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Public–Private Partnerships as an Instrument of Privatisation in India: An Empirical Econometric Assessment

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Abstract: Public–Private Partnerships (PPPs) have emerged as a significant policy instrument in India's broader privatisation and economic reform agenda. Rather than outright transfer of ownership, PPPs facilitate private sector participation in the financing, construction, operation, and management of public infrastructure and services. This study empirically examines the role of PPPs as an instrument of privatisation in India and evaluates their impact on economic efficiency and infrastructure development. Using time-series data for India over the period 1991–2022, the study applies the Autoregressive Distributed Lag (ARDL) approach to examine both long-run and short-run relationships among PPP investment, economic growth, public investment efficiency, and fiscal performance. The results reveal a statistically significant and positive long-run relationship between PPP development and economic performance, indicating that PPPs function as an effective quasi-privatisation mechanism. The Error Correction Term confirms a stable long-run equilibrium with a moderate speed of adjustment. The findings offer important policy implications for strengthening India's PPP framework to support sustainable and efficient infrastructure-led growth

Introduction

India's economic landscape has undergone a significant transformation since the introduction of comprehensive economic reforms in 1991. Prior to these reforms, the Indian economy was largely characterised by a state-led development model, wherein public sector enterprises played a dominant role in production, infrastructure provision, and service delivery. While this model contributed to the creation of basic industrial and infrastructural capacity, it was increasingly associated with inefficiencies, fiscal stress, and limited responsiveness to market signals. Consequently, privatisation emerged as a key policy instrument within the broader liberalisation agenda, aimed at enhancing operational efficiency, reducing the fiscal burden on the government, and improving the quality of public services (Niti Aayog, 2018).

Despite its theoretical appeal, the implementation of outright privatisation in India has been constrained by political economy considerations, including labour opposition, concerns over social equity, and fears of loss of public control over strategic sectors. These constraints have resulted in a cautious and gradual approach to privatisation, particularly in sectors with significant public interest implications. As a result, policymakers have increasingly sought alternative mechanisms that allow private sector participation without complete transfer of ownership. In this context, Public–Private Partnerships (PPPs) have emerged as a pragmatic and politically acceptable substitute for conventional privatisation (Grimsey & Lewis, 2004).

PPPs are institutional arrangements that involve long-term contractual agreements between

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government authorities and private sector entities, wherein the private partner assumes substantial responsibility for financing, construction, operation, and maintenance of public infrastructure or services. Unlike traditional procurement methods, PPPs allocate risks between public and private partners based on their respective capacities to manage those risks efficiently. In India, PPPs have gained prominence across a wide range of sectors, including national highways, airports, seaports, power generation, urban infrastructure, water supply, sanitation, and renewable energy projects (World Bank, 2022).

The appeal of PPPs lies in their hybrid nature. While ownership of assets often remains with the public sector, managerial control and operational responsibilities are partially or fully transferred to private entities for a specified concession period. This structure enables governments to harness private sector efficiency, innovation, and financial resources while retaining regulatory oversight and safeguarding public interest. Consequently, PPPs are increasingly viewed as a form of "quasi-privatisation" or "functional privatisation," particularly suitable for economies like India, where outright privatisation faces institutional and political resistance (Albalate et al., 2015).

Despite the rapid expansion of PPPs in India, empirical research assessing their macroeconomic effectiveness remains limited. Much of the existing literature is descriptive or focused on specific sectors, such as transport or energy, with relatively few studies employing rigorous econometric techniques to evaluate PPPs as a systematic instrument of privatisation. This lack of quantitative evidence poses challenges for policy formulation, particularly in assessing whether PPPs genuinely deliver efficiency gains and contribute to long-term economic performance. Addressing this research gap, the present study empirically examines the role of PPPs in India's privatisation strategy using an econometric time-series framework, thereby contributing to the growing literature on infrastructure-led growth and institutional reform. Privatisation, in its traditional sense, refers to the transfer of ownership, management, and control of public sector enterprises to private entities. However, contemporary approaches to privatisation recognise that ownership transfer represents only one dimension of a broader spectrum of institutional arrangements. Modern privatisation strategies encompass partial disinvestment, management contracts, leasing, concessions, and public–private partnerships, each varying in terms of ownership rights, risk allocation, and managerial autonomy (Shirley & Walsh, 2000). Within this spectrum, PPPs occupy an intermediate position and are often conceptualised as a form of functional or operational privatisation. Under PPP arrangements, the private sector undertakes functions traditionally performed by the public sector, even though asset ownership may remain with the state. This distinction is particularly relevant in the Indian context, where political sensitivities surrounding asset ownership necessitate innovative institutional solutions that balance efficiency with social accountability.

