Analysis of Economic Growth and Banking Nexus in India: An ARDL Approach

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Abstract

By analysing time series data for the years 1990 to 2022, this study seeks to understand the relationship between economic growth and the banking industry in India. In order to accomplish this, the Autoregressive Distributed Lag methodology has been applied while taking into account the ADF and PP Unit Root tests, the Optimum Lag length criterion, the Bounds test, the Error Correction Mechanism, and the Diagnostics statistics. FMOLS and DOLS models have also been estimated. The number of bank branches, the number of employees, foreign direct investment, trade openness, and the credit deposit ratio have all been examined as independent variables, with GDP per capita serving as a proxy for economic growth. According to the findings, the variables under consideration have a long-term correlation. With the exception of FDI, all independent factors have a considerable long-term impact on India's economic growth. FDI doesn't have any impact on economic growth in the short term. Additionally, CDR has little impact on economic growth this year. According to Rate of Adjustment, there will eventually be oscillations and equilibrium. The results for the FMOLS and DOLS models are nearly identical to those for the long term ARDL model. It is recommended that the government create an effective FDI policy so that FDI can have a substantial impact on India's economic growth rates.

Keywords: GDP per capita, ARDL, Statistically significant, Public Sector banks, Co-integration

Introduction

The World Bank claims that financial development is a key factor in encouraging economic growth in a country. According to Kumar and Paramanik (2020), it is a crucial component of Indian economic progress. Financial development makes it simpler to access savings, aids in the efficient use of resources, provides liquidity, and encourages investment, which in turn raises the level of economic activity and leads to the growth of the economy.

In developing nations like India, there is strong empirical support for the

link between financial inclusion and economic growth [Mohan (2006); Dixit and Ghosh (2013); Sharma (2016)]. Therefore, according to Laeven et al. (2015), financial innovation is seen as a key accelerator for financial development. Many researchers (Patrick, 1966; De Gregorio and Guidotti, 1995; Khan, 2001; Arestis and Demetriades, 1997; Calderón and Liu, 2003; Greenwood and Jovanovic, 1990; Kyophilavong et al., 2016; Saad, 2014) examined the relationships between financial development and economic growth with various econometric methodology and reached at the positive conclusion.

The expansion of the banking industry and the stock market together make up the financial sector. Since the 18th century (Smith, 1776; Schumpeter, 1911), researchers have been particularly interested in the function of the banking industry. This interest has been widely recognised and documented. The efficiency of a nation's financial system is a good indicator of its economic health. It has been noted that India's banking industry has contributed significantly to the nation's development, and the industry is currently pretty well established. This sector's present transformation process has opened the road for it to become even stronger and more capable of carrying out its duty.

In light of this, the purpose of this study is to investigate, utilizing the ARDL approach of co-integration, the relationship between India's economic growth and banking industry. The structure of this paper is as follows: Section II provides a quick assessment of the available literature after the introduction. The data, variables, and methodology utilized to analyse the relationship between the dependent and independent variables are covered in Section III. The empirical analysis and results are covered in Section IV, and the study's conclusion is covered in Section V.

Review of Literature

There is a wealth of literature that explains the beneficial effects of financial development on economic growth from theoretical and empirical viewpoints.

Alam and Alam (2021) examined the long-run and short-run relationships between financial development, economic growth, and poverty reduction in India from 1960 to 2016 using the ARDL and ECM model approaches. The findings demonstrate that the variables in the model have a long-run co-integration relationship.

Using the ARDL model, Ali et al. (2022) looked at a sample of established and emerging economies between 2005 and 2019 to determine the relationship between financial development and economic growth. The study's findings indicate that although developing countries need to implement

new policies in the same direction, rich countries should improve their financial structures and rates of economic growth.

Aziz, Pradhan, and colleagues (2022) used the ARDL model to examine the contribution of financial development and the combined effects of ICT and financial development on economic growth in ten Asian emerging economies during the years 2001–2017. FMOLS and DOLS validated that the model was robust. Incorporating contemporary ICT into the economy is encouraged by the findings to ensure inclusive financial development.

