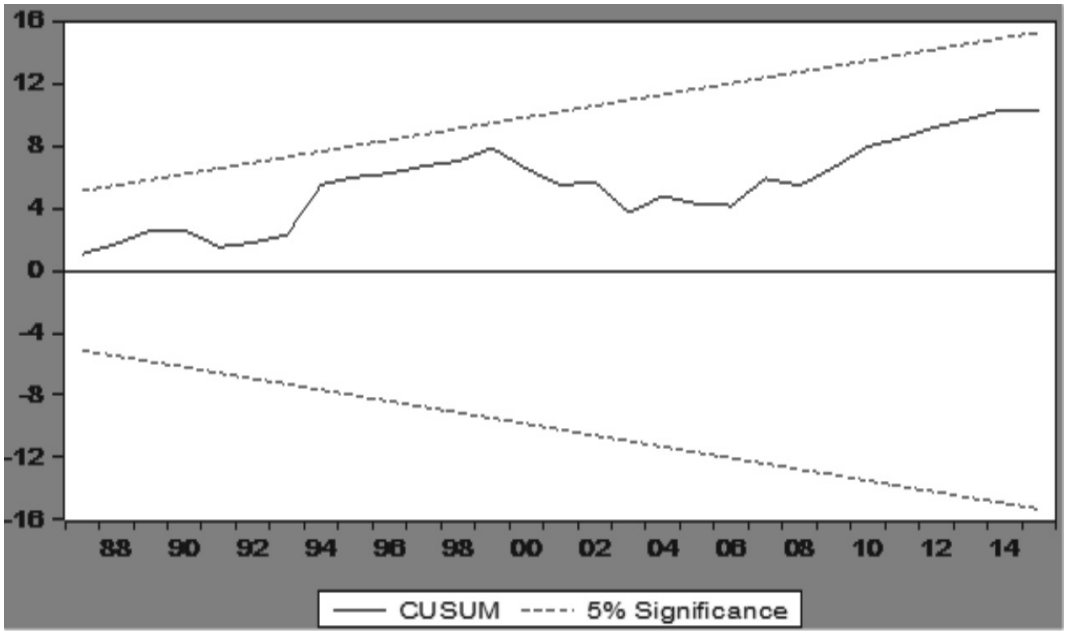


Figure 2 : CUSUM Plot for Pakistan

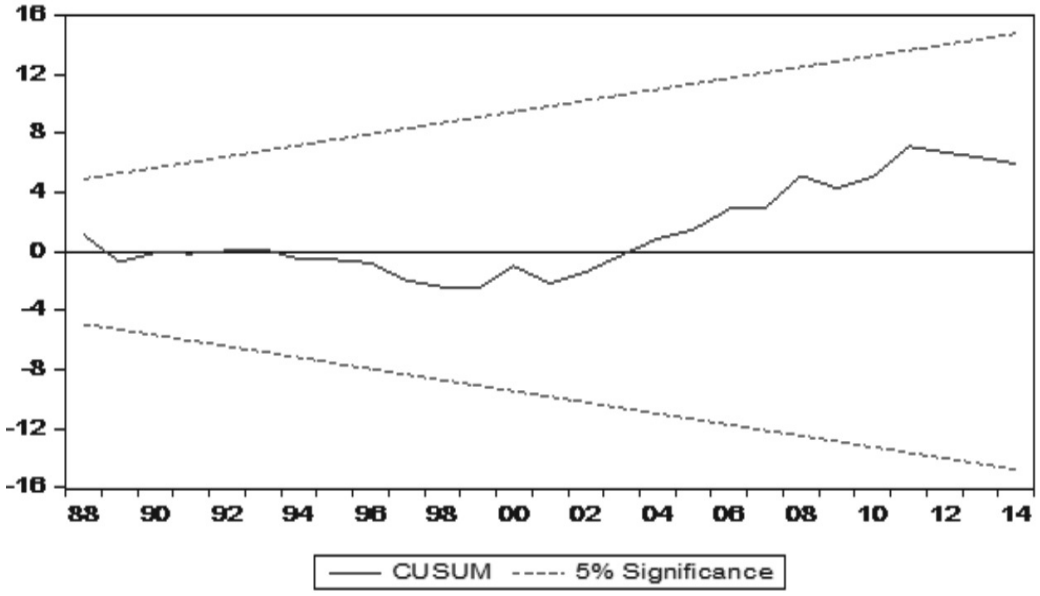
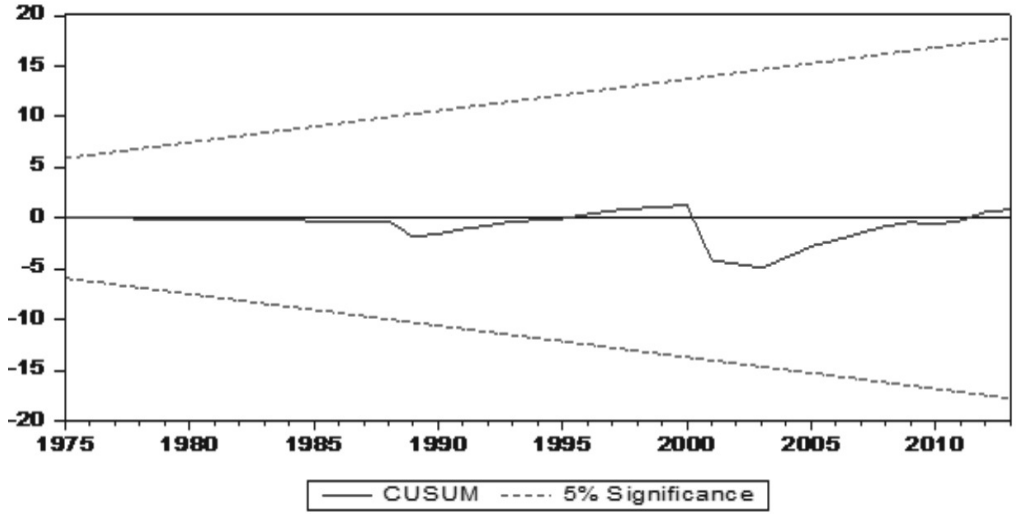