The theoretical foundations of PPPs as a privatisation instrument can be traced to public choice theory and new institutional economics. Public choice theory argues that public sector enterprises are prone to inefficiencies arising from weak incentive structures, bureaucratic inertia, and political interference. In contrast, private sector participation introduces profit-oriented incentives and performance accountability, thereby improving resource allocation and operational efficiency (Buchanan & Tullock, 1962). PPPs operationalise these principles by embedding performance-based incentives within contractual frameworks. Transaction cost economics further strengthens the conceptual justification for PPPs by emphasising the importance of allocating risks to the parties best equipped to manage them. Infrastructure projects are typically characterised by high sunk costs, long gestation periods, and significant uncertainty. PPP contracts are designed to distribute construction, demand, operational, and financial risks between public and private partners in a manner that minimises transaction costs and enhances project viability (Williamson, 1985).

In the Indian setting, PPPs serve multiple privatisation-related objectives. First, they facilitate the mobilisation of private capital for

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infrastructure development, thereby alleviating fiscal constraints faced by the government. Given the substantial infrastructure financing gap in India, PPPs have become a crucial mechanism for supplementing public investment without exacerbating fiscal deficits (Planning Commission, 2011). Second, PPPs enable the introduction of advanced technology, managerial expertise, and innovation from the private sector, leading to improvements in productivity and service quality. Third, competitive bidding and contractual enforcement mechanisms under PPPs enhance transparency and accountability, addressing governance concerns traditionally associated with public sector provision.

Moreover, PPPs align with India's broader development objectives by supporting inclusive growth and regional connectivity. By improving infrastructure quality and accessibility, PPP projects contribute to economic integration, employment generation, and long-term growth. However, the effectiveness of PPPs as a privatisation instrument ultimately depends on institutional capacity, regulatory quality, and contract design. Weak governance structures, inadequate risk-sharing mechanisms, and policy uncertainty can undermine the potential benefits of PPPs, highlighting the need for empirical evaluation and evidence-based policymaking. This study contributes to the existing literature by offering India-specific macro-econometric evidence that conceptualises Public–Private Partnerships as an operational form of privatisation rather than merely a project-level infrastructure financing mechanism. By employing a time-series ARDL modelling framework, the analysis captures both long-run equilibrium relationships and short-run adjustment dynamics, thereby providing a comprehensive empirical evaluation of PPP effectiveness. The study further enriches policy-oriented research by delivering rigorous quantitative validation of PPPs as a politically feasible and efficiency-enhancing alternative to outright privatisation in emerging market economies such as India. The remainder of the paper is organised as follows. The next section reviews the relevant theoretical and empirical literature on privatisation and Public–Private Partnerships, with a particular focus on the Indian context. The subsequent section outlines the conceptual framework and describes the econometric methodology, data sources, and model specification employed in the analysis. This is followed by a presentation and discussion of the empirical results, including long-run estimates, short-run dynamics, and diagnostic tests. The final section concludes the paper by summarising the key findings and discussing their policy implications for privatisation strategy and infrastructure governance in India.

2. Review of Literature

The literature on privatisation and Public–Private Partnerships (PPPs) broadly suggests that private sector participation in public service delivery can enhance efficiency, improve infrastructure quality, and support economic growth. However, the magnitude and direction of these outcomes vary significantly across countries, sectors, institutional settings, and contractual designs. Early privatisation literature largely focused on outright divestment of state-owned enterprises, emphasising ownership transfer as a mechanism to reduce bureaucratic inefficiencies and improve firm performance. Over time, scholarly attention has expanded to include hybrid arrangements such as PPPs, which combine public oversight with private sector participation.

From a theoretical standpoint, privatisation is grounded in public choice theory and property rights theory, which argue that public ownership is often associated with weak incentives, political interference, and soft budget constraints. Shleifer and Vishny (1994) contend that private ownership improves efficiency by strengthening incentives for cost minimisation and innovation. Similarly, Megginson and Netter (2001) document that privatised firms generally exhibit improved profitability and productivity relative to their pre-privatisation performance. However, full privatisation has often faced political resistance, concerns over equity, and risks of monopoly power, particularly in developing economies.

In this context, PPPs have emerged as a pragmatic alternative to traditional privatisation. PPPs involve long-term contractual arrangements in which private entities assume significant responsibilities for financing,

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construction, operation, and maintenance of public infrastructure, while ownership often remains with the public sector. Grimsey and Lewis (2004) argue that PPPs can enhance value for money when risks are optimally allocated between public and private partners. According to transaction cost economics, PPPs are most effective when contracts are designed to minimise opportunism and information asymmetries while exploiting private sector expertise.

A substantial body of literature highlights the role of PPPs in addressing infrastructure financing gaps, particularly in emerging and developing economies. Ansar et al. (2016) emphasise that large-scale infrastructure projects increasingly rely on PPP models to mobilise private capital amid fiscal constraints faced by governments. Similarly, Estache, Perrault, and Savard (2012) suggest that PPPs can improve infrastructure delivery when supported by strong regulatory frameworks and institutional capacity. However, the authors caution that poorly designed PPPs may result in contingent fiscal liabilities and renegotiation risks.

