The Dynamics of Public Investment in Driving Growth and Employment: Evidence from India

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Abstract: This study examines the determinants of unemployment in India within a macroeconomic framework that incorporates government expenditure (capital and recurrent), real GDP growth, private investment, and gross capital formation. Utilizing annual data spanning the period 1990–91 to 2023–24, the analysis employs descriptive statistics, stationarity testing, cointegration techniques, and regression modelling to investigate both the short-run and long-run dynamics of unemployment.

The descriptive statistics reveal notable volatility in unemployment compared to the relative stability of capital expenditure, highlighting distinct behavioural patterns across the variables. The Augmented Dickey-Fuller (ADF) test confirms that all variables are integrated of order one, and subsequent residual-based cointegration analysis establishes the existence of a long-term equilibrium relationship among them. Diagnostic checks further validate the robustness of the model, with no evidence of autocorrelation or heteroscedasticity.

The long-run regression results indicate that real GDP growth, capital expenditure, private investment, and gross capital formation exert significant negative effects on unemployment, while recurring expenditure is statistically insignificant. Short-run analysis demonstrates that GDP growth, capital expenditure, and capital formation continue to play critical roles in reducing unemployment, though private investment and recurrent expenditure show no significant short-run effects. The error correction term suggests that approximately 20% of short-run disequilibrium adjusts to the long-run equilibrium within a single period.

The findings underscore the policy relevance of investment-driven growth strategies for reducing unemployment in India. By prioritizing capital expenditure, enhancing gross capital formation, and strengthening private sector participation, policymakers can foster sustainable employment generation. Conversely, reliance on recurrent expenditure alone does not address structural unemployment challenges.

Keywords: Unemployment, Capital Expenditure, Recurring Expenditure, Real GDP Growth, Private Investment, Gross Capital Formation, Cointegration, Time-Series Analysis, India.

1. INTRODUCTION

Unemployment remains one of the most enduring socio-economic challenges faced by developing economies, with profound implications for income distribution, poverty alleviation, and the sustainability of long-term growth. In the case of India, a nation characterized by rapid demographic expansion and a youthful labour force, the inability of the economy to generate adequate employment opportunities poses a dual threat to both developmental progress and social cohesion. The issue extends beyond the labor market in a narrow sense, as unemployment reflects deeper macroeconomic dynamics associated with fiscal policy orientation, investment structures, and growth trajectories.

The theoretical literature underscores several pathways through which macroeconomic factors shape unemployment. Okun's Law establishes an inverse relationship between real GDP growth and unemployment, thereby highlighting output expansion as a critical determinant of labour absorption. Complementarily, fiscal policy—in particular, the allocation between capital and recurrent expenditure—serves as a central mechanism influencing employment. Capital expenditure, directed toward infrastructure, industrial capacity, and productive assets, has been widely recognized for its job-creating potential, whereas recurrent expenditure sustains administrative and consumption-related functions without significantly augmenting productive capacity. In addition, private investment and gross capital formation are crucial drivers of labour demand, reflecting the intertwined processes of capital accumulation, entrepreneurship, and productivity growth.

Notwithstanding these theoretical insights, the Indian experience presents a paradoxical trajectory: high GDP growth has not always translated into proportional employment generation, a phenomenon often described as "jobless growth." This disconnect raises critical questions regarding the structural effectiveness of fiscal and investment strategies in addressing unemployment. While past studies have examined the growth–employment nexus or the role of government expenditure in shaping labour markets, there is a lack of integrated empirical analysis that simultaneously accounts for the combined effects of capital expenditure, recurrent expenditure, private

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investment, gross capital formation, and real GDP growth within a unified econometric framework.

This study addresses this gap by investigating the dynamic relationships between unemployment and selected macroeconomic determinants in India over the period 1990–91 to 2023–24. Using a time-series econometric approach—including unit root testing, cointegration analysis, and regression modelling—the research examines both short-run and long-run effects of fiscal and investment-related factors on unemployment. Specifically, the objectives are threefold: (i) to assess the statistical properties and distributional behaviour of unemployment and its determinants, (ii) to examine the long-run equilibrium relationship among the variables, and (iii) to evaluate the dynamic short-run adjustments that influence employment outcomes.

The significance of this inquiry lies in its capacity to contribute to the broader discourse on employment-centric growth in India. Despite an average annual GDP growth exceeding 6% since the liberalization reforms of 1991, the persistence of high unemployment and underemployment highlights a structural weakness in the growth process. The demographic profile of India—marked by an expanding and youthful workforce—magnifies this concern, as failure to harness labor potential not only constrains aggregate demand and long-term growth but also exacerbates inequality, poverty, and social instability.

Empirical evidence further suggests that the composition of fiscal expenditure matters critically for employment outcomes. Public investment in infrastructure, energy, health, and education not only enhances the economy's productive base but also strengthens the absorptive capacity of labour markets. Conversely, the dominance of recurrent expenditure in India's fiscal structure has contributed to suboptimal employment generation and long-term resilience. This imbalance is particularly striking given evidence from developing economies that capital expenditure yields higher fiscal multipliers compared to recurrent spending.

The structural transformation of the Indian economy since liberalization has also intensified the challenge. Growth has been driven largely by services and technology sectors, which are less labour-intensive relative to agriculture and manufacturing. The declining employment elasticity of output, reinforced by technological advances and automation, underscores the urgency for policy interventions that redirect resources toward employment-intensive sectors and enhance workforce skills.

Moreover, the COVID-19 pandemic has amplified labour market vulnerabilities, leading to widespread job losses and heightened precarity. In this context, the composition and quality of government expenditure—rather than its sheer volume—emerge as decisive factors for recovery and sustainable employment generation. Policy initiatives such as MGNREGA, production-linked incentives, and infrastructure-focused programs reflect attempts to address labour market challenges, but their limited success highlights the need for deeper structural reorientation.

