International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Economic Growth and Reforms in India: An ARDL Approach

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Abstract

The study aims to evaluate the role of determinants of economic growth considering pre- & post-economic reforms periods in India. Time-series data from 1980-81 to 2020-2021 was collected & analyzed under the framework of the Autoregressive Distributed Lag methodology. It has been found that none of the considered determinants of growth have significant effects in the long-run. The estimates of short-run ARDL model show that employment has negative significant impact on economic growth. In post-reforms period, employment is positively & significantly affecting the growth in India.

Keywords: Gross domestic product, economic reforms, foreign direct investment, gross capital formation, ARDL model

Introduction

The condition of Indian Economy was not at all satisfactory during 1980s.This was primarily due to the immense falling down of foreign currency reserves. Due to that, the fiscal deficit was sky-high. There was an outflow of country's capital which further worsened the situation. Various foreign investors became pessimistic about the Indian Economy. Not only this, but there were various unanticipated changes which adversely affected the other economies of the world as well. So, it was the need of the hour for such a historic step for India to overcome all the struggles faced by the economy. This led to the integration of Indian economy with the world economy in order to make India competitive at a world level. The main objective of the economic reforms was to enhance the Indian economy and make it efficient and competitive.

Under the strategy of economic reforms India took seven major steps to achieve the prescribed goals regarding the economic growth. First, role of public and private sectors were clearly decided under the new industrial policy. Foreign investment was encouraged by abolishing the Foreign Exchange Regulation Act and thus Foreign Exchange Management Act was introduced. Under the new industrial policy licensing system was abolished, there was freedom of importing the technology, public sector was contracted, foreign investment was free to enter, MRTP and FERA restrictions were removed and importance of small industries was increased. Second, new trade policy was formulated for controlling and regulating imports and exports. Under this trade policy export-import restrictions were reduced, export-import tax was reduced, procedure of exports and imports was made easier, foreign capital market was established, full convertibility on current account was made applicable and incentives for exports were provided. Third, fiscal reforms were introduced to correct the fiscal deficit problem. For this individual and corporate taxes were reduced and tax procedure was simplified. Also, import duties were heavily reduced. Fourth, under monetary reforms statutory liquidity ratio was lowered, banks were

given the freedom to decide interest rate on deposits, nationalized banks were granted permission for collecting money by issuing shares and the permission was given to the private sector for opening the banks. Fifth, under capital market reforms the limit for investment was raised under the portfolio investment scheme, the Securities and Exchange Board of India was established, private sector was given permission for establishing mutual funds and the registration of the sub-broker was made mandatory. Sixth, under the program of phasing out subsidies, Cash Compensatory Support was stopped. Seventh, price control was dismantled in case of fertilizers, steel and iron, and petro-products. In brief, the economic reforms programme of India was oriented towards globalization, privatization and liberalization.

India witnessed a positive impact on the overall growth rate of the country as a result of the economic reforms of 1991. Process of economic reforms resulted into the increase in foreign direct investment (FDI) in India. In 1980-81, FDI inflow in India was $91.9 million which became $73.54 million in 1990-91 and further increased to $58.38 billion in 2019-20. In 1980-81, total labour employed in India was 16.2 million which became 34.6 million in 1990-91 and further increased to around 43.7 million in 2019-20. Similarly gross capital formation was $49.18 billion in 1980-81 in India which increased to $86.54 billion and further became $783 billion in 2019-20. As the result of increase in FDI, employment and gross capital formation, the gross domestic product of India increased to $470.16 billion in 1990-91 which was $287.22 billion in 1980-81.It became $2500.13 billion in 2019-20 (World Bank databank).

Clearly, the strategy under economic reforms has resulted into economic growth of India in terms of continuously increasing levels of gross domestic product. On comparison of growth of India under economic reforms era with pre-reforms era, there has been significant achievements in the Indian economy. So, it becomes essential to compare empirically pre-reforms economic growth with post-reforms economic growth in India. Under the process of economic reforms, FDI, labour employment, gross capital formation and foreign trade changed drastically which affected economic growth in terms of higher levels of gross domestic product. It proves that economic reforms have had significant impact on levels of economic growth of India and thus it becomes necessary to evaluate the growth process in India in view of economic reforms.

Research studies conducted so far about economic growth of India do not include economic reforms intensively as the determinant of growth. This study has considered economic reforms as a factor influencing the levels of growth in India along with the level of employment, FDI, gross capital formation and the foreign trade.

Review of Literature

Rahman, M. M. and Alam, K. (2021) analyzed the determinants of economic growth of 20 economies for the time period 1980-2018. They used international trade, energy use, human capital, foreign direct investment (FDI), capital and labour as independent variables and GDP as dependent variable. Cross - sectional dependence test, panel unit root test, cointegration tests, heterogeneous panel causality test and panel Autoregressive Distributed Lag method of PMG estimator were used for the analysis. It was concluded that in the long run, all the independent variables positively and significantly affected the economic growth. But in the short run, human capital negatively impacted the economic growth while energy use, trade and capital impacted positively and significantly. There was a two-way relation between economic growth and trade, capital, labour and human capital and one way relation from economic growth to energy use and foreign direct investment.

Malik, M. A., Masood, T., and Sheikh, M. A. (2021) studied econometrically the impact of determinants of total factor productivity in India. Considering Autoregressive Distributed Lag model (ARDL) for the data based on the period 1980-2016, this study went through two stages: firstly, measuring total factor productivity by using standard growth accounting approach and, secondly, establishing the determinants of total factor productivity growth using the ARDL model. It had been found that inflation and financial development had significant positive impact on total factor productivity. Levels of total factor productivity were insignificantly and positively related with foreign direct investment, imports and capital formation. Exports, size of the government expenditure and natural calamities were found to be statistically significantly negatively correlated with total factor productivity. This study suggested that policy makers should design policies to increase financial access to the entrepreneurs of the private sector.