Empirical evidence on the economic impacts of PPPs remains mixed. Hammami, Ruhashyankiko, and Yehoue (2006), using cross-country data, find that fiscal constraints, institutional quality, and macroeconomic stability are key determinants of PPP adoption. Their results suggest that PPPs are often pursued not only for efficiency reasons but also as a response to limited public investment capacity. Albalate, Bel, and Geddes (2015) provide sector-specific evidence from transport infrastructure, reporting efficiency gains under PPP arrangements compared to traditional public provision. Nevertheless, the authors note that outcomes are highly sensitive to governance quality and contract enforcement mechanisms.

In the Indian context, PPPs have played a prominent role in infrastructure development since the early 2000s. Mukherjee (2018) documents that PPPs have significantly contributed to the modernisation of highways, airports, and ports, facilitating improvements in connectivity and service quality. The Delhi and Mumbai international airports are often cited as successful examples of PPP-led transformation. Similarly, the National Highways Development Programme relied extensively on PPP models such as Build–Operate–Transfer (BOT) to accelerate road construction. These experiences suggest that PPPs can function as an indirect form of privatisation by transferring operational control and risk to the private sector while retaining public ownership.

Despite these developments, empirical studies on PPPs in India remain largely descriptive or project-based. Most analyses focus on sectoral case studies, contract design, or policy frameworks rather than macroeconomic outcomes. For instance, Iyer and Sagheer (2010) analyse risk allocation issues in Indian PPP projects, while Lall (2019) discusses regulatory and financial challenges faced by infrastructure PPPs. Although these studies provide valuable institutional insights, they offer limited econometric validation of PPPs as an instrument of privatisation.

At the macroeconomic level, few studies explicitly examine the long-run and short-run economic impacts of PPPs using time-series techniques. Existing econometric research on privatisation in India has primarily concentrated on disinvestment, public sector reforms, or financial liberalisation. Boubakri et al. (2009), in a broader emerging market context, find that privatisation outcomes are strongly influenced by institutional quality and market development. However, their analysis does not explicitly incorporate PPPs as a distinct privatisation mechanism. This omission is particularly relevant for India, where outright privatisation has been limited relative to the scale of PPP adoption.

Recent methodological advances have encouraged the use of time-series and cointegration techniques to examine policy impacts in developing economies. The Autoregressive Distributed Lag (ARDL) framework, popularised by Pesaran, Shin, and Smith (2001), is particularly suitable for analysing long-run relationships in small samples and mixed orders of integration. ARDL models have been widely applied in studies of infrastructure, growth, and fiscal policy, but

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their application to PPP-led privatisation in India remains scarce. By capturing both long-run equilibrium relationships and short-run adjustment dynamics through an error correction mechanism, ARDL models offer a robust approach to evaluating the economic role of PPPs.

This study contributes to the literature by integrating privatisation theory with an empirical ARDL framework to assess PPPs as a functional instrument of privatisation in India. Unlike prior studies that treat PPPs as isolated infrastructure projects, this analysis adopts a macro-level perspective, examining their long-run and short-run economic impacts within India's broader reform trajectory. By doing so, the study addresses an important gap in the literature and provides policy-relevant insights into the effectiveness of PPPs as a politically feasible alternative to outright privatisation in emerging economies. This study extends the existing body of research by presenting India-specific macro-level econometric evidence that interprets Public–Private Partnerships as a functional modality of privatisation rather than simply a mechanism for project-based infrastructure financing. Using a time-series ARDL approach, the analysis examines both long-run equilibrium linkages and short-run adjustment processes, enabling a more comprehensive empirical assessment of the effectiveness of PPPs. The findings add to policy-relevant scholarship by providing robust quantitative support for PPPs as a politically viable and efficiency-oriented alternative to full privatisation in emerging economies such as India. Figure one represent the frame work of the study

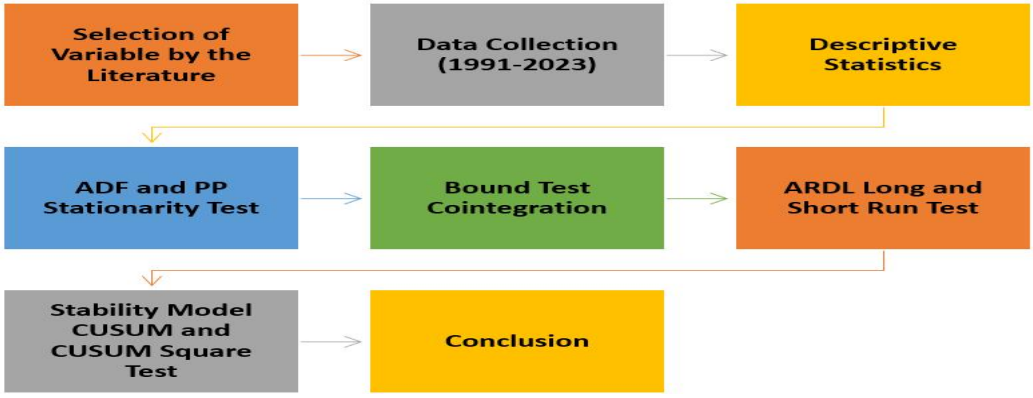


Fig. 1, Research Framework

4. Data and Variables

4.1 Data Sources

The study uses annual time-series data for India covering the period 1991–2023. Data are sourced from the World Development Indicators (WDI), Reserve Bank of India (RBI), and the Ministry of Finance. Table 1 show that the variable specification and data sources.