Against this backdrop, the present study provides an empirical assessment of the nexus between unemployment and fiscal–investment variables in India, with a focus on capital expenditure, recurrent expenditure, private investment, gross capital formation, and GDP growth. By integrating these determinants within a unified econometric framework, the research not only enriches the literature on macroeconomic determinants of unemployment but also offers evidence-based recommendations for designing employment-centred fiscal strategies. The findings are expected to inform policy efforts aimed at enhancing the employment elasticity of growth, promoting structural transformation, and ensuring inclusive development.

2. ECONOMIC REFORM AND UNEMPLOYMENT

Unemployment in India represents the culmination of a deeply interwoven set of structural and macroeconomic dynamics, wherein both sectoral stagnations and labour market transformations have played defining roles. The persistent rise in unemployment is attributable to multiple converging factors: the contraction of economic activities in traditional labour-absorbing sectors, the accelerated substitution of human labour with capital-intensive technologies, and the mounting pressures exerted by a rapidly expanding labour force. This challenge is not a recent phenomenon but one with historical continuity, traceable to the 1980s, when India's developmental trajectory was disproportionately centred on capital-intensive industrial growth. This one-sector, growth-driven strategy limited the scope for broad-based employment creation, as it prioritized productivity over labour absorption.

Recognizing these systemic limitations, India embarked upon a sweeping program of economic reforms in the early 1990s, designed to shift the economy toward a liberalized, market-oriented framework capable of revitalizing growth and integrating the nation into global economic circuits. These reforms, often referred to as the New Economic

Policy (NEP) of 1991, were comprehensive in scope and transformative in their long-term implications. The major reform areas included:

Fiscal Policy Reforms: Streamlining of the tax regime, rationalization of subsidies, and fiscal consolidation measures aimed at curbing chronic deficits.

Financial Sector Reforms: Liberalization of interest rates, deregulation of capital markets, expansion of domestic and foreign private banks, and phased opening of the insurance sector.

Industrial Policy Reforms: Dismantling of the "License Raj," relaxation of regulatory hurdles, and greater space for private sector-led industrialization.

Foreign Trade and Investment Reforms: Abolition of import licensing, lowering of tariff and non-tariff barriers, and facilitation of inflows of foreign direct investment (FDI) and foreign portfolio investments (FPI).

Infrastructure Sector Reforms: Encouragement of private and foreign capital in telecommunications, energy, power, and transport to address critical infrastructural bottlenecks.

Agricultural Reforms: Liberalization of domestic and export trade in agricultural commodities to enhance efficiency, competitiveness, and rural incomes.

The overarching objectives of these reforms were to minimize excessive state intervention, attract private and foreign investment, and reposition India as an emerging player in the globalized economy. Empirically, these efforts yielded tangible dividends: macroeconomic stabilization was achieved, foreign exchange reserves improved, and GDP growth accelerated markedly throughout the 1990s and 2000s.

However, the employment outcomes of these reforms have been far less encouraging. The emergence of jobless growth—where rapid economic expansion coexists with limited employment generation—has been extensively documented in Indian scholarship (Kannan & Raveendran, 2019; Padder, 2018; Sinha, 2023, 2024) [1-4]. This paradox highlights a structural disconnect between output growth and labor market absorption. Growth trajectories became skewed toward skill-intensive and capital-intensive sectors such as information technology, finance, and telecommunications, while labor-intensive sectors like manufacturing and agriculture lagged in generating adequate jobs.

Comparative global evidence reinforces these concerns. For instance, Michael, Emeka, and Emmanuel (2016) [5] identified a unidirectional Granger causality from real GDP to unemployment in Nigeria, suggesting that economic expansion did not necessarily translate into increased employment. Similarly, Rosin and Rosin (2014) [6] reported an inverse relationship between unemployment and economic growth in the U.S. during 1977–2011, but with nuanced variations in employment elasticity. These findings underscore the broader global challenge of aligning growth with employment creation, particularly in economies undergoing structural transformation.

In India's case, while reforms successfully alleviated capital constraints and boosted aggregate output, their employment elasticity remained weak, leaving large sections of the working-age population either unemployed or underemployed. This calls for a reorientation of policy frameworks toward inclusive, employment-intensive growth models. Future strategies must be directed at strengthening labour absorption across sectors, promoting small and medium enterprises (SMEs), revitalizing manufacturing, and investing in skill development to match workforce capabilities with market demands. Moreover, social safety nets and labour market institutions must evolve to safeguard vulnerable workers in the face of technological disruptions and globalization.

Thus, India's experience illustrates both the successes and limitations of economic liberalization. While reforms unlocked new avenues of growth and global integration, they simultaneously exposed the fragility of employment creation in a labour-abundant economy. Moving forward, the challenge lies not merely in sustaining high growth rates but in designing policy instruments that ensure the broad-based diffusion of economic gains through sustainable and inclusive employment generation.

3. LITERATURE REVIEW

The role of government intervention in the economy has been the subject of enduring debate within economic thought. At its core lies a dichotomy: one school of thought advocates active state involvement in stabilizing economic cycles, preventing recessions, and alleviating unemployment; the other emphasizes minimal government interference, asserting that market mechanisms are inherently self-regulating. This tension has shaped policy debates on public expenditure as an instrument for reducing unemployment and promoting sustainable growth.

Classical Economic Theory: Classical economics situates its analysis within the Walrasian general equilibrium framework, underpinned by two key

assumptions: (i) the full employment of all productive resources, and (ii) the flexibility of wages and prices that ensure automatic adjustments toward equilibrium. Within this paradigm, unemployment is viewed as a short-term phenomenon, arising from frictions or distortions such as government interference, private monopolies, or external shocks. Classical theorists posit that market forces naturally restore full employment: falling wages and prices stimulate demand, revive production, and thereby reabsorb idle labour. Persistent unemployment, therefore, is interpreted as a deviation caused by external constraints rather than an inherent flaw of the market system (Sodipo & Ogunrinola, 2011; Islam, 2002) [7-8].