Thaddeus, K. J., Ngong, C. A., Nebong, N. M., Akume, A. D., Eleazar, J. U., and Onwumere, J. U. J. (2021) analyzed the determinants of economic growth in Cameroon. Time series data for the period 1970-2018 was taken for the analysis. The paper used Autoregressive Distributed Lag model for investigating the relationship. The dependent variable was GDP per capita and the explanatory variables were the government expenditure, human capital development, foreign aids, trade openness, foreign direct investment, gross capital formation, broad money (M_2), official exchange rate and inflation. It was concluded that government expenditure, trade openness, gross capital formation and exchange rate positively and significantly impacted the economic growth both in the short-run and long-run. The remaining variables had a significant negative impact in the short-run and long-run.

Das, M.K. and Das, T. (2020) depicted the determinants of Indian economic growth. Time-series data from 1996-97 to 2017-18 was considered for the analysis. The dependent variable was economic growth (GDP) while the independent variables were foreign direct investment inflows, gross fixed capital formation, gross domestic product deflator, trade openness and real effective exchange rate. Vector Error Correction Model was used in the study and Johanssen Co-integration and Granger causality tests were conducted for the analysis. It was concluded that there was a positive impact of trade openness on GDP and a negative effect of GDP on trade openness. It was clear that foreign direct investment inflows positively affected the trade openness. Real effective exchange rate negatively affected the foreign direct investment inflows and gross fixed capital formation positively affected real effective exchange rate.

Bakari, S. and Tiba, S. (2019) examined the determinants of economic growth in the USA. Time series data from 1970 to 2016 was used for the analysis. The study used co-integration analysis and Vector Error Correction Model. The dependent variable was GDP per capita growth and the independent variables were population growth, foreign direct investment (net inflows), foreign direct investment (net outflows), military expenditure, tax revenue, imports of goods and services, gross fixed capital formation, final consumption expenditure and exports of goods and services. It was concluded that there was no impact of the independent variables on economic growth in the short-run. But, final consumption expenditure, population, gross fixed capital formation, foreign direct investment inflow, and export affected the dependent variable in the long-run. Moreover, there was no effect of foreign direct investment outflow, military expenditure, tax revenue, and imports on the economic growth of USA.

Sharma, R., Kautish, P., and Kumar, D. S. (2018) investigated the impact of determinants of economic growth in India. Time series data from 1971 to 2016 was taken for the analysis. The dependent variable was real GDP and the independent variables were foreign aid, government final consumption expenditure, foreign direct investment, trade openness, exchange rate, human capital development, and

inflation. ARDL model was used for the evaluation of the relationship. It was concluded that foreign aid, the government's final consumption expenditure and foreign direct investment affected the economic growth positively & significantly in the long-run. A negative impact of exchange rate and human capital development on the Indian economic growth was also evident. The impact of trade openness and inflation on Indian economic growth was not clear in the long run. Overall, the major determinants were government consumption expenditure and foreign direct investment. Foreign aid affected the economic growth negatively and significantly in the short-run.

Mohsen, A. S., Chua, S. Y., and Che, S. (2017) investigated the major determinants of economic growth in Syria for the time period of 1980-2010. Vector Auto Regression model along with the impulse response functions and variance decomposition analysis were used for the analysis. The dependent variable was gross domestic product and the independent variables were gross fixed capital formation of the public sector, gross fixed capital formation of the private sector, exports, oil price and population growth rate. It was concluded that public sector investment, private sector investment, exports, oil price, and population growth rate affected the dependent variable positively in the long-run. A two way relationship was found between public sector investment, private sector investment, oil price, population growth rate and GDP in the long-run. Exports also affected the GDP. In the short-run, a two-way relationship between public sector investment, private sector investment, exports, oil price, population growth rate and GDP was found.

Altaee, H. H. A., Al-Jafari, M. K., and Khalid, M. A. (2016) examined the relationship between economic growth and its determinants for the Kingdom of Saudi Arabia. Time-series data for the period 1980-2014 was considered for the analysis. The study used both Autoregressive Distributed Lag and Error Correction Methodology for evaluating the relationship. The dependent variable was real gross domestic product and the independent variables were gross fixed capital formation, export, import, and financial development. It was concluded that both, in short-run and long-run, there was a positive impact of fixed capital formation and export on the economic growth. A negative impact of import was also evident from the study in both short-run and long-run. It was also clear that financial development contributed negatively in the short-run but positively in the long-run.

Naby, M.A.E. and Sallam, M. (2016) examined the macroeconomic factors affecting the economic growth in Egypt. The study included time series data from 1970 to 2013 and both- Autoregressive Distributed Lag Modeling & Error Correction model were used for the analysis. The dependent variable was GDP economic growth rate and the independent variables were imports, exports, gross fixed capital formation and inflation. It was concluded that there exists a long-run relationship between the dependent variable and all the independent variables except gross fixed capital formation. It was found that imports and gross fixed capital formation significantly contributed to the Egyptian economic growth rate negatively whereas exports had a significant positive impact on the gross domestic product.

