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Determinants of Economic Growth in India: An Empirical Study (2000-2023)

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Abstract: India has achieved substantial economic progress over the past few decades but retains significant growth potential for the next 30 years. The primary challenge lies in transforming this theoretical growth potential into tangible economic advancements. This study investigates the determinants of India's economic growth by analyzing data from 2000 to 2023, focusing on key variables such as GDP, consumption, fixed asset investment, exports, and employment. Utilizing multiple regression analysis through E-Views software, the empirical results indicate that fixed asset investment, consumption, exports, and employment significantly and positively influence economic growth. These findings provide critical insights for policymakers, underscoring the importance of i) Enhancing social security systems and promoting credit consumption to boost consumer expenditure; ii) Improving investment layouts by focusing on rural investment and supporting emerging and innovative industries; iii) Optimizing export structures by increasing technological investment, and iv) Improving the comprehensive quality of the workforce by aligning educational outcomes with market needs and providing professional training for the unemployed. These strategies aim to sustain and enhance India's economic trajectory, ensuring long-term economic growth and development.

Keywords: Economic Growth, Multiple Regression Model, Influence Factors, Empirical Analysis.

1. INTRODUCTION

In the aftermath of the 2008 financial crisis, global economic growth decelerated significantly, plunging many countries into recessions marked by negative growth, widespread unemployment, and social unrest. The COVID-19 pandemic in 2020 further exacerbated these economic challenges, severely impacting economies worldwide, including India. The pandemic led to a stark decline in both demand and supply, with India's manufacturing Purchasing Managers' Index (PMI) dropping by 14.3% and the non-manufacturing business activity index falling by 24.5% in April 2020 compared to March. Consumer industries such as transportation, tourism,

accommodation, catering, and residential services were particularly affected, causing significant fluctuations in India's macro and microeconomic landscapes.

During the 2021 parliamentary sessions, it was emphasized that India's economy is currently navigating a "triple overlay period" of economic challenges. As the world's largest developing nation, India requires sustained economic growth to enhance living standards and ensure social stability and harmony. Consequently, understanding the mechanisms to stimulate economic growth is a critical and complex issue facing India today.

Consumption, investment, and export are widely recognized as the three pillars of economic development. As a primary driver of economic activity, consumption plays a crucial role in stimulating growth by directly contributing to GDP and indirectly driving investment and export, thereby further propelling economic growth. Conversely, investment can boost demand and stimulate growth in the short term while enhancing productivity and supply capabilities in the long run. This dual effect is a critical factor in economic growth and fluctuations. Exports, often termed the "engine of economic growth," positively impact growth by increasing domestic demand, accumulating foreign exchange, and facilitating the import of capital and technology. Export growth also enhances production efficiency, stimulates entrepreneurship, and promotes technological innovation through spillover effects, enabling participation in the international division of labor and reaping external economies of scale.

Economic growth and employment are intricately linked, and analyzing the factors influencing their relationship is essential for the healthy development of the economy. Theoretically, economic growth can create more employment opportunities, which in turn accelerates economic growth. Employment has always been a significant concern, as high unemployment can lead to serious social issues. In 2018, the central government prioritized employment stability in its macroeconomic policies to achieve higher quality and more stable employment. Despite a relatively low urban unemployment rate in India standing at 4.8% in 2019-20 (compared to 5.8% in 2018-19 and 6.1% in 2017-18), according to the Ministry of Statistics and Programme Implementation (MoSPI), ongoing research on unemployment remains crucial. Economic growth underpins improved employment rates, and vice versa.

This study selects the total retail sales of consumer goods to represent consumption, total investment in fixed assets to represent investment, total exports to represent exports, and the number of employees to represent employment. Gross Domestic Product (GDP) is used as the measure of India's economic growth, with consumption (X1), investment (X2), exports

(X3), and employment (X4) as independent variables. Utilizing statistical data from 2000 to 2023, this paper conducts an empirical analysis of the primary factors influencing India's economy through multiple regression analysis.

2. LITERATURE REVIEW

This section provides a comprehensive review of the existing empirical literature on the key macroeconomic determinants of economic growth in both developing and developed countries. While numerous empirical studies have examined these determinants using various econometric methods, the majority have not differentiated between the factors that drive or hinder economic growth in developing versus developed countries.

The review identifies that in developing countries, the primary macroeconomic determinants of economic growth include foreign aid, foreign direct investment, fiscal policy, investment, trade, human capital development, demographics, monetary policy, natural resources, reforms, and geographic, regional, political, and financial factors. In contrast, in developed countries, the key macroeconomic determinants associated with economic growth are physical capital, fiscal policy, human capital, trade, demographics, monetary policy, and financial and technological factors.