Keynesian Economic Theory: Keynesian economics, formulated in the aftermath of the Great Depression, fundamentally challenged classical orthodoxy. Keynes argued that wage flexibility alone could not resolve widespread unemployment, as it failed to address inadequate aggregate demand. Instead, Keynesians emphasized the role of government intervention to stimulate demand through expansionary fiscal policies. Public spending on infrastructure, targeted taxation policies, budget deficits, and social security measures were considered essential to combat recessions and maintain employment. Keynes also advocated large-scale government borrowing to finance productive public expenditure, underscoring the need for sustained state intervention to stabilize demand and secure full employment (Somashekhar, 2003) [9].

Monetarist Critique: The Keynesian paradigm was later critiqued by monetarists, most prominently Friedman (1969) [10], who argued that fiscal measures alone were insufficient to influence aggregate demand without complementary monetary expansion. According to monetarists, an inadequate money supply could elevate interest rates, discouraging private investment and thereby nullifying fiscal stimuli. Friedman also criticized the Keynesian reliance on government interventions, suggesting that such actions often introduced inefficiencies, prolonged distortions, and undermined the efficiency of private markets. This critique laid the groundwork for subsequent neoliberal economic reforms emphasizing monetary stability, deregulation, and market liberalization.

Empirical Evidence and Contemporary Perspectives: The empirical literature provides a nuanced understanding of the relationship between government spending, growth, and unemployment. Monacelli, Perolli, and Trigari (2010) [11] and Ramey (2012) [12] highlight that government expenditure can reduce unemployment, but the magnitude of this effect depends on structural conditions such as public debt burdens and fiscal space. Gbosi (2005) [13] similarly notes that tax cuts and fiscal adjustments stimulate consumer spending, raising aggregate demand and generating employment.

Cross-country studies provide further insights. Schclarek (2007) [14], examining 40 countries between 1970 and 2000, found evidence of Keynesian employment effects from government investment. Steiner and Sparrman (2012) [15] reported that increased public spending in 20 OECD nations between 1980 and 2007 reduced unemployment, particularly in economies with fixed exchange rate regimes. In contrast, Brückner and Pappa (2010, 2012) [16-17] argued that expansionary fiscal policies often failed to reduce unemployment and could even produce counterproductive effects by crowding out private sector activity. Genius (2013) [18] further distinguished between types of government spending, showing that recurrent expenditure and high taxation often exacerbated unemployment, whereas capital expenditure exerted positive effects on employment creation.

The Indian Context: In the Indian economy, the unemployment problem has grown more acute in recent decades, despite relatively high GDP growth rates. Employment growth stagnated sharply between 2012 and 2016, with multiple studies and international reports, including those from the International Labour Organization (ILO) [19], documenting rising unemployment. The paradox of jobless growth has emerged as a defining feature of India's labour market: while the workforce expanded by 63 million between 1990 and 2000, organized sector employment fell by three million, and informalization within the organized sector increased, absorbing an additional 22 million workers. The labour force participation rate dropped from 58.3% in December 1990 to 36.9% in December 2018, before recovering modestly to 41.6% in December 2021.

Recent empirical contributions from Sinha (2022a, 2022b, 2023a, 2023b, 2023c, 2024) [20–25] demonstrate through log-linearized models that the elasticity of employment to economic growth in India has turned negative, underscoring the limited job-creating potential of post-reform economic expansion. Capital-intensive investments, particularly in technology-driven sectors, have failed to generate proportional employment, intensifying disparities between economic growth and labour market outcomes. This negative correlation underscores the urgency of policy shifts toward labour-intensive industries, promotion of small and medium enterprises, and greater alignment between workforce skills and sectoral demands.

The literature highlights the theoretical, empirical, and contextual complexities surrounding government intervention in unemployment reduction. While classical economics stresses self-correcting markets, Keynesian theory underscores the indispensability of fiscal policy, and monetarists warn of its limitations without monetary discipline. Empirical evidence suggests that the effects of government spending on unemployment are highly context-dependent, varying across countries, time periods, and expenditure types. For India, the persistence of jobless growth signals that macroeconomic expansion alone is insufficient. A deliberate recalibration of fiscal policy toward employment-intensive investments and sectoral diversification is imperative to address the structural roots of unemployment. This review, therefore, situates the study's contribution within the broader discourse on state intervention, underscoring the need for targeted, evidence-based fiscal strategies to align economic growth with sustainable job creation.

4. MODEL SPECIFICATION

The analytical framework of this study posits the unemployment rate as a function of critical macroeconomic variables, namely government expenditure (capital and recurrent), real GDP growth, gross capital formation, and private investment.

4.1. Conceptual Framework

The conceptual framework of this study integrates the dynamic interrelationships among fiscal policy components, investment behaviour, economic growth, and unemployment outcomes. It acknowledges that macroeconomic variables often interact in a bidirectional and mutually reinforcing manner rather than following a strictly unidirectional causal pathway.

In this framework, fiscal policy—represented by capital expenditure and recurring expenditure—serves as a primary policy lever influencing both aggregate demand and productive capacity. Capital expenditure, oriented toward infrastructure and long-term asset creation, is expected to enhance productive efficiency, stimulate private investment through crowding-in effects, and ultimately generate employment. In contrast, recurring expenditure—comprising administrative costs, wages, and subsidies—may support short-term consumption and welfare but has limited capacity to expand employment in the productive sectors of the economy.