The relationship between exports, foreign direct investment, the current account deficit, and economic growth in Pakistan from 1975 to 2016 is examined by Zafar (2020). To trace long-run and short-run linkages, he used the autoregressive distributed lag (ARDL) approach to co-integration together with ECM approaches. The findings show a long- and short-term, significant positive association between exports, foreign direct investment, and economic growth in Pakistan. Results, however, show that economic growth, both in the long run and the short run, is negatively and significantly connected with the current account deficit.

Through cross-country research and the use of an autoregressive distributed lag (ARDL) model with control variables, Balasubramanian (2022) investigated the effect of overall bank loan on economic growth. The findings suggest that there is an equilibrium link between total long-term bank loan and overall economic growth in both the long run and the short run.

In their article, Dixit and Ghosh (2013) made the case that achieving inclusive growth requires an equitable distribution of growth opportunities and benefits, with financial inclusion being one of the most important opportunities that must be distributed fairly in the nation if comprehensive growth is to be achieved.

Using annual data from 15 developed and emerging economies between 2004 and 2017, Khan et al. (2022) examined the impact of financial inclusion on financial sustainability, financial efficiency, gross domestic product, and human development in the context of G20 countries. The findings showed that while there is no correlation between financial inclusions and financial sustainability in the near term, inclusive finance has a substantial impact on sustainability over the long term.

By using time-series data and GDP and the ratio of broad money to GDP as proxies for economic and financial development, respectively, Kumar and Paramanik (2020) investigated the relationship between financial development and economic growth in India. Evidence suggests that, unlike in the short run, financial development has a beneficial long-term impact on economic growth.

According to Laeven and Levine (2015), if financiers don't innovate, technical advancement and economic progress would eventually come to an end. Lenka and Sharma (2017) used annual time series data on the number of scheduled commercial bank deposit and credit accounts per 1,000 adults, the number of bank branches per 1,000 adults, the number of bank employees as the ratio of bank branches, and the amounts of deposits and credits as the ratio of GDP to examine the impact of financial inclusion on economic growth in India from 1980 to 2014. Using the Autoregressive Distributed Lag (ARDL) and Error Correction Model (ECM), the study came to the conclusion that financial inclusion has a favorable impact on economic growth in both the long run and the short run.

Mishra and Pradhan (2011) use the vector error correction model to examine the association between financial development and economic growth in India from 1960 to 2009. Based on the favorable impact of rising industrial production, it can be concluded that real economic expansion has a positive impact on the financial sector. Mishra and Pradhan (2009) investigated the causal link between the expansion of the loan sector and India's economic growth from 1980 to 2008. According to the analysis, the country's credit market has developed favourably as a result of economic expansion.

For the years 1980 to 2016, Mohanthy and Bhanumurthy (2019) used the autoregressive distributed lag and the Toda-Yamamoto causality technique to study the dynamic links between India's physical infrastructure, financial development, and economic growth. According to the empirical findings, economic growth is significantly but only marginally impacted by financial development.

The causal link between financial innovation and economic growth in China, India, and Pakistan from 1970 to 2016 was examined by Nazir and Tan (2021). The study discovers that financial innovation has a favorable and considerable impact on economic growth both in the short-run and long-run utilizing an Autoregressive Distributed Lag (ARDL) bound testing and Granger causality-based Error Correction Model (ECM).

Pradhan and Rudra (2013) looked into what factors contributed to India's long-term financial development from 1994 to 2011. Unit root, co-integration, ARDL bound test method, and VECM were used in the inquiry. The findings show that there is a long-term equilibrium relationship between financial development and economic growth, and they also support the idea that stock market development leads directly to both inflation and economic growth.

Pradhan et al. (2017) used a panel data set covering the ASEAN region

countries for the years 1961–2012 to examine the relationship between the depth of the banking sector, trade openness, and economic development. Both a general long-run and short-run link between these factors was found by the investigation.

These are a few of the studies that have been analysed and show a long-term connection between financial development and economic growth.

