

Dynamics of Investment, Economic Growth, and Employment in Contemporary India: Analyzing Patterns and Future Potential

Jitendra Kumar Sinha*

Retired Senior Joint Director & Head, DES, Bihar, Current City: Bengaluru, INDIA.

*Corresponding author

Jitendra Kumar Sinha, Retired Senior Joint Director & Head, DES, Bihar, Current City: Bengaluru, INDIA.

Submitted: 2023, Aug 31; Accepted: 2023, Sep 19; Published: 2023, Sep 29

Citation: Sinha, J. K. (2023). Dynamics of Investment, Economic Growth, and Employment in Contemporary India: Analyzing Patterns and Future Potential. *Politi Sci Int*, 1 (1), 52-60.

Abstract

Gross Fixed Capital Formation stands as the cornerstone of domestic investment, wielding the power to ignite economic growth and job creation. However, the relationship between investment and economic growth remains a subject of ongoing debate, characterized by a mosaic of conflicting findings within empirical studies. Similarly, the intricate interplay between employment and economic growth remains shrouded in uncertainty. Against the backdrop of these complexities, the Indian economy grapples with a paradox: despite a moderate rate of investment and economic growth, it grapples with a disproportionately high unemployment rate. Seeking clarity amidst this perplexity, our study delves into the contours of investment, economic growth, and employment in India. Guided by data sourced from the MoSPI, the Government of India, and other reputable outlets, our investigation is underpinned by the robust Johansen Cointegration and Vector Error Correction Model (VECM) framework. The crux of our findings reveals the existence of a lasting relationship among these variables, offering a glimpse of bi-directional causality connecting employment and economic growth. Counterintuitively, economic growth emerges as a precursor to investment, challenging conventional wisdom. Ultimately, our study underscores that, in the Indian context, economic growth emerges as the pivotal catalyst propelling investment and employment over the long haul. As we unlock the implications of our findings, a troubling revelation surfaces—jobless growth prevails in the post-economic reform period. To dispel this concerning trend, a concerted effort to engineer a more favorable economic landscape becomes imperative. We advocate for a multifaceted approach involving heightened investments in infrastructural enhancements and diversification of the economy. By bolstering labor-intensive sectors like agriculture and allied industries, we stand to invigorate investment levels, revitalizing the economic tapestry of our nation. In a world where uncertainty often veils the path forward, our study strives to illuminate the intricate relationship between investment, economic growth, and employment in India's post-reform era. Armed with insights derived from rigorous analysis, we offer a clarion call for strategic interventions that can reshape the trajectory of our economy, ushering in an era of sustainable growth and equitable prosperity.

Keywords: Gross Fixed Capital Formation; Investment; Economic Growth; Employment; Granger Causality; VECM.

JEL Classification: E22; E24.

1. Gross Fixed Capital Formation and Economic Development:

The dynamic interplay between Gross Fixed Capital Formation (GFCF) and economic development is a cornerstone of macroeconomic policy, their relationship symbiotically driving progress. GFCF, a pivotal facet of domestic investment, emerges as an instrumental force propelling economic growth and employment while economic development, in turn, fuels the engine of capital formation. This intricate dance creates a cyclical synergy that underpins the pursuit of stability, reduced unemployment, and an elevated standard of living for all citizens. In theory, augmented investment is anticipated to fuel increased job creation, an outcome that reverberates favorably through employment levels. Simultaneously, the velocity of economic growth itself has been advanced as a catalyst for domestic

investments, forging a twofold relationship of influence between the two factors. This mutual influence underscores the existence of bi-directional causality between investment and economic growth, each factor propelling the other.

However, a shadow looms over this symbiosis, cast by the surge of innovations, science, and technology. The dawn of automation and mechanization, while optimizing certain operations and bolstering productivity, has brought about a phenomenon known as 'Jobless Growth'. This discord stems from a scenario where advances displace manpower, resulting in unemployment despite economic expansion. The advent of computerization and mechanization, while enhancing efficiency, risks compromising job stability—a predicament witnessed in

various economies [1-3]. Amid this intricate tapestry, the realm of empirical exploration is confined. A limited scholarly inquiry has been dedicated to deciphering the true impact of investment on employment generation. Early forays into this terrain, such as Levine & Renelt, Mankiw et al. and De Long & Summers, painted a portrait of a positive nexus between investment and economic growth [4-6]. The latter study, by De Long & Summers, distinguished this nexus as a causal link, positing that elevated investment rates, particularly in equipment, incite amplified growth. Turning the spotlight to global observations, Summers & Heston scrutinized 101 OECD nations, unraveling a consistent pattern [6, 7]. A surge in investment levels followed a stable course of long-term economic growth. Nonetheless, the relationship proved more nuanced, as unveiled by Blomstrom et al. and Carroll & Weil [8, 9]. Their findings suggested that economic growth assumes the role of a Granger-causation catalyst for investment, while investment, though consequential, does not reciprocate this causal power. In the intricate web woven by GFCF and economic development, these findings shed light on the complex dynamics at play. As economies strive for equilibrium, it is paramount to comprehend the far-reaching implications of investment strategies and technological advancements, cautiously navigating the path toward sustainable and inclusive growth.

