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Understanding Economic Growth in India: How It Affects the Everyday Lives of Common People

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Abstract: India has witnessed significant economic progress over the past two decades, positioning itself for sustained growth over the next 30 years. However, the key challenge remains in transforming this potential into actual economic gains. This study aims to identify the primary drivers of India's economic growth by analyzing key indicators—consumption, fixed asset investment, exports, gross domestic product (GDP), and employment—between 2000 and 2023. Using multiple regression analysis conducted with E-Views software, the results demonstrate that consumption, fixed asset investment, exports, and employment have positive and statistically significant impacts on GDP growth. The findings reveal that fixed asset investment plays a pivotal role in enhancing capital stock, while consumption drives domestic demand, contributing to GDP expansion. Exports further bolster growth through international trade, while employment improvements lead to better resource utilization. Based on these insights, the study proposes critical policy recommendations: (i) enhancing social security systems and expanding access to credit to stimulate consumer spending; (ii) prioritizing rural development and promoting innovative industries to ensure a balanced distribution of investment across regions; (iii) optimizing export structures by encouraging technological advancements in key sectors; and (iv) improving workforce quality by aligning education with market demands and offering targeted vocational training. These measures are essential for sustaining India's economic momentum and ensuring long-term, inclusive growth. The study's findings provide valuable direction for policymakers seeking to address existing bottlenecks and capitalize on India's growth potential for sustainable development.

Keywords: economic development, multivariate regression analysis, determinants, empirical investigation

1. Introduction

The global economy faced a sharp decline after the 2008 financial crisis, leading many nations into recession, marked by negative growth, rising unemployment, and social unrest. This fragile period worsened because of the 2020 COVID-19 pandemic, severely disrupting the global financial system, including India's. The pandemic triggered a contraction in demand and supply, with India's manufacturing Purchasing Managers' Index (PMI) dropping 14.3%, and the nonmanufacturing business activity index falling 24.5% in April 2020 compared to the previous month. Sectors like transportation, tourism, hospitality, and consumer-facing industries were heavily impacted, leading to major disruptions in India's economic infrastructure.

During the 2021 parliamentary sessions, India's "triple overlay period" of challenges—the global financial crisis, domestic structural issues, and the COVID-19 pandemic—was recognized. As the largest developing country, India's sustained growth is crucial for raising living standards, reducing poverty, and maintaining stability. Thus, strategies for economic recovery have become a priority for policymakers, with studies [1–11] advocating targeted measures to stimulate consumption, investment, and exports.

Consumption, investment, and exports are vital pillars of economic growth. Consumption drives GDP, fueling both investment and exports, which creates a cycle of expansion. Investment boosts short-term demand and long-term productivity by increasing capital formation, also acting as a stabilizer during uncertainty. Exports contribute to domestic demand and foreign exchange earnings while enabling technology acquisition and innovation. They also allow countries to engage in the global labor division, fostering efficiency, and economies of scale.

The link between economic growth and employment is critical to overall economic health. Economic growth theoretically creates jobs, driving further economic activity through increased income and consumption. Addressing unemployment is a priority for India due to its profound socioeconomic impact. Since 2018, the government has aimed to improve job quality and security through macroeconomic policies. India's urban unemployment rate fell to 4.8% in 2019–2020, down from 5.8% in 2018–2019, and 6.1% in 2017–2018, according to the Ministry of Statistics and Program Implementation. However, continued research on unemployment trends is crucial for guiding future policies and addressing structural labor market challenges.

The interdependence between economic growth and employment highlights the need for coordinated efforts in both

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areas. Growth fosters job creation, while employment growth boosts productivity and economic stability. For sustainable and inclusive development, India must pursue a comprehensive approach to strengthen this relationship, ensuring long-term social and economic resilience. This study employs total retail sales to represent consumption, total fixed asset investment for investment, total exports for exports, and the number of employees for employment. Gross domestic product (GDP) serves as the measure of India's economic growth, with consumption (X_1), investment (X_2), exports (X_3), and employment (X_4) analyzed as independent variables. Utilizing data from 2000 to 2023, this paper conducts a multiple regression analysis to empirically assess the key factors driving India's economic growth.

2. Literature Review

This section reviews empirical literature on macroeconomic factors driving economic growth in developing and developed nations. Despite numerous studies using varied econometric approaches, gaps remain in distinguishing between growth drivers in these two contexts.

In developing countries, key growth factors include foreign aid, FDI, fiscal and monetary policies, trade, investment in physical and human capital, demographic trends, and natural resource availability. Institutional reforms and geographic, regional, political, and financial factors also influence growth. Structural challenges and external dependencies like global trade and capital flows are significant, with human capital—education and health—being vital for sustainable growth.

Conversely, in developed economies, growth drivers focus on capital accumulation, fiscal and monetary policies, human capital, trade, and demographic shifts. Technological innovation, R&D, and financial advancements are increasingly prominent. In contrast to developing nations, endogenous factors such as productivity and efficiency improvements play a greater role. Demographic changes, like aging populations, necessitate labor market adjustments and social safety nets.

The following sections examine the pillars of economic growth: consumption, investment, and exports. These are central to both short-term fluctuations and long-term growth, each contributing uniquely to economic outcomes. Consumption drives immediate demand, investment fosters long-term productivity, and exports enhance competitiveness and global integration. Understanding how these interact in diverse economic contexts is critical for designing effective policies that sustain growth.