Figure 3 : CUSUM Plot for Sri Lanka



In the final part of our analysis, we established the short run equilibrium & error correction between the long and short run (see Table VI) . The coefficient of the lagged error term showing the dynamics of adjustment towards equilibrium and reflects the speed of adjustment between short and long run is negative& statistically significant for India at 5 % and for Sri Lanka at 10 %. Further the backward adjustment process for India is fast at 47 % while for Sri Lanka is rather slow at 8.6 % per annum.

Table VI : ***Regression results for Error Correction and Short run Co-integration for our Optimal Model***

	India		*Pakistan*		*SriLanka*	
Variable	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**
D(PGDP(-1))	5.177711	0.0038	2.379802	0.0459	0.056751	0.0707
D(PGDP(-2))	-0.590198	0.0322	0.334320	0.7461		
D(PGDP(-3))	4.883198	0.0059	1.408139	0.1955		

D(CPI(-1))	0.194423	0.5648	-1.386274	0.0670	-1.306752	0.8402
D(CPI(-2))	-0.564311	0.2217	2.227436	0.4521		
D(CPI(-3))	-0.000961	0.9977	-4.337799	0.2372		
D(CREDIT(-1))	1.833034	0.0000	-2.372635	0.0219	0.532133	0.0726
D(CREDIT(-2))	-8.756672	0.0106	-1.308141	0.4206		
D(CREDIT(-3))	0.296130	0.0332	0.176600	0.9823		
D(TRADE(-1))	-0.664378	0.0994	-0.842118	0.0669	-6.978274	0.0723
D(TRADE(-2))	0.402226	0.8133	-0.917021	0.3821		
D(TRADE(-3))	2.090957	0.2011	-0.535937	0.7561		
ECM(-1)	**-0.466003**	**0.0577**	**-0.294698**	**0.4317**	**-0.086169**	**0.0782**

Conclusion &Policy Implications

The paper investigated the co-integrating relation between Financial Development & Economic Growth of India, Pakistan & Sri Lanka using ARDL Bounds Approach by analysing log transformed yearly data for fifty years for India & Sri Lanka and 48 years for Pakistan. The Economic Growth Variable has been represented by Per Capita GDP, the proxy for Financial Development Variable was taken as Pvt. Sector Credit to GDP. The model also considers two additional regressors; Consumer Price Index (a proxy for inflation) & ratio of Trade to GDP (a proxy for Trade Openness) so as to avoid omitted variable bias. Three model pre-requisites have also been tested and these included Stationarity of Variables(using Augmented Dickey Fuller) , Stability of Parameters (using CUSUM plots) & Serial Correlation (using BG-LM test). For Model Optimality the study employed AIC &SC Criteria. The results of the study revealed positive co-integrating relation between Financial Development & its Economic Growth for two countries namely India and Sri Lanka as given by the partial F Statistics for which we have used Narayan (2004)tables. For Pakistan, the results showed presence of no co-integrating relation between these variables. As far as Unit root test is concerned except Pvt. Credit to GDP of Pakistan , all other variables are stationary at I(1). Pvt Credit to GDP of Pakistan was found to be stationary at I(0) which justified the use of ARDL Methodology. The BG LM test for serial Correlation was found to accept the Null of No Co-integration of Variables for all the three . The CUSUM Stability test showed that the parameters of all three economies were stable. Finally we found that the lagged error term (ECM) coefficient was negative for both India and Sri Lanka, however it was significant at 5% and 10 % respectively for the two countries respectively. The corrective mechanism linking short and long run equilibrium worked out @ 47 % for India while it was at a much slower rate of 8.6 % for Sri Lanka.

There can be few policy implications of the study, first since the equilibrium is restored in a fast manner (approx. 2 ½ years in case of India and Sri-Lanka through ECM) the confidence of the Government should rise as the results of its reformative policies of boosting Financial Development shall lead to quick transformation into the fruits of economic growth which shall lead to the building of the positive image of the government, both amongst local and domestic investing community. However to achieve this, Government must ensure that adequate infrastructure is available and all hindrances to the path of economic growth via. Financial developments are removed at the earliest. This calls for taking fresh challenges and bold steps e.g. lending by banks and institutions at lower rates, identification & necessary boost to sectors which are productive in terms of economic growth etc. The most important part however is to keep a close watch on all the macro economic indicators as the country's financial development has strong linkages with the real sector.

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