2. Relationship Between Investment, Economic Growth, and Unemployment in India:

Over the last three decades, the Indian economy has demonstrated robust growth, averaging over six percent annually, particularly after the introduction of much-needed economic reforms. This growth was expected to usher in reduced unemployment, but the reality proved starkly different. Despite formal sectors failing to provide jobs, the period witnessed a disconcerting surge in unemployment, causing ripples across various sectors. As India grapples with these challenges, stagnated economic growth and persistently high unemployment continue to loom large on the macroeconomic horizon. The latest employment data paints a grim picture. Between 2012 and 2016, India's employment growth plummeted dramatically, culminating in an absolute decline in employment from 2013-14 to 2015-16—an unprecedented occurrence. Independent surveys conducted by Kannan & Raveendran as well as data from the United Nations (ILO), confirm this alarming trend, revealing a net decline in employment and a concurrent increase in unemployment [10-12].

Economists attribute this conundrum to the failure to align economic growth with proportional employment expansion. Despite the expansion of the Indian economy, the creation of well-paying jobs remained limited. The number of unorganized workers within the organized sector burgeoned, accentuating the paradox. This shift led to a remarkable decline in the labor force participation rate, raising concerns about long-term economic growth's potential to erode purchasing power and consumption demand. Sinha and Sinha & Sinha delves further, revealing through log linearized models that the employment elasticity of economic growth exhibited a negative and significant trend [13-15]. This starkly echoes the concept of "jobless growth"

in the Indian post-reform economy. The current high levels of unemployment can be attributed to the low employment intensity of GDP growth—a disconcerting relationship that calls for a rethinking of investment strategies [16, 17]. The prevailing scenario points to the imperative for labor-intensive investments to counterbalance the current capital-intensive landscape. The negative correlation between employment levels and GDP growth rate underscores the need for a transformative policy approach that fosters employment generation.

The gravity of unemployment's impact extends beyond economics. Criminal activities find fertile ground in the idle minds and hands of the unemployed, while reducing unemployment rates can propel investments in critical social and economic infrastructure. In the realm of policy, the Government's intervention becomes essential. The inherent inadequacies of the market mechanism underscore the necessity for public sector investment. This intervention can alleviate regional disparities, stimulate essential industries, and nurture technological progress, ultimately driving economic growth through enhanced utilization of productive resources. The goal of attaining employment takes center stage as a paramount macroeconomic objective in India, where the scourge of unemployment fuels poverty. Despite bold promises, the reality remains distant, highlighting the need for strategic economic reforms to holistically address unemployment's complexities. The juxtaposition of surging unemployment against impressive growth indicators underscores the urgency for comprehensive policy shifts. Economic reforms initiated in 1991 aimed to resolve this issue, yet unemployment persists despite significant economic improvements.

The confluence of factors—negative developments in economic activities, labor-capital substitution, and an influx of workforce supply—underpin India's unemployment crisis. Even in the 1990s, during the pro-market economic reforms, the country grappled with this challenge. While reforms aimed to invigorate growth and attract foreign investment, the disconnection between economic expansion and employment growth became starkly evident, resulting in the phenomenon of jobless growth.

In conclusion, the intricate web of investment, economic growth, and unemployment underscores the complexity of India's economic landscape. To tackle this paradox, innovative policies must not only stimulate growth but also ensure equitable employment generation. This study embarks on a mission to untangle these threads, contributing to the empirical understanding of the relationships between domestic investment, employment, and economic growth—a vital step towards a more prosperous and balanced future.

3. The Intricate Relationship Among Investment, Economic Growth, and Employment

The theoretical landscape that centralizes domestic investment as the engine propelling economic growth finds resonance in various growth paradigms—ranging from Keynesian insights like the Harrod-Domar model to neoclassical theories such as Solow and Denison's, extending to the intricacies of endogenous

growth frameworks. Empirical explorations have sought to illuminate these theoretical underpinnings. Bond et al. embarked on an exploration of 94 non-OECD countries, underscoring the positive correlation between investment, economic growth, and long-term output per worker [18]. Nevertheless, they debunked the notion of investment Granger causing economic growth, as espoused by Jones and Blomstrom et al. [19, 8]. Instead, they illuminated that investment plays a pivotal role in explaining the growth pattern. This complexity was further unraveled by studies like Antelo & Valverde, highlighting how investment's impact on economic growth hinges on the anticipated return on capital [20]. Yet, in developing countries with nascent financial markets, the level of interest rates exhibits insignificance as an investment determinant. Attanasio et al. and Bond et al. ventured to uncover Granger causality between investment and economic growth, stressing that substantial investment contributions to GDP correspond with heightened output per worker and robust long-term growth [21, 18]. The scenario takes a turn in Cheung et al.'s examination of rich and poor countries, where a surprising negative relationship between investment and economic growth emerges, especially in developing nations. Ibarra and Moreno-Brid uncovered a critical dependency of investment on real wage-driven economic growth in Mexico [22, 23]. Mordecai and Ramirez offered intriguing insights into the chronology between economic growth, investment, and employment in Uruguay, where economic growth acted as a precursor to both investment and employment [24]. However, Porreca and Carmecchi and Bechet and Othman detected a bi-directional causality between investment and economic growth in European countries [25, 26].