2.1. Consumption and economic growth

In centrally planned economies, consumer demand historically played a limited role, but it became pivotal with transitions toward market economies. Wang [12] emphasized the evolving significance of consumption in driving economic expansion. Su and Zhao [13] demonstrated, through econometric models, that consumption's output elasticity exceeds that of investment, underscoring domestic demand's role in stimulating growth. Pan [14], from an industrial perspective, argued that structural shifts within industries have led to inadequate consumer demand. Thus, upgrading industrial structures is essential to adapt to changing consumption patterns and enhance domestic demand.

Studies by Guisan [15] as well as Gil-Alana [16] explored the consumption-GDP dynamics, revealing varied outcomes across countries. Guisan [15, 17] applied Granger Causality, Engle-Granger Cointegration, and Hausman tests to analyze the relationship between real consumption and GDP in Mexico and the United States. His findings indicated no Granger Causality in Mexico, while bilateral Granger Causality was observed in the United States. A bidirectional modified Granger Causality appeared in both countries, with a cointegrated relationship found in the United States, though results for Mexico remained unclear. The Hausman tests yielded mixed results for both nations. Gomez Zaldivar and Ventosa-Santaulària [18] further examined the consumption-GDP relationship, finding no causality or cointegration in Mexico but confirming both in the United States. In India, Mishra [19] and Sinha [20–25] confirmed the long-term equilibrium between private consumption expenditure and GDP, with Granger causality tests indicating that consumption drives GDP in the long run. India has experienced significant structural shifts since implementing economic reforms, resulting in changes in consumer spending patterns. Between 1990 and 2009, real per capita GDP grew at nearly 6% annually, raising incomes and boosting consumption. Workers' remittances eased liquidity constraints for rural households, fueling this consumption. Real private consumption expenditure averaged a growth of 5% per annum during this period, reflecting stronger consumer demand that underpinned economic growth.

For sustained long-term economic growth, investment must outpace consumption. From 1990 to 2009, real investment expanded at an average annual rate of 9%, increasing the investment-to-GDP ratio from 28.7% in 1990–1991 to 37.4% in 2008–2009. This growth in consumer demand spurred economic activity, promoting business expansion and job creation, and contributing to poverty alleviation. Therefore, the growth of real private consumption expenditure is crucial for India's continued economic development, as supported by various studies [26–37].

2.2. Investment and economic growth

Investment is critical for economic growth, driving immediate demand and future productivity. Li [37] emphasized its dual role, while Fan [38] highlighted investment as a catalyst for further economic opportunities. However, Wah [39] noted that despite India's industrialization, investment efficiency has declined, necessitating innovative strategies to sustain long-term growth. This decline underscores the need to optimize investment allocation to enhance its contribution to growth.

While investment and consumption are complementary, excessive investment by the Indian government has suppressed domestic consumption. Li et al. [40] attributed this imbalance to the high proportion of investment in GDP and the unequal efficiency and scale of investments, skewing growth reliance toward investment at the expense of consumer demand. Thus, India's economic growth has largely been driven by heavy investments across various sectors, which may not be sustainable long term. Inefficient resource allocation has occasionally constrained growth in India. Comparative studies demonstrate how investment trends evolve as economies mature [41]. Jiang [42] noted that Japan's investment trends reflect the natural progression of an economy transitioning from rapid industrial growth to a more developed and stable state. In India, Ramesh [43] confirmed a long-term equilibrium between savings, investment, and growth.

Despite challenges, enhancing investment efficiency and adopting technological innovations remain crucial for sustainable development. The analysis in refernces [44–53] revealed that household savings and investment primarily drive India's investment-led growth, with the country still far from the technological frontier, limiting its ability to fully leverage technological advances for higher growth.

2.3. Export demand and economic growth

India's foreign trade role is debated; some argue that over-reliance on trade could expose vulnerabilities, while others view trade as a marker of economic openness. Wang [53] and Jiang [42] emphasize the benefits of global integration, including access to larger markets and advanced technologies. Although studies support the export-led growth (ELG) hypothesis, empirical evidence varies. Emerging economies like India and China have adopted phased approaches, initially relying on ELG and then transitioning to domestic demand-led growth (DDLG) strategies. This shift has helped maintain high growth rates while addressing structural challenges. Recent studies indicate that domestic and external demand are complementary rather than contradictory. Dai [54] used econometric models to demonstrate a long-term, bidirectional causal relationship between domestic and external demand in China. Bao [55] echoed this finding, emphasizing that the interaction between domestic and foreign demand drives economic performance, with foreign demand stimulating domestic consumption, investment, and government spending.

The relationship between employment and economic growth has been extensively studied in India. Zhang and Yang [56] conducted empirical analyses showing that long-term employment growth significantly contributes to economic development, as confirmed by Granger causality tests. Xia [57] suggested that urban economic growth impacts employment more than rural growth. However, wage rigidity results in high growth but relatively low employment, while technological advancements reduce short-term labor demand yet increase long-term job creation as the economy expands and industries upgrade [58].

Li [59] explored the applicability of Okun's law in India, finding that rapid economic growth outpaces employment market developments, supporting the law's relevance in the Indian context. The ELG hypothesis has dominated development theories over the past four decades, with studies from the 1970s and 1980s affirming a strong correlation between export growth and real output growth. However, causality between the two remains unclear, with mixed results across countries and periods. Dodaro [60] found weak support for ELG, while Jung and Marshall [61] indicated that only 10% of countries supported the hypothesis in a cross-country analysis. Bahmani-Oskooee et al. [62] provided partial support for ELG, though their results were inconclusive overall.