The subsequent sub-sections will discuss the literature on consumption, investment, and export—the three pillars of economic development.

2.1. Consumption and Economic Growth

In a highly planned economy, consumer demand historically played a limited role in driving social production. As economies transitioned to open market systems, a demand-oriented economy progressively supplanted the supply-oriented model, positioning consumer demand as a critical determinant of market dynamics.

Wang [1] emphasized that the influence of consumer demand on economic growth has increased over time. Initially driven by supply and later by investment, consumer demand has now become a primary driver of economic growth. Su and Zhao [2] used econometric models to examine the relationship between China's GDP, investment, consumption, and import-export trade. Their results indicated that China's consumption output elasticity is significantly higher than its investment elasticity, suggesting that expanding domestic demand is an effective strategy for promoting economic development.

One major issue in China's economic operations is insufficient consumption. This has led many scholars to investigate the causes of this insufficiency, changes in consumption structure, and strategies to enhance

consumption. Zhou argued that the primary reason for inadequate domestic consumption demand is the lag in residents' income growth compared to GDP growth. Pan [3], examining consumer demand from an industrial structure perspective, concluded that major adjustments in industrial structure are primarily responsible for the lack of consumer demand. Thus, upgrading the industrial structure is necessary to adapt to changes in consumption patterns and boost consumer demand.

Economists have empirically investigated the notion that consumption-led growth prevails in the long run across different countries and periods. Guisan [4] critically reviewed the causality and cointegration between private consumption and GDP in 25 OECD countries from 1960 to 1997. He suggested re-estimating the relation using each country's GDP as an explanatory variable and excluding the influence of other countries' GDPs. Gil-Alana [5] used fractional time series modeling to study the relationship between consumption and income in the UK from 1955 to 1984, suggesting that fractionally cyclical models may be appropriate for macroeconomic time series.

Guisan [6,7] analyzed several tests, including Granger Causality, Modified Granger Causality, Engle-Granger Cointegration, and Hausman tests, to detect the causal relationship between real consumption and real GDP in Mexico and the United States. Findings indicated no evidence of Granger Causality in Mexico but bilateral Granger Causality in the US. There was evidence of bidirectional modified Granger Causality in both countries and a cointegrated relationship between consumption and GDP in the US, but ambiguous results for Mexico. Hausman causality results were mixed for both countries.

Gomez-Zaldivar [8] further investigated the causality between consumption and GDP in Mexico and the US. The results showed no evidence of causality or cointegration in Mexico but confirmed causality from consumption to GDP and evidence of cointegration in the US.

Considering the mixed results about the causal relationship between real consumption expenditure and economic growth, and the lack of existing literature for developing countries like India, Mishra [9], and Sinha [10-17] investigated this relationship in India. Using time series methodologies, he analyzed private final consumption expenditure (PCE) at constant prices and GDP at factor cost. The Augmented Dickey-Fuller unit root test indicated that both series were I (1). Johansen's Cointegration test showed a long-run equilibrium relationship between GDP and PCE, though short-term disequilibrium was present. The vector error correction model (VECM) based on VAR indicated that about 21.12% of disequilibrium is corrected annually. The significant error correction term in the GDP equation

supported the long-run equilibrium relationship between PCE and GDP. The VECM estimates indicated unidirectional causality from PCE to GDP. The Granger causality test confirmed a long-term causal relationship between PCE and GDP but not in the short term.

Since implementing new economic policies, India has experienced a structural shift due to sustained economic growth, leading to changes in consumer spending patterns. Real per capita GDP grew at an average rate of almost 6% per annum during 1990-2009, increasing average income and encouraging higher consumption expenditure. Increased workers' remittances also eased liquidity constraints for recipient households, particularly in rural areas, enhancing their purchasing power and influencing consumption behavior. Real private consumption expenditure grew by an average of 5% per annum during this period, reflecting higher consumer spending that supported ongoing economic growth and indicated the emergence of a strong middle class.

However, investment must grow faster to sustain long-term growth momentum than consumption expenditure. Real investment (gross fixed capital formation) grew at an average rate of 9% per annum during 1990-2009, outpacing private consumption expenditure. The investment-to-GDP ratio increased from 28.7% in 1990-91 to 37.4% by 2008-09, an increase of 8.7 percentage points over two decades. Rising consumer spending fueled economic activity, increasing demand for goods and encouraging business expansion. This expanding economy generated jobs, increased incomes, and helped alleviate poverty. Therefore, the growth of real private consumption expenditure is crucial for the economic development of a country like India.

