

Unemployment and output in India: An examination of Okun's Law

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Received: 30 October 2025 / Revised 19 January 2026 / Accepted: 20 January 2026 /
Published online: 20 January 2026 © The Author(s), under exclusive licence to SPD

**Vertex Journal of
Economic Sciences**

(VJES) | Bi-Annual |
Open Access | Double-
Blind Peer Reviewed |
International Academic e-
Journal |

Website

www.vjesjournal.org

Volume 1 Issue 1

Winter Edition 2026

Page Number 1-15



Abstract

This study discusses the importance of Okun's law in India by examining the relationship between unemployment and output across various states from 1993 to 2011. A panel data framework using fixed and random effects models is applied on state-level data collected from the National Sample Survey Office (NSSO) and the Central Statistical Office (CSO). The unit root tests and robustness checks, such as the Hausman test and the use of heteroskedasticity-consistent errors, validate the dependability of the findings. The estimated Okun coefficient of -0.12 indicates that a 1% increase in GDP results in a mere 0.12% reduction in unemployment, which is significantly lower than what is observed in advanced economies. This weak relationship highlights India's phenomenon of jobless growth, influenced by structural rigidities, the prevalence of informal employment, and skill mismatches throughout the study period. The findings suggest that economic growth by itself does not guarantee widespread employment, underscoring the necessity for additional policies like promoting labour-intensive industries, aiding small businesses, and enhancing workforce skills.

Keywords: Okun's law, Unemployment, Panel regression

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1. Introduction

The high unemployment rate represents a significant challenge confronting economy globally (ILO, 2023). Finding effective solutions to mitigate unemployment is seen as a critical strategy for those in positions of authority and influence. In this context, economic growth is often seen as a crucial factor in reducing unemployment. The economic literature has introduced this relationship as a law referred to as Okun's Law (Ferhat, 2016; Lee, 2000).

Arthur Okun, an esteemed professor from Yale, conducted an in-depth analysis of the relationship between unemployment and economic output. His initial publication on the subject emerged in the 1960s (Okun, 1962), and the results were later acknowledged as Okun's Law. The law establishes a fundamental concept indicating that there is an inverse relationship between unemployment and a country's output. The relationship between the percentage change in unemployment and a 1% change in GDP is commonly known as the Okun coefficient (Ball, Leigh, & Loungani, 2013).

The relationship between unemployment and GDP varies from one country to another. In the United States, Okun's coefficient indicates that a 1% decrease in unemployment is associated with an approximate 2% increase in GDP. On the other hand, a 1% increase in unemployment is expected to correspond to a 2% decrease in GDP (Prachowny, 1993). Countries with more rigid labour markets compared to the United States, like France and Germany, often exhibit higher Okun coefficients (Villaverde & Maza, 2009). In these economies, the same percentage change in GDP results in a lesser effect on the unemployment rate than what is observed in the U.S.

Although there is broad agreement among economists regarding Okun's Law, it is frequently viewed as an approximation rather than a precise rule. This is due to the involvement of various factors in GDP changes, including labour force participation, productivity, and sectoral shifts (Knotek, 2007). While the inverse relationship between unemployment and output is widely recognized, the extent of the relationship changes over time and among countries.

Subsequent investigations into the relationship between unemployment and output have broadened the analytical framework by incorporating an additional set of labour market variables to assess their impact on GDP. These encompass overall labour force participation, hours contributed by employed individuals, and levels of productivity (Lee, 2000; Ball et al., 2013). Through a more thorough examination, it has been revealed that the variation in output corresponding to a 1% shift in unemployment is more unstable than the initial implications of Okun's Law indicated.

This study is organized in the subsequent manner: Section 2 examines the prevailing literature, Section 3 discusses the research methodology, Section 4 exhibits data and trends, Section 5 analyses the results, and Section 6 concludes up the paper.

2. Review of literature

A wide range of studies investigated the relationship between economic growth (national product) and unemployment worldwide, including works by Smith (1975), Gordon (1984), Knoester (1986), Kaufman (1988), Harris and Silverstone (2001), Sögner and Stiassny (2002), Silvapulle et al. (2004), Fouquau (2008), and Lal et al. (2010). These studies have conducted

thorough empirical analyses regarding the validity of Okun's Law across various countries and time periods, estimating the Okun coefficient through various methodologies.