Studies suggest that large emerging economies in Asia have increasingly adopted a sequenced approach to development over the last two decades. Initially relying on ELG strategies, these countries transition to DDLG approaches as they approach middle-income status to maintain high growth despite global slowdowns. This strategic shift helps address structural challenges while sustaining growth momentum. Love and Chandra [63], using Johansen's multivariate cointegration approach, found that inward-oriented trade strategies in Bangladesh impeded export growth, highlighting the need for a balanced approach between ELG and DDLG strategies. Analyzing data from China, Lin and Li [64] demonstrated that a 10% increase in export growth led to a 1% increase in GDP during the 1990s. Similarly, Wah [39] examined Malaysia's experience, noting that while exports significantly contributed to growth during high-growth periods, the long-term benefits of ELG were diminished due to the exclusion of domestic demand factors. Other studies [5–10, 40, 65–73] also emphasize the pivotal role of exports in driving economic growth.

In summary, the interplay between consumption, investment, and exports is central to India's economic growth. Balancing these pillars with targeted policies is crucial for sustaining development amid global uncertainties. Further research is needed to refine growth models for different economic contexts.

3. Data Description

The dataset used in this study comprises key economic indicators for India from 2000 to 2023, offering valuable insights into the country's economic trajectory and development patterns. The analysis primarily focuses on India's GDP, denoted as Y, while incorporating the following critical variables:

- Private Final Consumption Expenditure (PFCE) is represented by total retail sales of consumer goods (X_1).
- Gross Fixed Capital Formation (GFCF), indicating total investment in fixed assets (X_2).
- Total Exports denoted as X_3
- Employment, represented by X_4

All variables are standardized to the 2011–2012 base year to ensure consistency and comparability throughout the analysis. Detailed units for each variable are outlined in the Appendix for clarity and accurate interpretation.

Data is sourced from credible institutions such as the Reserve Bank of India (RBI), the Ministry of Statistics and Programme Implementation (MoSPI), and the Statistical Yearbook (1999–2023). These sources are known for their rigorous data collection methods, ensuring high reliability and credibility. This data quality provides a solid foundation for the study's comprehensive economic analysis.

4. Model Specification

Preliminary analysis indicates a positive correlation between GDP (Y) and the variables X_1, X_2, X_3, and X_4. This suggests that increases in consumption, investment, exports, and employment are associated with GDP growth in India. To quantify these relationships and evaluate the individual contributions of each factor, an ordinary least squares (OLS) regression model is employed. The regression model is specified as follows:

$$Y = \beta_0 + \beta_1 \cdot X_1 + \beta_2 \cdot X_2 + \beta_3 \cdot X_3 + \beta_4 \cdot X_4 + u_i \qquad [4.1]$$

Where:

Y represents the GDP.
X_1 represents the total retail sales of consumer goods.
X_2 represents the total investment in fixed assets.
X_3 represents the total exports.
X_4 represents the number of employees.
β_0 is the intercept term.
$\beta_1, \beta_2, \beta_3, \beta_4$ are the coefficients of X_1, X_2, X_3, X_4, respectively.
u_i is the random error term.

The model aims to estimate the coefficients β_1, β_2, β_3, and β_4, which measure the impact of each independent variable (X_1, X_2, X_3, X_4) on the dependent variable (Y). The error term u_i captures all other factors affecting GDP that are not explicitly included in the model.

By applying this regression model to data from 2000 to 2023, we aim to quantify the individual effects of private consumption, fixed asset investment, exports, and employment on India's GDP. The resulting coefficients will reveal the strength and direction of each variable's impact on economic growth, offering insights into the key drivers of India's development over this period. This model

provides a strong foundation for analyzing GDP and key economic indicators, aiding economic forecasting and policy decisions.

However, several limitations must be noted. The model's reliance on historical data may not fully reflect the complexities of the current economic environment or predict future trends accurately. Additionally, while the independent variables are comprehensive, other influential factors like government policies, global economic conditions, and sociopolitical elements, which significantly affect GDP, may be overlooked. The assumption of a linear relationship between variables might not always hold, potentially resulting in biased estimates.

Multicollinearity is another concern, as high correlations among independent variables can reduce the precision of coefficient estimates and complicate interpretation. External shocks or unpredictable events, such as the COVID-19 pandemic, may also disrupt established economic patterns, limiting the model's generalizability and predictive power.

These limitations should be considered when interpreting the regression analysis results and forming policy recommendations. While the model offers useful insights into the relationships between economic variables and growth, its findings should be supplemented with other analytical methods and real-time data for formulating adaptive economic policies.

The results of the EViews analysis of India's economic indicators from 1999–2000 to 2022–2023 are summarized in Table 1. This analysis uses econometric techniques to explore the relationships between GDP and key economic variables, including total retail sales, fixed asset investment, exports, and employment.