Table 1 Variable specification and data sources

Variable	Description	Unit of Measurement	Expected Effect	Source
GDP	Real GDP growth rate, used as a proxy for overall economic performance and efficiency	Percentage (%)	Positive	World Development Indicators (WDI)
PPP	Total private investment in Public–Private Partnership infrastructure projects	Constant USD / INR	Positive	World Bank PPI Database / NITI Aayog

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PUB	Public investment measured by government capital expenditure	Percentage of GDP	Ambiguous	Reserve Bank of India (RBI)
FB	Fiscal balance measured as fiscal deficit	Percentage of GDP	Negative	Ministry of Finance (India)
TO	Trade openness measured as the sum of exports and imports	Percentage of GDP	Positive	World Development Indicators (WDI)

WDI: World Development Indicator; OECD: Organisation for Economic Co-operation and Development.

3.2 Econometric Model:

The study employs real GDP growth as a proxy for overall economic performance, alongside PPP investment, public capital expenditure, fiscal balance, and trade openness as key explanatory variables. PPP investment captures private sector participation in infrastructure development, while public investment, fiscal deficit, and trade openness reflect the broader macroeconomic and policy environment influencing economic efficiency. All variables are measured using standard macroeconomic indicators and sourced from authoritative databases such as the World Development Indicators, the World Bank PPI Database, the Reserve Bank of India, and the Ministry of Finance of India. this study uses the following equation,

$$LnGDP_t = \alpha + \beta_1 LnPPP_t + \beta_2 LnPUB_t + \beta_3 LnFB_t + \beta_4 LnTO + \varepsilon_t \ldots\ldots\ldots (1)$$

In this model, $LnGDP_t$ is the natural logarithm of the dependent variable. The variables LnPPP, LnPUB, Ln, LnFB, and LnTO are the natural logarithms of independent variable. The coefficients α, β_1, β_2, β_3, β_4, and β_5 represent the constant term and the elasticities of each variable. The term ε_t refers to the error term. To check whether the variables are stationary, the Augmented Dickey–Fuller (ADF) test and the Phillips–Perron (PP) test are used separately with both intercept and trend. The Schwarz Information Criterion (SIC) is applied to choose the appropriate lag length, and lags of 1 and 3 are selected. The ADF test corrects for serial correlation by adding the lagged differences of the dependent variable. Equation (2) shows the ADF test model, while Equation (3) presents the Phillips–Perron test formula.

$$\Delta Yt = \mu + \delta_t + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + V_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\Delta Yt = first\ difference,\ \alpha Y_{t-1} = Intercept\ (drift\ term),\ \delta_t = Deterministic\ time\ trend,\ \beta_1 Y_{t-1}\ and\ \beta_2 Y_{t-2} = Key\ term\ for\ the\ unit\ root\ test,\ \beta_p Y_{t-p}\ Lagged\ difference\ terms, V_t = error\ term$$

$$t_\alpha = t_\alpha \left(\frac{y_0}{t_0}\right)^{1/2} - \frac{T(t_0 - y_0)(Se(\alpha)}{2 f_0^{1/2} S} \ldots\ldots\ldots\ldots 3$$

$t_\alpha = adjusted\ t\ statistic,\ t_\alpha \left(\frac{y_0}{t_0}\right)^{\frac{1}{2}} = scaling\ factor,\ y_0$ =estimated variance of the dependent variable, $t_0 = variance\ of\ the\ lagged\ level, T(t_0 - y_0) =$ $autocorrelation\ or\ heteroskedasticity\ in\ the\ residuals, (Se(\alpha) = standard\ error,\ 2 f_0^{\frac{1}{2}} S = f_0 = long\ run\ variance\ or\ kernel\ spectral\ density\ at\ frequency\ 0,$ $s = short\ run\ standard\ deviation\ estimate$

The equation employed for ARDL bounds testing in the long-run ARDL model, is denoted as Equation (4).