One notable study utilizing the Autoregressive Distributed Lag (ARDL) approach to investigate Okun's Law is Moosa (2008), who analysed the Okun equation for Algeria, Egypt, Morocco, and Tunisia using annual data on growth and unemployment spanning from 1990 to 2005. The findings indicate that the Okun coefficients in this study lacked statistical significance, leading to the rejection of Okun's Law for these economies.

A study conducted in Nigeria used the VAR Granger causality approach, revealing a one-way relationship between unemployment and economic growth for the period spanning 2006 to 2016 (Victoria Kenny, 2019). Key findings indicate that economic growth did not substantially decrease unemployment, highlighting the presence of structural rigidities in the labour market. In India, although it ranks as one of the fastest-growing economies worldwide, the generation of employment has fallen behind due to institutional and regulatory factors (Kumar & Murali, 2016).

Findings from Asian economies indicate that Okun's Law may not be true in all contexts. Countries like Korea, Malaysia, China, and Singapore have realized significant employment increases due to swift economic growth, although the dynamics vary from those found in developed economies (Irfan et al., 2010). In India, the average annual growth rate of long-term employment was approximately 2 percent, but this figure has decreased to about 1.5 percent in the last decade, even though GDP growth has averaged 7.5 percent. This indicates a comparatively weak connection between unemployment and growth (Papola, 2013). Garavan (2013) focused on the disparities in the short-term connection between output growth and unemployment, concluding that Okun's Law continues to be a significant factor in policy discussions. In a similar vein, Kiran et al. (2014) observed that despite the increases in GDP and per capita income, employment growth has not matched this upward trend.

Lancaster (2015), employing an OLS time series methodology from 1960 to 2015, calculated Okun's coefficient for India to be just under 3 percent annually, with a standard error margin of ± 1 , which is consistent with global findings. Abu (2017), utilizing an ARDL model for Nigeria covering the years 1970 to 2014, found a notable long-run negative correlation between unemployment and economic growth, whereas oil prices exhibited a positive and significant impact on growth. Nonetheless, the projected impact on unemployment (0.18 percent) was significantly less than Okun's initial estimates. Chand and Tiwari (2018) identified a significant negative correlation between GDP growth and unemployment, indicating that GDP accounts for approximately 48 percent of the variation in unemployment. Notable differences based on gender were observed, indicating that unemployment rates for men are more responsive to changes in GDP compared to those for women, which can be attributed to occupational segmentation.

Other research focused on institutional factors. In Sweden, it was observed that young workers exhibited greater susceptibility to fluctuations in GDP as a result of the Employment Support Act (LAS), whereas older workers enjoyed a degree of protection (Stjernström & Goussakov, 2017). Amin-Naseri and Rasouli (2017) employed a multiple linear regression analysis covering the years 1992 to 2013, which showed that literacy and money supply had a positive impact on GDP, whereas unemployment, inflation, and quasi-money volume had negative effects. Zidong et al. (2016) utilized panel data to determine that Okun's Law might not be

applicable to low-income countries; however, they found a stronger connection between the labour market and output when total employment was analysed instead of unemployment.

In the context of India, Sahoo (2018) highlighted the significance of private entrepreneurship and MSMEs in generating employment, asserting that structural employment policies are equally important as GDP growth. Soylu et al. (2018), in their analysis of Eastern European economies from 1992 to 2014, discovered that a 1% increase in GDP corresponded to a mere 0.08% decrease in unemployment, indicating an insignificant relationship as described by Okun's law. In a similar vein, Acaroğlu (2018) conducted a comparison of G-20 countries utilizing filtering techniques (HP, CF, BW) and discovered varied Okun coefficients, with certain economies not adhering to the law under particular filters. Pehlivanoğlu and Tanga (2016), in their analysis of data from 1990 to 2014, observed that Okun's Law does not consistently apply, particularly in emerging economies like Turkey, South Africa, and Brazil.