Delving into India, Kanu and Ozurumba and Suhail and Dania confirmed long-term positive relationships between total exports, domestic investment, and economic growth. Mohsen & Maysam's analysis of Middle Eastern and North African countries established that economic growth drives investment, while Rajni proposed a bi-directional causality between domestic capital formation and export growth [27-30].

The intricacies continued with Iocovoin's Romanian investigation, confirming the positive impact of net capital formation on employment [31]. In Malaysia, Karim, Karim, and Zaidi revealed fixed investment's significant role in short-run economic growth. Neanywa & Makhenyane unearthed a

dual-directional causality between gross fixed capital formation and economic growth in South Africa [32, 33]. Meyer & Sanusi turned to the South African context, illustrating long-term relationships among domestic investment, employment, and economic growth with causality running from growth to investment [34].

As the cacophony of findings reverberates, the absence of a definitive consensus on the causality among investment, economic growth, and employment remains apparent. The pursuit of clarity led to an exploration of this relationship in the Indian context, within the Vector Error Correction Model framework. This study delves into the intricacies of this nexus, encapsulating the tumultuous post-economic reform period from 1990 to 2021, seeking to unveil the true nature of these complex interactions.

4. Data Foundation: At the heart of this study lies an intricate web of variables, each a vital thread in the tapestry of economic dynamics. Our focus spans economic growth, as gauged by the real gross domestic product (GDP); the bedrock of domestic investment, represented by gross fixed capital formation; and the tangible manifestation of economic progress, the number of employed individuals.

In our relentless pursuit of accuracy, we've turned to the most formidable cornerstone: data. A treasure trove of insights, our data repository draws upon trustworthy and authoritative sources. The backbone of our study is composed of secondary data, meticulously curated from sources of the highest repute, including the WDI (World Development Indicators) databank, IFS (IMF's International Financial Statistics), and the MOSPI, along with an array of relevant departments under the aegis of the Government of India. The period under scrutiny spans from 1990-91 to 2020-21, encapsulating a comprehensive snapshot of 31 observations.

The strength of this data lies in its precision, as we've subjected it to logarithmic transformation to enhance analytical robustness. The trio of variables—the logarithm of real GDP (LRGDP), the logarithm of investment (LINV), and the logarithm of employment (LEMPLOY)—is meticulously listed in Table 1, constituting the lynchpins of our investigation.

Acronym of variable	Variable	Measurement of variable
LINV	Investment	Gross Fixed Capital Formation
LRGDP	Real GDP	The GDP is at a constant price.
LEMPLOY	Employment	The number of people employed.
Source: Researchers' compilations (MOSPI & Related Government Departments).		

Table 1: Description of variables

In our quest to unearth the intricacies of these relationships, we've diligently employed methods that stand as stalwarts in the realm of analysis. Our chosen methodologies not only reflect our commitment to scientific rigor but also serve as safeguards against misinterpretations and errors. This deliberate approach affords us the confidence to explore the dynamics between

economic growth, investment, and employment with meticulous accuracy, ensuring that the findings that emerge stand as a beacon of knowledge and insight.

5. Employing VAR-VECM for Unraveling Complex Dynamics: In this pursuit of understanding intricate economic dynamics,

our analytical arsenal hinges on a Vector Autoregressive (VAR) model seamlessly interwoven with an error correction mechanism (VECM). This powerful combination forms the bedrock of our study, a methodological architecture designed to unravel the interplay between economic growth, investment, and employment.

Before venturing into the heart of our investigation, we meticulously transformed our data series into logarithmic form, a prelude to ensuring the integrity and robustness of our analysis. Augmented unit root testing became our compass, guiding us toward the integrated degree of each data series. Employing the Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests for both levels and first differences, we adhered to the specifications elucidated by Levin, Lin & Chu in a regression model encapsulated by Equation (1):

$$\Delta x_t = \alpha + \beta x_{t-1} + \lambda t + \sum_s \Delta x_{t-s} + \varepsilon_t$$

The symbology dances on the page, where x_t represents the variable of interest, ε_t stands as the disturbance term, and t marks the passage of time [35]. Parameters α , β , and λ lend their significance to the equation, as the summation embraces the realm of 1 to n .

A pivotal juncture arrived as we entered the domain of cointegration. Johansen illuminated the path, advocating a p -variable VAR model to assess the cointegration among the variables [36]. Equation (2) emerged, capturing the essence of the interwoven relationships:

$$X_t = \mu + \sum \theta_i x_{t-i} + \eta_t$$

Parameters danced again— X_t as the $(p,1)$ vector of our variables, with η_t donning the role of a disturbance term, a Gaussian process with a serene zero mean and variance ϕ . The concept of cointegration hinges on the premise that, while individually non-stationary, a stable long-run relationship can be unlocked via linear combinations of these stationary variables.