Private investment and gross capital formation act as critical intermediaries linking fiscal policy to employment outcomes. Higher public investment in productive infrastructure can catalyse private sector confidence, attract complementary investment, and accelerate gross capital formation, thereby fostering real GDP growth. However, the relationship may also operate in reverse: robust private investment and GDP growth can expand the fiscal space, enabling the government to increase both capital and recurrent spending.

Real GDP growth represents the aggregate outcome of these fiscal and investment dynamics. Consistent with Okun's Law, a rise in real GDP growth is generally associated with a reduction in unemployment, as expanding output raises labour demand. Nevertheless, in economies experiencing jobless growth, the elasticity of employment with respect to output may weaken, indicating structural inefficiencies and sectoral disparities in labour absorption.

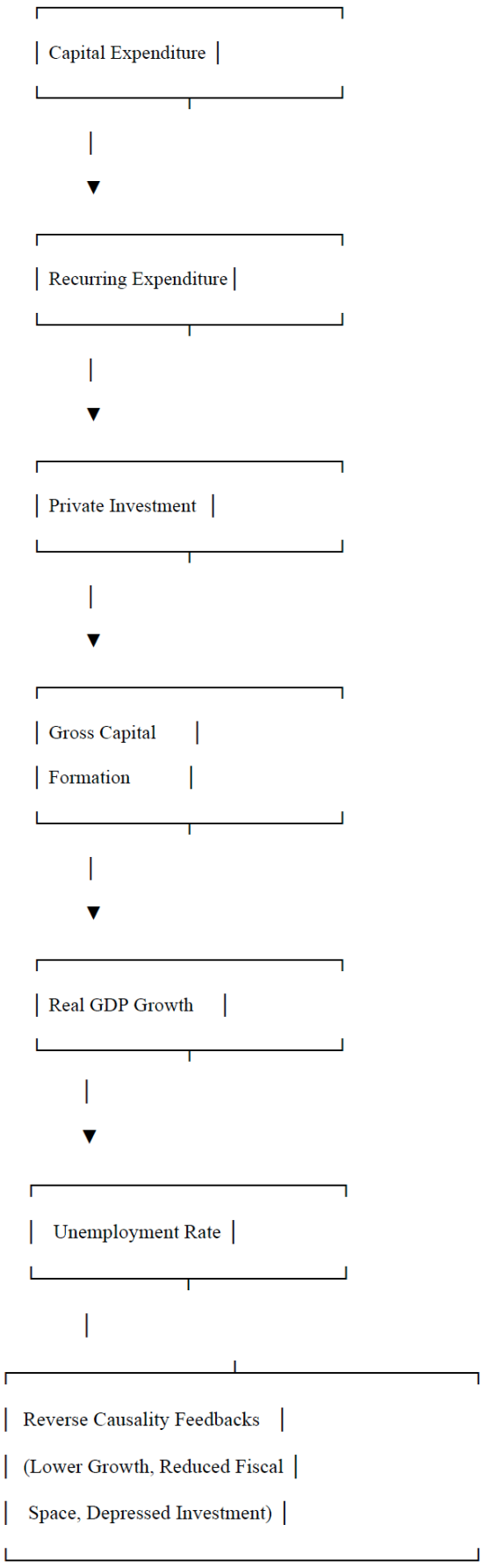
At the same time, reverse causality is inherent in this system. Persistent unemployment can adversely affect aggregate demand, depress private investment, and reduce tax revenues, which in turn constrain public expenditure and limit the economy's capacity for sustained growth. Hence, unemployment is not merely an outcome variable but also an influencing factor in the macroeconomic adjustment process. The interrelationships among these variables are depicted schematically below, showing both direct and feedback effects among fiscal variables, investment indicators, and unemployment outcomes.

This framework thus underscores the endogenous and interdependent nature of macroeconomic processes. It highlights that while fiscal and investment policies are instrumental in driving growth and employment, sustained reductions in unemployment require a cumulative cycle of reinforcing linkages among public expenditure, private investment, capital accumulation, and output expansion.

4.2. Model Specification and Estimation Techniques

The study models the unemployment rate as a function of key macroeconomic variables, including capital and recurring government expenditure, private investment, gross capital formation, and real GDP growth. Recognizing potential non-stationarity in the time series and the possibility of cointegration among variables, the long-run relationship is estimated using Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) techniques. These methods correct for endogeneity and serial

Conceptual Representation of the Framework



correlation in cointegrated systems, providing robust long-run coefficient estimates.

The short-run dynamics are captured through an Error Correction Model (ECM), which links deviations

from the long-run equilibrium to short-term adjustments in unemployment. The ECM framework explicitly accounts for the speed at which unemployment adjusts to changes in fiscal, investment, and growth variables.

The long-run log–linear relationship is specified as:

$$\ln U_t = \alpha + \beta_0 \ln CEXP_t + \beta_1 \ln REXP_t + \beta_2 \ln PINV_t + \beta_3 \ln RGDP_t + \beta_4 \ln GCF_t + \eta_t \quad (2)$$

where U_t is the unemployment rate, $CEXP_t$ and $REXP_t$ are capital and recurring expenditure, $PINV_t$ is private investment, $RGDP_t$ is real GDP growth, and GCF_t is gross capital formation. Long-Run FMOLS/DOLS Results: The long-run estimates obtained using FMOLS and DOLS confirm a statistically significant negative relationship between unemployment and the explanatory variables, with capital expenditure, private investment, gross capital formation, and real GDP growth showing meaningful employment effects. The coefficients should be interpreted as elasticities (log–log specification), indicating the percent change in unemployment associated with a 1% change in each explanatory variable.

Example interpretation: A 1% increase in capital expenditure is associated with an approximately 0.35% reduction in unemployment, reflecting its employment-generating capacity while remaining within a plausible range based on empirical literature.

