



Evaluating the Key Drivers of Economic Growth of India: A Time-Series Analysis

Sheetal Rawat¹, Devayani Keer², Tanu Vaidya³

¹Assistant Professor, International Institute of Management Studies, Pune, India

²Research Scholar, Department of Economics, IIS (Deemed to be University), Jaipur, India

³Assistant Professor, Department of Economics, IIS (Deemed to be University), Jaipur, India

sheetalrawat0303@gmail.com

Abstract. India's transformation from a post-independence developing nation to a rapidly expanding emerging economy across the globe has been driven by decades of structural reforms and institutional development. Although numerous studies have been conducted to study the major factors of India's economic growth, limited evidence exists on the simultaneous effects of labour, capital formation, education expenditure, health expenditure, inflation and FDI in both long-run and short-run using recent time-series data. To bridge this gap, the present study simultaneously examines the influence of labour, capital formation, human capital, macroeconomic stability and foreign investment on Indian economy within a unified ARDL framework for the time period from 1980-81 to 2022-23. The findings reveal that while FDI inflows and inflation negatively affected economic growth, the rest variables carry positive influence over Real GDP. While impact of labour, GCF and health expenditure is statistically significant, that of educational expenditure is insignificant. In short-run, economic growth is significantly influenced by labour force and FDI inflows. The results emphasized the significance of improvement in the efficiency of education and health expenditure to enhance labour productivity, ensuring price stability by regularly monitoring inflation to mitigate its adverse effects, and productive use of FDI to promote economic growth by directing it towards growth-enhancing sectors.

Keywords: Labour force, Gross Capital Formation, human capital, ARDL, FDI inflows, health expenditure, education expenditure

1. Introduction

Economic growth has always been a central tenet in the quest for prosperity, stability, social and cultural development of the nations; several studies have found that its determinants include investment (both domestic and foreign), human capital (e.g., schooling, health), macroeconomic stability (e.g., low inflation), population growth, and trade openness (Solow, 1956; Barro, 1991; Mankiw, Romer, & Weil, 1992). With the onset of globalisation, economies have transitioned from traditional, closed, and state-controlled systems to liberalised, market-oriented, and highly integrated ones through global value chains. Over time, the relevance of these factors with respect to their impact on economic growth has undergone great transformation as can be understood by the changing course of theories in economics of growth and development. While economists from classical school such as Adam Smith, Ricardo and Malthus emphasized on physical capital accumulation, division of labour, and population growth; the neoclassical theories stated long-run economic growth to be determined by technology and not just capital accumulation alone. The role of research and development, human capital stock, and innovation in economic growth has been extensively studied by researchers such as Romer (1986, 1990), Lucas (1988), and Barro (1991). The focus in recent years has shifted towards institutional, inclusive and sustainable Growth theories. However, empirical studies also suggest that the significance of these parameters vary across geographies and time periods. Thus, the debate on variables, economic and non-economic, affecting economic growth has remained an ongoing issue. This highlights the need to understand the key drivers of growth and their interplay in the short and long run in various economies.

Given the financial resources of economies around the globe have prominent limitations, it hence becomes vital to recognize the true major growth drivers for the economies in the short and long-term context. The extensive review of literature highlights the key role of various forms of capital- human, physical, natural and macroeconomic policy variables in shaping long-run economic growth across developing economies. Based on the Nigerian economy, the study by Ismaila and Imougehele (2015) discovered that capital investment, foreign capital inflow, and public expenditure were the main factors impacting economic growth. Another study by Wadud et al. (2007) based on Bangladesh economy, highlighted the relevance of human capital for the economic performance of the nation reflected

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by the existence of a bidirectional causal association between education and GDP. The path to long-run economic progress in Brunei Darussalam is highly affected by its export growth and optimal government size, wherein heavy spending by government had led to weakening performance (Anaman 2004). The econometric analysis aimed at empirically analyzing the relationship between educational investment and economic growth in India over the period 1951–2015 confirmed the existence of a stable long-run association between educational investment and GDP, with evidence of unidirectional causality flowing from educational investment to GDP (Jariwala 2017).

India presents a unique case when it comes to examining the determinants of growth, given its historical and institutional setup. While the economy faced massive financial exploitation and drain of wealth during the initial decades of 20th century under the colonial rule. The journey to recovery, started post-independence, though the start was slow given the poor state of economy, but dedicated efforts were made from the very beginning to restructure the Indian economy into becoming a self-reliant developing economy. Under the aegis of erstwhile Planning Commission, five-year plans were formulated, focusing on various sectors. It evolved over time with dynamic global order through several reforms and moved away from a state-run system to a liberalised market economy. Presently, India has not just overcome the historically slow GDP growth, but has also established itself as a leading emerging economy. This further necessitates the need to extensively research on the factors explaining this growth pattern of the economy.