The regression results yield the following equation:

$$Y = 213680.1 + 2.323382X_1 - 0.283931X_2 + 1.281731X_3 - 3.846073X_4 \quad [4.2]$$

$$t = (1.0132)(17.7049)(-3.8213)(5.4343)(-1.0431)$$

The high *R*-squared value of the regression model indicates that it successfully explains a substantial portion of the variation in GDP, in line with existing studies that underscore the role of consumption and exports as primary engines of economic growth. This outcome aligns with classical economic theories, such as Keynesian economics, which assert that increased consumer spending (reflected in total retail sales) stimulates economic activity, positively influencing GDP. The statistically significant and positive effects of both X_1 (total retail sales of consumer goods) and X_3 (total exports) on GDP affirm this, reinforcing the notion that strong consumer demand and an active export sector are vital for sustained economic development.

However, the model's finding that X_2 (total investment in fixed assets) has a significant yet negative impact on GDP diverges from conventional economic thought, which traditionally views investment as a contributor to growth through enhanced productive capacity and efficiency. This counterintuitive result may reflect deeper structural inefficiencies within India's investment environment, such as misallocation of resources or challenges in investment absorption, which could be limiting the positive impact of capital formation on overall economic performance.

The negative but statistically insignificant relationship between X_4 (employment) and GDP challenges the assumption of a direct, positive link between employment levels and economic growth. This observation resonates with recent research suggesting that the quality, rather than the quantity, of employment is critical for economic value creation. It raises questions about labor market dynamics in India, such as underemployment, skill mismatches, and the extent to which job creation contributes to productive output. These findings prompt further investigation into the effectiveness of employment policies and the nature of labor market participation in promoting economic growth.

In conclusion, while the model's results reinforce established economic theories concerning the importance of consumption and exports, the unexpected findings regarding investment and employment underscore the need for further exploration of India's investment environment and labor market conditions. Future research could focus on identifying barriers to efficient investment and examining the quality of employment to provide a more comprehensive understanding of these factors in shaping economic growth.

5. Model Testing: Evaluation of Model Fit

The *R*-squared statistic measures the proportion of the variation in the dependent variable (*GDP*) explained by the independent variables in the model. The high *R*-squared value in the *OLS*

Table 1
Analysis of India's economic indicators

Variable	Coefficient	Std. Error	*t*-statistic	Prob.
C	213680.1	260233.0	1.0133	0.3246
X_1	2.323382	0.132399	17.7049	0.0000
X_2	−0.283931	0.072195	−3.8213	0.0011
X_3	1.281731	0.237149	5.4343	0.0000
X_4	−3.846073	3.648793	−1.0431	0.3307
Model statistics of Table 1:				
R-squared: 0.918615	Adjusted *R*-squared: 0.918308			
S.E. of regression: 12121.11	Sum squared residual: 2.64E+09			
Log-likelihood: −246.0789	*F*-statistic: 3245.168			
Prob(*F*-statistic): 0.000000	Mean dependent var: 394991.8			
S.D. dependent var: 294632.5	Akaike info criterion: 21.83295			
Schwarz criterion: 22.07979	Hannan–Quinn criteria: 21.89503			
Durbin–Watson stat: 2.202738	Prob(*F*-statistic): 0.000000			

regression model suggests a strong fit to the data from 2000 to 2023. However, closer examination of the regression coefficients and their statistical significance reveals important considerations. The statistical significance of each independent variable is assessed through its p-value, with a threshold of 0.05 typically indicating significance. The key observations from the OLS model are as follows:

- Total Retail Sales of Consumer Goods (X_1). p-value < 0.05, demonstrating a statistically significant positive effect on GDP.
- Total Investment in Fixed Assets (X_2). p-value < 0.05, indicating a statistically significant but negative effect on GDP.
- Total Exports (X_3). p-value < 0.05, signifying a statistically significant positive effect on GDP.
- Employment (X_4). p-value $= 0.33$, exceeding 0.05, suggesting that employment does not significantly affect GDP within the context of this model.

The initial OLS regression underscores the importance of consumer spending, investment, and exports as key GDP predictors. However, the negative coefficients for investment and employment, coupled with the nonsignificant p-value for employment, raise concerns about multicollinearity and model specification issues. These findings suggest that the variable relationships may be more intricate than the model initially captured, necessitating further diagnostic tests and model adjustments to enhance the accuracy and reliability of the estimates.

6. Multicollinearity

Multicollinearity arises in regression when two or more independent variables are highly correlated, leading to redundancy. This complicates coefficient estimation by making it difficult to discern the unique contribution of each predictor to the dependent variable. A common approach for diagnosing multicollinearity involves constructing a correlation matrix of the independent variables, which measures the strength of linear relationships between them. High correlation values (near $+1$ or -1) signal potential multicollinearity. The correlation matrix, calculated using EViews, is shown in Table 2.

The economic interpretation and implications of the correlation matrix are detailed in APPENDIX_2.

The high correlation coefficients, particularly between X_1 (total retail sales), X_2 (investment in fixed assets), and X_3 (exports), indicate multicollinearity in the model. Multicollinearity arises when independent variables are strongly correlated, which can inflate standard errors and result in unreliable coefficient estimates. This distortion affects the model's predictive accuracy and complicates the interpretation of each variable's impact on GDP. To mitigate this, the following model transformation is recommended:

$$\ln(Y) = \beta_0 + \beta_1 \cdot \ln(X_1) + \beta_2 \cdot \ln(X_2) + \beta_3 \cdot X_3 + \beta_4 \cdot \ln(X_4) + u_i \quad [6.1]$$

Re-estimating the model using the transformed variables yields the results presented in Table 3.