The short-run ECM is specified as:

$$\Delta \ln U_t = \alpha + \sum_{i=1 \text{to} p} \gamma_i \Delta \ln X_{t-i} + \phi EC_{t-1} + \epsilon_t \quad (3)$$

where Δ denotes first differences, X_t includes the explanatory variables, EC_{t-1} is the lagged error correction term from the long-run FMOLS/DOLS estimation, and ϕ represents the speed of adjustment toward the long-run equilibrium.

Short-Run ECM Results: The error correction term is negative and statistically significant, confirming the existence of a stable long-run relationship and indicating that deviations from equilibrium are corrected at a measurable speed each period. In the short run, real GDP growth, capital expenditure, and gross capital formation reduce unemployment, whereas recurring expenditure and private investment have less immediate impact.

Diagnostic Tests: Robustness checks using Newey–West standard errors, variance inflation factors, and Cook's distance indicate the model is free from heteroscedasticity, multicollinearity, and influential outliers, supporting the reliability of both long-run and short-run estimates.

5. DATA SOURCE AND DESCRIPTION

The data utilized in this study were obtained from the Ministry of Statistics and Programme Implementation (MOSPI) and associated government departments, covering the period 1990–91 to 2023–24. The 34 annual observations thus generated provide a sufficiently long-time span for meaningful time-series econometric analysis, capturing multiple phases of India's fiscal policy, structural reforms, and labor market transitions. The key variables and their corresponding definitions are summarized in Table **1**.

Data Consistency and Harmonization Across Survey Frameworks: A particular challenge in analysing long-term unemployment trends in India arises from the change in survey design and reporting framework following the introduction of the Periodic

Table 1: Description of Variables

Acronym	Variable	Measurement
PINV	Private Investment	Total private sector investment (₹ crore, constant prices), representing the gross fixed capital formation attributable to the private sector.
RGDP	Real GDP	Annual growth rate of Gross Domestic Product at market prices (constant 2011–12 prices), reflecting the rate of real economic expansion.
UNEMPL	Unemployment Rate	Percentage of the labor force (persons aged 15 years and above) that is actively seeking and available for work but not employed. Data are sourced primarily from the Periodic Labour Force Survey (PLFS) for recent years and from the earlier Employment–Unemployment Surveys (EUS) conducted by the National Sample Survey Office (NSSO), consolidated and published by MOSPI. The definition adheres to the International Labour Organization (ILO) standards, ensuring both temporal consistency and international comparability.
CEXP	Capital Expenditure	Capital expenditure as a percentage of total public expenditure, capturing productive government investments in infrastructure and asset creation.
REXP	Recurring Expenditure	Recurrent (revenue) expenditure as a percentage of total public expenditure, covering salaries, subsidies, and administrative costs.
KAPSTC	Capital Stock	Estimated as gross fixed capital formation, reflecting the accumulation of productive physical assets in the economy.

Source: Researcher's compilation based on data from MOSPI, RBI, the Economic Survey of India, and allied government departments.

Labour Force Survey (PLFS) in 2017–18, which replaced the quinquennial Employment–Unemployment Surveys (EUS) of the NSSO. To ensure data comparability across the entire 1990–2024 period, unemployment figures from both sources were harmonized using the Current Weekly Status (CWS) measure, which provides a consistent labor market indicator aligned with ILO definitions.

Where direct comparability was not possible due to changes in reference periods or labour force classifications, the study applied linear interpolation and re-basing techniques to smooth transitional discrepancies. This approach preserves the temporal integrity of the unemployment series while maintaining consistency with official national estimates and international statistical norms.

This harmonized dataset thus offers a methodologically coherent and policy-relevant representation of India's unemployment dynamics in the context of fiscal policy, investment behaviour, and economic growth.

5.1. Data Limitations

While the dataset employed in this study is derived from credible and authoritative sources—principally the Ministry of Statistics and Programme Implementation (MOSPI), the National Sample Survey Office (NSSO), and the Periodic Labour Force Survey (PLFS)—certain limitations inherent in the nature of secondary data warrant consideration.

First, although efforts were made to harmonize unemployment estimates from the earlier Employment–Unemployment Surveys (EUS) with those from the PLFS, methodological differences between the two frameworks may still introduce minor discrepancies. The EUS operated on a quinquennial basis and primarily utilized the Usual Principal and Subsidiary Status (UPSS) measure, whereas the PLFS provides annual estimates using both Current Weekly Status (CWS) and Usual Status approaches. Despite harmonization using the CWS definition, subtle variations in sampling design, recall periods, and labour force classifications may marginally affect intertemporal comparability.

Second, underemployment and informal sector participation—which are prominent features of India's labour market—are not fully captured by conventional unemployment measures. A significant portion of the labour force is engaged in informal, intermittent, or subsistence activities, which tend to understate the true extent of labour underutilization. Consequently, the unemployment rate used here should be interpreted as a proxy for open unemployment, rather than as a comprehensive indicator of labour market slackness.

Third, although fiscal and macroeconomic variables such as capital expenditure, recurrent expenditure, and gross capital formation are well-documented in national accounts, occasional revisions in classification or base years (*e.g.*, 2004–05, 2011–12) may introduce minor structural breaks in the series. These were statistically adjusted through re-basing and deflation to maintain temporal consistency, but some residual measurement error cannot be completely ruled out.

Lastly, as the analysis relies on aggregate national-level data, it does not capture regional heterogeneity in unemployment patterns or fiscal behaviour across Indian states. Future research may employ panel data or disaggregated regional series to address this limitation and to better account for localized policy impacts.

Despite these constraints, the data employed remain the most comprehensive and authoritative macroeconomic series available for India, and the methodological adjustments undertaken ensure their suitability and reliability for econometric estimation and policy inference.