Table 1: Comparative Estimates of Okun's Coefficient Across Country Groups

Authors	Sample	Okun's law version	Okun's coefficient
Ball, Furceri, Leigh, Loungani	Adv = 29	DIFF	-0.29
		GAPS	-0.39
	Developing and emerging = 42	DIFF	-0.18
		GAPS	-0.20
Huang, Yeh	OECD	ARDL (ECM)	-0.27
	OECDNOT	ARDL (ECM)	-0.15
For Different Income Group			
Authors	Sample	Okun's law version	Okun's coefficient
Bartolucci, Choudhry, Marelli, Signorelli	High income	DIFF	-0.174
	Low income	DIFF	-0.131
Farole, Ferro, Michel Gutierrez	High income	DIFF	-0.21
	Upper middle income	DIFF	-0.08
	Lower middle income	DIFF	-0.03
	Low income	DIFF	-0.005

Source: Based on Pizzo (2019)

Note: ARDL refers to the "Auto Regressive Distributed Lag" model used by Huang & Yeh (2013). ECM means "Error Correction Model".

The table 1 presented above, sourced from Pizzo (2019), indicates that Okun's coefficient tends to be greater in advanced economies compared to developing and emerging economies. In low-income countries, the coefficient approaches zero, indicating the occurrence of "jobless growth," a critical issue for policymakers in these economies.

Another pertinent investigation is Lee et al. (2013). Their findings, described in the table below, indicate that Okun's coefficient exhibits variation across various global regions. The findings indicate that Okun's coefficient is generally larger in high-income countries compared to low-income countries, which further supports the notion that economic growth in developing economies is not necessarily linked to adequate job creation.

Table 2: Okun's Coefficients 1992–2017, Pooled Regression (OLS) Against 1-Period Distributed Lag of the Explanatory Variable

Variable / Region	(1) LFS data set		(2) LFS+ modelled estimates data set	
	coefficient	countries	coefficient	countries
Change in GDP (smoothed)	-0.121***	75	-0.035***	180
High income	-0.152***	43	-0.114***	52
Upper-middle income	-0.095***	24	-0.022**	49
Lower-middle income	-0.072***	8	-0.034***	49
Low income	–	–	-0.002	30
Pre-crisis (1992–2007)	-0.137***	75	-0.039***	178
Crisis (2008–2009)	-0.308***	75	-0.117***	178
Post-crisis (2010–2017)	-0.084***	75	-0.019**	180
Arab States	–	–	0.001	11
Central and Western Asia	-0.156	3	-0.060***	11
Eastern Asia	-0.044***	5	-0.030**	7
Eastern Europe	-0.119***	8	-0.101**	10
Latin America and the Caribbean	-0.074***	23	-0.024	29
Northern Africa	-0.450	2	-0.012	6
Northern America	-0.236	2	-0.240	2
Northern, Southern and Western Europe	-0.218***	25	-0.170***	29
South-Eastern Asia and the Pacific	-0.054**	6	-0.011*	19
Southern Asia	-0.042	1	-0.021	9
Sub-Saharan Africa	–	–	-0.010	47

Source: Based on Pizzo (2019)

Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

in the last decade, numerous studies have examined Okun's Law, evaluating the Okun coefficient in various contexts and influences. The results indicate that the coefficient fluctuates over different time periods and geographical areas, and there are cases where Okun's Law does not hold true. This has resulted in an extensive amount of economic literature concentrating on the reasons behind the occurrence of such deviations. A violation of Okun's Law could suggest

inadequate modeling of economic behavior or the influence of unique structural factors specific to a country (Irfan Lal et al., 2010).

Okun's Law continues to hold significance for various reasons. By connecting the unemployment rate to the actual output of the economy, having access to real economic growth estimates may help in predicting trends in unemployment. In addition to assisting policymakers in formulating strategies for employment and growth, it offers a framework for identifying the optimal growth rates required to attain sustainable employment (Kumar & Murali, 2016).

2.1 Research Objective

The objective of this study is to investigate the empirical validity of Okun's law in the Indian context by analysing the relationship between unemployment and gross domestic product (GDP) across states. The study seeks to estimate the Okun coefficient and assess whether the unemployment–output dynamics observed in advanced economies also hold for India's diverse and structurally heterogeneous state economies.

3. Research Methodology

To examine the relationship between GDP and unemployment across Indian states over the period 1993–2011 (with adjustments for data gaps), this study employs a panel data framework to test the validity of Okun's law. The baseline specification is expressed as:

$$\Delta \text{UNEMPLOYMENT}_{it} = \alpha + \beta \Delta \text{GDP}_{it} + \varepsilon_{it} \quad (1)$$

where α and β are the coefficient to be estimated, ε is error term and ' Δ ' represent the difference between present and lag value.