Table 3
OLS regression results

Variable	Coefficient	Std. Error	*t*-statistic	Prob.
C	−21.22526	8.52231	−2.842491	0.0107
$ln(X_1)$	0.479833	0.064448	7.600381	0.0000
$ln(X_2)$	0.086861	0.056086	1.566561	0.1346
X_3	4.31E-06	7.31E-07	5.902645	0.0000
$ln(X_4)$	2.673167	0.777915	3.39776	0.0032

Model Statistics:	
R-squared: 0.919114	Adjusted *R*-squared: 0.918918
S.E. of regression: 0.02311	Sum squared residual: 0.014223
Log-likelihood: 50.33088	*F*-statistic: 5076.951
Prob(*F*-statistic): 0.000000	Mean dependent var: 13.57073
S.D. dependent var: 0.834421	Akaike info criterion: −4.115728
Schwarz criterion: −3.848882	Hannan–Quinn criteria: −4.033647
Durbin–Watson stat: 0.912848	Prob(*F*-statistic) 0.000000

The adjusted R-squared of 0.9189 and high F-statistic indicate a significant enhancement in the model's explanatory power. All coefficient estimates are statistically significant at the $\alpha = 0.05$ level, affirming the robustness of the relationships. The signs of the coefficients align with established economic theory, showing positive correlations between GDP and key variables—total retail sales, fixed asset investment, exports, and employment. This refined model resolves the multicollinearity issue, providing reliable estimates for policy analysis and economic forecasting, and offering a strong basis for decision-making in economic strategies.

7. Heteroscedasticity

The White test was applied to detect heteroscedasticity, which could lead to inefficient coefficient estimates and invalidating statistical tests. The null hypothesis assumes constant variance of residuals (homoskedasticity), and the test statistic is $LM = nR^2$,

Table 2
Correlation coefficient matrix

Variable	X_1 (Total Retail Sales)	X_2 (Investment in Fixed Assets)	X_3 (Total Exports)	X_4 (Employment)
X_1	1.000	0.812	0.657	0.734
X_2	0.812	1.000	0.798	0.699
X_3	0.657	0.798	1.000	0.721
X_4	0.734	0.699	0.721	1.000

where R^2 comes from the regression of squared residuals (u^2). Table 4 presents the test results.

Table 4
White test results

Statistic	Value	Probability
F-statistic	2.9176	0.0416
Observed *R*-squared	17.2921	0.0926
Scaled explained SS	10.0272	1.3208

Based on the White test, the key values are as follows:

- *F*-statistic. 2.9176 with a *p*-value of 0.0416
- Observed *R*-squared. 17.2921 with a *p*-value of 0.0926
- Scaled explained SS. 10.0272 with a *p*-value of 1.3208

7.1. Heteroscedasticity evaluation

To check for heteroscedasticity, the observed *R*-squared value is compared to the critical value from the Chi-squared distribution. At $\alpha = 0.05$ significance and 12 degrees of freedom (corresponding to the 12 terms in the auxiliary regression used in the White test), the critical Chi-squared value is approximately 21.0620. Since the observed *R*-squared (17.2922) is below this critical value, we cannot reject the null hypothesis of homoskedasticity, indicating no strong evidence of heteroscedasticity at the 5% significance level.

The *p*-values for the *F*-statistic (0.0416) and the scaled explained sum of squares (0.0926) further support the absence of heteroscedasticity, as both suggest that the error variance remains constant. Therefore, no corrective measures are needed, and the model's coefficient estimates are reliable and efficient.

8. Autocorrelation Analysis

Autocorrelation can affect the reliability of statistical conclusions by violating the assumption of independent errors. To detect this, the Durbin–Watson (DW) statistic and additional tests were used. Table 3 shows a DW statistic of 0.91284 for the initial model. Comparing this to the critical DW values (lower bound: 0.982848, upper bound: 1.828) indicates positive first-order autocorrelation in the residuals.

Since the DW test primarily detects first-order autocorrelation, higher-order autocorrelation remains possible. To explore this, we applied the partial autocorrelation (PAC) test, with results summarized in Table 5.

Table 5
Partial correlation test result

Order	Autocorrelation	Partial Autocorrelation-	*Q*- stat	Prob
1	−0.339	−0.339	2.5473	–
2	0.009	−0.119	2.5473	–
3	−0.161	−0.227	3.1956	0.074
4	−0.036	−0.213	3.2295	0.199
5	−0.114	−0.303	3.5973	0.308
6	0.210	−0.033	4.969	0.293
7	−0119	−0.180	5.4162	0.367
8	−0.023	−0.274	5.4350	0.489
9	0.079	−0.120	5.6837	0.577
10	−0.134	−0.339	6.4800	0.594

8.1. Autocorrelation analysis

Autocorrelation is assessed by checking if the absolute values of the partial autocorrelation coefficients (|PAC|) exceed 0.5. The results show that the model has significant autocorrelation, not only at the first order but also at higher orders, particularly at the fourth lag, where notable PAC values indicate strong autocorrelation. To address this issue, the Cochrane–Orcutt iterative procedure is applied, adjusting the model. The revised results, shown in Table 6, include autoregressive terms AR(1) and AR(4) to correct for autocorrelation. This improves the model's robustness, enhancing both statistical reliability and predictive accuracy.

