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The Causal Effect of Financial Development on Economic Growth in India: Autoregressive Distributed Lag Estimation

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Abstract: The influence of economic reforms on economic growth is mainly channelled through the financial sector. This paper analyses the dynamic causal relationship between financial development and economic growth in India during the period 2000 to 2023 applying the autoregressive distributed lag (ARDL) model. A comprehensive financial development index for India is constructed by applying the principal component analysis over six indicators of the depth, access and efficiency of the financial system in India viz. broad money supply, domestic credit to the private sector by banks, gross domestic savings and credit to government-owned enterprises and stock market turnover ratio. The ARDL estimates show that financial development and trade openness influence economic growth positively both in the short and long runs, but the short-run effect is less than the long-run effect. The effect of trade openness implies that import-led growth is harmful to the Indian economy. The estimated error correction coefficient suggests that any divergence from the long-run relationship in the short-run is adjusted by around 37% in the following period indicating a slow pace of adjustment of the Indian economy to shocks.

Keywords: Financial development, economic growth, economic reforms, dynamic causality, autoregressive distributed lag estimation

Introduction

The relationship between financial development and economic growth dates back at least to Schumpeter (1911) who emphasised the positive role of financial development on economic growth. The subsequent debate centred around the issue of whether the financial sector actually leads the real sector in the process of economic development or the reverse. There is no universal consensus to date on the causal link between financial

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development and economic growth. In the theoretical literature, there exist three different streams of views on the direction of the causality between economic growth and financial development. The first view is the "supply leading" notion a la Schumpeter (1911) and Patrick (1966) which states that financial development is a precondition for economic growth; The second view is the "demand-following" due to Robinson (1952) which advocates that real economic growth leads financial development; and the third view is the bidirectional causality between financial development and economic growth (Demetriades and Hussein, 1996; Greenwood and Smith, 1997).

The link between financial development and economic growth is amply demonstrated by the experience of India. Following the balance of payments crisis, India introduced financial sector reforms as a part of the structural economic reforms programme in 1991. The adoption of liberalisation and globalisation policies and market reforms were designed to promote efficiency in the economy through the promotion of competition. The principal objective of financial sector reforms has been to improve the allocative efficiency of resources, ensure financial stability and maintain confidence in the financial system by enhancing its soundness and efficiency. No doubt the economic and financial reforms have yielded significant results and the Indian economy has undergone tremendous transformation achieving higher growth rates and high investment rates especially foreign direct investments and foreign collaborations over the subsequent periods.

Empirical evidence suggests that the strength and direction of the relationship between financial development and economic growth are sensitive to the variables used to measure financial development. In addition, the findings suggest that the outcome between the two sectors differs from country to country over time. The elusive causal direction of the two seems from certain limitations of the existing literature on this issue: most studies are mainly cross-sectional, which cannot satisfactorily address the country-specific issues; and many studies are largely drawn from bivariate causality analysis and may therefore suffer from the omission of variables bias.

An appropriate measure of financial development plays an important role in analysing the causal relationship between financial development and economic growth. However, with the wide diversification of financial services, the construction of financial development indicators is not a simple task (Ang and McKibbin, 2007). In the literature, the most commonly used measures of financial development do not capture the actual development of the financial system of a country, especially for developing countries. For example, the ratio of broad money (M2) to GDP is typically considered a standard measure of financial development, it may not necessarily reflect financial depth as money is used as a store of value in the absence of other more attractive alternatives (Khan and Senhadji, 2003). These indicators also overlook the financial openness of a country and ignore the utilisation angle of the domestic financial system. Given the multi-dimensional nature of the financial system, it is to be noted that the deep financial systems do not necessarily provide high degrees of financial access and highly efficient systems are not necessarily more stable than the less efficient ones. To overcome these shortcomings, a more robust indicator that captures all aspects of the financial system is required.

The findings from the available literature do not clearly establish a harmony about the direction of causality between financial development and economic growth. Several studies have used different types of financial proxy variables for measuring financial development, which does not encompass all the aspects of the financial sector and therefore fail to provide an efficient measure of financial development. Therefore, this paper attempts to construct a comprehensive index of financial development for India by applying the principal component analysis of the financial data over the period 2000 to 2023 from the Global Financial Development Database of the World Bank. This paper also investigates the causal relationship between financial development and economic growth applying the autoregressive distributed lag (ARDL) model that examines the dynamic interaction of economic growth with financial development. The long-run and short-run relationships between them respectively are analysed by the cointegration and error correction models. This paper further takes into account the influence of economic reforms on economic growth and financial development, an important gap overlooked by most of the past Indian studies in this literature.