Udeaja, E. and Onyebuchi, O. (2015) investigated the impact of determinants of economic growth in Nigeria. The study incorporated Vector Error Correction model for the analysis. Time series data from 1970 to 2009 was used for the analysis. The dependent variable was annual growth rate of real GDP and the independent variables were domestic saving rate, expenditures on education and health, public infrastructure, foreign direct investment, trade openness and share index and financial deepening (private domestic credit as a ration of GDP). It was concluded that all these variables have a positive impact on the Nigerian economic growth except foreign direct investment and public infrastructure. A negative impact of health expenditures on economic growth of Nigeria was also evident from the study.

Mbulawa, S. (2015) explored the relationship between macroeconomic variables and economic growth. Time series data from 1975 to 2012 of Zimbabwe was taken and Vector Error Correction Model was used for the analysis. The dependent variable was per capita gross domestic product (proxy for economic growth) and the independent variables were trade openness, gross fixed capital formation, foreign direct investment and inflation. It was concluded that inflation had a negative impact on economic growth while trade openness was positively related to it. Gross fixed capital formation & foreign direct investment affected the economic growth negatively and insignificantly.

Abdalla, M. A. and Abdelbaki, H. H. (2014) analyzed the determinants of economic growth in six GCC countries. Time series data from 1980 to 2007 was collected where the dependent variable was economic growth and independent variables were exports, foreign direct investment and gross domestic investment. They used Vector Autoregressive and Vector Error Correlation Model in their study. It was concluded that for Bahrain, foreign direct investment and gross capital formation mainly determined the economic growth. For Kuwait, Qatar and Saudi Arabia, the major factors impacting economic growth were exports and gross capital formation. In UAE, exports and foreign direct investment determined the economic growth. Moreover, there was no significant impact of independent variables on the economic growth for Oman.

Biswas,S. and Saha, A.K. (2014) examined the macroeconomic determinants of Indian economic growth using time-series data from 1980-81 to 2010-11. The independent variables were export level, foreign capital (foreign direct investment inflow), money supply (broad money), general price level (whole sale price index for all commodities), and government expenditure (gross fiscal deficit), gross domestic capital formation and labour force (employment in public and organized private sectors). The dependent variable was economic growth (proxied by gross domestic product). For the analysis, Vector Error Correlation Model and co-integration tests were used. It was concluded that there was a long run relationship between the dependent and independent variables. There was a positive impact of gross domestic capital formation, employment, export, foreign direct investment & money supply on GDP of India. On the contrary, a negative impact of inflation & fiscal deficit was evident. It was clear that gross domestic capital formation has a significant impact on GDP in the short-run.

Hussin, F., Ros, N. M., and Noor, M. S. Z. (2013) analyzed the determinants of Malaysian economic growth. Time-series data from 1970 to 2010 was used in the study. The dependent variable was economic growth, measured in terms of GDP and the independent variables were trade openness, foreign direct investment, government development expenditure and gross fixed capital formation. Vector Autoregressive approach, Vector Error Correction Model and Auto-regressive conditional heteroskedasticity test were used for the analysis. It was concluded that there was a negative yet significant effect of foreign direct investment and trade openness on economic growth in short-run. It was also clear that government development expenditure strongly impacted the Malaysian economic growth.

Shahbaz, M., Ahmad, K., and Chaudhary, A. R. (2008) examined the determinants of economic growth in Pakistan. Time series data from1991Q1 to 2007Q4 was taken for the analysis. The dependent variable was GDP per capita and the explanatory variables were financial development, trade openness, foreign direct investment and annual inflation. The paper used both Error Correction Model and Autoregressive Distributed Lag Modeling for analyzing the relationship. It was concluded that there exists a long-run relationship between the variables. In short-run, financial development had a positive impact on the economic growth. A negative relationship between trade openness and economic growth & a positive

relationship between financial development and economic growth was evident from the study. There was also an inverse correlation between inflation and economic growth in Pakistan.

Having reviewed the concerned research studies, it becomes clear that the issue related with economic reforms has not been considered as the determinant of economic growth particularly in case of India. To fill up this research gap, this study considers economic reforms as determinant of economic growth.

Data, Variables and Econometric Model

Data Sources

This study aims to examine the impact of labour employment, gross capital formation, foreign direct investment, trade and economic reforms on gross domestic product of India both in long-run and short-run. Based on the secondary time-series data for the period 1980-81 to 2020-2021, this study uses data collected for the variables of labour employment, gross capital formation, foreign direct investment, trade and gross domestic product from the World Bank Databank (data.worldbank.org).

Variables

The logarithmic value of gross domestic product (LNGDP) at constant prices has been considered as the dependent variable and used as the proxy variable for the economic growth. Level of labour employment (EMP), gross capital formation (GCF), foreign direct investment (FDI) and trade (TRADE) have been considered as the independent variables. It is hypothesized that all these explanatory variables have the positive relationship with the explained variable. The variable of economic reforms has also been considered as the independent variable (as dummy variable) for which the value 0 has been assigned to the pre- economic reforms period (from 1981-1991) and the value 1 has been assigned to the post-economic reforms period (1992 - 2021). The dummy variable has been considered for the purpose of both intercept and slope coefficients. The variable labour employment has been measured in the unit of 0.1 million while all the other considered variables have been measured in USD ($).