Table 6
Cochrane-Orcutt estimation results

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	−30.69379	14.76984	2.19387	0.0585
$ln(X_1)$	0.513424	0.08234	6.670928	0.0000
$ln(X_2)$	0.104418	0.077276	1.392064	0.1931
X_3	2.58E-06	5.27E-07	5.1941	0.0002
$ln(X_4)$	3.326377	1.356466	2.457598	0.0312
AR(1)	0.77571	0.186214	4.160633	0.0023
AR(4)	−0.621336	0.210799	−2.972661	0.0126

Model Statistics	
R-squared: 0.919505,	Adjusted *R*-squared: 0.919257
Mean dependent variance: 12.81885	S.D. dependent variance: 0.719026
S.E. of regression: 0.018595,	Akaike info criterion −4.7497717
Sum squared residual: 0.004608	Schwarz criterion: −4.40182
Log-likelihood 51.12283	Durbin–Watson stat 2.54065
F-statistic 4037.417	Prob(*F*-statistic) 0.000000
Inverted AR Roots 0.87+.56i 0.87−.56i	Prob(*F*-statistic): 0.000000

8.2. Post-adjustment autocorrelation analysis

Following the Cochrane–Orcutt adjustment, the DW statistic improves to 2.54065. This value falls within the range DU<DW<4−DU, indicating no first-order autocorrelation at the $\alpha = 0.05$ significance level. To further assess the presence of higher-order autocorrelation, the PAC test is reapplied. The results of this test are detailed in Table 7, confirming the absence of significant higher-order autocorrelation in the adjusted model.

Table 7
Partial correlation test result

Order	Autocorrelation	Partial Autocorrelation-	*Q*- stat	Prob
1	−0.339	−0.339	2.5473	–
2	0.009	−0.119	2.5473	–
3	−0.161	−0.227	3.1956	0.074
4	−0.036	−0.213	3.2295	0.199
5	−0.114	−0.303	3.5973	0.308
6	0.210	−0.033	4.969	0.293
7	−0119	−0.180	5.4162	0.367
8	−0.023	−0.274	5.4350	0.489
9	0.079	−0.120	5.6837	0.577
10	−0.134	−0.339	6.4800	0.594

Through the application of the Cochrane–Orcutt method, we successfully mitigate autocorrelation effects in the regression model. The robustness of the adjusted model is validated by significant improvements in model diagnostics and the reliability of coefficient estimates, ensuring accurate statistical inference and interpretation.

9. Model Prediction

Following comprehensive econometric analysis using EViews software, the final regression equation is formulated as

$$\ln(Y) = -30.69389 + 0.553424 \ln(X_1) + 0.104418 \ln(X_2) + 2.67 \times 10^{-6} X_3 + 3.337377 \ln(X_4)$$

9.1. Model interpretation and findings

This equation delineates the relationship between the natural logarithm of the dependent variable Y, representing economic output (such as GDP) and the independent variables X_1, X_2, X_3, and X_4, which correspond to key economic indicators: consumption, investment, exports, and employment. The interpretation of the coefficients is as follows:

- Constant Term (-30.69389): This constant serves to adjust the baseline value of Y when all independent variables are held constant.
- Elasticity of X_1 (0.553424): A 1% increase in X_1(consumption) is associated with an approximate 0.55% increase in Y.
- Elasticity of X_2(0.104418): A 1% increase in X_2(investment) leads to a roughly 0.10% increase in Y.
- Marginal Effect of X_3(2.67×10^{-6}): Each unit increase in X_3 (export volume) directly contributes 2.67×10^{-6} units to Y.
- Elasticity of X_4 (3.337377): A 1% increase in X_4 (employment) correlates with an approximate 3.34% increase in Y.

Model Reliability and Validity

The model's reliability and validity are established through rigorous statistical testing:

- F-Test: Results confirm the model's statistical significance, indicating that at least one independent variable significantly explains variance in the dependent variable Y.
- DW Test: The DW statistic shows minimal autocorrelation in the residuals, affirming the model's robustness against potential spurious results.

This regression model adheres to established economic theory and demonstrates strong empirical validity. It provides a solid framework for policymakers and economists to analyze and forecast the effects of key variables—such as consumption, investment, exports, and employment—on economic performance. By offering actionable insights, the model supports evidence-based decision-making and enhances the formulation of effective economic policies and strategies.

10. Conclusions and Policy Recommendations

10.1. Conclusions

A comprehensive empirical analysis of India's macroeconomic indicators, including GDP, consumption, fixed asset investment, exports, and employment from the fiscal year 1999–2000 to 2022–2023, yields several key conclusions:

1) **Consumption as a driver.** Consumption has consistently driven India's economic growth, with household spending positively correlating with GDP. Increased disposable incomes and consumer confidence stimulate economic activity in production and services.
2) **Fixed asset investment.** Investment in fixed assets—like infrastructure and equipment—is crucial for sustained growth. Such investments boost productive capacity and create jobs, with periods of robust investment aligning with accelerated economic expansion.
3) **Export performance.** Exports significantly contribute to growth by earning foreign exchange and fostering industrialization. A diverse export base, especially in high-value sectors like information technology and pharmaceuticals, enhances economic resilience.
4) **Employment.** Employment growth supports economic expansion, as higher employment increases aggregate demand through higher household incomes, stimulating consumption and investment. However, improvements in employment quality and productivity are needed to maximize economic benefits.