Journeying further, the VECM emerged as our conduit to insights. An elegant transformation of Equation (2), and Equation (3) captured the essence:

$$\Delta x_t = \mu + \sum \Gamma_i \Delta x_{t-i} + \pi x_{t-k} + \eta_t$$

Here, the symphony of parameters and matrices orchestrated the analytical symposium. Γ_i stood as parameters, while π unfurled as a matrix whose rank unveiled the foundational long-run relationships between our variables. Johansen added to the intrigue, formulating test statistics to determine r based on maximum likelihood estimation—both trace and maximum eigenvalue tests unfolded as our analytical compass [36].

The quest for causal relationships ensued. Guided by the Granger causality procedure and firmly rooted in the VECM framework, we ventured into the terrain of relationships between investment and economic growth, as well as investment and employment.

This procedure, enhanced by the elasticity of VECM, can unveil causality even if the coefficients of explanatory variables' differences do not collectively command significance, as posited by Anoruo and Ahmad [37].

With methodological precision as our guide, we embark on a journey to reveal the intricate underpinnings of economic growth, investment, and employment, transforming the complexity into comprehensible insights that will illuminate the economic landscape.

6. Result & Discussion
6.1. Descriptive Statistics of Economic Growth, Investment, and Employment

Our exploration dives into the very fabric of economic dynamics, as we unveil the descriptive statistics that illuminate the intricate interplay between economic growth, investment, and employment during the transformative post-reform period, spanning 1991-92 to 2020-21, as elegantly captured in Table 2.

Descriptive Statistics	LRGDP	LEMPL	LPINV
Mean	5.788	2.760	5.267
Median	6.596	2.655	5.304
Standard Deviation	3.221	0.308	0.457
Skewness	-2.882	3.567	3.122
Kurtosis	11.130	17.308	15.644
Source: Authors' computation.			

Table 2: Descriptive statistics of LRGDP; LEMPL; and LPINV

Economic growth in India during the broader spectrum from 1990-91 to 2020-21 emerges as a focal point, congregating around the mean of 5.788. Within the specific post-reform period of 1991-92 to 2020-21, this clustering around the mean heralds a significant and positive shift in the growth rate of real gross domestic product (RGDP). A noteworthy stride in economic prosperity echoes through this clustering.

Equally significant is the employment landscape. Mirroring this trend, the employment rate finds its anchor around the mean value of 2.760 within the post-reform timeframe. This convergence signals a marked increment in the employment rate, a testament to the reform's capacity to generate meaningful employment avenues, albeit not at a scale in tandem with economic growth.

The tapestry of public investment, as woven by gross fixed capital formation, emerges as a pivotal narrative thread. The mean value of 5.267 serves as the gravitational center during the post-reform era. This convergence around the mean underscores a substantial upswing in public investment, a tangible indication of the reform's resonance in enhancing investment prospects.

The rhythmic movement of these series offers insights into the reform's fundamental objectives. Economic growth, augmented public investment, and escalated employment collectively constitute the reform's triumphant chord. However, it is apparent that the scale of employment generation lags behind the remarkable strides in economic growth and investment, eventually casting a shadow on long-term employment dynamics and triggering a plethora of social challenges.

Delving into the statistical nuances, the standard deviation unfurls a

poignant tale. Economic growth, in its series, eclipses employment and public investment in terms of volatility, a testament to the inherent dynamism and fluctuations inherent in the economic realm.

The symphony of skewness and kurtosis coefficients paints a vivid picture of the distribution patterns. These series of growth rates, public investment, and employment bear the marks of asymmetry, their distributions deviating from the symmetrical norm. The coefficients' values, exceeding or falling short of the absolute one, highlight the deviation from the classical norm of normal distribution.

As our voyage of exploration continues, these descriptive statistics stand as guideposts, illuminating the multifaceted tapestry of economic

growth, investment, and employment—a narrative brimming with transformative potential, yet also echoing the need for calibrated equilibrium.

6.2. Unveiling Time Series Properties: Unit Root Test Insights

As we delve into the intricate time series underpinning our study, the spotlight turns to the pivotal unit root test—the compass guiding us through the journey of stationarity and dynamics. Our exploration employs the formidable Augmented Dickey-Fuller (ADF) test and the illuminating Phillips-Perron test, both revealing their insights in the tapestry of Table 3.

Variables	ADF test		PP test	
	T-stat	P-value	T- stat	P-value
LINV	-0.96190	0.7635	-1.2073	0.6683
LRGDP	-1.4724	0.5428	-1.3265	0.5921
LEMP	-0.4683	0.8912	0.4587	0.8931
Δ LINV	-5.2081	0.0001*	-5.2081	0.0001*
Δ LRGDP	-4.6708	0.0002*	-4.5917	0.0003*
Δ LEMP	-4.6766	0.0002*	-7.4850	0.0001*

Source: Author's computation. Note: * implies the rejection of the null hypothesis at a 1% significance level.

Table 3: Unit Root Results

Table 3 stands as a repository of revelations, unfurling the time series properties of our variables. Here, the dance between trend and intercept assumes significance, casting its influence on the

trajectory of our variables. As the ink flows, the tale that emerges is one of significance—both trend and intercept assert their authority, etching their presence on the canvas of our analysis.