Econometric Model

According to the classical, neo-classical and modern growth economists, the factors influencing economic growth are many as natural capital, institutional set up, foreign direct investment, capital formation, labour, human capital, technology, economic policies, trade openness, socio-cultural issues, political factors, etc. Different researchers considered different determinants of economic growth and analyzed the growth process. This study considers labour employed (EMP), gross capital formation (GCF), foreign direct investment (FDI), trade openness (TRADE), economic reforms (DUMMY), economic reforms related employment (EMPDM), economic reforms related gross capital formation (GCFDM), economic reforms related foreign direct investment (FDIDM) and economic reforms related trade (TRADEDM) as the determinants of economic growth. Thus the general functional form of the model is expressed as below:

$$LnGDP = F (EMP, GCF, FDI, TRADE, DUMMY, EMPDM, GCFDM, FDIDM, TRADEDM) \quad (1)$$

Equation (1) has to be specified econometrically as:

$$LnGDP = \beta_0 + \beta_1 EMP + \beta_2 GCF + \beta_3 FDI + \beta_4 TRADE + \beta_5 DUMMY + \beta_6 EMPDM + \beta_7 GCFDM + \beta_8 FDIDM + \beta_9 TRADEDM + e \quad (2)$$

where, LnGDP- natural logarithmic value of gross domestic product and β_0, β_1, β_2, -------- , β_9 are the parameters to be estimated.

In case of the ARDL (p,q) model specification, equation (2) can be expressed as below:

$$\Delta LnGDP = \beta_0 + \mu_1 LnGDP_{t-i} + \mu_2 EMP_{t-i} + \mu_3 GCF_{t-i} + \mu_4 FDI_{t-i} + \mu_5 TRADE_{t-i} + \mu_6 DUMMY_{t-i} + \mu_7 EMPDM_{t-i} + \mu_8 GCFDM_{t-i} + \mu_9 FDIDM_{t-i} + \mu_{10} TRADEDM_{t-i} + \sum_{i=1}^{p} \beta_1 \Delta LnGDP_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta EMP_{t-i} + \sum_{i=1}^{q} \beta_3 \Delta GCF_{t-i} + \sum_{i=1}^{q} \beta_4 \Delta FDI_{t-i} + \sum_{i=1}^{q} \beta_5 \Delta TRADE_{t-i} + \sum_{i=1}^{q} \beta_6 \Delta DUMMY_{t-i} + \sum_{i=1}^{q} \beta_7 EMPDM_{t-i} + \sum_{i=1}^{q} \beta_8 \Delta GCFDM_{t-i} + \sum_{i=1}^{q} \beta_9 \Delta FDIDM_{t-i} + \sum_{i=1}^{q} \beta_{10} \Delta TRADEDM_{t-i} + e_t \quad (3)$$

where Δ is used as the first difference operator, p and q shows the optimal length of lag and μ_1, μ_2,…, μ_{10} are the long run coefficients. β_1, β_2, …, β_{10} are the short run regression coefficients. Various information criteria (LR, FPE, AIC, SC and HQ) have been used for the selection of optimal lag length (p,q). Before the estimation of the ARDL model, the stationarity of all the variables have been checked by using the standard augmented Dicky-Fuller and PP tests both in cases of intercept and trend & intercept. For testing the null hypothesis of the non-existence of co-integration (a long-run relationship between variables), the Bounds test based on F-Statistic have been used where lower critical bound and upper critical bound values at various levels of significance have been applied. The null hypothesis regarding no co-integration is H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \ldots = \mu_{10} = 0$ but if H_1: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \ldots \neq \mu_{10} \neq 0$ then there will be no existence of co-integration.

Based on the above equation (3) the long-run form of the ARDL model can be expressed as below:

$$\Delta LnGDP = \beta_0 + \mu_1 LnGDP_{t-i} + \mu_2 EMP_{t-i} + \mu_3 GCF_{t-i} + \mu_4 FDI_{t-i} + \mu_5 TRADE_{t-i} + \mu_6 DUMMY_{t-i} + \mu_7 EMPDM_{t-i} + \mu_8 GCFDM_{t-i} + \mu_9 FDIDM_{t-i} + \mu_{10} TRADEDM_{t-i} + e_t \quad (4)$$

After knowing about the establishment of co-integration, the error correction model (ECM) aspect of the above equation (3) has been specified as given below:

$$\Delta LnGDP = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta LnGDP_{t-i} + \sum_{i=1}^{q} \beta_2 \Delta EMP_{t-i} + \sum_{i=1}^{q} \beta_3 \Delta GCF_{t-i} + \sum_{i=1}^{q} \beta_4 \Delta FDI_{t-i} + \sum_{i=1}^{q} \beta_5 \Delta TRADE_{t-i} + \sum_{i=1}^{q} \beta_6 \Delta DUMMY_{t-i} + \sum_{i=1}^{q} \beta_7 EMPDM_{t-i} + \sum_{i=1}^{q} \beta_8 \Delta GCFDM_{t-i} + \sum_{i=1}^{q} \beta_9 \Delta FDIDM_{t-i} + \sum_{i=1}^{q} \beta_{10} \Delta TRADEDM_{t-i} + \delta ECT_{t-1} + E_t \quad (5)$$

In equation (5), δ measures the speed of adjustment towards the long –run equilibrium as the result of occurrence of shocks in the short-run. Here, ECT is the error correction term which has to be derived from the equation (5) based on the long-run relationship. The estimated models will be tested by applying different tests as coefficient diagnostics, residual diagnostics and stability diagnostics. In case of coefficient diagnostic, Bounds test and Error Correction model will have to be applied while in case of residuals, Jarque- Bera test, B-G-Serial Correlation LM Test and B-P-G test have been applied. In case of stability Ramsey RESET test, CUSUM and CUSUM of Squares test have been used.

Analysis of Results

Descriptive Statistics:

Table 1 presents the calculated values of descriptive statistics for the variables used in this study. These are the values of mean, median, maximum value, minimum value, standard deviation, skewness, kurtosis and Jarque- Bera test. On the basis of Jarque- Bera test, it can easily be understood that the p-values in case of employment and FDI are less than 0.05 which indicates that these variables do not have the normal distribution. GCF, LnGDP and trade are the normally distributed variables as being shown by the respective p-values which are greater than 0.05. All the variables used have been shown graphically in Figure 1. All the graphs depict the increasing trend in GDP, LnGDP, GCF, EMP, FDI and TRADE.