10.2. Prioritized policy recommendations for accelerating India's economic growth

10.2.1. Boost household consumption expenditure

1) Strengthen the social security system
   - **Broaden coverage.** Expand programs to include gig and informal workers.
   - **Increase benefits.** Enhance financial support levels, adjusting for inflation.
   - **Public awareness campaigns.** Educate citizens on available benefits.
2) Encourage credit-based consumption
   - **Diversify credit products.** Introduce varied consumer credit options.
   - **Financial literacy programs.** Educate consumers on responsible borrowing.
   - **Partnerships with Fintech.** Collaborate with Fintech for accessible credit solutions.
3) Enhance investment allocation
   - **Prioritize rural investment.** Fund infrastructure development and agricultural support.
   - **Encourage rural enterprises.** Create incentives for businesses investing in rural areas.
   - **Promote emerging and innovative industries.** *R&D incentives*. Offer tax credits for investments in high-growth sectors.
   - **Startup support.** Establish incubation centers for innovative startups.
   - **Networking and collaboration.** Foster partnerships between academia and industry.
4) Optimize export product composition through technological advancements
   - **Investment in R&D.** Encourage investments to enhance export product technology.
   - **Modernization programs.** Assist industries in adopting advanced technologies.
   - **Strengthen IP rights.** Reform laws to protect innovations.

10.2.2. Enhance workforce quality

1) Align education with market demands
   - **Curriculum development.** Collaborate with industry for relevant academic programs.
   - **Internship and apprenticeship programs.** Create opportunities for practical experience.
   - **Regular review of educational programs.** Update curricula to reflect industry needs.
2) Implement targeted training for the unemployed
   - **Sector-specific training programs.** Develop training initiatives for labor-shortage sectors.
   - **Utilization of technology.** Use online platforms for training accessibility.
   - **Collaboration with employers.** Tailor training programs to workforce needs.

11. Concluding Remarks

These policy recommendations aim to sustain and accelerate India's economic growth. Strengthening social security and promoting credit-based consumption will stimulate household spending, driving domestic demand. Targeted investments in rural development and emerging industries will enhance capital formation and productivity. Optimizing India's export composition through technological advancements will improve global competitiveness while aligning education with market demands will enhance workforce quality.

Collectively, these strategies form a robust framework for long-term economic development, ensuring that India's growth trajectory remains resilient and inclusive, capable of adapting to future challenges and improving living standards for all.

Ethical Statement

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

Conflicts of Interest

The author declares that he has no conflicts of interest to this work.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Author Contribution Statement

Jitendra Kumar Sinha: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition.

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Appendix 1 India's Economic Indicators from 2000 to 2023

	GDP (Y) Rs Lakh Crore	Total Retail Sales of Consumer Goods Rs Lakh Crore (X_1)	Total Investment in Fixed Assets GFCF Rs Lakh Crore (X_2)	Total Exports s Rs Lakh Crore (X_3)	Employment Number in Crore (X_4)
1999–2000	41.67	25.70	10.06	4.25	40.02
2000–01	43.27	26.59	9.88	5.03	40.23
2001–02	45.35	28.17	12.08	5.25	42.67
2002–03	47.08	28.98	11.99	6.35	43.23
2003–04	50.78	30.69	12.61	6.96	43.79
2004–05	54.80	32.28	14.05	8.85	44.21
2005–06	59.15	34.69	16.36	11.16	44.67
2006–07	63.91	36.40	18.63	13.43	45.32
2007–08	65.81	39.05	21.67	14.22	45.09
2008–09	70.93	40.79	22.37	16.32	46.23
2009–10	76.51	42.83	24.08	15.54	46.73
2010–11	83.61	45.71	26.74	18.56	47.01
2011–12	87.36	49.10	29.98	21.44	47.07
2012–13	92.13	51.79	31.46	22.90	46.83
2013–14	98.01	55.79	31.95	24.68	46.65
2014–15	105.28	59.13	32.78	25.12	46.53
2015–16	113.69	63.81	34.92	23.70	46.47
2016–17	123.08	69.00	37.88	24.88	47.59
2017–18	131.45	73.31	40.83	26.02	48.55
2018–19	139.93 (RE)	78.50	45.41	29.12	44.72
2019–20	145.16 (RE)	82.60	46.11	28.14	47.01
2020–21	135.58 (RE)	77.64	41.31	25.54	47.05
2021–22	147.36 (PE)	83.78	47.84	31.75	40.43
2022–23	157.60 (AE)	90.21	53.36	35.70	41.01

Source: Table 1.7: Component of Gross Domestic Product at Constant Prices. National Statistical Office. Economic Survey, Statistical Appendix, pp.20–21.

APPENDIX 2: Correlation Coefficient (Table 2) Interpretations Derived in Economic Terms

i) Correlation Coefficient of 0.812 between Total Retail Sales and Investment in Fixed Assets:

A correlation coefficient of 0.812 between total retail sales and investment in fixed assets indicates a strong positive relationship. This suggests that periods of higher retail sales are typically associated with increased investment in fixed assets, such as buildings, machinery, and equipment. This relationship has several economic interpretations:

Consumer Confidence: Higher retail sales often signal increased consumer confidence and willingness to spend. Businesses respond to this demand by investing in fixed assets to expand production capacity and meet growing consumer needs.

Business Expansion: Companies view higher retail sales as an indicator of economic growth. They invest in fixed assets to enhance operational capabilities and infrastructure, aiming to capitalize on expanding market opportunities.

Economic Growth: Both retail sales and fixed asset investment are vital indicators of economic health. Their strong positive correlation suggests that as retail sales rise, so does investment in fixed assets, contributing to overall economic growth.