Literature Review

Ample literature exists, both theoretical and empirical, on the relationship between financial development and economic growth over the years. The theoretical contributions highlight the different services provided by the financial sector that can affect output and economic growth. However, the empirical relationship between economic growth and financial development has been controversial as the causality has remained an important issue of debate.

King and Levine (1993) use cross-country data to analyse four kinds of evidence to evaluate the theoretical predictions regarding the links between financial development and growth. First, an analysis of 80 countries over the period 1960-1989 using the three-stage least squares (3SLS) estimation method shows that the predictable components of financial depth - the relative importance of banks as opposed to central banks and the ratio of private credit to GDP - are positively and significantly related to each growth indicator and the sources of growth. Second, they evaluate five countries' experiences with financial sector reforms. Third, they review firm-level evidence on the allocative effects of financial reforms. Finally, the success of general policy reforms on financial development is investigated. All the results indicate that the initial level of financial development is a good predictor of the subsequent rates of economic growth. The findings suggest that government policies toward financial systems may have an important causal effect on long-run growth.

Sinha and Macri (2001) examine the relationship between financial development and economic growth using time series data for eight Asian countries - India, Japan, Korea, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand. The study uses a multivariate vector autoregression model in Granger over the period 1950-1997. Two types of analyses are performed in this study: The estimated regression results for augmented production function show a positive and significant relationship between the income variables and financial variables for India, Malaysia, Pakistan and Sri Lanka. The multivariate causality tests show a two-way causal relationship between income and financial variables for India and Malaysia, oneway causality from financial variables to income variables for Japan and Thailand and reverse causality for Korea, Pakistan and the Philippines. The empirical results do not support the general view of a clear and positive relationship between financial development and economic growth in Asian economies.

Rioja and Valev (2004) examine the relationship between financial development and economic growth by grouping countries a panel of 74 countries according to the levels of financial development and income levels. The study applies the generalised method of moments (GMM) dynamic panel technique for the period 1961-1995 averaging over 5-year intervals. The dynamic panel GMM results prove a consistent nonlinear relationship between financial development and economic growth. The differential effect of financial development is positive but diminishes as countries reach a high region. The results also suggest that the effect of financial development on economic growth is uncertain for countries with low levels of financial development.

Halkos and Trigoni (2010) examine the direction of the causality between the financial sector and economic growth of the 15 countries European Union for the period 1975-2005 using VAR models. The growth of the real sector is expressed by real GDP per capita growth, while the size of the financial system is by the ratio of domestic credit to GDP. The deposit rate and inflation are used as indexes of monetary policy. The estimated VAR results show that in the short run, the size of the financial system does not directly affect growth, although its increase leads to an increase in the deposit rate and consequently to a decrease in real GDP per capita. However, according to the estimated vector error correction (VEC) model, the significance of the error correction coefficients implies that there is a relationship between the real sector, financial sector and monetary policy in the long run.

In the Indian context, Bell and Rousseau (2001) examine whether financial intermediaries have played a leading role in influencing India's economic performance using the National Accounts Statistics during the post-independence era from 1951 to 1991. A set of vector autoregressive (VAR) and vector error correction models (VECM) are constructed to evaluate the strength and direction of the links between measures of formal intermediation and various economic aggregates. The estimated results show that the expansion of the financial sector has played an enabling role in promoting capital accumulation and has been instrumental in promoting aggregate investment and output. However, financial development has not influenced the total factor productivity in the organised manufacturing sector. Thus, the activities of the financial sector have had an important impact on India's post-independence economic performance.