Table 1: Descriptive Statistics

Test and Value	EMP	FDI	GCF	LnGDP	TRADE
Mean	368.65	1.63E+10	3.31E+11	11.94	3.13E+11
Median	391.40	3.68E+09	1.82E+11	11.92	1.62E+11
Maximum	482.60	6.59E+10	8.71E+11	12.43	8.18E+11
Minimum	162.00	5640000	4.92E+11	11.46	3.38E+10
Standard Dev.	80.01	1.99E+10	2.79E+11	0.31	2.83E+11
Skewness	-1.10	0.90	0.67	0.08	0.58
Kurtosis	3.47	2.43	1.94	1.73	1.69
Jarque- Bera	8.65 (0.013)	6.06 (0.048)	4.95 (0.084)	2.81 (0.246)	5.22 (0.074)
Observations	41	41	41	41	41

Note: Value in parenthesis is the p-value.

Source: Author's own work

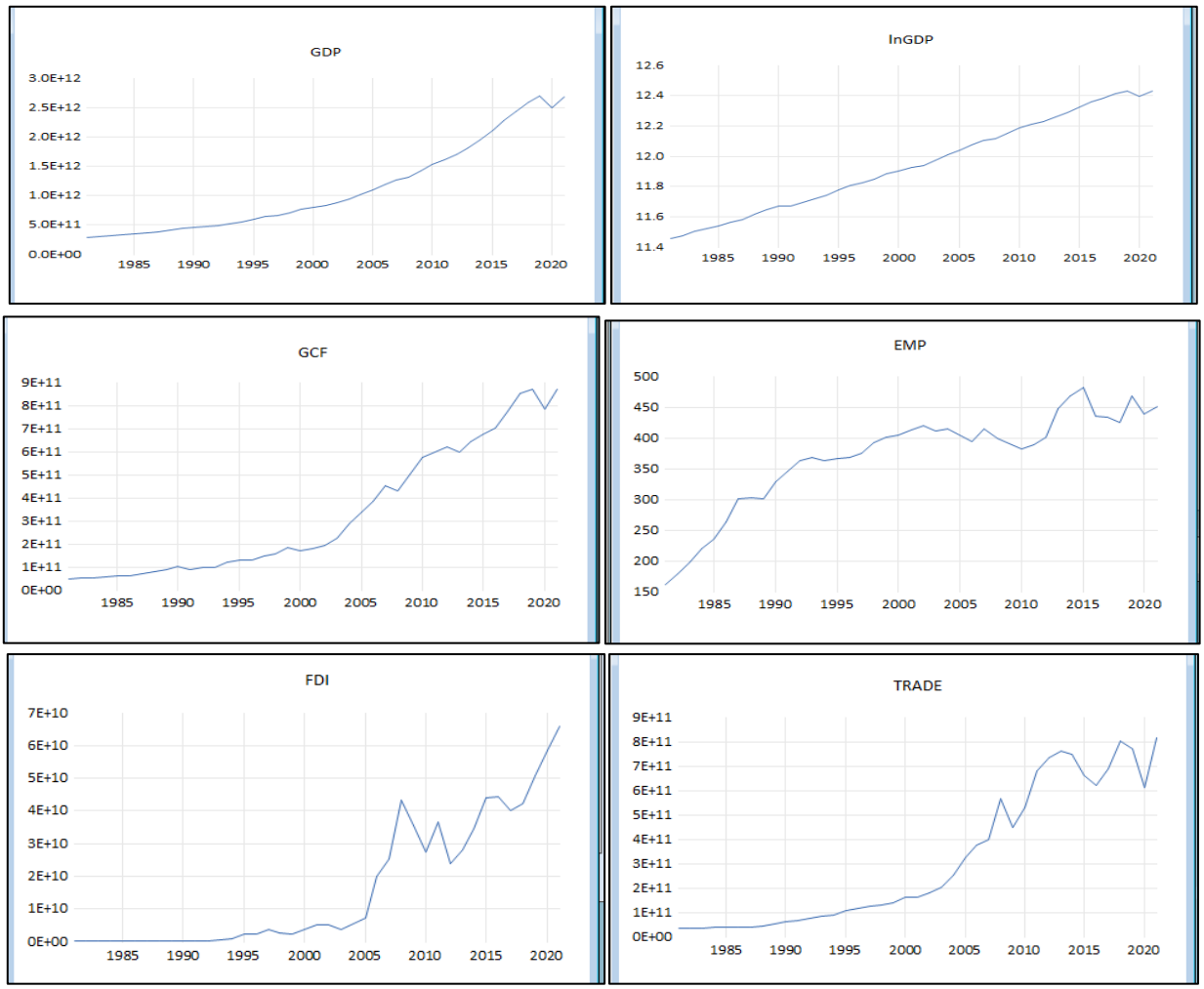

Figure 1. Trend in Variables

Source: Author's own work

Unit Root Test

For testing the stationarity of variables, Augmented Dicky-Fuller and Phillips-Perron tests have been used as shown in Table 2. In each of these tests, intercept and trend & intercept have been used both in cases of Level and first difference. LnGDP is stationary at first difference according to both ADF and PP tests. EMP has been found to be stationary at level in case of intercept and according to ADF and PP tests. The variable of FDI is stationary at first difference and according to the applied tests. Clearly, GCF, TRADE, EMPDM, FDIDM, GCFDM and TRADEDM are stationary variables at the first difference in all cases and according to both the tests of ADF & PP. The results of unit root tests approves the specification of the ARDL methodology.