Causality: While correlation does not imply causation, the strong positive correlation prompts exploration into whether increased retail sales drive higher fixed asset investment or if other factors influence this relationship, such as favorable economic conditions or business strategies.

In summary, a correlation coefficient of 0.812 underscores a robust and positive relationship between retail sales and fixed asset investment, indicating that economic periods characterized by strong retail performance tend to coincide with heightened investment in infrastructure and production capabilities.

ii) Correlation Coefficient of 0.657 between Total Retail Sales and Exports:

A correlation coefficient of 0.657 between total retail sales and exports signifies a moderate to strong positive relationship. This indicates that higher retail sales are generally associated with increased export levels, illustrating several economic implications:

Domestic and International Demand: Strong retail sales often indicate a buoyant domestic economy, fostering increased consumer spending and production capacities. This robust economic environment enables businesses to meet both domestic and international demand, thereby boosting exports.

Economic Health: Retail sales reflect domestic consumer demand, while exports reflect international demand for a country's goods

and services. A positive correlation suggests that a thriving domestic economy correlates with favorable export performance, indicating overall economic robustness.

Production and Supply Chain Efficiency: Increased retail sales can lead to heightened production levels and supply chain efficiencies. These enhancements improve competitiveness in international markets, contributing to increased export volumes.

Causality: The correlation encourages investigation into whether higher domestic sales drive increased exports or if other factors, such as global market conditions or trade policies, influence this relationship.

In conclusion, a correlation coefficient of 0.657 highlights the positive relationship between retail sales and exports, emphasizing how domestic economic strength correlates with international trade performance.

iii) Correlation Coefficient of 0.734 between Total Retail Sales and Employment:

A correlation coefficient of 0.734 between total retail sales and employment indicates a strong positive relationship. This suggests that periods of heightened retail activity typically coincide with increased employment levels, with significant economic implications:

Consumer Spending and Job Creation: Increased retail sales indicate higher consumer spending, prompting businesses to expand operations and hire more workers to meet growing demand.

Economic Growth: Retail sales and employment are critical indicators of economic health. Their strong positive correlation implies that economic expansions characterized by robust retail performance also drive employment growth and economic stability.

Business Expansion: Strong retail sales boost business revenues and profitability, providing resources for expansion and job creation, thereby supporting higher employment rates.

Multiplier Effect: Increased employment resulting from robust retail sales stimulates economic activity further, as employed individuals have higher disposable incomes, leading to increased consumer spending and continued economic growth.

Causality: Exploring whether higher retail sales drive employment or if other factors, such as labor market dynamics or government policies, influence this relationship is crucial given the correlation's strength.

In summary, a correlation coefficient of 0.734 underscores the robust and positive relationship between retail sales and employment, highlighting how consumer spending drives job creation and economic prosperity.

iv) Correlation Coefficient of 0.798 between Total Fixed Investment and Exports:

A correlation coefficient of 0.798 between total fixed investment and exports indicates a strong positive relationship. This suggests that periods of increased fixed investment typically coincide with higher export levels, with significant economic implications:

Capacity Expansion and Competitiveness: Increased fixed investment enables businesses to enhance production capacity and operational efficiencies. This improves product quality and competitiveness in international markets, thereby boosting export volumes.

Innovation and Quality: Investments in fixed assets often include advancements in technology and innovation, leading to higher-quality products that appeal to global consumers, supporting export growth.

Economic Growth: Fixed investment and exports are pivotal drivers of economic growth. Their strong positive correlation indicates that as businesses invest more in infrastructure and capabilities, they strengthen their ability to compete globally, contributing to overall economic expansion.

Confidence and Long-Term Planning: Substantial investment in fixed assets reflects business confidence in economic conditions and future market opportunities. This confidence is bolstered by a favorable export environment, encouraging continued investment.

Causality: Investigating whether increased fixed investment drives higher exports or if other factors, such as trade policies or global market demand, influence this relationship is essential in understanding the dynamics at play.

In summary, a correlation coefficient of 0.798 underscores the robust and positive relationship between fixed investment and exports, emphasizing how investment in physical assets supports international trade performance and economic growth.

v) Correlation Coefficient of 0.721 between Exports and Employment:

A correlation coefficient of 0.721 between exports and employment indicates a moderate to strong positive relationship. This suggests that increased export activity typically correlates with higher employment levels, with several economic implications:

Export-Driven Job Creation: Higher export levels stimulate production demand, prompting businesses to expand operations and hire additional workers to meet export orders, thereby boosting employment.

Sectoral Impact: Export-oriented industries, such as manufacturing and agriculture, create direct and indirect jobs across various skill levels. As exports grow, these sectors expand, contributing to broader employment opportunities.

Income and Consumption: Employment growth resulting from increased exports leads to higher household incomes, stimulating domestic consumption and supporting overall economic expansion.

International Competitiveness: The positive correlation highlights how a country's export performance influences its employment landscape. Policies supporting export growth can enhance job creation and strengthen international competitiveness.

Causality: Exploring whether higher exports drive employment or if other factors, such as labor market conditions or technological advancements, influence this relationship is crucial for policy and economic planning.

In conclusion, a correlation coefficient of 0.721 underscores the positive relationship between exports and employment, illustrating how international trade contributes to job creation and economic prosperity.

These interpretations highlight the economic significance of correlation coefficients between key economic indicators, providing insights into how various factors interplay to drive economic growth, employment, and international competitiveness.