2.2. Investment and Economic Growth

Domestic demand comprises both investment and consumption components, with investment being the most dynamic among the factors driving economic growth. It is widely recognized that investment and economic growth have a mutually reinforcing and constraining relationship. Yiping [18] mentioned that investment not only enhances future production capacity but also generates current demand.

Fan Guishan [19] asserted that investment acts as a direct catalyst for economic growth, which in turn stimulates further investment growth. Lai [20] observed that despite India's ongoing industrialization, there is a decline in investment efficiency, necessitating new developmental strategies for sustained economic growth.

Investment and consumption are complementary components of economic activity. However, excessive investment by the Indian government has suppressed domestic consumption. Wang [21] attributed the imbalance

between consumption and investment to the disproportionately large share of investment in GDP and the unequal efficiency and scale of investments. Overall, India's economic growth is predominantly driven by substantial investment in various sectors.

Liu and Cai [22] compared the cost of economic growth and GDP composition between China and Japan, concluding that Japan's investment rate increased consistently during its rapid economic growth phase, eventually declining as economic strength solidified (Jiang Xiaojuan, [23].

Ramesh [24] investigated the relationship between saving, investment, and economic growth in India from 1950-51 to 2007-08. The literature on the role of saving in promoting economic growth generally points to saving-led growth. However, few studies show evidence for growth-driven saving, and some suggest no relationship. In theory, saving may stimulate economic growth, but economic growth may also induce saving. This paper adds to the literature by analyzing the existence and nature of these causal relationships, focusing on India, where the saving rate has been notably high.

The co-integration analysis suggests a long-run equilibrium relationship between saving, investment, and economic growth. The results of the Granger causality test show that higher savings and investment lead to higher economic growth, but reciprocal causality is not observed. Furthermore, it is empirically evident that saving and investment-led growth primarily comes from the household sector. It may be inferred from the results that India is not close to the technological frontier and hence is not catching up with new technologies.

2.3. Export Demand and Economic Growth

Opinions in India are divided regarding foreign trade dependence. Some scholars argue that high foreign trade dependence negatively impacts the national economy, while others contend that India's foreign trade dependence is insufficient to hinder economic development, noting that this metric is not universally comparable. Wang [25] suggested that foreign trade dependence is an indicator of economic openness rather than the sole measure of reliance on foreign trade. Jiang 26[] emphasized that a notable feature of deepening economic globalization is the global economy's growth rate lagging behind that of international trade. Despite barriers erected by countries to protect their economies and restrict imports, global trade remains robust, with rising foreign trade dependence.

Recent research indicates that growth in domestic and external demand is not contradictory; rather, they influence and promote each other. Dai [27], using econometric models to analyze China's data, found a cointegration

relationship between domestic and external demand, indicating a bidirectional causal relationship and significant interactive dynamic impact between changes in both demands. Bao [28] posited that the relationship between domestic and foreign demand reflects the interplay between domestic and international economic operations, each promoting and constraining the other. Foreign demand (exports) can directly stimulate increases in domestic consumption, investment, and government expenditure.

The relationship between employment and economic growth has also been extensively studied in India. Yang and Zhang [29] conducted empirical analyses, suggesting that long-term employment growth significantly promotes economic development, with increased employment positively impacting GDP growth, as confirmed by Granger causality tests. Xia [30] proposed that economic development affects employment both positively and negatively, with urban economic growth having a more pronounced effect on employment than rural growth. Additionally, from an industrial structure perspective, there is a labor surplus in the primary industry and a labor shortage in the secondary industry. Zhou [31] discussed how wage rigidity leads to high growth but low employment in India. Technological advancements reduce short-term labor demand but, in the long run, expand the economic scale and upgrade industrial structures, creating new jobs and driving employment growth. Li [32] analyzed the applicability of Okun's law in India, noting that India's rapid economic growth outpaces employment market development, thereby validating Okun's law in the Indian context.

The Export-Led Growth (ELG) hypothesis has dominated development literature for the last four decades. Several studies examined the relationship between exports and growth in the 1970s and 1980s, supporting the assertion that export growth has a strong association with the growth of real output. However, causation between the two variables is not established with certainty across different countries and periods. Various studies using time-series approaches lend mixed support to the ELG hypothesis. For instance, Dodaro [33] found weak support for the hypothesis that export growth promotes GDP growth. Jung and Marshall [34] found that the ELG hypothesis supported ten percent of the sample in a cross-country analysis. Bahmani-Oskooee et al. [35] demonstrated some agreement with the ELG hypothesis, although the evidence was inconclusive overall.

The choice of variables to represent ELG and DDLG models is mostly left to researchers, considering the study period and relevance of variables based on their statistical significance and support from current literature. For instance, FDI became an important growth agent in India towards the

middle of the last decade. Developing countries, like India and China, have selectively used ELG and DDLG strategies at different periods to minimize the detrimental effects of global business cycles on their growth performance.