The empirical research points towards a broad spectrum of macroeconomic factors responsible for growth in India. The study by Biswas and Saha (2014), highlighted the importance of investment, employment, exports and money supply in growth promotion, but reported a detrimental impact of inflation and fiscal deficits. Das and Das (2020) established that trade openness and FDI had positive impact on GDP but trade openness was found to have detrimental influence of GDP on it. Capital formation and labour force participation were found to be the main drivers for Indian economy and significance of export promotion had been highlighted (Pandey and Bishnoi 2022). These results reiterate the need for context oriented macroeconomic policies suitable to India.

In this context, the Viksit Bharat @2047 initiative of the government envisages a developed India by the centenary of independence. The key aspirations for it are inclusive development, raising middle-class purchasing power, strengthening household sentiments, increasing private sector investments and boosting growth. It necessitates a consistent growth rate of GDP at 7-8% per year, poverty eradication, provision of universal healthcare and quality education. The initiative aims to place India amongst the top three economies globally, achieve the net-zero emissions by 2070 with emphasis on adoption of renewable energy sources and manufacturing induced industrial modernization. However, the persistence of regional disparity indicates an unbalanced growth pattern in India. Therefore, it necessitates analysis of various sectors and macroeconomic variables to achieve these goals in the long run.

It is against this background that the current paper analyzed six key factors of India's economic growth with the Autoregressive Distributed Lag (ARDL) modelling technique. Based on existing literature, the selected determinants include gross capital formation, labour force, government education expenditure, health expenditure, foreign direct investment, and inflation. This study aims to add to the literature on economic growth, using recent data and econometric techniques to derive policy implications from the empirical findings. The paper comprises of five sections. Introduction is mentioned in Section 1 followed by a review of selected literature in Section 2. Section 3 outlines the data and methodology employed. Section 4 focuses on data analysis and the results obtained, and conclusions of the study are summarized in the final section.

2. Review of Literature

A brief description of selected studies from across the globe based on exploring various factors influencing economic growth is presented under this section.

Ishfaq et al. (2024) explored the relationship between various forms of capital formation-natural, physical, and human-and their contribution to GDP growth in Pakistan during 1971-2020 using ARDL modelling approach. The outcomes showed that different forms of capital (human, physical and natural), financial development and labour participation positively impact the economic growth in Pakistan whereas FDI was insignificant in its impact. The need of heavy

investment in physical infrastructure, health and education has been highlighted. Kaur(2023) studied the association among government health expenditure, health status, and economic growth in India during 1981-82 to 2015-16 using Johansen Cointegration and Toda- Yamamoto causality framework. The analysis pointed that health expenditure has a positive effect on economic growth of India while life expectancy is positively affected by the economic growth. The study recommended prioritizing health expenditure in India to increase the country's pace of economic development.

Pandey and Bishnoi (2022) investigated the drivers of economic growth of India from 1980 to 2019 using ARDL Bounds Cointegration Approach. The independent variables were capital formation, FDI, labour force, government expenditure and trade volume. The study found positive impact of all the independent variables on economic growth of India except FDI. It recommended to increase the speed of capital formation and promote employment through skill development. It is also suggested to focus on trade expansion with specific attention to be given to export promotion. Das and Das (2020) used time series data for the period 1996–97 to 2017–18 using VECM to study the influence of selected macroeconomic variables on Indian economy. The results confirmed a positive impact of trade openness on GDP. Granger causality results pointed that GDP granger causes FDI, capital formation and inflation. The study recommended that policies should be on enhancing domestic investment, for increasing the absorptive capacity of FDI and manage inflation arising in the economy. Sharma et al. (2018) applied ARDL bounds testing approach to study the impact of macroeconomic variables on the India's economic growth from 1971 to 2016. The study used foreign aid, net FDI inflow, human capital, exchange rate, inflation, public expenditure and size of trade openness as independent variables. The study found a long-term positive impact of FDI, foreign aid and government spending on the India's economic growth whereas exchange rate and human capital development showed a negative impact. In the short run, foreign aid showed a negative impact on economic growth.