Kar and Mandal (2014) study the impact of financial structure, financial deepening and measures of financial activity on the economic growth in India following the financial sector reforms. Particularly, the test of whether the financial reforms facilitate the growth process operating through the stock market or the banking sector. They use monthly data for the post-reform Indian economy from April 1994 to March 2008 applying the modified Pantula principle associated with the VECM method. The variables considered are the constant price index of industrial production (IIP) as a proxy for growth and a set of alternative financial sector variables to capture the stock market and banking sector, viz. size vs activity of financial sector and bank-based vs stock market-based financial structure. The estimated results show that financial deepening has a strong long-run impact on economic growth. In the banking sector, both the size and activity variables contribute independently to economic growth, while in the stock market, it is the size that contributes to the growth process. The activity level is much more significant for the banking sector but for the stock market, it is only the size of the sector that is significant. The long-run coefficients of banking sector variables in the cointegrating relationships are significantly higher than those for the stock market. This indicates that even though the stock market has become important after financial reforms, banks continue to play a dominant role in facilitating the growth process.

Chakrabarty (2010) examines the impact of the developments in the financial sector on economic growth in India in the post-1991 economic reforms period using quarterly data applying the techniques of cointegration and VECM. The cointegration results show that the capital-output ratio and rate of growth of human capital have a positive effect on the real rate of growth of GDP, irrespective of the indicator of stock market development. An increase in market capitalisation has a negative effect, whereas turnover has no significant effect on economic growth in India. On the other hand, the effects of the money market rate of interest have a positive effect on economic growth, which indicates that the banking system reforms have improved the growth rate of real GDP in the post-reform period in India. From the results of VECM, the error correction term relating to market capitalisation and inflation helps to adjust the short-run dynamics of economic growth when market capitalisation is used as an indicator of stock market development. On the other hand, while using turnover as the indicator of stock market development, the error correction term relating to turnover does not help to adjust the short-run dynamics of economic growth. Thus, the stock market development makes no significant contribution while the reforms in the banking sector, particularly those related to interest rate deregulation, play a significant role in economic growth. These findings imply that the liberalisation of foreign portfolio flows in the Indian stock market since 1991 has not effectively interacted with the real sector of the Indian economy.

Nain and Kamaiah (2014) examine the relationship between financial development and economic growth in India in the non-linear Granger causality framework employing the Toda and Yamamoto test for the period 1990-2010. Separate indices are constructed to capture the stability, access, depth and efficiency characteristics of the financial system of India. The Johansen cointegration test results show that there is no cointegration between economic growth and access, depth, and efficiency characteristics of the financial system and financial development as a whole, except between stability characteristics and economic growth. The estimated VECM shows that the coefficients are insignificant, except that the stability of the financial system and economic growth tend to be in equilibrium. The non-linear Diks and Panchenko causality test shows that there is no non-linear causal relationship between financial development and economic growth.

Lenka (2015) and Lenka and Sharma (2017) use annual time series data for India for the period 1980-2011 to examine the relationship between economic growth and financial development. The study employs the autoregressive distributed lag (ARDL) bound testing approach to cointegration and error correction model (ECM) to find the long-run and short-run causality between economic growth and financial development. The study uses the principal component method to combine eleven selected measures of financial development into a single index. The result of the cointegration test based on the ARDL bound test presents strong evidence for the long-run relationship among the variables suggesting that financial development is one of the long-run determinants of economic growth and not vice-versa. Diagnostic tests for the presence of serial correlation, heteroscedasticity and normality in the data are also performed before estimating the long-run and short-run relationships. The estimated error correction coefficient suggests that about 2 of the disequilibria in GDP growth of the previous year's shock adjusts back to the long-run equilibrium in the current year.

Overall, the literature reflects ambiguity about the impact of financial development on economic growth. One possible reason for the mixed empirical evidence is the choice of proxy for financial development. A number of different proxy measures for financial development across different sample periods coupled with different techniques might have led to different results. Hence, this paper attempts to construct a comprehensive index for financial development capturing various dimensions of financial development and evaluating its impact on economic growth in India.

Data and Methodology

The data used in this paper over the period 2000 to 2023 is derived from the Global Financial Development Indicators and World Development Indicators of the World Bank. In the empirical estimation of the effect of financial development on economic growth, besides financial development indicators and GDP per capita, other commonly used variables in the literature are government spending as a share of GDP as an indicator of macroeconomic stability and volume of trade as a share of GDP that captures the degree of openness. The estimating model in the log liner form is specified as:

$$lnGDPpc_t = \beta_o + \beta_1 ln(FDI)_t + \beta_2 lnx_t + u_t \tag{1}$$

where y_t is GDP per capita at factor cost, FDI is an index of financial development, x_t is a vector of control variables - inflation, trade openness and government consumption expenditure and u_t is the error term. All variables are in natural logarithm.