Objectives and Hypotheses

Below given are the objectives of the study:

- To study the impact of banking sector related determinants on economic growth in India.
- To diagnose whether there is long-run association between economic growth and banking sector in India by estimating the Bounds Test.

This study considers the following mentioned hypotheses to be tested:

1. H_0: There is no significant impact of banking sector related determinants on economic growth of India.
2. H_1: There is significant impact of banking sector related determinants on economic growth of India.
3. H_0: There is no long- run association between economic growth and banking sector in India.
4. H_1: There is long- run association between economic growth and banking sector in India.

Data, Variables and Methodology

Public Sector Banks are the sole subject of the current study. The World Development Indicators (statistics on population, trade openness, foreign direct investment, and gross domestic product) and EPWRF India Time Series (data on branches, employees, and credit deposit ratio) were the sources of the annual time series data used in the analysis, which covered the years 1990 through 2022. This period has been considered in the study because of the availability of data on different variables related with public sector banks.

The study's variables are all expressed in natural logarithmic form. Table-1 below provides a summary analysis of the many variables taken into account in the proposed study.

Table 1: Analysis of Variables

S. No.	Variable Name and Use	Specification/Measurement	Expected algebraic sign with dependent variable
1.	Gross Domestic Product per capita (GDPPC) Dependent variable	Economic growth of India	-
2.	Number of Bank branches (BRN) Independent variable	Number of public sector bank branches in India	Positive
3.	Number of Employees (EMP) Independent variable	Total strength of the employees in the Public Sector banks in India	Positive
4.	Trade Openness (TOP) control variable	Ratio of exports plus imports over GDP	Positive
5.	Credit Deposit Ratio (CDR) Independent variable	Ratio of assets and liabilities of the bank	Positive
6.	Foreign Direct Investment (FDI) Control variable	Inflow of FDI	Positive

Source: Authors' compilation

The stages below have been taken into consideration with regard to the methodology:

Unit Root Test

To make sure that none of the series is I (2), the stationary nature of each variable is checked. The Augmented Dickey Fuller (ADF) and Phillips Perron (PP) Unit Root tests are used to achieve this. Two methods, one with an intercept only and the other with an intercept and a trend, are used to estimate the Unit Root tests. Here, the idea that the series has unit roots is the null hypothesis, while the hypothesis that the series does not contain unit roots is the alternative hypothesis. The series is stationary if the null

hypothesis is rejected.

Optimum Lag Length Selection

Different criteria, such as the sequential modified LR test statistic, the final prediction error, the Akaike information criterion, the Schwarz information criterion, and the Hannan-Quinn information criterion, have been used to determine the ideal lag length.

ARDL Model

In investigating the relationship between the variables, the economic growth model is specified as follows:

GDPPC= f (BRN, EMP, TOPN, CDR, FDI)

The model can be described as below:

$LNGDPPC = a + b\ LNBRN_{it} + c\ LNEMP_{it} + d\ LNTOPN_{it} + e\ LNCDR_{it} + f\ LNFDI_{it} + e_{it}$

In the form of ARDL model, the above equation can be expressed by following Pesaran and Shin (1999):

$\Delta LNGDPPC = + \Delta LNBRN_{t-i+} \Delta LNEMP_{t-i+} \Delta LNTOPN_{t-i+} \Delta LNCDR_{t-i+} \Delta LNFDI_{t-i+} LNGDPPC_{t-i+} LNBRN_{t-i+} LNEMP_{t-i+} LNTOPN_{t-i+} LNCDR_{t-i+} LNFDI_{t-i} + \mu_t$

To check the existence of long run relationship, the ARDL Model can be expressed in the long run form as shown below:

$LNGDPPC_{t=} + LNGDPPC_{t-i+} LNBRN_{t-i+} LNEMP_{t-i+} LNTOPN_{t-i+} LNCDR_{t-i+} LNFDI_{t-i} + \mu\square_t$

In case of the short run impact of independent variables on economic growth, the short run form of ARDL Model can be shown as below:

$\Delta LNGDPPC = + \Delta LNGDPPC_{t-i+} \Delta LNBRN_{t-i+} \Delta LNEMP_{t-i+} \Delta LNTOPN_{t-i+} \Delta LNCDR_{t-i+} \Delta LNFDI_{t-i} + \gamma ECM_{t-1+t}$

Diagnostic Statistics

To confirm the efficiency and consistency of the model Co-efficient diagnostics (Long Run form and Bounds Test and Error Correction form), Residual diagnostics (Normality test, Serial Correlation LM test and Heteroscedasticity test) and Stability diagnostics (Ramsey RESET Test and Cumulative Sum of Recursive residuals CUSUM and Cumulative Sum of Squares of Recursive Residuals CUSUM sum of squares) tests have been conducted on the proposed data.

Robustness of Model

We estimate the Fully Modified OLS and Dynamic OLS models since they are the ones that provide estimates by accounting for serial correlation and

endogeneity.

Analysis of Results

The descriptive and correlation matrix between the variables is established first.

The following Table-2 displays the mean, median, standard deviation, skewness, kurtosis, coefficient of variation, and Jarque-Bera test for the provided variables:

Table 2: Descriptive Statistics

	GDPPC	BRN	EMP	TOPN	CDR	FDIN
MEAN	60592.73	61163.39	792935.4	3.08E+13	65.318	1.16E+12
MEDIAN	54517.00	49241.00	782956.0	2.94E+13	65.800	1.20E+12
MAXIMUM	112697.0	94142.00	886490.0	7.83E+13	78.700	3.28E+12
MINIMUM	28586.00	41874.00	664768.0	4.02E+12	53.400	2.51E+10
STD. DEV.	26809.15	19191.13	62069.14	2.24E+13	9.137	9.88E+11
SKEWNESS	0.514	0.676	-0.071	0.328	0.056	0.3735
KURTOSIS	1.914	1.744	1.973	1.785	1.336	1.7603
CV	44.244	31.376	7.827	72.72	13.988	85.17
JARQUE-BERA	3.079	4.688	1.477	2.619	3.822	2.8806
PROBABILITY	0.214	0.095	0.477	0.269	0.147	0.2368

Source: Authors' compilation

The table clearly demonstrates that all of the variables taken into consideration have a normal distribution, as indicated by the Jarque Bera test's non-significant results. The coefficient of variation has been used to calculate the dispersion of variables. In the case of the distribution of the variables, all variables except EMP are positively skewed.

The pair-wise correlation coefficients in Table 3 illustrate how strongly certain variables are related to one another. It is obvious that the calculated regression models do not contain any multi-collinearity problems. Between independent variables, none of the pair-wise correlation coefficients have a value of 1.

Table 3: Correlation Matrix

VARIABLE	LNGDPPC	LNFDIN	LNEMP	LNBRN	LNCDR	LNTOPN
LNGDPPC	1.000					
LNFDIN	0.909	1.000				
LNEMP	-0.005	-0.063	1.000			
LNBRN	0.952	0.793	0.172	1.000		
LNCDR	0.772	0.747	-0.153	0.741	1.000	
LNTOPN	0.971	0.952	-0.088	0.872	0.817	1.000

Source: Authors' compilation

The Unit Root test has been estimated to determine whether a time series variable is non-stationary and has a unit root.