Abubakar and Abdulkadir (2015) evaluated the impact of public expenditure on India's economic growth from 1980-2012. The study showed a positive impact of lagged value of education expenditure on economic growth limited to only short run, with no significant association among the variables in long run. Redistribution of funds towards productive sectors such as research, infrastructure and vocational training has been recommended. Ismaila and Imoughele (2015) studied the variables affecting Nigeria's economic growth from 1986 to 2012. The findings based on Johansen cointegration, and Error Correction Model, highlighted that FDI, government expenditure and capital formation impacted GDP positively, while labour force, trade openness, and inflation showed insignificant effects. It recommended improving infrastructure to lower business costs, maintaining tight monetary and fiscal policies to curb inflation, minimizing labour strikes, and ensuring macroeconomic stability through growth oriented policies to boost Nigeria's economic growth.

Biswas and Saha (2014) studied the primary factors influencing India's economic growth during the post liberalization period using time-series data from 1980-81 to 2010-11 using Johansen cointegration and vector error correction model. The study showed that India's GDP growth was positively affected by capital formation, export, foreign capital inflow, employment level and money supply. On the other hand, inflation and fiscal deficit impacted economic growth inversely. The study recommended the policymakers to focus on encouraging investment, maintaining fiscal prudence, and controlling inflation to support sustainable economic development. Islam et al. (2007) based their study on association between education and Bangladesh's economic growth for the period 1976-2003. Employing a multivariate framework that included Real GDP, education expenditure, capital, and labour, the authors utilized unit root tests, Johansen cointegration analysis and VECM to assess long-run relationships. The study found evidence of mutual causality between education and GDP, highlighting their interdependent relationship. Anaman (2004) investigated the key factors influencing long run economic performance in Brunei Darussalam using ARDL bounds testing method with real GDP as dependent variable for annual data from 1980 to 2019. The study used a quantitative time-series econometric approach for the period spanning 1980-2019 and ARDL bounds testing method to study the relationship between the variables. The explanatory variables taken were exports, workforce, government size and investment-GDP ratio. Trade openness and government expenditure positively impacted economic growth in long run whereas inflation rate affected negatively.

The present study examines the factors promoting economic expansion in India using the ARDL bound cointegration

approach. Solow (1956) and Swan (1956), in their neoclassical growth theory, emphasized on role of physical capital accumulation, labour force growth, and exogenous technological progress. While the presence of labour force ensured sufficient human resource for production process, accumulation of capital increased the productive capacity of the nation. Therefore the variables, Labour and Gross Capital Formation are taken as proxy for available labour force and domestic investment respectively. The endogenous growth theory by Romer (1986, 1990) and Lucas (1988) extended the neoclassical framework. They focused on the role of human capital, innovation, and knowledge spillovers on economic wellbeing of nations. The expenditure on education is known to increase the technical knowhow, skills and abilities of labour. Whereas, a healthy workforce with higher cognitive and physical capabilities tends to raise the total factor productivity and economic performance. Though higher expenditure on education and health alone cannot guarantee upgradation of human capital potential of a nation as it needs to be backed by institutional efficiency, governance, and the quality standards. But due to availability of consistent annual time-series data and their evident relevance as observed in empirical growth literature, both education and health expenditure are thus taken as measures for human capital formation. Foreign Direct Investment facilitates transfer of technology, capital inflow and deeper integration with international markets encouraging long-term economic growth. Inflation represents the macroeconomic stability of the economy. While persistently high inflation creates uncertainty, at moderate levels it leads to economic expansion. Thus, the selection of variables in present study is theoretically consistent with neoclassical and endogenous growth frameworks and represents the major channels through which economic growth is influenced. In the ever dynamic world order, India has surfaced as the fastest growing major emerging economy globally. It necessitates a continuous and in-depth study of the inter-relationship of different factors influencing the growth path of the economy. The present study employs econometrical techniques to empirically examine the association of chosen drivers of economic growth of India.

3. Data sources and Methodology

3.1 Data Sources

The study utilizes time series analysis based on annual data spanning from 1980–81 to 2022–23 for dependent as well as independent variables. The Real Gross Domestic Product (GDP) is used as the dependent variable to measure India’s economic growth. LAB (labour force), GCF (Gross Capital Formation), EdnExp (educational expenditure), HeaExp (health expenditure), FDI (foreign direct investment inflows), and INF (inflation rate) constitute the variables under independent classification. The description of these dependent and independent variables is mentioned in Table 1.

Table 1: Description of the Variables

Variable	Form of the Variable	Data Source
GDP	In Rupees	National Accounts Statistics
LAB	In Millions	Handbook of Statistics on the Indian Economy, RBI
GCF	In Rupees	National Accounts Statistics
EDnExp	In Rupees	Analysis of Budgeted Expenditure on Education report
HeaExp	In Rupees	Annual Financial Statements and the National Health Accounts Cell

INF	In Percentage	WDI, World Bank
FDI	In US Dollars	WDI, World Bank

There are numerous macroeconomic and institutional factors that influence economic growth such as trade openness, infrastructure development, technological innovation and institutional quality. However, including all potential determinants within a single time-series framework could lead to the problem of over-parameterization, reduce the degrees of freedom available for estimation, and make the model unnecessarily complex and more difficult to interpret. Hence, the study deliberately focuses on six core macroeconomic variables representing which are widely recognised in economic growth literature.