Financial development encompasses the depth, size, access and efficiency of the financial system and the performance and activities of the financial markets, banks, bond markets and financial institutions. The inclusion of all indicators of financial development separately in the same estimation model may cause problems of multicollinearity and over-parameterisation. To comprehensively capture all these dimensions in a single measure, a composite index seems inevitable. To construct such an index, the financial development index, this paper uses the principal component analysis over several dimensions of financial indicators. Following Cihak et al. (2013), several measures of some important characteristics of financial systems are considered: (i) depth - the size of financial institutions and markets, (ii) access - the degree to which individuals can and do use financial institutions and markets, and (iii) efficiency - efficiency of financial institutions and markets in providing financial services. Table 1 presents the indicators of financial markets that are used in the construction of the financial development index. The six selected measures of the depth, access and efficiency of the financial system viz. BMS, PCB, DCP, GDS, CGE and STR are combined to derive a single index of financial development using the principal component analysis (PCA).

Table 1: Description of Financial Indicators

Indicator	*Description*	*Proxy measure*
BMS	Broad money supply (% GDP)	Financial institution depth
PCB	Private credit by banks (% GDP)	Financial institution depth
DCP	Domestic credit to private sector (% GDP)	Financial market depth
GDS	Gross domestic savings (% GDP)	Financial institution access
CGE	Credit to government-owned enterprises (% GDP)	Financial institution efficiency
STR	Stock market turnover ratio	Financial market efficiency

The PCA captures the potentially high correlation among the different measures of financial development in the construction of the financial development index. The PCA retains all the variations in the data even though it reduces the dimensionality of it. It transforms the data into uncorrelated new variables i.e. principal components. The maximum variation of the original variables is contained in the first component. The second component accounts for the next largest amount of variability not accounted for by the first component, and so on. Thus, each principal component is basically a weighted average of the underlying variables. According to the PCA procedure, the j^{th} factor F_i can be expressed as:

$$F_i = w_{J1} z_1 + w_{J2}\, z_2 + \dots \dots \dots + w_{JN}\, z_N \qquad j = 1, 2, \dots \dots, N \qquad (2)$$

where F_j is the estimate of j^{th} factor, w_j is the weight on factor score coefficient and N is the number of variables.

In the econometric analysis, to estimate the long-run and short-run impact of financial development on economic growth, the Auto-Regressive Distributed Lag (ARDL) method of Pesaran, Shin and Smith (2001) is employed. There are several advantages of using the ARDL method as it is adoptable irrespective of whether the underlying variables are I(0) or I(1) process and also it provides a unified framework for testing and estimation of cointegration relations in the context of a single equation. If the F-statistic (Wald test) establishes that there is a single long-run relationship and the sample data size is finite, the ARDL error correction representation becomes relatively more efficient. The ARDL model can also be reparameterised into ECM to give the short-run dynamics and long-run relationship of the underlying variables.

Generally, time series data contain unit root and non-stationary. However, the time series is required to be stationary to avoid any inconsistencies in coefficient estimation. Therefore, it is critical to check the stationarity properties and to identify the integration order of each series. It is standard that a variable is said to be stationary if it has a time-invariant mean, time-invariant variance and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed. The standard Augmented Dickey-Fuller (ADF) unit-root test addresses the potential non-stationary concerns.

The regression to be estimated for the application of the ADF test is specified as:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \Sigma_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t$$

where y_t is a variable at time t, ε_t is the disturbance term that is generated from a white noise process and is assumed to be independently and identically distributed with zero mean and constant variance. Sufficient lags of Δy_t must be included to ensure no autocorrelation in the error term. Hence, the Schwarz Information Criterion (SIC) test is utilised to confirm that autocorrelation is not present. The null hypothesis is that the series has a unit root ($\delta = 0$) meaning that the series is non-stationary against the alternative hypothesis of the series being stationary. If a unit root (non-stationarity) exists, then δ would not be statistically different from zero. If the p-value of the coefficient of y_{t-1} is less than 0.05 at the 5% level of significance, the null hypothesis is rejected indicating that the series is stationary.