Table 2: Results of Unit Root Test

Variable	ADF (Level)		ADF (First Difference)		Phillips - Perron (Level)		Phillips - Perron (First Difference)	
	Intercept	Trend and intercept	Intercept	Trend and intercept	Intercept	Trend and intercept	Intercept	Trend and intercept
LnGDP	-0.14 (0.94)	-2.35 (0.40)	-5.82 (0.00)	-5.75 (0.00)	-0.14 (0.94)	-2.38 (0.38)	-5.81 (0.00)	-5.74 (0.00)
EMP	-3.04 (0.04)	-2.19 (0.48)	-4.25 (0.00)	-3.17 (0.11)	-6.55 (0.00)	-2.82 (0.20)	-5.78 (0.00)	-6.58 (0.00)
FDI	0.87 (0.99)	-1.45 (0.83)	-6.04 (0.00)	-3.98 (0.02)	1.11 (0.99)	-1.44 (0.83)	-6.04 (0.00)	-6.76 (0.00)
GCF	1.58 (0.99)	-1.59 (0.78)	-5.83 (0.00)	-3.19 (0.11)	1.97 (0.99)	-1.50 (0.81)	-5.82 (0.00)	-6.71 (0.00)
TRADE	0.54 (0.99)	-2.38 (0.38)	-5.78 (0.00)	-3.78 (0.03)	0.50 (0.98)	-2.32 (0.42)	-6.64 (0.00)	-6.73 (0.00)
EMPDM	-1.51 (0.52)	-1.67 (0.75)	-6.28 (0.00)	-6.30 (0.00)	-1.49 (0.53)	-1.67 (0.75)	-6.28 (0.00)	-6.34 (0.00)
FDIDM	0.87 (0.99)	-1.45 (0.83)	-6.04 (0.00)	-3.98 (0.02)	1.11 (0.99)	-1.44 (0.83)	-6.04 (0.00)	-6.76 (0.00)
GCFDM	1.33 (0.99)	-2.08 (0.54)	-6.10 (0.00)	-6.63 (0.00)	1.75 (0.99)	-2.02 (0.57)	-6.09 (0.00)	-6.93 (0.00)
TRADEDM	0.48 (0.98)	-2.57 (0.30)	-5.81 (0.00)	-5.95 (0.00)	4.45 (0.98)	-2.51 (0.32)	-6.69 (0.00)	-6.75 (0.00)

Source: Author's own work

Optimal Lag Selection

Table 3 represents the results of optimal lag selection according to the criteria of LR, FPE, AIC, SC and HQ in case of all the variables considered in the study.

Table 3: Optimal Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6007.16	NA	2.2e+118	300.86	301.28	301.01
1	-5539.19	678.57*	2.6e+11*	282.50*	287.10*	284.14*

Source: Author's own work

* - indicates lag order selected by the criterion

Bounds Test

Estimates of Bounds Test have been reported in Table 4. The Bounds Test has been used to know whether there is long-run association between the dependent and independent variables. Results show that the null hypothesis of no co-integration has to be rejected on the basis of the value of F-statistic which is 4.90 and this value is greater than the upper critical bound value even at 1per cent level of significance. The rejection of null hypothesis ensures the presence of long-run association in the model. Value of F-statistic has been found to be greater than the values of I (1) at all the levels of significance.

Table 4: Estimates of Bounds Test

Test Statistic	Value	Level of Significance	I (0)	I (1)	Decision
F K	4.90 9	10% 5% 2.5% 1%	1.88 2.14 2.37 2.65	2.99 3.3 3.6 3.97	Existence of Co-integration (H_0 rejected)

Source: Author's own work

Estimates of Long-Run ARDL Model

Considering unrestricted constant and no trend, Table 5 reports the estimates of ARDL model associated with the long-run form. No variable is having significant impact on the economic growth in the long-run. Only gross capital formation and employment with economic reforms is having a positive insignificant impact. Employment is not having any impact at all in the long-run. All other variables are having negative yet insignificant impact on the economic growth of the country.

Table 5: Long-Run Form: ARDL Model Estimates (1,1,0,0,0,1,1,1,0,0) Unrestricted Constant and No Trend

Variable	Coefficient	Standard Error	t-statistic	Probability
EMP	0.000	0.001	0.327	0.747
GCF	1.44E-11	8.51E-12	1.697	0.102
FDI	-7.05E-10	5.67E-10	-1.243	0.225
TRADE	-1.58E-11	1.01E-11	-1.576	0.128
DUMMY	-0.357	0.306	-1.168	0.254
EMPDM	0.002	0.001	1.335	0.194

GCFDM	-1.45E-11	8.79E-12	-1.646	0.112
FDIDM	7.03E-10	5.67E-10	1.241	0.226
TRADEDM	1.65E-11	1.03E-11	1.606	0.121

Source: Author's own work

Estimates of Short-Run ARDL Model

Table 6 reports the estimates of ARDL model associated with the short-run form. In the estimated results, all the coefficients have been found to be statistically significant. In the short-run, level of employment, where instantaneous growth rate (0.04 per cent) is negative, level of employment in case of economic reforms (having instantaneous growth rate of 0.05 per cent) and gross capital formation under economic reforms (having negative instantaneous growth rate of (1.11E-12)*100 have the significant effect on growth of India. It is also clear that it is only the level of employment under economic reforms having the positive significant effect on economic growth. All the other determinants have been found to be having negative significant impact on economic growth in India in the short-run.