Table 4: Results of Unit Root Test

Variable	Augmented Dickey Fuller Test				Phillips Perron Test			
	At Level		At First Difference		At Level		At First Difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LNGDPPC	0.53 (0.985)	-3.18 (0.106)	-5.56 (0.0001)	-5.46 (0.0005)	0.65 (0.989)	-3.22 (0.098)	-5.97 (0.000)	-5.83 (0.0002)
LNFDIN	-2.20 (0.210)	-1.81 (0.672)	-5.33 (0.0001)	-5.83 (0.0002)	-4.43 (0.001)	-1.26 (0.879)	-5.33 (0.0001)	-8.14 (0.000)
LNTOPN	-1.48 (0.530)	-1.06 (0.919)	-5.02 (0.0003)	-5.25 (0.0009)	-1.52 (0.506)	-1.06 (0.919)	-5.02 (0.0003)	-5.24 (0.001)
LNBRN	1.96 (0.999)	-3.64 (0.044)	-2.86 (0.064)	-3.61 (0.050)	-0.48 (0.881)	-1.70 (0.726)	-1.81 (0.366)	-1.69 (0.73)
LNEMP	-2.40 (0.148)	-2.38 (0.380)	-3.55 (0.013)	-3.52 (0.054)	-2.05 (0.264)	-2.02 (0.567)	-3.52 (0.014)	-3.49 (0.057)
LNCDR	-1.14 (0.686)	-1.51 (0.80)	-4.65 (0.0008)	-4.58 (0.005)	-1.11 (0.698)	-1.36 (0.851)	-4.65 (0.001)	-4.58 (0.005)

LNG-DP	-0.11	-2.54	-5.51	-5.45	-0.09	-2.54	-5.70	-5.79
	(0.939)	(0.305)	(0.0001)	(0.0006)	(0.941)	(0.305)	(0.000)	(0.0002)

Source: Authors' compilation (The values in the parenthesis indicates the ρ value)

It is evident from the above-tabulated results of the ADF and PP unit root tests (Table -4) that no series is I (2) and that all the variables are stationary at first difference I (1) aside from the variable LNFDI which is stationary at both the level and the first difference. As a result, the requirements for applying the ARDL are met. When taking into account the scenarios of intercept and intercept & trend, both Unit Root tests have been applied at the level and first difference.

Table 5: Optimum Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	109.042	NA	4.19E-11	-6.869	-6.589	-6.770
1	328.620	336.687	2.14E-16	-19.108	-17.146*	-18.480
2	384.342	63.150*	7.86E-17	-20.422	-16.779	-19.257
3	440.456	41.150	5.56E-17*	-21.763*	-16.439	-20.060*

*indicates the lag order selected by the criterion

Source: Authors' compilation

LR: sequential modified LR test statistic

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

The optimal lag length in this study was chosen to be three based on the many lag length selection criteria that were taken into consideration, including the AIC criterion. According to the majority criterion, three is also the ideal lag length.

The full ARDL Model, encompassing both the short- and long-term effects of independent factors on the dependent variable, is shown in Table 6.

Table 6: Estimates of ARDL Model

Variable	Coefficient	t-statistic	Probability
LNGDPPC(-1)	0.0029	0.0145	0.9887
LNGDPPC(-2)	-0.3292	-2.0912	0.0605
LNFDIN	-0.0049	-0.3925	0.7022
LNEMP	0.0533	0.6436	0.5330
LNEMP(-1)	-0.0851	-0.8012	0.4400
LNEMP(-2)	0.1296	1.0088	0.3347
LNEMP(-3)	0.1436	1.3704	0.1979
LNCDR	-0.0126	-0.1799	0.8605
LNCDR(-1)	0.0762	0.8870	0.3940
LNCDR(-2)	0.0689	0.8650	0.4055
LNCDR(-3)	0.2011	2.6491	0.0226
LNBRN	-1.0060	-3.8484	0.0027
LNBRN(-1)	0.3456	1.1297	0.2826
LNBRN(-2)	1.1638	4.9601	0.0004
LNTOPN	0.1605	4.2199	0.0014
LNTOPN(-1)	0.1614	3.3517	0.0065
LNTOPN(-2)	0.0975	1.7533	0.1073
LNTOPN(-3)	0.0371	0.8836	0.3958
C	-9.5335	-7.1161	0.0000
R squared	0.99		
Adjusted R squared	0.99		
F- statistic	2265.59		0.0000
Durbin Watson stat	2.63		

Source: Authors' compilation

Bounds Test

The Bounds Test has been computed to determine whether the variables have long-term associations or are co-integrated. Table-7 displays the findings. The alternative hypothesis is that there is co-integration, as opposed to the null hypothesis that there is not co-integration.