Econometric Strategy

Given the panel structure of the data, panel regression techniques are utilized to leverage both the cross-sectional and time-series dimensions. The subsequent steps are carried out as follows:

1. Stationarity Tests

- Panel unit root tests, including Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS), are utilized to confirm the stationarity of the variables, thereby ensuring that the regression results are valid and not misleading.

2. Model Estimation

- Both fixed effects and random effects specifications are estimated. The fixed effects model controls for time-invariant, unobserved heterogeneity across states (such as institutional structures and labour market characteristics), whereas the random effects model presumes that such heterogeneity is not correlated with the explanatory variables.
- The Hausman test is conducted to determine the appropriate specification between FE and RE.

Interpretation

The key parameter of interest is β , the Okun coefficient. A statistically significant negative value of β would confirm the inverse relationship anticipated by Okun's law, while an insignificant or positive value would indicate potential deviations from the theoretical expectation. This study assesses the model across Indian states, examining both the presence and the extent of Okun's relationship, as well as its stability within a developing economy characterized by distinct regional labour market conditions.

4. Data and Trends

The analysis uses state-level data related to unemployment and real gross domestic product (GDP) in India. Data on unemployment was obtained from the National Sample Survey Office (NSSO) covering 22 states and two union territories for the years 1993, 1999, 2004, 2007, 2009, and 2011. This study uses a measure of unemployment derived from the Current Daily Status (CDS), which effectively accounts for both open unemployment and underemployment by documenting the activity status of individuals on a daily basis throughout the reference week. The CDS measure is regarded as more comprehensive and sensitive within the Indian context compared to alternative indicators like the usual or current weekly status.

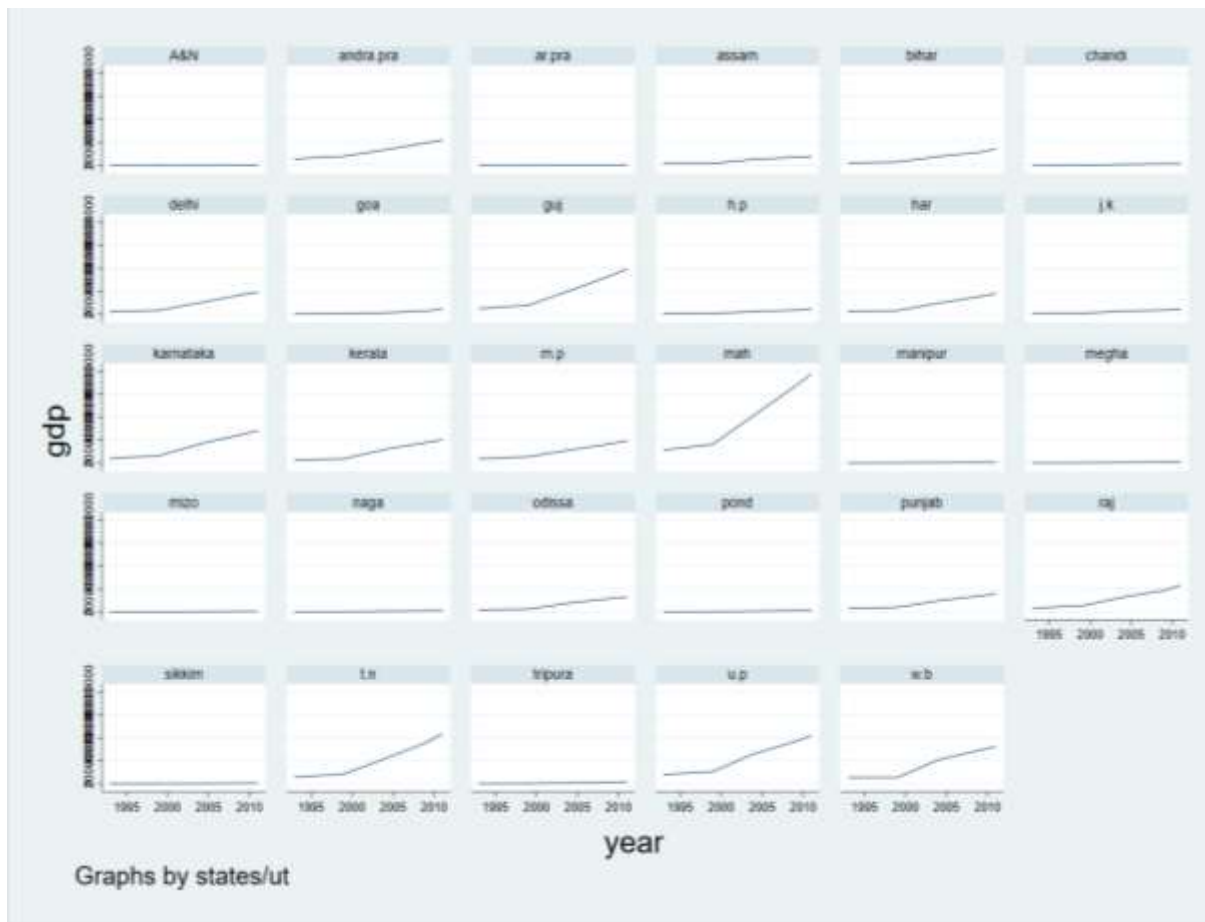
Data on state-level real GDP were obtained from the Central Statistical Office (CSO) for the relevant years. The CSO reports present domestic product series using different base years: the period from 1993 to 2004 uses base year 1993, whereas the period from 2004 onward uses base year 2004. To ensure comparability across years, the GDP series was spliced into a uniform base year (2004=100). This approach maintains the growth rates from the original series and aligns the data to a consistent base year, which enables effective cross-temporal analysis.