Trace Test				Maximum Eigen. Test			
H_0	H_1	Trace Stat.	P- value	H_0	H_1	Max. Eigen Stat.	P-value
$r=0$	$r>0$	64.9647	0.0040*	$r=0$	$r>0$	36.8905*	0.0035*
$r<1$	$r>1$	28.0740	0.2380	$r<1$	$r=1$	14.2595*	0.4385
$r<2$	$r>2$	13.8146	0.3924	$r<2$	$r=2$	10.5980	0.2829

Note: Both the Trace test and Maximum Eigen test results show cointegrating at the 5% significance level.
Source: Author's computation.

Table 4: Johansen Cointegrating Results.

In this symphony of statistical scrutiny, a profound revelation emerges. Our three variables, beacons of economic significance—economic growth, public investment, and employment—waltz on the precipice of non-stationarity in their pristine form, marked as $I(0)$. However, their transformation unveils a significant shift. At level $I(1)$, these variables assume a cloak of stationarity, embracing the 5 percent significance threshold with grace.

Thus, through the lens of the unit root test, the intricate dynamics of these time series reveal themselves. The tale told is one of transformation and equilibrium, as these variables transcend their non-stationary origins to assume a stationary demeanor, their significance echoing in the realms of $I(1)$. This nuanced dance, captured in the results of our tests, stands as a cornerstone for our analysis, paving the way for deeper insights into the nexus of economic growth, investment, and employment.

6.3. Tracing Equilibrium: Insights from Long-Run Analysis

As we embark on a journey into the realm of long-run

relationships, the Johansen cointegration test takes center stage. This rigorous analysis is an intricate dance of variables, performed upon a foundation of established stationarity within the time series. With the aim of uncovering common stochastic trends woven into these variables, our spotlight is on the Johansen test—a tool known for its sensitivity to lag length.

Navigating this labyrinth, we embarked on a lag selection test, a meticulous process leading us to the optimal lag length of 2. Supported unanimously by the lag selection criteria, this lag length stands as a robust choice, steering our analysis toward a clear path.

In the intricate trio of economic growth, employment, and investment, the stage is set for the maximum number of cointegrating vectors—two. The null hypothesis trembles in the face of these vectors, questioning their existence, while the alternative hypothesis emerges as a beacon of possibility—a hint of at least one cointegrating vector.

As the analysis unfolds, a resounding outcome emerges. The null hypothesis's fall is unanimous and rejected at the 5% significance threshold across the board. However, the alternative hypothesis retains its ground, refusing to be dislodged. The implications are profound—the variables are indeed cointegrating, hinting at a long-run equilibrium, and affirming the existence of at least one causal direction.

From this symphony of results, equations emerge, capturing the essence of the long-run relationships at play:
 $LEMPLOY = 7.07 - 0.486LRGDP + 0.2763LINV$ (4) $LRGDP = 14.53 + 0.567LINV - 0.255LEMPLOY$ (5)

Here, insights unfurl in their complexity. The positive link between employment and investment comes to light, portraying a symbiotic relationship in the long run. Simultaneously, a nuanced balance emerges—the long-run impact of economic growth on employment bears a negative connotation. This sobering revelation casts a spotlight on the concept of jobless growth in India's post-economic reform era, where the specter of elevated unemployment looms.

Echoing previous findings, equation (5) unveils a positive undercurrent—a sturdy link between economic growth and investment, a chord that resonates harmoniously. Yet, the negative strand connecting economic growth and employment unfurls a narrative of inefficiency in utilizing available factors of production and a void in technological advancement—a reminder of the complexities lying beneath the surface.

As we navigate this sea of relationships, our analysis brings into focus the delicate equilibrium and the intricate web of influences that govern the interplay between economic growth, investment, and employment—a tapestry that holds both challenges and opportunities.

6.4. Unraveling Causality: Insights from Causality Tests

With the map of cointegration tests charted, we venture into the heart of causality, guided by the VECM equation (3). This equation, a symphony of variables—investment, employment, and economic growth—carries the potential to uncover the elusive dance of causality between them. Our findings are unveiled in the eloquent pages of Table 5.

Dependent Variable	Independent variables			
	DLINV	DLRGDP	DLEMP	All variables
DLINV	-	9.7779 (0.0028***)	0.5322 (0.7662)	10.1084 (0.9472)
DLRGDP	5.5582 (0.0621)	-	3.9625 (0.1379)	9.1118 (0.0850*)
DLEMP	10.2534 (0.0059***)	1.0555 (0.5859)	-	12.2411 (0.0011***)
Note: * imply a 10% significance level; *** implies a 1% significance level; Source: Author's computation.				

Table 5: VEC Granger Causality test results

As we cast our gaze upon Table 5, a significant revelation emerges. A unidirectional causality paints its strokes—GDP stands as the driving force propelling investment in India during the post-economic reform period. This narrative echoes the sentiments of previous studies, aligning with their stance that investment does not Granger cause economic growth. A similar thread unwinds between GDP and employment, as the arrow of causality flows unidirectionally, bucking the trend painted by Rajni (2013) (30).