Table 7: Results of ARDL Bounds Testing

Name of the test	Value of the test	Signif-icance level	I(0)	I(1)	Decision
F-Statistic	14.368	10%	2.26	3.35	Co-integra-tion
k	5	5%	2.62	3.79	
		2.5%	2.96	4.18	
		1%	3.41	4.68	

Source: Authors' compilation

There is no co-integration if the F statistic is less than I (0) values, and co-integration exists if the F statistic exceeds I (1) values at various degrees of significance. The estimated F statistic (14.368) is greater than I (1) values at all levels of significance, which leads to the conclusion that the variables are co-integrated, according to the results of the Bound Test for co-integration.

The calculated long run coefficients using the ARDL technique are displayed in Table-8.

Table-8: Estimates of ARDL Model: Long Run

Variable	Coefficient	t-Statistic	Probability
LNFDIN	-0.0037	-0.3866	0.7064
LNEMP	0.1820	2.3347	0.0395
LNCDR	0.2516	2.6108	0.0242
LNBRN	0.3795	6.8652	0.0000
LNTOPN	0.3444	17.3757	0.0000

Source: Authors' compilation

The calculated long run coefficients of the chosen ARDL model for the variables EMP, CDR, BRN, and TOPN are significant at 5% level of significance and have expected signs, as shown in Table 8. This demonstrates that these factors have a substantial long-term impact on the economic development of India. In the long run, if the number of employees increases by 100%, the GDPPC must increase by 18.2%, according to the positive coefficient of employees (EMP) of 0.1820. The values of GDPPC rise by 25.16% when CDR grows by 100%. Furthermore, the coefficient of FDI is negatively insignificant (-0.0037), which shows that a 100% increase in FDI over time reduces GDPPC by.37%.

The estimates for the ARDL Model's short run form and the Error Correction term are shown in Table-9.

Here the joint null hypothesis is tested by conducting the F-test. This hypothesis along with alternative hypothesis can be stated as below:

H_0: $\beta_{1i} = \beta_{2i} = \beta_{3i} = \beta_{4i} = \beta_{5i} = 0$

H_1: $\beta_{1i} \neq \beta_{2i} \neq \beta_{3i} \neq \beta_{4i} \neq \beta_{5i} \neq 0$

Table-9: – Estimates of ARDL Model: Short Run

Variable	Coefficient	t-Statistic	Probability
C	-9.5335	-11.175	0.0000
D(LNGDPPC(-1))	0.3292	3.535	0.0047
D(LNEMP)	0.0533	1.006	0.3359
D(LNEMP(-1))	-0.2732	-4.985	0.0004
D(LNEMP(-2))	-0.1436	-2.715	0.0201
D(LNCDR)	-0.0126	-0.253	0.8045
D(LNCDR(-1))	-0.270	-5.289	0.0003
D(LNCDR(-2))	-0.2011	-4.218	0.0014
D(LNBRN)	-1.006	-7.166	0.0000
D(LNBRN(-1))	-1.1638	-6.370	0.0001
D(LNTOPN)	0.161	7.560	0.0000
D(LNTOPN(-1))	-0.1347	-4.018	0.0020
D(LNTOPN(-2))	-0.0371	-1.386	0.1930
CointEq(-1)	**-1.3262**	-11.197	0.0000

R^2	0.93		0.0000
Adjusted R^2	0.88		
F-statistic	18.88		
Durbin-Watson Test	2.01		

Source: Authors' compilation

The preceding table demonstrates that in the short term, FDI has no significant impact on economic growth and that CDR has no significant impact on economic growth in the current year. The lagged error correction term is estimated to be -1.3262. Thus the value of the coefficient of error correction term is negatively significant as 132.62%. The value of SPEED OF ADJUSTMENT shows that there will be equilibrium in the long run in the economy and the equilibrium will take place through the process of oscillations of the decreasing magnitude.

Diagnostic and Stability Tests

These test reveal that the model has achieved the desired econometric properties and the model has the sufficient appropriateness.

Figure-1 shows the results of the histogram normality test (Jarque-Bera Test). The results indicate that the ρ value is greater than 5%, we therefore cannot reject the null hypothesis which states that residuals are normally distributed.