The co-integration coefficient has been found negative (-0.0954) which shows that the speed of adjustment in the economy is 9.54 per cent which will lead to the equilibrium to the long-run. This coefficient is also statistically significant. The coefficient of determination shows that 82. 3 per cent variation in growth of India is being explained significantly by the considered variables in the short-run ARDL model.

Table 6: Estimates of Short-Run ARDL Model

Variable	Coefficient	Standard Error	t-statistic	Probability
Constant	1.10	0.13	8.31	0.0000
D(EMP)	-0.0004	0.0001	-4.07	0.0004
D(EMPDM)	0.0005	0.0001	4.09	0.0004
D(GCFDM)	-1.11E-12	1.67E-13	-6.64	0.0000
D(DUMMY)	-0.17	0.04	-4.25	0.0003
CointEq(-1)	-0.0954	0.012	-8.16	0.0000

R-squared	0.823	AIC	-7.45
Adjusted R-squared	0.797	SC	-7.19
F-statistic	31.55	HQ	-7.36
Prob (F-statistic)	0.000	D-W statistic	2.40

Source: Author's own work

Granger Causality Analysis

Results about pair-wise granger causality have been reported in Table 7. It can be seen that employment and growth do not have the causal relationship. In case of gross capital formation there can be seen the presence of significant bidirectional granger causality between gross capital formation and economic growth of India. Foreign direct investment does not granger cause growth significantly but growth granger causes foreign direct investment significantly and thus there is unidirectional causality. In case of trade, there is unidirectional causality showing that growth granger causes trade significantly in India.

Levels of employment under economic reforms and economic growth do not granger cause in any way. Gross capital formation under economic reforms does not granger cause growth but growth granger causes capital formation significantly under economic reforms. In the same way, growth granger causes foreign direct investment in economic reforms significantly but there is no case of granger cause from foreign direct investment to growth of India. Also, growth significantly granger causes trade in economic reforms period in India.

Table 7: Granger Causality Diagnostics

Null hypothesis	F-Statistic	Probability
EMP does not Granger Cause LnGDP	0.910	0.346
LnGDP does not Granger Cause EMP	1.095	0.302
GCF does not Granger Cause LnGDP	4.68	0.038
LnGDP does not Granger Cause GCF	4.890	0.033
FDI does not Granger Cause LnGDP	0.929	0.342
LnGDP does not Granger Cause FDI	5.146	0.029
TRADE does not Granger Cause LnGDP	0.398	0.532
LnGDP does not Granger Cause TRADE	6.882	0.013
EMPDM does not Granger Cause LnGDP	1.901	0.176
LnGDP does not Granger Cause EMPDM	0.649	0.426
GCFDM does not Granger Cause LnGDP	3.649	0.064
LnGDP does not Granger Cause GCFDM	6.221	0.017
FDIDM does not Granger Cause LnGDP	0.920	0.344
LnGDP does not Granger Cause FDIDM	5.156	0.029
TRADEDM does not Granger Cause LnGDP	0.173	0.680
LnGDP does not Granger Cause TRADEDM	7.580	0.009

Source: Author's own work

Diagnostic Statistics

Results regarding diagnostic tests have been reported in Table 8. These tests have been performed for residual normality, serial correlation, heteroscedasticity, model specification and the stability of the estimated model. In case of residual normality, Jarque-Bera test has been applied and it has been found that the value of the test statistic is insignificant so null hypothesis has to be accepted that residuals are normally distributed. On the basis of Breusch- Godfrey Serial Correlation LM Test, the model is not being suffered from the serial correlation. In the estimated model, results are not there with the issue of heteroscedasticity as shown by the insignificant value of the Breusch-Pagan-Godfrey test. The model specification does not have any specification error as shown by the results based on the Ramsey RESET test. CUSUM test and CUSUM of squares test have been applied for testing the stability of the specified model as shown in Figure 2 and Figure 3 respectively. In case of both these tests, the results show that there is stability in the estimated model because the plots of both CUSUM and CUSUMSQ are within the critical bound of 95 per cent level of confidence (5 per cent level of significance).

Table 8: Diagnostic Tests

Test description	Name of the test	Value of the test	Probability	Decision
Normality	Jarque-Bera	0.50	0.780	H_0 is accepted (Normal distribution of residuals)
Serial correlation	B-G-Serial Correlation LM Test	F=1.34 N*R^2= 2.06	0.265 0.151	H_0 is accepted (No serial correlation)
Heteroscedasticity	Breusch-Pagan-Godfrey	F=1.55 N*R^2= 18.61	0.163 0.180	H_0 is accepted (No heteroscedasticity)
Model Specification	Ramsey RESET	t= 1.65 F=2.74	0.111 0.111	H_0 is accepted (No model specification error)

Source: Author's own work

CUSUM TEST

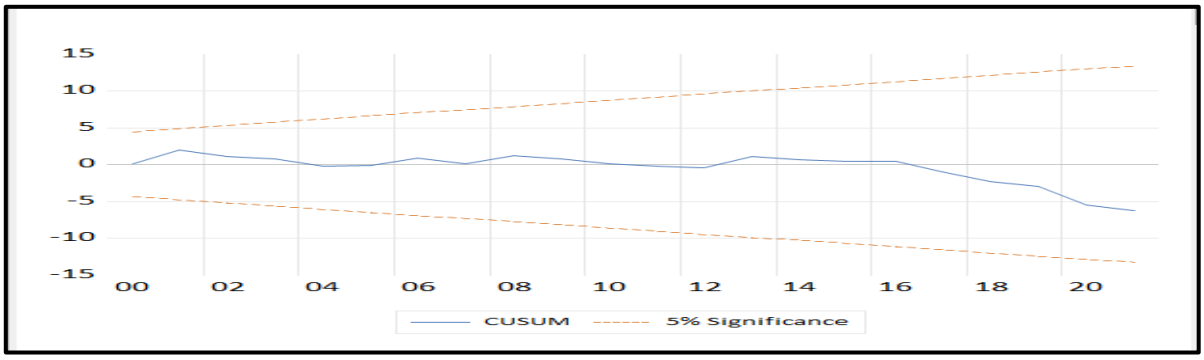

Figure 2.