To empirically analyse the long-run relationship and dynamic interaction of economic growth with financial development, equation (1) has been estimated by the ARDL cointegration method. The procedure is adopted for four important reasons: (i) The bound test is simple as opposed to other multivariate cointegration techniques such as Johansen cointegration; it allows a cointegrating relationship to be estimated by ordinary least squares (OLS) once the lag order is selected. (ii) The bound test procedure does not require the pre-testing of the variables included in the model for unit root unlike other techniques such as Engle and Granger and Johansen tests which require that all the variables be integrated of the same order I(1). However, the ARDL technique is applicable irrespective of whether the regressor in the model is I(0) or I(1).

(iii) The test is relatively more efficient in small sample data sizes as is the case of this study. (iv) The error correction method integrates the short-run dynamics with long-run equilibrium without losing long-run information.

The unrestricted error correction model of the ARDL model is used to examine the long-run and short-run relationship which takes the following form:

$$\Delta lnGDPpc = \gamma_0 + \gamma_1 lnGDPpc_{t-1} + \gamma_2 lnFD_{t-1} + \gamma_3 lnINF_{t-1} + \gamma_4 lnGEXP_{t-1} + \gamma_5 lnTROP_{t-1} + \sum_{i=1}^{q} \theta_i \Delta lnGDPpc_{t-i} + \sum_{i=1}^{q} \omega_i \Delta lnFD_{t-i} + \sum_{i=1}^{q} \eta_i \Delta lnINF_{t-i} + \sum_{i=1}^{q} \kappa_i \Delta lnGEXP_{t-i} + \sum_{i=1}^{q} \xi_t \Delta lnTROP_{t-i} + \varepsilon_t \quad (4)$$

where Δ is the difference operator and q is the lag length. The first part of equation (4) with δ_2, δ_3, δ_4, and δ_5 refers to the long-run coefficients and the second part with θ, ω, η, κ and ξ refers to the short-run coefficients and ε_t is the error term assumed to be uncorrelated with the independent variables. The null hypothesis of no cointegrating relationship H_0: $\gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$ is tested against the alternative hypothesis H_1: $\gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$ which implies cointegrating relationship.

The ADRL bounds F-test procedure is about imposing restrictions on long-run parameters using the Wald coefficient restrictions check and obtaining the Wald F-statistics. There could be three probable outcomes in relation to cointegration amid the F-statistic is compared against the lower and upper band critical values. When the estimated F-statistic surpasses the upper band critical value, then the null proposition can be rejected. If the expected F-statistic is less than the lower band critical value, then the null hypothesis cannot be rejected. When the estimated F-statistic is in between the lower and upper band critical values, then the outcome is inconclusive. Narayan (2004) proposes critical values for small samples while the critical values of Pesaran, Shin and Smith (2001) are for large samples. Since this paper uses a small sample size, the estimated F-statistics are evaluated against Narayan's critical values to ascertain the long-term relationship between the series.

The first step in the ARDL test is to estimate equation (4) by OLS to test for the existence of a long-run relationship among variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of variables. When cointegration is established, the conditional ARDL long-run model for $LGDPpc_t$ can be estimated as:

$$\Delta lnGDPpc = \gamma_0 + \sum_{i=1}^{q} \gamma_1 lnGDPpc_{t-1} + \sum_{i=1}^{q} \gamma_2 lnFD_{t-1} + \sum_{i=1}^{q} \gamma_3 lnINF_{t-1} + \sum_{i=1}^{q} \gamma_4 lnGEXP_{t-1} + \sum_{i=1}^{q} \gamma_5 lnTROP_{t-1} + \varepsilon_t \quad (5)$$

In the final step, the short-run dynamic parameters are obtained by estimating an error correction model (ECM) with the long-run estimates. The short-run error correction model is used to identify short-run dynamics and to verify the robustness of the estimated long-run coefficients with respect to equation (4). The estimating equation is specified as:

$$\Delta lnGDPpc = \mu_0 + \sum_{i=1}^{q} \theta_i \Delta lnGDPpc_{t-i} + \sum_{i=1}^{q} \omega_i \Delta lnFD_{t-i} + \sum_{i=1}^{q} \eta_i \Delta lnINF_{t-i} + \sum_{i=1}^{q} \kappa_i \Delta lnGEXP_{t-i} + \sum_{i=1}^{q} \xi_t \Delta lnTROP_{t-i} + \tau ECM_{t-1} + \varepsilon_t \quad (6)$$

where θ, ω, η, κ and ξ refer to the short-run dynamic coefficients to equilibrium and τ is the coefficient of speed adjustment. To check the goodness of fit of the ARDL model, diagnostic tests to examine the serial correlation, functional form, normality heteroscedasticity and stability tests are performed.