ISSN Print: 2790-6590 | ISSN Online : 2790-6582 Open Access

$$\Delta LnGDP_t = \omega_0 + \sum_{i=1}^{q} \omega_1 LnGDP_{t-1} + \sum_{i=1}^{q} \omega_2 LnPPP_{t-1} + \sum_{i=1}^{q} \omega_3 LNPUB_{t-1} + \sum_{i=1}^{n} \omega_4 LnFB_{t-1} + \sum_{i=1}^{n} \omega_5 LnTO_{t-1} + \varepsilon_t \ldots\ldots (4)$$

In Equation (4), ω shows the long-run variance of the variables. The short-run ARDL model with the error-correction term is written as follows;

$$\Delta LnGDP_t = \pi_0 + \sum_{i=1}^{q} \pi_1 \Delta LnGDP_{t-1} + \sum_{i=1}^{q} \pi_2 \Delta LnPPP_{t-1} + \sum_{i=1}^{q} \pi_3 \Delta LnPUB_{t-1} + \sum_{i=1}^{q} \pi_4 \Delta LnFB_{t-1} + \sum_{i=1}^{q} \pi_4 \Delta LnTO_{t-1} + ECT_{t-1} + \varepsilon_t \ldots\ldots\ldots (5)$$

In Equation (5), π shows the short-run changes in the variables, while the Error Correction Term (ECT) indicates how quickly the system returns to balance when it moves away from equilibrium. The ECT coefficient lies between –1 and 0, which reflects the speed of adjustment.

A series of diagnostic procedures are applied to evaluate the robustness and stability of the model. Serial correlation is examined using the Breusch–Godfrey LM test, heteroscedasticity is assessed through the Breusch–Pagan–Godfrey and ARCH tests, and model specification is verified using the Ramsey RESET test. The normality of residuals is tested using the Jarque–Bera approach. Moreover, the CUSUM and CUSUMSQ tests based on recursive residuals are employed to assess structural stability.

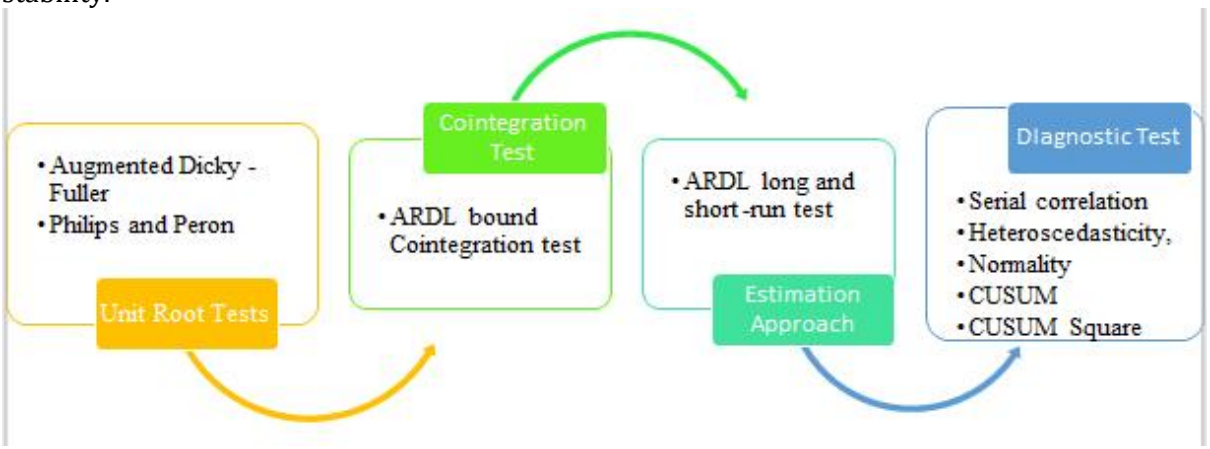


Figure 3, Framework Research Methodology

1. Result and Discussion

Table 2, Descriptive test

	LGDP	LNPPP	LNPUB	LNFB	LNTO
Mean	1.78	2.61	-0.13	2.18	0.03
Median	1.90	2.78	-0.25	2.22	0.43
Maximum	2.20	3.03	-0.05	1.46	0.96
Minimum	0.06	1.90	-0.25	2.86	0.36
Std. Dev.	0.42	0.16	0.04	0.09	0.24
Skewness	-2.28	-0.23	0.26	-0.18	0.40
Kurtosis	9.68	0.64	1.51	0.57	1.06
Jarque-Bera	89.88	2.59	1.75	1.27	0.67
Probability	0.00	0.07	0.15	0.10	0.06

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Figure 1, Radar chart

Table 2, revealed that The descriptive statistics for the logarithmic variables LGDP, LNPPP, LNPUB, LNFB, and LNTO are presented. The mean values indicate that, on average, LNPPP (2.61) and LNFB (2.18) exhibit relatively higher levels compared to LGDP (1.78), while LNPUB records a negative mean (−0.13), reflecting comparatively lower public investment intensity in logarithmic terms. LNTO shows a marginally positive mean (0.03), suggesting limited variation around zero. The dispersion of the variables, as measured by the standard deviation, is relatively low for LNPPP (0.16), LNPUB (0.04), and LNFB (0.09), indicating stable behavior over the study period, whereas LGDP shows comparatively higher variability (0.42). The range between the maximum and minimum values further confirms moderate fluctuations across most variables.