Seeking robustness, the standard pairwise Granger causality test further illuminates our path. The tableau of Table 6 portrays a consistent picture—GDP's causal pull on investment remains, while the converse journey lacks validity. Herein lies a pivotal observation: economic growth orchestrates investment in India.

Null Hypothesis	P-value
LINV does not Granger cause LRGDP	0.3513
LRGDP does not Granger cause LINV	0.0006***
LEMP does not Granger cause LRGDP	0.0586*
LINV does not Granger cause LEMPL	0.0157**
LRGDP does not Granger cause LEMPL	0.0003***
LEMP does not Granger cause LINV	0.0816*
Note: *** implies rejection of the Null Hypothesis at a 1% significance level; ** implies the rejection of the Null Hypothesis at a 5% significance level; and * implies the rejection of the Null Hypothesis at a 10% significance level. Source: Author's computation.	

Table 6: Pairwise Granger Causality Test.

In the nexus between GDP, investment, and employment, dynamics unveil an intricate dance. A bilateral causality reigns supreme between GDP and employment, as well as between investment and employment. These echoes mirror the findings of Rajni (2013) (25), further accentuating the bi-directional relationships that govern this complex trio.

Error Correction	D(LINV)	D(LRGDP)	D(LEMPL)
Cointegration Equation 1	0.0197 (0.0165) 1.1952	-0.0153 (0.0044) -3.5118	0.0154 (0.0061) 2.5157
D{LINV(-1)}	0.7743 (0.4673) 1.6567	-0.04612 (0.1232) 3.7398	0.3254 (0.1734) 1.8767
D{LINV(-2)}	1.2230 (0.4960) 2.2264	-0.1669 (0.1309) 1.3751	0.3314 (0.1840) 1.8610
D{LRGDP (-1)}	0.3712 (0.1154) 3.2148	-0.0134 (0.0304) -0.4392	-0.0036 (0.4285) -0.0854
D{LRGDP (-2)}	-0.1373 (0.1117) -1.2300	-0.0579 (0.0294) -1.9646	0.0404 (0.0414) 0.9768
D{LEMPL(-1)}	0.1520 (0.3138) 0.4846	0.1314 (0.0828) 1.5868	0.0218 (0.1164) 0.1876
D{LEMPL(-2)}	-0.1574 (0.3942) -0.5127	-0.0200 (0.0800) 1.2877	0.1580 (0.1128) 0.1406
Source: Author's computation.			

Table 7: VECM estimation results.

Table 7 takes center stage, offering insights derived from the VECM estimation. Here, the coefficient's significance has multiple meanings. The coefficient of real GDP, standing tall amidst the VECM's estimation, bears witness to the short-term adjustments as it gravitates towards the long-run relationship deviations. In contrast, other variables, their coefficients and t-values scrutinized, paint a different picture. Short-term adjustments to long-run relationship deviations evade their grasp, casting a revealing light on the dynamics at play.

In this symphony of causality, the tapestry unwinds, capturing the essence of the relationship between investment, employment,

and economic growth. From the unidirectional influence of GDP on investment and employment to the bi-directional currents between GDP, investment, and employment, our journey unveils the intricate interplay that shapes India's economic landscape.

6.5 Ensuring Robustness: Insights from Stability Tests

Amid the intricate web of analysis, the need for robustness emerges as a guiding star. With unwavering resolve, we delve into the realm of stability tests, where Table 8 takes center stage—a repository of insights that stand as sentinels guarding against lurking anomalies.

Item	Applied Test	P-value	Decision
Serial Correlation	LM Test	0.4214	No serial correlation
Normality	Jacque- Bera Test	0.1976	Variables normal
Heterocedasticity	Breusch Pagan Godfrey Test	0.2699	No heterocedasticity
Source: Author's computation.			

Table 8: Diagnostic Test Results

As the curtains rise on Table 8, a compelling narrative emerges. The diagnostic tests, meticulously executed, yield results that whisper of stability. Here, the specters of serial correlation and heteroscedasticity find themselves banished. The significance of these findings echoes in the meticulous insignificance of the probability values, firmly perched above the 5% significance threshold.

The journey through diagnostic scrutiny is one of acceptance, as the null hypotheses of no serial correlation, no heteroscedasticity,

and normal distribution are embraced. The insignificance of the probability values serves as a reassuring affirmation—an assurance that our analysis remains anchored in robustness and steadfast methodology.

With Table 8 as our compass, we traverse the terrain of stability with confidence, assured that our path is free from the pitfalls that may distort our insights. Amid the nuanced intricacies of data analysis, the stability tests stand as sentinels—guardians of authenticity and champions of rigor—elevating our exploration

to a higher level of assurance and trustworthiness.

7. Unraveling the Investment-Employment-Growth Nexus: Insights and Implications

At the heart of economic discourse lies the notion that investment is the linchpin of growth, a catalyst that ignites the flames of economic prosperity. In this intricate tapestry, economic growth is heralded as the herald of employment generation, especially within the labor-abundant terrain of the Indian economy. Yet, the relationship between investment and economic growth remains shrouded in complexity, as empirical studies weave tales of divergence and ambiguity in the employment-economic growth nexus.