Source: Author's own work

CUSUM OF SQUARES TEST

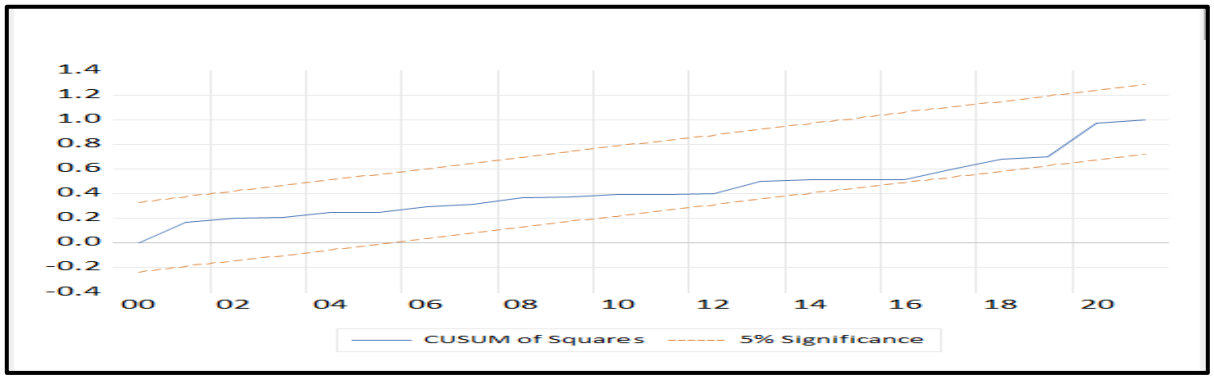

Figure 3.

Source: Author's own work

Robustness of the Model

To study the robustness of the model, Fully Modified OLS & Canonical Cointegrating Regression models have been estimated for getting the results corrected from the issues of serial correlation & endogeneity. Estimates of these models have been presented in Table 9 & Table 10. It is clear that in both these models, none of the independent variables is affecting economic growth significantly. The results of both these models are similar to the results estimated in ARDL model.

Table 9: Fully Modified OLS Model

Variable	Coefficient	Standard Error	t-statistic	Probability
EMP	0.001	0.000	1.389	0.175
GCF	1.91E-12	2.38E-12	0.801	0.429
FDI	-7.04E-11	2.13E-10	-0.330	0.745
TRADE	4.20E-13	2.39E-12	0.176	0.862
DUMMY	0.005	0.118	0.043	0.966
EMPDM	0.000584	0.000538	1.086	0.286
GCFDM	-1.22E-12	2.38E-12	-0.511	0.613
FDIDM	7.01E-11	2.13E-10	0.328	0.745
TRADEDM	-3.49E-13	2.39E-12	-0.146	0.885
C	11.258	0.058	195.313	0.000
$R^2 = 0.990$		Adj. $R^2 = 0.987$		

Table 10: Canonical Cointegrating Regression

Variable	Coefficient	Standard Error	t-statistic	Probability
EMP	5.06E-05	0.001	0.046	0.964
GCF	6.89E-12	8.67E-12	0.795	0.433
FDI	-2.41E-10	3.98E-10	-0.538	0.594
TRADE	-3.96E-12	7.84E-12	-0.506	0.617
DUMMY	0.003	0.137	0.023	0.982
EMPDM	0.001	0.001	0.998	0.325
GCFDM	-6.19E-12	8.67E-12	-0.713	0.481
FDIDM	2.14E-10	3.98E-10	0.536	0.596
TRADEDM	4.05E-12	7.84E-12	0.517	0.609
C	11.27	0.071	159.598	0.000
$R^2 = 0.987$		Adj. $R^2 = 0.983$		

Conclusion

The study aims to evaluate the role of economic reforms in affecting the levels of economic growth considering labour employment, gross capital formation, foreign direct investment and trade as the main growth contributors. For economic reforms, both intercept and slope dummy variables have been considered for the cases of pre and post economic reform periods in India. Secondary time-series data

for the period 1980-81 to 2020-21 has been collected for the analysis. Considering natural logarithmic values of gross domestic product at constant prices as the dependent variable, both long–run and short-run effects of regressors have been estimated under the ARDL methodology. The estimated Bounds test value proves the non- existence of long-run association between the considered variables. In all the estimated models, the goodness of fit is statistically significant. Various diagnostic statistics have been estimated to see whether there are issues related with residual normality, serial correlation, heteroscadasticity, model specification and the model stability. On all the grounds, it has been found that residuals are normally distributed. There is no existence of serial correlation, heteroscedasticity and specification error. The models satisfy all the conditions of the stability. It is suggested that government policy towards foreign direct investment must be designed in such a way that it can be helpful in making foreign direct investment more productive in India.

Summary of findings

It has been found that none of the considered determinants of growth have significant effects in the long-run. The estimates of short-run ARDL model show that employment has negative significant impact on economic growth. In post-reforms period, employment is positively & significantly affecting the growth in India.

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