Empirical Analysis

The PCA has been applied to the raw data to construct the financial development index. The first principal component explains the variation of the dependent variable better than any other linear combination of the indicators used. Therefore, the first principal component is considered an appropriate measure of the characteristics of the financial system as well as financial sector development in each PCA performed. The component scores/loadings indicate the contributions of variables included in the PCA to the standardised variance of the first principal component. These contributions are the weights used to construct the financial index using the aggregation method.

Table 2 presents the components score coefficient matrix. The eigen values indicate that the first principal component explains about 74% of the standardised variance. Hence, the first principal component is the more relevant measure of financial development as it explains the variations of the dependent variable better than the linear combination of other explanatory variables. Therefore, only information related to the first principal component is considered to form the composite indicator. The

Table 2: Components Score Coefficient Matrix

Variable	*Eigen value*	*Component*	*Cumulative %*
lnDCP	9.938	0.462308	0.7420
lnCGE	0.460	0.430950	0.9253
lnPCB	0.266	0.462308	0.9789
lnGDS	0.186	0.404854	0.9992
lnBMS	0.099	0.269501	0.9999
lnSTR	0.033	0.049861	1.0000

factor scores are obtained by the corresponding factor score coefficients using equation (2). Thus, a composite financial development indicator (FDI) is constructed through the PCA method.

Table 3 presents the descriptive statistics of the variables. The average gross domestic product per capita is $1031.79 and the average GEXP is 11.05% of GDP. The average inflation rate is 7.43% and the mean of trade openness is 36.39% of GDP.

Table 3: Descriptive Statistics of Variables

Variable	*Description*	*Mean*	*Median*
GDPpc	Per capita GDP measured at factor cost (2010 U.S dollars) as a proxy for economic growth	1031.789 (402.66)	902.906
FDI	Financial development index constructed over proxy measures for depth, access and efficiency of financial institutions and markets	3.674 (3.710)	3.026
GEXP	General government final consumption expenditure as a share of GDP	11.058 (0.687)	11.084
TROPN	Sum of exports and imports as a share of GDP as a measure of trade openness	36.394 (12.962)	37.910
INF	Inflation measured by the consumer price index	7.434 (3.015)	6.649

Note: Standard deviation in parentheses.

The correlations among the variables of the study are reported in Table 4. The correlation matrix shows that financial development (FDI) and trade openness are strongly and positively correlated with per capita GDP. Trade openness also has a strong positive correlation with economic growth. Both inflation and government expenditure show a weak correlation with financial development and economic growth.

Table 4: Correlation Matrix of Variables

Variable	*FDI*	*GDPpc*	*GEXP*	*INF*	*TROPN*
FDI	1.000	-	-	-	-
GDPpc	0.811	1.000	-	-	-
GEXP	-0.418	-0.324	1.000	-	-
INF	0.219	-0.027	-0.089	1.000	-
TROPN	0.923	0.821	-0.471	0.068	1.000

As a first step in the time series econometric analysis of the relationship between financial development and economic growth, the ADF test is performed. Even though the ARDL model does not necessitate prior checking of the unit root issue, in the empirical analysis it is essential to ascertain that variables do not have a unit root problem and their integration order is not more than one. The ADF unit-root test results presented in Table 5 indicate that the null hypothesis that the series is non-stationary is rejected for FDI, GEXP and INF at levels for GDPpc and TROPN at first difference. At first difference all the variables are stationary. Further, the order of integration of all the variables is not greater than one i.e. I(1), which is important for long-term cointegration analysis.