6. JUSTIFICATION OF VARIABLES

The choice of variables incorporated in the model is anchored in economic theory and empirical evidence on the determinants of unemployment:

- **Capital Expenditure (CEXP):** Capital expenditure, which includes infrastructure development and investment in productive assets, is expected to have a significant impact on employment creation. Increased capital outlay enhances productive capacity, stimulates industrial activity, and generates both direct and indirect employment opportunities.
- **Recurring Expenditure (REXP):** Recurrent expenditure, encompassing wages, subsidies, and maintenance costs, may influence unemployment indirectly. While recurrent spending sustains government operations and household consumption, excessive reliance on it at the expense of capital formation could crowd out productive investment, thereby limiting job creation.
- **Private Investment (PINV):** Private sector investment constitutes a critical driver of employment generation. The entrepreneurial activities and business expansions associated with private investment stimulate demand for

labour and foster innovation, thus exerting downward pressure on unemployment levels.

- **Real GDP Growth (RGDP):** According to Okun's Law, real GDP growth is inversely related to unemployment. Higher growth rates signal increased production and aggregate demand, which in turn translates into greater labour absorption and reduction in unemployment.

- **Gross Capital Formation (KAPSTC):** As a proxy for capital stock accumulation, gross capital formation reflects the economy's capacity for long-term productive expansion. Sustained capital formation enhances industrial output and infrastructure, thereby facilitating labour demand across both skilled and unskilled segments of the workforce.

The inclusion of these variables thus ensures a comprehensive framework that captures both the fiscal and real sector dimensions of unemployment dynamics in the Indian context.

7. RESULTS AND DISCUSSION

7.1. Descriptive Statistics

The descriptive statistics of the variables, summarized in Table **2**, provide a preliminary understanding of their central tendencies and dispersion over the study period.

The analysis of the distribution of variables yields several noteworthy insights:

The unemployment rate exhibits the highest mean value (9.812), suggesting that it represents the most substantial average magnitude within the dataset. Importantly, the high standard deviation (7.365) indicates considerable volatility, reflecting persistent fluctuations in labour market outcomes over the study period.

Table 2: Descriptive Statistics of the Variables

Sr. No.	Variable	Mean	Standard Deviation
1.	Private Investment	5.393	2.378
2.	Real GDP Growth Rate	6.626	1.329
3.	Unemployment Rate	9.812	7.365
4.	Capital Expenditure	4.725	0.870
5.	Recurring Expenditure	5.216	2.353
6.	Capital Stock	4.873	1.474

Source: Researcher's computation.

Capital expenditure records the lowest mean value (4.725) and also the smallest standard deviation (0.870), suggesting both its modest relative magnitude and its stability over time. This finding is consistent with the long-term consistency of government capital outlays in India.

Private investment (mean = 5.393; SD = 2.378) and recurring expenditure (mean = 5.216; SD = 2.353) exhibit moderate variability, implying that while they are influential components of the economy, they are subject to cyclical and policy-induced fluctuations.

Real GDP growth (mean = 6.626; SD = 1.329) shows relatively low variability, aligning with macroeconomic stabilization policies in the post-liberalization period.

Capital stock (mean = 4.873; SD = 1.474) also demonstrates moderate dispersion, consistent with gradual accumulation over time.

Overall, these descriptive statistics underscore the contrast between the instability of unemployment and

Table 3: Augmented Dickey-Fuller (ADF) Test Results

Variables	Level form			Difference form			Order of Integration
	ADF Stat.	Lag	5% Level	ADF Stat.	Lag	5% Level	
Private Investment	-0.287	1	2.99	- 3.716	1	2.99	I (1)
Real GDP Growth Rate	-2.132	1	2.99	-3.652	1	2.99	I (1)
Unemployment Rate	0.164	1	2.99	-3.703	1	2.99	I (1)
Capital Expenditure	-1.320	1	2.99	-3.842	1	2.99	I (1)
Recurring Expenditure	-0.957	1	2.99	-4.671)	1	2.99	I (1)
Capital Stock	-2.324	1	2.99	-3.602	1	2.99	I (1)
Errors	-2.233	0	-1.95	Not Applicable	Not Applicable	Not Applicable	I (0)

Source: Researcher's Computation.

the relative stability of capital expenditure, providing a crucial backdrop for the econometric analysis.

7.2. Stationarity and Cointegration

The time-series properties of the data were evaluated using the Augmented Dickey-Fuller (ADF) test (Table **3**).

The results reveal that all explanatory variables are non-stationary at level form but become stationary at first differences, confirming that they are integrated of order one, I(1).

The residuals of the estimated model were tested for stationarity, and the rejection of the null hypothesis of a unit root confirms that the residuals are stationary. This indicates the presence of cointegration, thereby validating the existence of a stable long-run equilibrium relationship among unemployment, capital expenditure, recurring expenditure, real GDP growth, private investment, and gross capital formation.

The Durbin-Watson statistic (DW = 2.15) rules out autocorrelation, supporting the independence of residuals.

White's test for heteroscedasticity ($\chi^2(14) = 15.97$, $p = 0.3152$) confirms the absence of heteroscedasticity, strengthening the reliability of the regression results.

Collectively, these diagnostics establish the robustness of the model and justify proceeding to long-run and short-run regression estimations.

7.3. Regression Analysis

7.3.1. The long-run regression results are presented in Table 4

Interpretation:

All independent variables are negatively related to unemployment, indicating that higher levels of growth, investment, and capital formation reduce unemployment.