The final dataset thus comprises a balanced panel of Indian states and union territories over six time points between 1993 and 2011, combining unemployment and real GDP indicators suitable for estimating the unemployment–output relationship under the framework of Okun's law.

Trends

From figure 1, it is evident that the state-wise GDP trends show significant regional variation in economic performance. States such as Gujarat, Karnataka, Puducherry, Tamil Nadu, Uttar Pradesh, and West Bengal experienced rapid and sustained growth following 1999, reflecting industrial expansion and structural reforms implemented during this period. Conversely, the other states and union territories exhibited more moderate and consistent growth patterns. The observed variations highlight the disparities in growth throughout India, indicating that regional structural elements and policy contexts significantly influenced economic results.

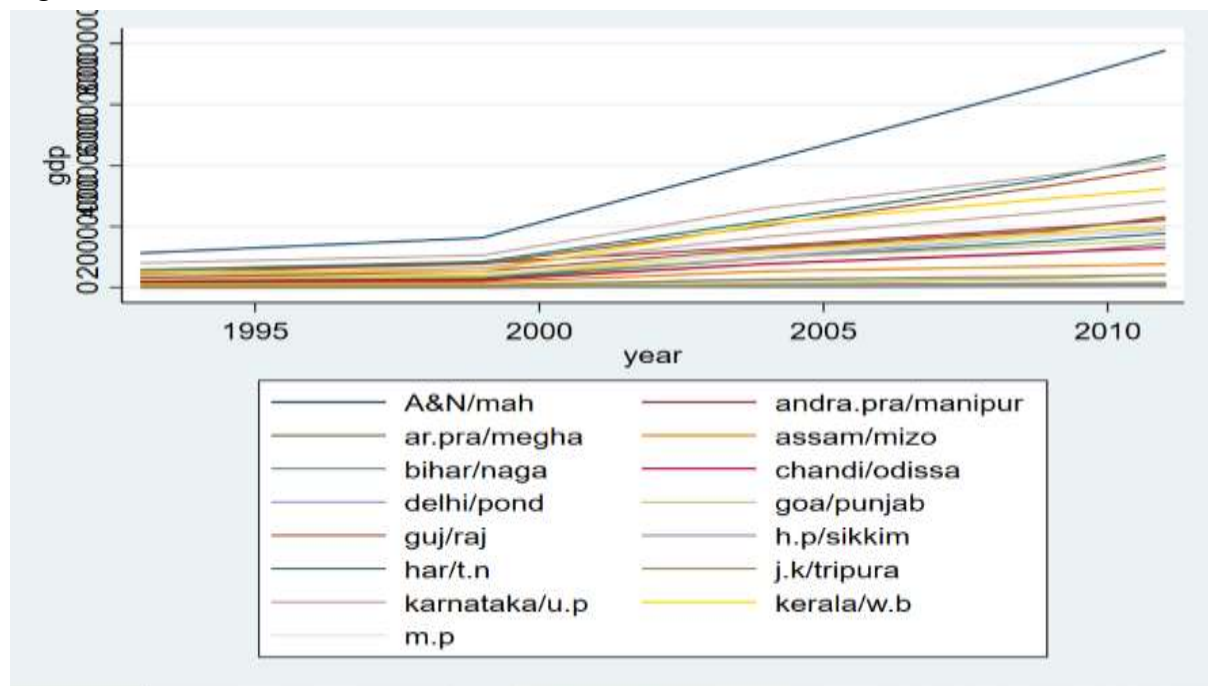
Figure 1: Trends in State-Level GDP



Source: Computed by authors