3.2 Research Design and Methodological Approach

The study utilizes a log-linear regression model to investigate the impact of the selected factors on economic growth of India:

$$\ln \text{GDPT} = \beta_0 + \beta_1 \ln \text{LABt} + \beta_2 \ln \text{GCFt} + \beta_3 \ln \text{EdnExpt} + \beta_4 \ln \text{HeaExpt} + \beta_5 \ln \text{INFt} + \beta_6 \ln \text{FDIt} + \mu_t \quad (1)$$

where t denotes the time period (in years), and μ captures the stochastic error term.

The descriptive statistics explains underlying nature of variables reflected by measures of central tendency, skewness and kurtosis. The association between variables was analyzed by correlation analysis. The normality of data was assessed using Jarque–Bera test.

The stationarity of the time series data is examined using unit root tests, to ascertain the constancy of mean, variance and covariance of data over time. Failure to address non-stationarity may result in spurious regression outcomes, wherein the estimated relationships among variables appear statistically significant despite being non-existent in reality (Phillips and Perron, 1988). Thus, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test were employed in the study to evaluate the stationarity characteristics of the variables.

3.3 Selection of Optimal Lag Length

The autoregressive terms in ARDL model contain the lagged dependent variable whereas the distributed lag terms incorporate lagged values of independent variables. For the identification of optimal lag length, several criteria such as the Hannan–Quinn (HQ) Criterion, Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) among others are used.

The ARDL model

The economic relationship between Real Gross Domestic Product of India and the selected independent variables are examined under the ARDL framework. ARDL model can only be estimated if all variables are either stationary at level $I(0)$ or at first difference $I(1)$, and none should be integrated at the second difference $I(2)$, as the ARDL model cannot be applied in the presence of $I(2)$ variables (Nkoro and Uko, 2016).

The ARDL Bounds Test, as proposed by Pesaran and Shin (1999) and Pesaran et al. (2001), is applied to determine the existence of a long-run relationship among the variables. After establishing a long-run equilibrium relationship among the variables, the corresponding estimation of long-run coefficients is undertaken. To explain the short run dynamics of the equation, the Error Correction Model (ECM) is used. It also indicates that post the short-term deviations, whether the system converges or diverges towards long-run equilibrium.

The following equation depicts the estimation of coefficients in the ARDL (Autoregressive Distributed Lag) model technique:

$$\Delta \ln \text{GDP}_t = \alpha_0 + \delta_1 \ln \text{GDP}_{t-1} + \delta_2 \ln \text{LAB}_{t-1} + \delta_3 \ln \text{GCF}_{t-1} + \delta_4 \ln \text{EdnExp}_{t-1} + \delta_5 \ln \text{HeaExp}_{t-1} + \delta_6 \ln \text{INF}_{t-1} + \delta_7 \ln \text{FDI}_{t-1} + \sum_{i=1}^{p-1} \theta_i \Delta \ln \text{GDP}_{t-i} + \sum_{j=0}^{q_1-1} \beta_{1j} \Delta \ln \text{LAB}_{t-j} + \sum_{j=0}^{q_2-1} \beta_{2j} \Delta \ln \text{GCF}_{t-j} + \sum_{j=0}^{q_3-1} \beta_{3j} \Delta \ln \text{EdnExp}_{t-j} + \sum_{j=0}^{q_4-1} \beta_{4j} \Delta \ln \text{HeaExp}_{t-j} + \sum_{j=0}^{q_5-1} \beta_{5j} \Delta \ln \text{INF}_{t-j} + \sum_{j=0}^{q_6-1} \beta_{6j} \Delta \ln \text{FDI}_{t-j} + e_t \quad (2)$$

The coefficients corresponding to the long-run are indicated by $\delta 1$ to $\delta 7$. Number of lags for Real GDP is denoted by p , while q_1 to q_6 indicate the lag length for the respective independent variables.

ARDL Bounds test is applied to test if Real GDP and the selected factors of economic growth possess any long run relationship or not using the following hypothesis:

Null Hypothesis (H0): There exists no long run relationship *i.e.* $\delta 1 = \delta 2 = \delta 3 = \dots = \delta 7 = 0$ Alternative

Hypothesis (H1): There exists long run relationship *i.e.* at least one $\delta i \neq 0$

The value of F-statistic used for interpretation of results. When the calculated F-statistic is more than the upper bound critical value, the null hypothesis is rejected. This ascertains the presence of a long-run association between the variables. On the other hand, if the F-statistic lies below the lower bound critical value, we fail to reject the null hypothesis and thus conclude that no relationship exists between variables in long-run.