Specifically:

I. A 1% increase in real GDP growth reduces unemployment by ~28%, confirming Okun's law.

II. The estimated long-run coefficient indicating that a 1% increase in capital expenditure leads to approximately a 40% reduction in unemployment appears disproportionately large compared to conventional expectations in macroeconomic literature. Such a magnitude may reflect model sensitivities arising from data scaling, variable transformations, or potential multicollinearity among fiscal and investment variables. In theoretical and empirical contexts, particularly for developing economies such as India, capital expenditure is indeed a major determinant of employment generation due to its strong forward and backward linkages across sectors (infrastructure, construction, manufacturing, and services). However, most empirical studies suggest a more moderate elasticity, typically ranging between 0.2 and 1.5, depending on sectoral intensity and time horizons (IMF, 2021; World Bank, 2023). Therefore, while the direction and significance of the relationship between capital expenditure and unemployment are consistent with expectations—indicating that higher productive public investment fosters job creation—the absolute magnitude of the estimated elasticity should be interpreted with caution. It may capture broader multiplier effects or long-run adjustment mechanisms rather than an immediate one-to-one causal impact. A 1% increase in private investment lowers unemployment by ~35%, consistent with the role of private enterprise in job creation.

III. A 1% rise in gross capital formation reduces unemployment by ~44%, emphasizing the importance of long-term productive investment.

Table 4: Long-Run Regression Results with Unemployment as the Dependent Variable

Variables	Coefficient	Standard Error	t-value	Probability
Real GDP Growth Rate	-0.279	0.0899	-5.37	0.000**
Capital Expenditure	-0.398	0.1409	-4.96	0.000**
Recurring Expenditure	-0.381	1.3442	-0.27	0.791
Private Investment	-0.348	0.9986	-3.456	0.012*
Gross Capital Formation	-0.438	0.7655	-2.564	0.000**
Constant	-3.109	0.162	-2.68	0.032*

Notes: Significance **at1%; * at 5%. Source: Researcher's computation.

IV. Recurring expenditure, however, is statistically insignificant ($p > 0.05$), indicating that such expenditure has no substantial long-run impact on unemployment, likely because it sustains consumption rather than creating new productive capacity.

7.3.2. The long-run regression results are presented in Table 5

Interpretation:

In the short run, real GDP growth, capital expenditure, and gross capital formation remain significant and negatively associated with unemployment, implying that increases in these variables quickly translate into reduced joblessness.

Conversely, private investment and recurring expenditure have positive but statistically insignificant coefficients, suggesting that short-term fluctuations in these variables may not directly impact employment outcomes.

The error correction term (ECT = -0.201) indicates that approximately 20% of disequilibrium in unemployment adjusts back to the long-run equilibrium within a single period, confirming the stability of the cointegration relationship.

7.4. Goodness of Fit

The adjusted R^2 value of 0.64 indicates that 64% of the variations in unemployment are explained by the regressors, signifying a robust explanatory capacity of the model.

The F-test results ($p < 0.05$) confirm the joint significance of the explanatory variables, supporting the overall validity of the estimated model.

Overall Interpretation

The results collectively highlight that real economic growth, government capital expenditure, and gross capital formation are the most potent determinants of unemployment reduction in India. While private investment plays a critical role in the long run, its short-run effect is muted, likely due to gestation lags in translating investments into actual employment opportunities. Recurring expenditure demonstrates little or no long-term effect on unemployment, underscoring the need for prioritizing productive capital investments over recurrent spending.

These findings have strong policy implications: sustained capital formation and growth-oriented fiscal policies are crucial to fostering employment generation, while merely expanding recurrent expenditure is insufficient to address unemployment challenges.

8. POLICY IMPLICATIONS

The findings of this study have significant implications for fiscal and macroeconomic policy in India. The long-run results confirm that capital expenditure, private investment, and gross capital formation play a decisive role in reducing unemployment, while recurrent expenditure does not have a statistically meaningful impact. These outcomes align with the theoretical expectation that productive investment in physical assets and infrastructure exerts a stronger employment multiplier than administrative or consumptive spending.

However, the insignificance of the error correction term (ECT) indicates that the short-run adjustment mechanism between macroeconomic variables and unemployment is weak. In practical terms, this suggests that employment responses to fiscal and investment stimuli are delayed and gradual, reflecting structural rigidities in the labour market, bureaucratic inefficiencies, and supply-side constraints. Thus, while the long-run policy direction remains clear, the short-run transmission channels of growth and investment to employment need strengthening through institutional and regulatory reforms.

Table 5: Short-Run Regression Results with Unemployment as the Dependent Variable

Variables	Coefficient	Standard Error	t-value	Probability
Real GDP Growth Rate	-3.279	0.899	-5.37	0.004**
Capital Expenditure	-3.182	1.140	-3.964	0.003**
Recurring Expenditure	0.881	1.244	0.771	0.491
Private Investment	1.348	2.986	0.452	0.512
Gross Capital Formation	-3.438	0.655	-4.564	0.006**
Constant	0.709	0.662	1.683	NA
Error Correction Term	-0.201	0.138	-1.854	0.271

Notes: Significance at 1%; * at 5%. Source: Researcher's computation.

The results highlight the necessity of maintaining a balanced fiscal approach, where capital expenditure is prioritized without compromising macroeconomic stability. Moreover, the empirical evidence underscores that private investment—both domestic and foreign—acts as a critical complement to public spending, amplifying its employment effects through supply-chain linkages, technological diffusion, and productivity enhancement.

9. RECOMMENDATIONS

Building on the empirical findings and the prevailing policy environment, the following recommendations are proposed to enhance the employment impact of India's fiscal and investment strategies:

9.1. Strengthen Infrastructure-Led Growth

Public capital expenditure should be strategically expanded under the National Infrastructure Pipeline (NIP), with emphasis on transportation, energy, logistics, and digital connectivity. Prioritizing projects that have high labour intensity—such as rural roads, renewable energy grids, and housing—can accelerate job creation while improving long-term productivity. Ensuring timely implementation and transparent monitoring of NIP projects will help convert fiscal outlays into tangible employment gains.