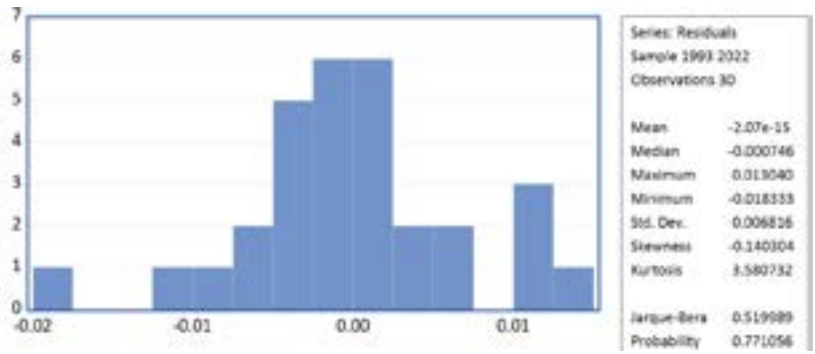

Figure 1: Histogram - Normality Test

Source: Authors' compilation

Table 11: Estimates of LM Test, Heteroscedasticity and RESET Test

Purpose	Name of the test	Value of the test	Probability	Null hypothesis	Decision
Serial Correlation LM test	Breush-Godfrey	F statistic = 3.19 $N*R^2$ = 3.06	0.090 0.062	No serial correlation at up to 2 lags	H_0 accepted There is no serial correlation
Heteroscedasticity	Breush-Pagan-Godfrey	F-Statistic = 3.19 N*R Squared = 3.06	0.090 0.062	Homoscedasticity	H_O accepted There is no heteroscedasticity
RESET test	Ramsey RESET test	t-Statistic = 0.18 F-Statistic = 0.03 Likelihood Ratio = 0.10	0.857 0.857 0.750	The model has no omitted variables	H_0 Accepted The model has no omitted variables

Source: Authors' compilation

The results of LM Test indicates that the values of F-statistic and $N*R^2$ are not statistically significant and thus the null hypothesis of no serial correlation is accepted. As per Heteroscedasticity Test it is clear that there is no presence of heteroscedasticity in the estimated model according to the values of F statistic and N*R2. On the basis of this test the estimated model can be considered to be an appropriate model.

The Ramsey RESET Test shows that the values of t-Statistic, F-Statistic and Likelihood Ratio are found to be statistically significant showing that the null hypothesis has to be accepted which means there is no specification error in the results of the model.

The stability of the model has been tested with the help of the CUSUM and CUSUM of Squares Tests. Results has been shown in Figure-2 and Figure-3.