The total GDP of Indian states and union territories shows a distinct upward trend over the study period, as illustrated in figure 2. This illustrates the comprehensive macroeconomic growth of India, propelled by market liberalization, heightened investment, and deeper integration into the global economy. However, the smooth nature of the overall growth path masks significant variations between states, highlighting the necessity for a detailed analysis.

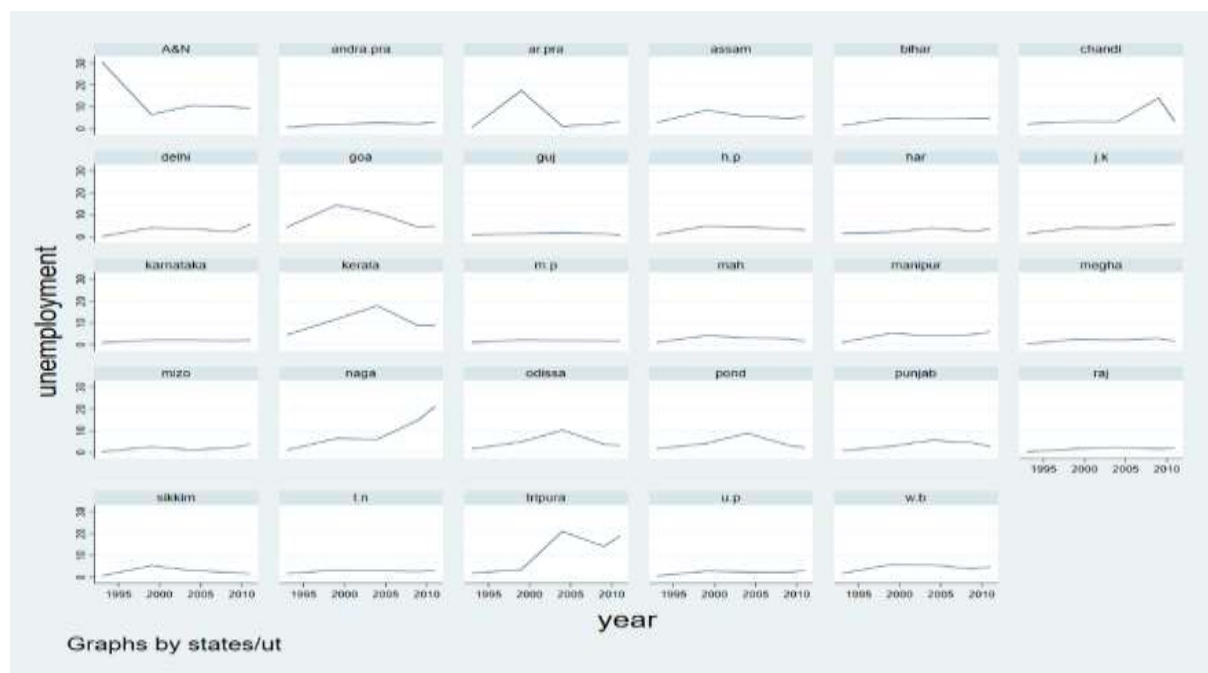
Figure 2: Combined GDP Trends of Indian States and Union Territories.



Source: Computed by authors

Figure 3 illustrates that the unemployment trends exhibit a mixed pattern across states. Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Rajasthan, Tamil Nadu, and Uttar Pradesh showed stable unemployment rates over time, indicating a robust capacity for labor absorption despite variations in economic growth. Conversely, various states exhibited significant variations, potentially indicating underlying structural changes in job availability, shifts across sectors, or cyclical trends in labor demand. This divergence highlights the intricate nature of the relationship between unemployment and growth within the Indian framework.