Table 5: Unit Root Test

Variable	*At levels*		*At first difference*		*Order of intergration*
	Constant	*Constant + trend*	*Constant*	*Constant + trend*	
lnFDI	0.027*	0.810	0.007*	0.017*	I(1)
lnGDPpc	1.855	0.785	0.004*	0.021*	I(1)
lnGEXP	0.115*	0.367	0.719	0.010*	I(1)
lnINF	0.016*	0.077*	0.005*	0.007*	I(1)
lnTROPN	0.414	0.997	0.000*	0.0002*	I(1)

Note: * significant at 1% level.

The result of the estimated bounds F-test is reported in Table 6. For equation (4) when GDP per capita is the dependent variable, the F-statistic of 10.96 is higher than the upper band critical value of 6.200 at 1% significance level. Hence, the null hypothesis of zero cointegration is rejected implying that there is a single cointegration. The bound test evidence confirms the long-run relationship because the calculated F-statistic is greater than the critical values of the upper level of the bound at 1 per cent level of significance. Hence, the series are cointegrated in the long run.

Table 6: Bounds Cointegration Test

Level of significance	*Lower bound*	*Upper bound*	*F-statistic*
1%	4.760	6.200	10.96*
5%	3.470	4.630	

The estimates of the ARDL model of the relationship between per capita GDP and financial development and other control variables are reported in Table 7. Table 7 also presents the results of a number of diagnostics checks conducted to assess the overall reliability of the estimated model. The diagnostic checks indicate that the model does not suffer from severe econometric problems. The ARDL estimates show that nearly 80% of the variation in GDPpc is explained by the chosen independent variables showing the ADRL model to be efficient. The LM test indicates that the serial correlation assumption should be rejected. The Ramsey test check for model specification and normality showed that the specification is correct and the errors are normally distributed. The autoregressive conditional heteroscedasticity (ARCH) test indicates that the regressors are independent and errors are homoscedastic. Thus, the estimated autoregressive distributed lag (ADRL) model is reliable.

Table 7: ARDL Estimates of the Causal Relationship between Financial Development and Economic Growth

Variable	*Estimate*	*Variable*	*Estimate*
lnGDPpc(-1)	2.802** (23.23)	lnINF(-2)	-0.053*** (14.42)
lnGDPpc(-2)	-1.560*** (9.61)	lnINF(-3)	-0.013*** (2.30)
lnGDPpc(-3)	0.165** (2.37)	lnGEXP(-1)	0.179*** (6.57)
lnFDI	0.078*** (17.89)	lnGEXP(-2)	-0.170*** (5.79)
lnFDI(-1)	0.0345*** (9.49)	lnGEXP(-3)	0.227*** (5.79)
lnFDI(-2)	-0.025*** (15.21)	lnTROPN	-0.356*** (18.75)
lnFDI(-3)	0.029*** (8.02)	lnTROPN(-1)	-0.250*** (13.71)
lnINF	-0.095*** (17.50)	lnTROPN(-2)	-0.292*** (21.54)
lnINF(-1)	-0.078*** (14.80)	lnTROPN(-3)	-0.168*** (8.27)
Constant	-1.368*** (8.27)	Functional form	0.020 (0.886)
R-square	0.795	Normality	1.320 (0.517)
DW statistic	1.884	Heteroscedasticity	3.259 (0.071)

Note: Absolute t-values in parentheses. *,** significant at 1, 5% levels.

The ADRL estimates for the long-run dynamic relationship between economic growth and financial development are presented in Table 8. The estimates show that all the variables are as statistically significant. The positive coefficient of FDI implies that a 1% increase in financial development will lead to an increase of about a half point in real GDP per capita in the economy. The negative coefficient of TROPN shows that trade openness decreases real GDP per capita by more than 1%. A negative sign for trade openness against the strategy of export-led growth hypothesis. However, in a developing country like India, which is heavily dependent on raw materials, agricultural exports and capital-intensive imports, open trade may adversely affect economic growth. As expected inflation is negatively related to GDP per capita, a 1% increase in inflation will reduce real GDP per capita by one-third of a point. Similarly, an increase in government expenditure reduces economic growth by one-fourth of a point. Over-public expenditure causes high inflation which in turn may lead to underdeveloped financial systems in a developing country like India thereby reducing economic growth.

Table 8: ADRL Estimates of Long run Dynamic Relationship between Economic Growth and Financial Development

Variable	Estimate
lnFDI	0.492** (2.28)
lnINF	-0.330* (3.25)
lnGEXP	-0.267** (2.27)
lnTROPN	-1.390* (3.83)
Constant	3.359356

Note: Absolute t-values in parentheses. *,** significant at 1, 5% levels.