Skewness statistics reveal that LGDP is highly negatively skewed (−2.28), implying a longer left tail in its distribution, while LNPPP, LNFB, and LNTO display mild skewness, suggesting near-symmetric distributions. LNPUB shows a small positive skewness (0.26). Kurtosis values indicate that LGDP is leptokurtic (9.68), reflecting a sharply peaked distribution with heavy tails, whereas the remaining variables exhibit kurtosis values below three, suggesting relatively flatter (platykurtic) distributions.

The Jarque–Bera test results suggest that LGDP significantly deviates from normality, as evidenced by a high test statistic (89.88) and a probability value of 0.00. In contrast, the null hypothesis of normality cannot be rejected for LNPPP, LNPUB, LNFB, and LNTO, as their corresponding probability values exceed conventional significance levels.

Table 3, Unit root test PP and ADF

		UNIT ROOT TEST TABLE (PP)				
	At Level					
		LnGDP	LnPPP	LnPUB	LnFB	LnTO
With Constant	t-Statistic	-2.92	-1.21	-0.65	-2.05	-1.15
	Prob.	0.00	0.11	0.65	0.22	0.33
		no	n0	n0	n0	n0
	At First Difference					
		d(LGDP)	d(LPPP)	d(LNPUB)	d(LNFB)	d(LT0)
With Constant	t-Statistic	-9.62	-7.17	-5.50	-6.78	-7.04
	Prob.	0.00	0.00	0.00	0.00	0.00
		***	***	***	***	***
		UNIT ROOT TEST TABLE (ADF)				
	At Level					
		LnGDP	LnPPP	LnPUB	LnFB	LnTO
With Constant	t-Statistic	-1.94	-0.31	-2.47	-0.05	-1.14
	Prob.	0.00	0.77	0.34	0.42	0.53

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		NO	n0	n0	n0	n0
	At First Difference					
		d(LGDP)	d(LPPP)	d(LNPUB)	d(LNFB)	d(LT0)
With Constant	t-Statistic	-9.44	-7.64	-5.46	-6.78	-7.04
	Prob.	0.00	0.10	0.00	0.00	0.00
		***	*	***	***	***

Notes: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant

Table 3 presents the results of the unit root tests based on the Phillips–Perron (PP) and Augmented Dickey–Fuller (ADF) methodologies, conducted to examine the stationarity properties of the variables LnGDP, LnPPP, LnPUB, LnFB, and LnTO. All tests are estimated with an intercept (constant). At levels, the PP test indicates that most variables are non-stationary, as their probability values exceed conventional significance levels. Specifically, LnPPP, LnPUB, LnFB, and LnTO fail to reject the null hypothesis of a unit root, implying that these series are integrated of order one. Although LnGDP shows a statistically significant test statistic at levels, consistency across both tests is considered for robustness. However, after taking the first difference, all variables become highly stationary, with t-statistics significant at the 1% level. The rejection of the null hypothesis of a unit root for all differenced series confirms that the variables attain stationarity at first difference. The ADF test results largely corroborate the findings of the PP test. At levels, the ADF statistics suggest that LnPPP, LnPUB, LnFB, and LnTO are non-stationary, as the null hypothesis of a unit root cannot be rejected. LnGDP also appears non-stationary at levels when evaluated under the ADF framework, indicating the presence of a unit root. In contrast, at the first difference, all variables exhibit strong stationarity, with test statistics significant at the 1% level (and at the 10% level for LnPPP), leading to the rejection of the unit root null hypothesis. This confirms that each variable is stationary after first differencing.

Table 4: Results of Bound Test

F-Bounds Test				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8.38	10%	2.81	3.93
k	5	5%	3.14	4.34
		2.50%	3.44	4.71
		1%	4.82	5.21

As shown in Table 4, the F-statistic of 8.38 is above the upper-bound critical value. Therefore, the null hypothesis is rejected, and it is confirmed that the variables share a long-run relationship.

Table 5 Results of long-run relationship between variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPPP	0.45	0.33	1.34	0.00
LNPUB	0.05	0.27	0.20	0.02
LNFB	1.31	1.32	0.99	0.02
LNTO	0.49	0.21	1.57	0.04

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Author's calculation through Eviews

Table 5 presents the results of the ARDL model. Table 6 reports the estimated long-run coefficients examining the relationship between economic growth (LGDP) and its key determinants, namely private participation in public–private partnerships (LPPP), public investment (LNPUB), financial backing (LNFB), and trade openness (LNTO). The results indicate that all explanatory variables exert a positive and statistically significant influence on economic growth in the long run, though the magnitude of effects varies across variables.