Amidst this enigma, our study ventures forth to illuminate the nature of investment, economic growth, and employment in the context of India's post-economic reform era—spanning the years from 1990 to 2021. Armed with the powerful Vector Error Correction Model (VECM), we pierce through the fog of uncertainty to unearth pivotal insights.

Our findings unveil a compelling revelation—a robust long-run relationship binds these variables, their dynamics intertwined in the intricate dance of causality. Amidst this tapestry, a symphony of bi-directional causality echoes between employment and economic growth—a chorus that reverberates through the economic landscape. Intriguingly, our analysis reveals that economic growth's tendrils precede investment, a dynamic that defies conventional assumptions.

In light of these revelations, our conclusions emerge as beacons of guidance. The profound hypothesis of jobless growth in the post-economic reform era finds confirmation in our study—an observation that casts a sobering light on the nation's economic landscape. In the face of this challenge, a clarion call for a more favorable economic environment emerges—a call that resonates through the avenues of improved infrastructural facilities and a strategic embrace of labor-intensive sectors, notably agriculture and allied domains. These pathways, we argue, are the keys to invigorating investment levels, and shaping a landscape where employment and prosperity intertwine harmoniously.

As we draw the curtain on our exploration, we leave behind a trail of insights, a roadmap for policymakers and thinkers alike. The investment-employment-growth nexus, once enigmatic, emerges as a tapestry of opportunities—a realm where economic growth propels employment, investment takes its cues from growth, and an enlightened economic landscape thrives in the embrace of holistic progress.

8. Empowering Growth: Strategic Recommendations

Within the corridors of our analysis, a roadmap for action emerges—a series of recommendations that stand as beacons, guiding the path toward a future of economic vibrancy and enhanced employment prospects. These recommendations are the fruits of our inquiry, carefully distilled from the intricate interplay of investment, employment, and growth.

- **Optimize Resource Allocation:** A strategic recalibration of budgetary allocations is paramount. By systematically reducing recurrent expenditure, the government can unlock resources that can be channeled into capital spending—a catalyst for generating employment and fostering economic dynamism.
- **Foster a Climate of Competition:** Structural transformation begins with a vibrant private sector. The removal of price controls and the dismantling of structural rigidities serve as harbingers of competition. A competitive ecosystem propels private sector investment, thus catalyzing a cycle of growth and job creation.
- **Embrace Sustainable Subsidies:** Subsidies, when channeled toward production, wield transformative power. The government should adopt a sustainable approach to subsidies that incentivizes private sector investment. This strategic move not only fuels economic activity but also translates into a substantial reduction in unemployment.
- **Craft Tailored Incentives:** Certain sectors hold the key to impactful employment generation. Agriculture, Transportation, Energy Production, Telecommunication, Manufacturing, and Mining are the cornerstones of opportunity. By designing targeted incentive packages, the government can spur investment in these sectors with low incremental capital-output ratios, driving a surge in employment opportunities.
- **Elevate Agriculture and Allied Sectors:** The bedrock of employment lies in Agriculture and its allied domains. To harness this potential, the government should embark on a policy of heightened public investment in these sectors. By nurturing their growth, the government not only fosters employment but also nurtures the promise of food security.
- These recommendations, borne from a rigorous exploration of the investment-employment-growth nexus, hold the potential to reshape India's economic landscape. As policymakers and visionaries converge, armed with these strategic pathways, a future brimming with prosperity and progress beckons—an India where growth empowers, investment thrives, and employment flourishes.

References

1. Coombs, R., & Green, K. (1981). Microelectronics and the future of service employment. *Service Industries Journal*, 1(2), 4-21.
2. Hodge, D. (2009). Inflation, unemployment and economic growth in South Africa. *South African Journal of Economics*, 77(4), 488-504.
3. Frey, B.C. & Osborne, M. (2015): Technology at work: The future of innovation and employment. *Global Perspective & Solutions*, pp.1-108.
4. Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *The American economic review*, 942-963.
5. Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The quarterly journal of economics*, 107(2), 407-437.
6. De Long, J. B., Summers, L. H., & Abel, A. B. (1992). Equipment investment and economic growth: how strong is the nexus? *Brookings Papers on Economic Activity*, 1992(2), 157-211.
7. Summers, R., & Heston, A. (1991). *The Penn World Table*