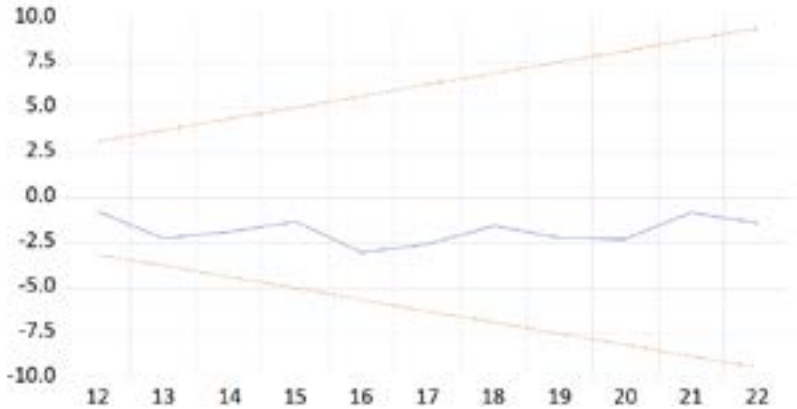

Figure 2: Plot of Cumulative Sum of Recursive Residuals

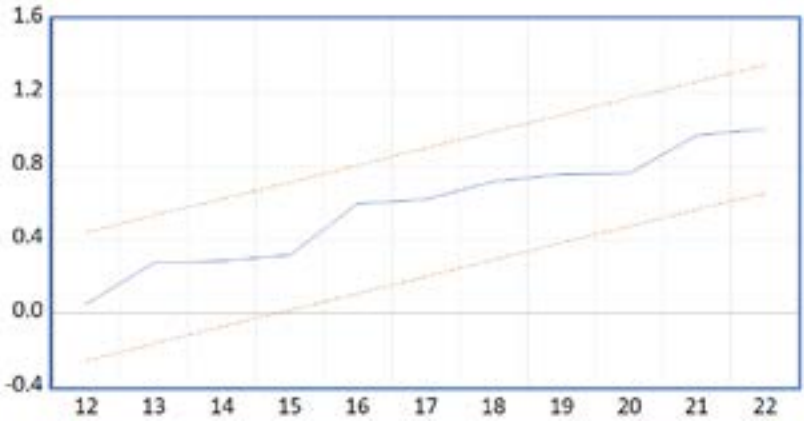

Figure 3: Plot of Cumulative Sum of Squares of Recursive Residuals

It can be seen that the plot of both the figures stays within the critical 5% bounds (dotted lines) that confirms the long run relationship among the variables and shows the stability of the coefficients.

Table 13: Estimates of Fully modified OLS and Dynamic OLS Models

Variable	FMOLS		DOLS	
	Coefficient	Prob.	Coefficient	Prob.
LNFDIN	0.011	0.434	0.053	0.0000
LNEMP	-0.354	0.0008	0.039	0.568
LNCDR	-0.400	0.0000	0.175	0.036
LNBRN	0.796	0.0000	0.619	0.0000
LNTOPN	0.274	0.0000	0.199	0.0008

Source: Authors' compilation

The estimated results of the FMOLS and DOLS models have been reported in Table-13. These are the long run models and the estimated results have been corrected for the issues related with serial correlation and endogeneity. It is clear that according to the FMOLS model FDI does not have significant long run impact on economic growth of India but according to DOLS model FDI has significant long run impact on economic growth. Levels of employment have significant negative impact on economic growth according to FMOLS model but the DOLS shows that the employment is positively and insignificantly related with the levels of economic growth. Other considered variables of economic growth are having the significant impact on the growth of India.

Findings & Conclusion

The primary goal of this study is to examine the relationship between India's banking sector and economic growth by using time series data from 1990 to 2022. It uses the Autoregressive Distributed Lag methodology to achieve this goal while taking into account the ADF and PP Unit Root tests, Optimum Lag length criterion, Bounds test, Error Correction Mechanism, and Diagnostics statistics. In addition, estimates for the FMOLS and DOLS models have been made. Due to data availability, the analysis is restricted to Public Sector Banks only. GDP per capita has been used as a proxy for economic growth, with the number of bank branches, employees, foreign direct investment, trade openness, and credit deposit ratio serving as independent variables. Variables of foreign direct investment and trade openness have been considered as the control variables.

Credit -deposit ratio, number of branches, number of employees and trade openness have been found statistically significant in having the long run impact on economic growth of India. And thus the null hypotheses related with these variables have been rejected. Foreign direct investment does not have significant impact on economic growth in long run. Thus the null

hypotheses regarding foreign direct investment has been accepted. In case of the null hypotheses regarding long run association, it has been rejected showing that there is long run association between dependent and independent variables. In short run gross domestic product per capita, number of branches and trade openness have significant impact with one lag. In the same way number of employees and credit deposit ratio are having significant impact on economic growth with two lags. Regarding the long run adjustment mechanism the rate of adjustment has been estimated as 132.62 percent which depicts that there will be Long-term equilibrium in the economy but with oscillations. The FMOLS and DOLS models' conclusions are nearly identical to those of the long-run ARDL model. To allow FDI to have a substantial impact on India's economic growth, it is recommended that the government should design an effective FDI policy so that the productivity of FDI can be increased up to the significant levels. It is also recommended that the credit creation capacity of public sector banks must be increased by suitable plan formulation so that the economy of India can be benefitted more.

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