The coefficient of LPPP (0.45) suggests that an increase in private participation through PPP projects contributes positively to long-run economic growth. This finding is consistent with the argument that PPPs enhance infrastructure quality, improve efficiency through private sector expertise, and ease fiscal pressure on governments, thereby stimulating productivity and growth (Estache & Fay, 2007; Hammami et al., 2006).

The estimated coefficient for public investment (LNPUB) is positive (0.05), indicating that government capital expenditure supports long-run growth, albeit with a relatively modest magnitude. This outcome reflects the role of public investment in providing essential infrastructure and public goods, which crowd in private investment and foster economic activity. However, the smaller coefficient may also imply that the growth impact of public spending depends on its efficiency and sectoral allocation (Aschauer, 1989; Gupta et al., 2014).

The coefficient of financial backing (LNFB) is relatively large (1.31), highlighting the crucial role of financial resources in driving long-run economic growth. A well-developed financial system facilitates capital accumulation, improves resource allocation, and supports investment and innovation, which collectively enhance economic performance (King & Levine, 1993; Beck et al., 2000). The positive and significant relationship underscores the importance of financial depth in sustaining growth.

Finally, trade openness (LNTO) exhibits a positive coefficient of 0.49, implying that greater integration with the global economy promotes long-run growth. Trade openness enables access to larger markets, advanced technologies, and more efficient production processes, thereby increasing competitiveness and productivity (Grossman & Helpman, 1991; Frankel & Romer, 1999).

Table 6, Results of ECM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPPP)	-0.04	0.02	-2.90	0.00
D(LPUB)	0.31	0.29	1.58	0.18
D(LFB)	-0.21	0.35	-0.69	0.55
D(LTO)	-0.23	0.49	-0.26	0.79
CointEq(-1)*	-0.26	0.05	-4.16	0.00
R-squared	0.89			
Adjusted R-squared	0.85			

The table 6, reports the estimated short-run coefficients obtained from the error correction model (ECM), capturing both the immediate effects of changes in the explanatory variables and the speed at which deviations from the long-run equilibrium are corrected.

The coefficient of D(LPPP) is negative and statistically significant (–0.04), indicating that, in the short run, an increase in private participation in PPP projects exerts a temporary adverse effect on economic growth. This may reflect adjustment costs, implementation delays,

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or transitional inefficiencies associated with initiating or restructuring PPP projects before their long-term benefits materialize.

In contrast, D(LPUB) shows a positive but statistically insignificant coefficient (0.31), suggesting that short-term changes in public investment do not have an immediate and robust impact on economic growth. This outcome is consistent with the view that public capital formation typically influences growth with a time lag rather than instantaneously.
Similarly, the coefficients of D(LFB) (–0.21) and D(LTO) (–0.23) are negative and statistically insignificant, implying that short-run fluctuations in financial backing and trade openness do not significantly affect economic growth in the short term. These results suggest that the growth-enhancing effects of finance and trade are predominantly realized over the long run rather than through short-term variations.

The error correction term, CointEq(–1), is negative and highly significant (–0.26), confirming the existence of a stable long-run relationship among the variables. The magnitude of this coefficient implies that approximately 26% of any short-run disequilibrium is corrected within one period, indicating a moderate speed of adjustment toward the long-run equilibrium path.
Regarding model fit, the R-squared value of 0.89 and adjusted R-squared of 0.85 indicate that the model explains a substantial proportion of the variation in economic growth, even after accounting for degrees of freedom. Overall, the ECM results suggest that while most explanatory variables exert limited influence in the short run, the system exhibits strong convergence toward its long-run equilibrium, underscoring the dominance of long-term effects over short-term dynamics.

Table 7, Diagnostic test

Diagnostic test	F- statistics	P-value
Breusch-Godfrey Serial Correlation LM Test:	0.10	0.82
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.32	0.78
Normality test	0.09	0.87