The short-run coefficients of the model are estimated using Error Correction Model as in following equation:

$$\Delta \ln \text{GDP}_t = \alpha_1 + \sum_{j=0}^{q_1-1} \beta_{1j} \Delta \ln \text{LAB}_{t-j} + \sum_{j=0}^{q_2-1} \beta_{2j} \Delta \ln \text{GCF}_{t-j} + \sum_{j=0}^{q_3-1} \beta_{3j} \Delta \ln \text{EdnExp}_{t-j} + \sum_{j=0}^{q_4-1} \beta_{4j} \Delta \ln \text{HeaExp}_{t-j} + \sum_{j=0}^{q_5-1} \beta_{5j} \Delta \ln \text{INF}_{t-j} + \sum_{j=0}^{q_6-1} \beta_{6j} \Delta \ln \text{FDI}_{t-j} + \gamma \text{ECT}_{t-1} + \varepsilon_t \quad (3)$$

Here, ECT_{t-1} refers to the lagged value of the error correction term and γ represents the speed of adjustment. The model is said to move towards long-run equilibrium if the value of γ is negative and is statistically significant.

Residual and Diagnostic Tests

After the estimation of model coefficients, several residual diagnostic tests are employed to assess the robustness of the model. The Breusch–Godfrey LM test is used for identification of serial correlation in the residuals. The Jarque–Bera test ensures the normality of data whereas Breusch–Pagan–Godfrey test examines the case for heteroskedasticity.

The CUSUM and CUSUM of Squares tests assess the stability of the estimated model. Further, to verify the correctness of the model specification, Ramsey Regression Equation Specification Error Test (RESET) is performed.

4. Results and Discussions

This section presents and discusses the results obtained from the data analysis.

4.1 Descriptive Overview and Correlation Assessment

The descriptive statistics of the variables considered for the analysis are mentioned in Panel A of Table 2 whereas Panel B indicates the linear association between different sets of variables.

Table 2: Descriptive Statistics and Correlation Matrix

Panel A: Descriptive Statistics							
Variable	lnGDP	lnLAB	lnGCF	lnEdnExp	lnHeaExp	lnINF	lnFDI
Mean	15.3737	5.9174	14.0431	11.2761	14.4039	1.8509	21.7433

Median	15.3274	6.0014	13.8543	11.3204	14.2885	2.0249	22.0267
Maximum	16.5186	6.1919	15.4691	13.8138	17.1402	2.6212	24.8878
Minimum	14.2553	5.184	12.5447	8.366	12.1804	0.824	15.5454
Std. Dev.	0.7122	0.2667	0.9759	1.6225	1.4408	0.4736	2.1435
Skewness	0.0879	-1.0907	0.2646	-0.0692	0.2478	-0.6758	-0.5503
Kurtosis	1.7346	3.3423	1.5659	1.8597	1.9062	2.3429	2.1431
Jarque Bara	2.7882	8.3287	3.5179	2.2541	2.4632	3.8581	3.3238
Prob. Value	0.2481	0.0155	0.1722	0.3239	0.2918	0.1453	0.1898

Panel B: Correlation Matrix							
Variable	lnGDP	lnLAB	lnGCF lnEdnExp	lnHeaExp	lnINF	lnFDI	
lnGDP	1						
lnLAB	0.9116	1					
lnGCF	0.9943	0.9141	1				
lnEdnExp	0.9959	0.9331	0.9883	1			
lnHeaExp	0.9951	0.8859	0.9826	0.9919	1		
lnINF	-0.5402	-0.4826	-0.4920	-0.5386	-0.5398	1	

lnFDI	0.9457	0.929 4	0.9518	0.9525	0.9247	-0.4924	1
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All the variables are found to be normally distributed except labour as reflected by the probability values for Jarque-Bera statistic. While labour, inflation and FDI are negatively (leftward) skewed, all the rest variables are positively (rightward) skewed. The kurtosis values are generally below 3, implying that the distributions are platykurtic except labour, whose kurtosis slightly exceeds 3, suggesting a slightly leptokurtic distribution.