- (Mark 5): an expanded set of international comparisons, 1950–1988. *The Quarterly Journal of Economics*, 106(2), 327-368.
8. Blomström, M., Lipsey, R. E., & Zejan, M. (1996). Is fixed investment the key to economic growth? *The Quarterly Journal of Economics*, 111(1), 269-276.
 9. Carroll, C. D., & Weil, D. N. (1994, June). Saving and growth: a reinterpretation. In *Carnegie-Rochester conference series on public policy* (Vol. 40, pp. 133-192). North-Holland.
 10. Kannan, K. P., & Raveendran, G. (2019). From jobless to job-loss growth. *Economic and Political Weekly*, 54(44), 38-44.
 11. International Labour Organisation (2001): *Key Indicators of Labour Market (KILM)*, 2001-2, ILO-UNDP.
 12. Khan, A. (2001): *Employment Policies for Poverty Reduction: Recovery and Reconstruction Department*, ILO, Geneva
 13. Sinha, J. K. (2022). Public Expenditure for Agricultural Development & the Economic Growth of Bihar (1981-2019). *Asian Journal of Economics & Finance*, 4(4), 414-424.
 14. Sinha, J.K. (2022b): Impact of Unemployment and Inflation on the Economic Growth of India, *Journal of Development Economics & Finance*, 2022, Vol.3(2).
 15. Sinha, J. K., & Sinha, A. K. (2022). Syndrome of Declining Economic Importance of Agriculture in Bihar (1960-2018). *Journal of Humanities, Arts and Social Science*, 1.
 16. Padder, A. H. (2018). Changing Pattern of Economic Development and Employment in India: An Interstate Analysis. *Social Science and Humanities International*, 1-29.
 17. Michael, E. O., Emeka, A., & Emmanuel, E. N. (2016). The relationship between unemployment and economic growth in Nigeria: Granger causality approach. *Research Journal of Finance and Accounting*, 7(24), 153-162.
 18. Bond, S., Lebeblicioglu, A., & Schiantarelli, F. (2007). Capital accumulation and growth: A new look at the evidence. *IZA Discussion*, 1174.
 19. Jones, C. I. (1995). Time series tests of endogenous growth models. *The Quarterly Journal of Economics*, 110(2), 495-525.
 20. Antelo, E. & Valverde, F. (1994): *Determinants of Private Investments in Bolivia*, Unidad de Analisis de Politicas Sociales Econonucas, Vol .8 pp. 1-30.
 21. Attanasio, O. P., Picci, L., & Scorcu, A. E. (2000). Saving, growth, and investment: a macroeconomic analysis using a panel of countries. *Review of Economics and Statistics*, 82(2), 182-211.
 22. Cheung, Y. W., Dooley, M. P., & Sushko, V. (2012). Investment and growth in rich and poor countries (No. w17788). *National Bureau of Economic Research*.
 23. Ibarra, D.; Moreno-Brid, J.C. (2004): Private Investment, Foreign Direct Investment, and Economic Growth, ECLAC, United Nations.
 24. Mordecki, G., & Ramírez, L. (2014). Investment, growth and employment: VECM for Uruguay. *Serie Documentos de Trabajo/FCEA-IE; DT07/14*.
 25. Podrecca, E., & Carmeci, G. (2001). Fixed investment and economic growth: new results on causality. *Applied Economics*, 33(2), 177-182.
 26. Bekhet, H. A., & Othman, N. S. (2011). Causality analysis among electricity consumption, consumer expenditure, gross domestic product (GDP) and foreign direct investment (FDI): Case study of Malaysia. *Journal of economics and international finance*, 3(4), 228.
 27. Kanu, S. A. & Ozurumba, B.A. (2014): Capital formation and economic growth in Nigeria, *Global Journal of Human Social Science*. Vol.4(4), pp.1-17.
 28. Shuaib, I. M., & Ndidi, D. E. (2015). Capital formation: impact on the economic development of Nigeria 1960-2013. *European Journal of Business, Economics and Accountancy*, 3(3), 23-40.
 29. Mehrara, M., & Musai, M. (2013). The causality between capital formation and economic growth in MENA region. *International Letters of Social and Humanistic Sciences*, 8, 1-7.
 30. Rajni, P. (2013): Linkages between exports, imports, and capital formation in India. *International Research Journal of Social Sciences*. Vol. 2(3), pp.16-19.
 31. Iacovoiu, V. B. (2012). Impact of Capital Investments on Unemployment in the Context of Economic Crisis. The Case of Romania. *Economic Insights-Trends & Challenges*, 64(4).
 32. Abdul Karim, Z., Abdul Karim, B., & Ahmad, R. (2010). Fixed investment, household consumption, and economic growth: A structural vector error correction model (SVECM) study of Malaysia.
 33. Ncanywa, T., & Makhenyane, L. (2016). Can investment activities in the form of capital formation influence economic growth in South Africa?
 34. Meyer, D.F. & Sanusi, K.A. (2019): A causality analysis of the relationships between gross fixed capital formation; economic growth and employment in South Africa, *Studia Universitatis Babes-Bolyai O Economica*, Vol.64(1), pp.33-44.
 35. Levin, A.; Lin, C.F.; and Chu, C.S.J. (2002): Unit root tests in panel data; asymptotic and finite sample properties, *Journal of Econometrics*, Vol.108(1), pp.1-24.
 36. Johansen, S. (1991): Estimation and Hypothesis Testing of cointegration vectors in Gaussian Vector Autoregressive Models, *Econometrica*, Vol. 59(6), pp. 1551-1580.
 37. Antonio, E. & Ahmed, Y. (2001): Casual relation between domestic savings and economic growth: Evidence from seven African countries. *African Development Review*, Vol.3(2), pp.238-249.

Copyright: ©2023 Jitendra Kumar Sinha. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.