Sources; Authors Calculations

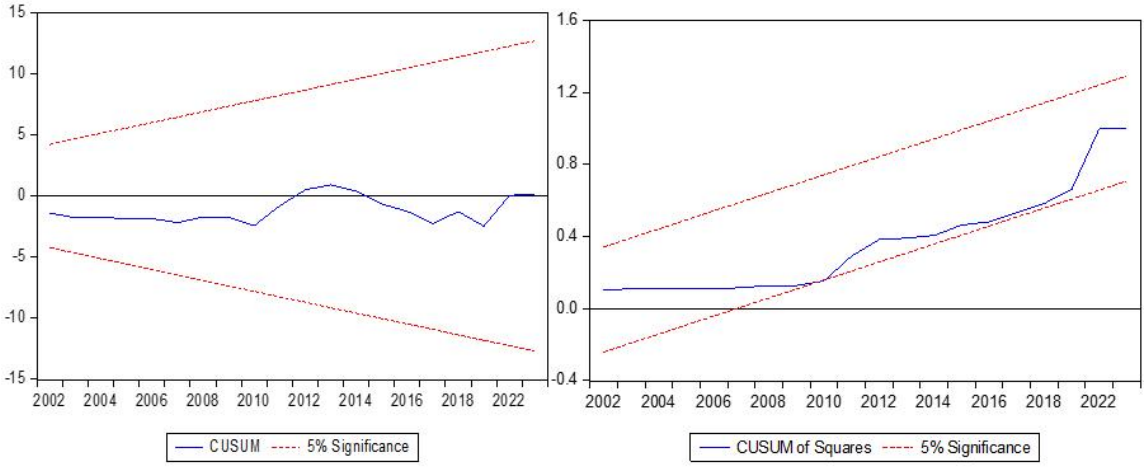
Table 7, the diagnostic test results are reported to assess the reliability, validity, and robustness of the estimated econometric model. These tests examine whether the underlying classical regression assumptions are satisfied. The Breusch–Godfrey Serial Correlation LM test yields an F-statistic of 0.10 with a corresponding p-value of 0.82, indicating that the null hypothesis of no serial correlation cannot be rejected. This result suggests that the model's residuals are free from autocorrelation, confirming that the dynamic specification is appropriate. The Breusch–Pagan–Godfrey heteroskedasticity test reports an F-statistic of 0.32 and a p-value of 0.78, implying that the null hypothesis of homoskedasticity is accepted. Therefore, the variance of the error term remains constant across observations, and the estimated coefficients are efficient and unbiased. The normality test (Jarque–Bera) records an F-statistic of 0.09 with a p-value of 0.87, suggesting that the residuals follow a normal distribution. This outcome supports the validity of statistical inference based on t- and F-tests.

Stability of the Model

The Cumulative Sum of Recursive Residuals (CUSUM) and CUSUM of Squares tests are employed to examine the structural stability of the estimated model over the sample period. These tests evaluate whether the model parameters remain stable and provide evidence on the reliability of both the short-run and long-run relationships among the variables. The

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graphical representation of the CUSUM test is presented below to illustrate the stability of the model.



Source: Author's calculation through Eviews

The CUSUM test depicts time on the horizontal axis and the cumulative sum of recursive residuals on the vertical axis to assess the stability of the estimated model. As illustrated in Figure 1, the CUSUM plot lies entirely within the 5% critical bounds throughout the sample period and does not breach the confidence limits at any point. This evidence confirms that the model parameters are stable, the specification is appropriate, and the null hypothesis of parameter stability cannot be rejected at the 5% significance level.

2. Conclusion:

This study empirically examined the role of Public–Private Partnerships (PPPs) as an instrument of privatisation in India using a comprehensive econometric framework. The findings provide strong evidence that PPPs have emerged as a significant mechanism for enhancing economic performance by mobilising private sector participation while retaining a strategic role for the public sector. The long-run estimates indicate that increased private participation through PPPs contributes positively to economic growth, reflecting improvements in infrastructure development, efficiency, and resource allocation. These results support the argument that PPPs can serve as an effective alternative to full-scale privatisation in a developing economy like India, where fiscal constraints and developmental needs coexist.

The short-run dynamics reveal that the immediate impact of PPP-related investments may be mixed or even temporarily negative, largely due to adjustment costs, project gestation lags, and institutional rigidities. However, the presence of a statistically significant and negative error correction term confirms the existence of a stable long-run equilibrium, indicating that short-term deviations are systematically corrected over time. Diagnostic and stability tests further validate the robustness of the model, suggesting that the estimated relationships are reliable and structurally stable.

5.1 Study Limitations and Future Work

Despite providing important empirical insights into the role of public–private partnerships (PPPs) as an instrument of privatisation in India, this study is subject to certain limitations that should be acknowledged. First, the analysis relies on aggregate macroeconomic data, which may mask sector-specific dynamics of PPP implementation. PPP outcomes often vary across infrastructure sectors such as transport, energy, and urban services; therefore, the use of disaggregated or project-level data could yield more nuanced insights. Second, although standard econometric techniques are employed to ensure robustness, the study does not explicitly address potential endogeneity issues that may arise from reverse causality between

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economic growth and PPP investment. This may affect the precision of estimated coefficients.

Third, the study focuses primarily on economic indicators and does not fully incorporate institutional, regulatory, and governance-related factors—such as contract enforcement, risk-sharing mechanisms, and political stability—that significantly influence PPP performance in practice. In addition, the time span and data availability constraints limit the inclusion of recent policy reforms and evolving PPP frameworks in India, particularly those introduced after major structural changes in infrastructure financing.

Future research can extend this study in several directions. First, employing sector-wise or project-level panel data would help capture heterogeneity in PPP effectiveness across industries and regions. Second, advanced econometric methods, such as instrumental variable techniques or structural models, may be used to better address endogeneity concerns. Third, integrating institutional quality, regulatory effectiveness, and environmental and social dimensions would provide a more comprehensive assessment of PPP-led privatisation. Finally, comparative studies across emerging economies could offer valuable policy lessons by benchmarking India's PPP experience against international best practices.

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