The correlation coefficients reported in Panel B capture the linear relationships among the variables. With the exception of inflation, the pairwise correlations reveal a strong positive linear association among the variables. Conversely, inflation exhibits negative correlations with all other variables, suggesting that elevated inflation levels may adversely affect economic performance and investment outcomes. Such high correlations are expected in long-term macroeconomic time-series as these variables generally exhibit a common upward trend associated with continuous economic development over time. Although pairwise correlations may indicate the possibility of multicollinearity, they do not necessarily imply the presence of harmful multicollinearity within the estimated ARDL model. The overall stability of the estimated model will be evaluated through the post-estimation diagnostic and stability tests. Nevertheless, the estimated coefficients should be interpreted with appropriate caution given the strong association among certain explanatory variables.

4.2 Stationarity Test

Table 3 summarizes the results of the ADF and PP tests for stationarity check.

Table 3: Results of ADF Test and PP Test

Variable	ADF Test				PP test			
	With Intercept		With Intercept and Trend		With Intercept		With Intercept and Trend	
	Level	First Difference	Level	First Difference	Level	First Difference	Level	First Difference
lnGDP	0.147	-6.123*	- 2.45 3	-6.039*	0.19 3	-6.140*	- 6.123*	-6.035*
lnLAB	- 10.250*	-3.538*	- 6.08 9 *	-4.229*	- 9.911 *	-3.469*	- 6.127*	-4.119*
lnGCF	-0.543	-6.873*	- 2.09 3	-6.819*	-0.542	-6.939*	-2.202	-6.831*

lnEdnExp	-0.979	-3.502*	- 2.21 0	-3.687*	-1.701	-4.475*	-2.313	-4.510*
lnHeaExp	1.796	-4.132*	- 1.396	-5.225*	2.31 7	-3.502*	-0.718	-3.817*
lnINF	-2.454	-6.668*	- 2.47 4	-6.615*	-2.454	-6.667*	-2.606	-6.617*
lnFDI	-1.030	-6.675*	- 2.85 5	-6.602*	-0.817	-7.779*	-2.977	-6.913*

*Note: * indicates the rejection of null hypothesis of unit root at 5% level of significance*

The results of the stationarity tests point labour to be stationary I(0) i.e. at level. Rest all variables become stationary after first differencing i.e. at I(1). Since all the variables selected in the study are integrated of order I(0) or I(1) and no variable is stationary at the second difference I(2), the ARDL estimation technique can be suitably applied for this analysis.

4.3 Selection of Optimal Lag Length

The appropriate lag length for the variables is selected based on outcomes of criteria mentioned below in Table 4.

Table 4: Lag Length Selection Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	93.2407	NA	2.52e-11	-4.5389	-4.2373	-4.4317
1	387.963	465.3514	6.37e-17	-17.4718	-15.0585*	-16.6131
2	460.286	87.5481*	2.45e-17*	-18.6992	-14.1743	-17.0893*
3	521.929	51.9101	2.89e-17	-19.3647*	-12.7281	-17.0035

*Note: * indicates lag order selected by the respective criterions*

Since, out of the five selection criteria, three - namely the LR (Likelihood Ratio), FPE (Final Prediction Error), and HQ (Hannan-Quinn) - suggest that a lag length of 2 is optimal. Hence, the lag length of 2 is selected considering the majority rule.

ARDL Bounds Test

The ARDL Bounds test is applied to test the long-run relationship between GDP and the considered six factors of economic growth, and outcomes obtained are displayed in Table 5.

Table 5: Results of Bounds Test

Test Statistics	Value	K
F-Statistic	20.7249	6
Critical Value Bound		
Significance	I(0)	I(1)
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

The calculated value of F-statistic (20.7249) is more than upper bound critical values at all the four levels of significance. Therefore, the null hypothesis of no long-run association among the variables stands rejected. The results of Bounds test confirm that there exists a significant long-run association between GDP and the chosen key determinants of economic growth.

ARDL Long run form Estimation and Error Correction Model

Once the significant long-run relationship between variables is established, the long-run and short-run coefficients of the variables are estimated. The coefficients of the estimated ARDL model and the Error Correction Model (ECM) are mentioned in Table 6.

Table 6: Estimates of ARDL Model Coefficients

Panel A: Long Run Coefficient			
Variable	Coefficient	t-Statistic	Prob.
lnLAB	0.3658	3.0195	0.0054
lnGCF	0.3758	11.000	0.0000
lnEdnExp	0.0469	0.6483	0.5220
lnHeaExp	0.1759	2.9436	0.0065
lnINF	-0.0440	-3.8232	0.0007
lnFDI	-0.0185	-1.6925	0.1016

Panel B: Short Run Coefficient: Error Correction Model			
Variable	Coefficient	t-Statistic	Prob.
C	2.5622	13.5372	0.0000
D(lnLAB)	0.7616	9.9112	0.0000
D(lnFDI)	-0.0043	-1.7577	0.0897
D(lnFDI(-1))	0.0060	2.4563	0.0205