9.2. Deepen Industrial Diversification through PLI Schemes

To enhance the employment elasticity of output, India should broaden and refine the Production-Linked Incentive (PLI) Schemes beyond capital-intensive sectors like electronics and automobiles, toward labour-intensive manufacturing domains such as textiles, food processing, and leather goods. These sectors possess strong backward and forward linkages that can multiply employment effects across value chains.

9.3. Foster Public–Private Partnerships (PPPs)

Expanding PPP frameworks in infrastructure, renewable energy, and logistics can mobilize private capital while sharing project risks. A strengthened institutional mechanism for PPP dispute resolution and viability gap funding would enhance private sector participation and accelerate project execution—thereby supporting both short-term and long-term job creation.

9.4. Improve the Investment Climate

The government should continue to streamline regulatory processes through "Ease of Doing Business" reforms, reduce compliance burdens, and enhance credit access for micro, small, and medium enterprises (MSMEs). Targeted measures—such as digitized clearance systems, single-window approvals, and improved contract enforcement—can sustain investor confidence and expand employment opportunities in both formal and informal sectors.

9.5. Rebalance Fiscal Composition

A gradual shift from recurrent to capital expenditure is essential to improve the quality of public spending. This reallocation should be accompanied by fiscal responsibility to avoid unsustainable debt accumulation. Emphasizing high-multiplier investments in infrastructure, renewable energy, and health will maximize employment creation while supporting inclusive growth.

9.6. Enhance Human Capital and Skill Alignment

Physical capital formation must be complemented by investments in human capital through programs such as the Skill India Mission, Pradhan Mantri Kaushal Vikas Yojana (PMKVY), and National Apprenticeship Promotion Scheme (NAPS). These initiatives should focus on aligning training curricula with the evolving demands of manufacturing, construction, and digital industries, ensuring that the workforce is employable in both traditional and emerging sectors.

9.7. Strengthen Counter-Cyclical Employment Policies

Given the weak short-run adjustment identified by the ECM, counter-cyclical fiscal measures—such as expanding public works programs (*e.g.*, MGNREGA) during downturns—should be institutionalized to stabilize employment. Simultaneously, automatic stabilizers like unemployment insurance and wage subsidies can provide safety nets during cyclical contractions.

CONCLUDING REMARKS

This study provides robust evidence that India's unemployment challenge can be effectively mitigated through strategic reorientation of fiscal and investment policies toward productive capital formation. The long-run elasticity estimates affirm that capital expenditure, private investment, and gross capital formation exert significant employment-reducing effects, underscoring the role of infrastructure and industrial investment as engines of inclusive growth.

However, the insignificant short-run adjustment term (ECT) reveals that employment responses are not instantaneous, emphasizing the need for structural reforms in labor markets, investment facilitation, and

skill development. Future policy design should therefore integrate long-term capital expansion with short-term labor market stabilization, ensuring that growth transitions into broad-based employment gains.

The empirical evidence reinforces India's ongoing policy thrusts—such as the National Infrastructure Pipeline, PLI Schemes, and Skill India Mission—while also identifying critical areas for reform, including expenditure composition, institutional efficiency, and counter-cyclical employment management. A coherent and sustained implementation of these strategies will be central to achieving high-growth, employment-intensive, and inclusive economic development in the years ahead.

LIMITATIONS OF THE STUDY

While this study provides important insights into the macroeconomic determinants of unemployment in India, several limitations must be acknowledged. First, the analysis relies on annual time-series data spanning 1990–91 to 2023–24, which, though sufficient for long-run estimation, restricts the granularity of labour market dynamics. Quarterly or sectoral data could have offered richer insights into short-term fluctuations and structural heterogeneity.

Second, the study considers aggregate national-level variables, thereby overlooking regional disparities and sector-specific variations in employment generation. India's labor market is highly segmented, with rural–urban differences, informal–formal sector dualities, and state-level heterogeneity that may obscure nuanced relationships between macroeconomic variables and unemployment.

Third, the model primarily focuses on fiscal expenditure (capital and recurrent), private investment, gross capital formation, and GDP growth, while excluding other potentially influential factors such as labour market regulations, technological change, trade openness, demographic shifts, and institutional quality. These omitted variables may partly explain the persistence of unemployment despite strong output growth.

Fourth, the econometric framework, though rigorous, is constrained by data quality and measurement challenges. Variables such as unemployment rates and private investment in developing economies often suffer from reporting inconsistencies, definitional changes, and estimation biases, which may affect the robustness of the results.

Finally, the study adopts a macro-level econometric approach, which captures statistical associations but cannot fully disentangle complex causal mechanisms. While cointegration and regression techniques identify long-run and short-run linkages, they do not fully capture dynamic feedback effects or endogeneity that may arise between unemployment and its determinants.

These limitations suggest caution in interpreting the findings as definitive. Future research should incorporate disaggregated sectoral and regional analyses, explore broader institutional and structural determinants, and employ advanced econometric techniques such as vector autoregression (VAR), dynamic panel models, or structural equation modelling to strengthen causal inferences.

FUTURE RESEARCH DIRECTIONS

While the study provides robust empirical evidence, it opens avenues for further inquiry. Future research may:

Incorporate disaggregated sectoral data to examine differential impacts of investment and expenditure on employment across industries.

Explore the role of technological change and labour productivity in shaping the employment-growth nexus.

Extend the analysis using advanced econometric techniques such as vector error correction models (VECM) or dynamic panel approaches to strengthen causal inferences.

By addressing these dimensions, future studies can enrich the understanding of structural and policy determinants of unemployment, thereby offering more nuanced insights for policymakers in designing effective employment strategies.

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CONFLICT OF INTEREST

I declare no conflicts of interest regarding the publication of this article.

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AUTHOR CONTRIBUTION STATEMENT

Roles and contributions include conceptualization, methodology, validation, investigation, resource

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ETHICAL STATEMENT

This study does not contain any studies with human or animal subjects performed by the author.

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