Table 9 presents the estimated short-run dynamics of the ARDL model. The statistical significance of the error correction term (ECM) implies there exists a long-run causality such that past equilibrium errors play a significant role in determining current outcomes. The negative sign of the ECM coefficient shows the short-run adjustment to shocks towards long-run values. The coefficient of ECM determines the speed of the correction towards the equilibrium relationship. The estimated ECM coefficient of -0.371 shows that any divergence from the long-run relation in the current period should be adjusted by around 37% in the following period, which implies that the speed of adjustment is rather slow. This finding is consistent with the cointegration test results.

Table 9: ADRL Estimates of Short-Run Dynamic Error Correction Model

Variable	*Estimate*
Δ(lnGDPpc(-1))	1.395* (6.55)
Δ(lnGDPpc(-2))	-0.165* (8.34)
Δ(lnFDI)	0.078* (4.83)
Δ(lnFDI(-1))	0.076* (5.17)
Δ(lnFDI(-2))	0.029 (1.43)
Δ(lnINF)	-0.095* (3.64)
Δ(lnINF(-1))	0.039* (6.12)
Δ(lnINF(-2))	-0.013 (1.61)
Δ(lnGEXP)	-0.127* (2.62)
Δ(lnGEXP(-1))	-0.057* (5.20)
Δ(lnGEXP(-2))	-0.227** (1.98)
Δ(lnTROPN)	0.356* (2.80)
Δ(lnTROPN(-1))	0.460 (0.14)
Δ(lnTROPN(-2))	0.168 (1.55)

Variable	*Estimate*
ECM (error correction)	-0.371** (2.48)
Adjusted R-square	0.690
AIC	-5.543
SIC	-4.495
Durbin-Watson statistic	2.066
F-statistic	46.581

Note: Absolute t-values in parentheses. *,** significant at 1,5% levels.

The estimated ARDL results further reveal that the short-run ΔFDI coefficient magnitude is less than that of the long-run. The coefficients of variables TROPN and FD index in the current year are positive indicating that trade openness and financial development have a positive impact on GDP per capita. The coefficients of INF and GEXP are negative reflecting that inflation rate and general government final consumption expenditure have a negative impact on economic growth. The reliability checks validate that the estimated ECM equation does not have serious estimation issues.

Conclusion

There exists a close association between financial development and economic development in an economy. Studies that explore this relationship have employed various measures of financial development indicators. This paper attempts to construct a single financial development index, applying the principal components analysis method over six indicators of the depth, access and efficiency of the financial system in India viz. broad money supply, domestic credit to the private sector by banks, gross domestic savings and credit to government-owned enterprises, all as percentage of GDP, and stock market turnover ratio. The data for the period 2000-2023 are obtained from the World Development Indicators and Global Financial Development Indicators of the World Bank. The dependent variable is economic growth measured as GDP per capita and the independent variable is the financial development index (FDI) along with certain macroeconomic variables inflation (INF), trade openness (TROPN) and general government final consumption expenditure (GEXP). In the empirical estimation, this paper follows the autoregressive distributed lag (ARDL) model, employing a bound testing approach, to cointegration techniques and error correction model (ECM).

The ARDL bounds cointegration test supports the long-run relationship between financial development and economic growth. The estimated effect of financial development on economic growth is significantly positive. In the long run, trade openness has a significant negative impact on economic growth implying that import-led growth is harmful to the Indian economy. The inflation rate and government expenditure also significantly reduce the long-run growth of the economy. The short-run error correction model suggests that financial development has a significantly positive effect but the magnitude of the short-run effect is less than that of the long-run. The coefficients of trade openness in the current year is positive indicating that trade openness and financial development have a positive impact on GDP per capita in the short span. The estimated error correction coefficient (-0.371) indicates that any divergence from the long-run relation in the current period should be adjusted by around 37% in the following period. This indicates a slow pace of adjustment of the Indian economy to shocks. The financial system in India, comprising both the bank-based and market-based indicators of financial development, has played a significant positive role in India's post-independence economic performance. Thus, financial development can promote long-term economic growth even in an environment in which financial activities are highly regulated.

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