CointEq(-1)	-0.4767	-13.2726	0.0000
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*Note: * p-value incompatible with t-Bounds distribution*

Labour, capital formation and health expenditure show a statistically significant and positive relationship with economic growth reflecting the importance of all these variables for the long-run economic prosperity of India. The long-run coefficient of educational expenditure is positive but is insignificant which points out the need to have better allocation of educational funds with special focus on enhancing the standard of education provided. The coefficient of inflation is found to be significantly negative. Persistent inflationary pressure leads to reduced purchasing power and discourages investment in long term projects which hampers the pathway of economic growth. While the estimated coefficient of FDI inflows is negative, it is statistically insignificant, indicating that foreign investments may be channelled into sectors with limited impact on overall economic growth. It can be due to inefficient choice of sectors where these foreign investments are being put.

The coefficients of ECM correspond to short-run period, thereby capturing the instant dynamics between the variables. The error correction term indicates an adjustment speed of 47.7%. Since the term is statistically significant and negative, it reaffirms that a stable equilibrium is restored in the long-run. In the short run, only Labour and FDI are found to influence the Real GDP.

The results of ECM depicts that labour possesses significant relationship with economic growth at 5% significance level, hence highlighting its importance of being a major factor in the short span. For a highly populated nation like India, such a positive labour-economic growth relationship is a boon. In terms of FDI inflows, the current period change in FDI possesses a negative effect on economic growth but the impact is insignificant. The lagged value of real GDP exhibits a positive and statistically significant effect, indicating that the growth-enhancing benefits of foreign investment materialise only after a certain period rather than instantaneously.

Robustness Check: Diagnostic and Stability Tests

The Table 7 summarizes of the results of diagnostic test alongside their interpretations to ascertain the robustness, consistency and reliability of the estimated model. Further, stability quotient of the model is ensured by CUSUM and CUSUMSQ tests undertaken in the present study.

Table 7: Diagnostic Tests Summary

Test	Test Statistic	Probability	Results
Jarque- Bera test (normality test)	2.9336	0.2307	Normally distributed residuals
Breusch Godfrey Serial Correlation LM test	0.3702	0.6942	Absence of serial correlation
Breusch Pagan Godfrey (Heteroskedasticity)	0.2591	0.9854	Absence of Heteroskedasticity
Ramsey RESET Test	1.2673	0.3758	No Specification error

The above results confirm that the absence of serial correlation and heteroskedasticity in the estimated model. The residuals are found to be in normal distribution. Furthermore, the Ramsey RESET test statistics rule out the existence of any specification bias in the model implying the correct specification of the model.

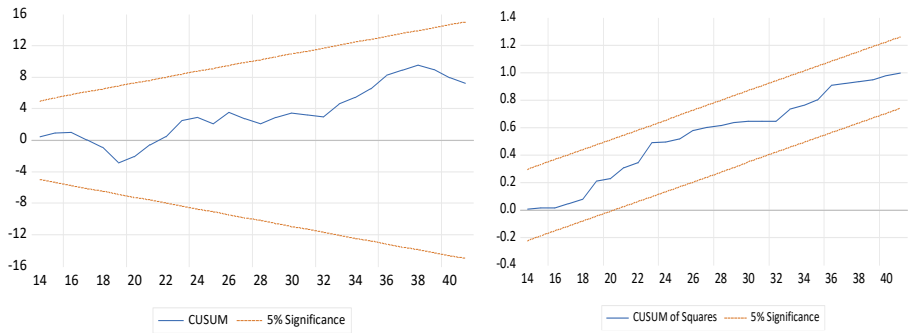


Figure 1: CUSUM and CUSUMSQ Tests

Figure 1 shows that the plotted lines remain within the 5% critical bounds in case of both the graphs with Graph (A) and (B) depicting the results of CUSUM test, and the CUSUMSQ test respectively. It signifies the stability of the estimated model thereby confirming that the model has no issues of structural instability over the sample period.

5. Discussion of the Findings

Labour and gross capital formation, in the current study are found to exert a positive and statistically significant impact on India's economic growth in the long run. These findings are consistent with several empirical studies (Pandey and Bishnoi (2022); Ishfaq et al. (2024); Biswas and Saha (2014); Anaman (2004)). For a labour-intensive country like India, such outcomes are highly encouraging, as they indicate that the labour force remains one of the most important drivers of

economic growth. Labour continues to be a significant factor even in the short run. This finding highlights the importance of promoting labour-intensive industries such as MSMEs, agriculture-based industries, and other employment-generating sectors, which have the potential to absorb India's large workforce while simultaneously contributing to economic growth.