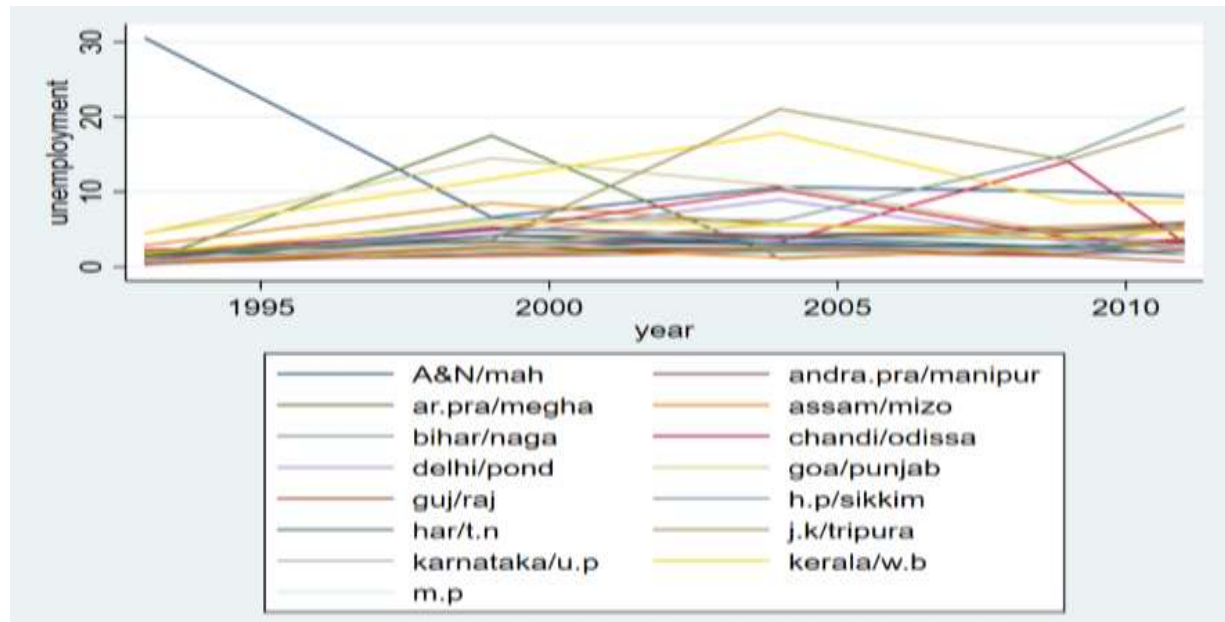
Figure 3: Trends in State-Level Unemployment



Source: Computed by authors

The overall unemployment rate across states and union territories exhibits significant variations throughout the analyzed years, as illustrated in figure 4. In contrast to GDP, which tends to show a steady increase, unemployment does not display a stable declining trend.

Figure 4: Combined Unemployment Trends of Indian States and Union Territories



Source: Computed by authors

This highlights the concept of “jobless growth” in India, where economic development has not led to a corresponding decrease in unemployment rates. This pattern demonstrates the existing structural rigidities and discrepancies within the labour market that constrain the capacity for growth to generate employment opportunities.

5. Results and Discussion

5.1. Descriptive Trends

The analysis of state-level GDP in section 4 reveals significant variability in economic performance throughout India from 1993 to 2011. Regions like Gujarat, Karnataka, Puducherry, Tamil Nadu, Uttar Pradesh, and West Bengal underwent significant and consistent development, whereas other areas exhibited more gradual or steady growth patterns.

Table 3: Patterns of GDP Growth Across States (1993–2011)

Growth Pattern	States/UTs
High & Sustained Growth	Gujarat, Karnataka, Puducherry, Tamil Nadu, Uttar Pradesh, West Bengal
Moderate Growth	Andhra Pradesh, Maharashtra, Haryana, Kerala, Punjab
Low/Uniform Growth	Bihar, Jharkhand, Chhattisgarh, Assam, Odisha, Madhya Pradesh, others

Source: Computed by authors

At the aggregate level, the combined GDP of states and union territories shows a clear upward trend, consistent with India's overall macroeconomic expansion following liberalization and integration into the global economy. However, this aggregate smoothness conceals significant interstate disparities.

Unemployment trends did not consistently mirror GDP growth. Several states maintained relatively stable unemployment despite fluctuations in growth, while others exhibited sharp volatility, reflecting sectoral shifts and cyclical labour demand.