If appropriately skilled and effectively utilised, India's large workforce has the potential to significantly contribute to long-term economic development. Similarly, the positive and significant impact of gross capital formation highlights the importance of domestic investment in promoting economic growth. Capital formation enhances the productive capacity of the economy through infrastructure development, technological upgradation, industrial expansion, and improved production capabilities.

The significant negative impact of inflation on economic growth, highlights the need to maintain price stability for sustainable economic development. Similar results have been observed in earlier studies (Biswas and Saha (2014); Anaman (2004); Ismaila and Imoughele (2015)). However, moderate and well-managed inflation generally reflects growing economic activity and rising demand within the economic structure. The coefficient of FDI in the current study is negative though statistically insignificant in the long run. The results obtained are in accordance with few studies (Pandey and Bishnoi (2022); Ishfaq et al. (2024)). The insignificant and negative relationship suggests the need for a deeper understanding of the composition of FDI inflows and whether they are directed towards productive sectors capable of generating long-term economic benefits.

Both education expenditure and health expenditure are found to exhibit a positive impact on economic growth. But, while the health expenditure effect is statistically significant, education expenditure is found to be statistically insignificant. The significant impact of health expenditure may be attributed to its relatively immediate influence on labour productivity (Kaur 2023). Better healthcare improves the physical and cognitive abilities of the workforce, reduces absenteeism, and enables workers to return to productive activities within a shorter period, thereby contributing directly to economic performance.

Several studies have empirically found that educational expenditure impacts economic growth (Adel & Imen (2018); Jariwala (2017)). The insignificant impact of education expenditure may be explained by the long gestation period associated with educational investments. The benefits of education generally materialise over a longer period and depend not solely on the level of expenditure but also on the quality of education provided and institutional effectiveness. Merely increasing educational expenditure may not immediately translate into higher economic growth unless accompanied by improvements in educational quality, employability, and learning outcomes.

6. Study Limitations and Policy Implications

The present research is subjected to certain limitations, which also provide directions for future research. The work is based on annual time-series data for India covering the period 1980–81 to 2022–23. Extending the time period, may provide deeper insights into the long-run dynamics of economic growth. Secondly, the present study focuses on six core macroeconomic variables identified from established growth theories. However, economic growth is influenced by several other factors, future studies may incorporate alternative sets of explanatory variables to provide a broader understanding of the determinants of economic growth. Furthermore, education and health expenditure have been used as proxies for human capital due to the availability of consistent long-term data. Future research may employ alternative indicators reflecting the quality of education and healthcare, such as learning outcomes, educational attainment, life expectancy, healthcare accessibility and institutional efficiency, to provide a more comprehensive assessment of the contribution of human capital to economic growth.

From a policy perspective, policymakers should focus on generating enough and relevant employment opportunities for the massive labour force of the nation. Special emphasis should be placed on promoting labour-intensive manufacturing industries, MSMEs and other employment-generating sectors so that India's abundant labour force can be productively absorbed. The gross capital formation highlights the need to encourage continuous domestic investment in physical infrastructure, industrial development and technological upgradation. Policies should encourage FDI in sectors capable of

generating technology transfer, innovation, employment generation and stronger linkages with the domestic economy, thereby maximising its long-term contribution to economic growth. Enhancing the quality standard of education and improving the accessibility and timely delivery of healthcare services should remain a policy priority. Finally, maintaining price stability remains essential for sustaining long-term economic growth.

7. Conclusion

The paper evaluated the influence of six selected factors of economic growth of India. To test the long and short-run dynamics of the association between the chosen factors and Real GDP, ARDL modelling technique was used and applied on time series data from year 1980-81 to 2022-23. Bounds test ascertained a long run association between Real GDP and the selected factors. While Inflation and FDI influenced economic growth inversely, the impact of rest four variables that include labour, capital formation, health expenditure, education expenditure was found to be positively associated with prosperity of the economy. Labour force proved to be a crucial factor influencing growth positively both in short and long run. Government should extensively focus on developing labour intensive industries along with highly qualified skill-based jobs in order to absorb the large labour force available in the economy. It is recommended that the government consistently allocate adequate funds to the health and education sectors, as strengthening these areas is expected to enhance labour productivity and further augment the nation's human capital potential. The government is expected to frame effective policies leading to FDI getting invested towards productive sectors, so that the impact of FDI inflows can turn positive and it reaches its true potential of being a major driver of economic growth. Inflation rate needs to be consistently monitored so as to avoid it from turning into a major constraint in the growth path of the economy.

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