Table 4: Patterns of Unemployment Trends Across States (1993–2011)

Trend Type	States/UTs
Stable Unemployment	Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh
Fluctuating Unemployment	Kerala, Punjab, Maharashtra, West Bengal, Assam, Odisha, Jharkhand, Chhattisgarh, others

Source: Computed by authors

At the aggregate level, GDP followed a steady upward path, while unemployment exhibited fluctuations without a sustained decline. This divergence is consistent with the notion of jobless growth in India.

5.2. Econometric Results

Prior to estimation, unit root and normality tests were conducted to ensure robustness. Both GDP and unemployment series were found to be stationary and normally distributed at the 5% level.

Table 5: Stationarity and Normality Tests

Variable	Stationarity (p-value)	Result	Normality (p-value)	Result
Unemployment	> 0.05	Stationary	> 0.05	Normal
GDP	> 0.05	Stationary	> 0.05	Normal

Source: Computed by authors

A fixed effects panel regression was then estimated. The results are summarised below.

Table 6: Fixed Effects Regression Results

Parameter	Coefficient	Significance
Constant (α)	3.80	Significant at 5%
GDP growth (β)	-0.12	Significant at 5%

Source: Computed by authors

The Hausman test confirmed the superiority of the fixed effects model over the random effects specification, validating the robustness of the results.

5.3. Discussion

The estimated Okun coefficient of -0.12 suggests that a 1% increase in GDP corresponds to a mere 0.12% decrease in unemployment. This magnitude is significantly lower than Okun's initial estimate for the United States (-0.30 to -0.40) and falls below the coefficients usually seen in advanced economies (Ball et al., 2017; Cazes et al., 2013). The limited responsiveness of unemployment to growth supports previous studies conducted in India that highlight structural constraints within the labour market (Papola, 2013; Lancaster, 2015). Several factors help explain this phenomenon:

1. High informality of employment limits the transmission of growth into formal job creation.
2. Sectoral composition of growth has been biased towards capital- and skill-intensive industries such as IT and finance, which generate limited employment opportunities.
3. Skill mismatches persist due to inadequate vocational training and rapid technological change.
4. Labour market rigidities constrain firms' ability to expand employment during growth phases.

These findings position India within the broader global literature, where Okun's law is found to be weaker or unstable in developing and emerging economies (Zidong et al., 2016; Moosa, 2008). Unlike high-income countries, where growth tends to translate more directly into employment gains, India's labour market is characterised by low employment elasticity of growth.

From a policy standpoint, the results indicate that growth acceleration alone is insufficient to reduce unemployment significantly. Complementary strategies are required, including:

- Promoting labour-intensive sectors such as textiles, agro-processing, and construction.
- Strengthening MSMEs, which play a disproportionate role in employment generation.
- Investing in skill development and vocational training to bridge labour demand–supply mismatches.
- Enhancing labour market flexibility while ensuring adequate social protection for workers.

6. Conclusion

This study's findings validate Okun's law within the Indian context, though demonstrating a relatively weak correlation between output growth and unemployment. The estimated Okun coefficient of -0.12 indicates that a 1% increase in GDP corresponds to a mere 0.12% decrease in unemployment. This level is significantly lower than what is observed in developed economies, highlighting the constrained employment responsiveness of growth in India from 1993 to 2011.

The findings suggest that although economic growth plays a role in reducing unemployment, its effect is limited and inadequate for creating widespread job opportunities. The occurrence of "jobless growth" in India underscores the necessity for policymakers to consider factors

beyond GDP growth as the exclusive approach for creating employment opportunities. Structural factors, such as labour market rigidities, the prevalence of the informal sector, and discrepancies between skills and labour demand, seem to undermine the relationship between unemployment and output.

From a policy perspective, the findings indicate that strategies focused on growth should be paired with specific employment policies. These strategies could involve fostering sectors that require significant labour, supporting micro, small, and medium enterprises, investing in skill enhancement and training programs, and creating incentives that drive job creation. In the absence of these complementary policies, mere increases in GDP are improbable to lead to significant decreases in unemployment.

The study illustrates that Okun's law offers a valuable but limited framework for comprehending the interplay between growth and employment in India. Future research should expand this analysis by integrating more comprehensive labour market indicators, exploring sectoral heterogeneity, and investigating asymmetries across business cycles to yield deeper insights into the intricate relationship between growth and employment in developing economies.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used ChatGPT in order to check the grammar of the sentences. After using ChatGPT, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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