The empirical evidence suggests that the sequencing of development strategies has become apparent in large emerging countries in Asia over the last two decades. Low-income countries engage in ELG strategies initially but shift towards DDLG strategies as they become middle-income countries to maintain high growth performance despite global slumps. The transitions in development strategies aim to respond to structural problems and global economic conditions, helping countries join the league of high-income Countries.

Using Johansen's multivariate cointegration approach, Love and Chandra [36] studied Bangladesh and found causality from income to export, suggesting that inward-oriented trade strategies can hinder export growth. This highlights the importance of pursuing both ELG and Domestic Demand-Led Growth (DDLG) strategies to mitigate adverse global business cycles.

Empirical studies indicate that models often fail to capture the full impact of domestic demand, which can skew results. Lin and Li [37], analyzing China's data, showed that a 10% increase in export growth led to a 1% GDP growth in the 1990s. Wah [38] examined Malaysia and found that while exports contributed significantly during high growth periods, long-term support for ELG was weak due to omitted domestic demand factors. Wong [39] explored the ASEAN-5 during and post-Asian Economic Crisis, revealing bilateral Granger causality between exports, economic growth, and private consumption. Similar studies in the Middle East by Wong [40] highlighted the simultaneous necessity of export and domestic demand growth for sustained economic growth, although specific development strategies remained inconclusive.

The literature emphasizes the need for both exports and domestic demand to achieve sustainable high growth. However, empirical analysis of development paradigms shows that strategies vary across countries and periods. For instance, India's shift towards Foreign Direct Investment (FDI) in the last decade underscores the dynamic nature of growth drivers. ELG strategies often correlate income with export variables, while some studies incorporate imports, openness, or terms of trade, reflecting diverse methodological approaches.

Studies by ADB [41]; Mohanty & Chaturvedi [42] ; and Mohanty [43] revealed that China and India selectively employed ELG and DDLG strategies to navigate global economic fluctuations. The 1970s marked a consistent shift in development strategies among developing nations. For

large countries, low wages drive export competitiveness in manufacturing, fostering ELG adoption. However, structural issues and global business cycles necessitate alternative strategies to sustain growth.

In conclusion, the role of both exports and domestic demand is crucial for placing economic growth on a high growth trajectory sustainably. Emerging Asian countries have recently sequenced development strategies, beginning with irreversible economic reforms under ELG. As these countries transition to middle-income status, external shocks, and rising costs prompt a shift towards DDLG to maintain high growth despite global downturns. Moving to upper-middle-income status presents challenges, where DDLG may better facilitate advancement to high-income status. This transition, evidenced in various countries, warrants further empirical investigation.

3. DATA DESCRIPTION

The dataset used in this study comprises key economic indicators of India from the year 2000 to 2023. These indicators are essential for analyzing India's economic landscape and development trends. The primary focus is on India's Gross Domestic Product (GDP), denoted as Y. The other variables include:

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

All data are aligned with the 2011-12 base year series, ensuring consistency and comparability over the years. The units for each variable are specified in the respective columns of the **Appendix**, providing clarity and standardization for accurate analysis and interpretation. The data sources, including the Reserve Bank of India (RBI), the Ministry of Statistics and Programme Implementation (MoSPI), and the Statistical Yearbook from 1999 to 2023, are highly credible. These sources are well-regarded for their meticulous data collection and reporting standards, thus providing a solid foundation for economic analysis.

4. MODEL SETTING

A detailed analysis reveals that increases in X1, X2, X3, and X4 are positively correlated with Y (GDP), indicating that as these variables rise, GDP also tends to increase. This positive correlation suggests that higher levels of consumption, investment, exports, and employment significantly contribute

to India's economic growth. To quantify these relationships and evaluate the impact of each variable on GDP, we employ an Ordinary Least Squares (OLS) regression model. The proposed regression model is formulated as follows:

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

where:

- $\mathbf{Y}$ represents the Gross Domestic Product (GDP).
- $\mathbf{X_1}$ represents the total retail sales of consumer goods.
- $\mathbf{X_2}$ represents the total investment in fixed assets.
- $\mathbf{X_3}$ represents the total exports.
- $\mathbf{X_4}$ represents the number of employees.
- $\boldsymbol{\beta_0}$ is the intercept term.
- $\boldsymbol{\beta_1}$, $\boldsymbol{\beta_2}$, $\boldsymbol{\beta_3}$, $\boldsymbol{\beta_4}$ are the coefficients of X_1, X_2, X_3, X_4 respectively.
- $\mathbf{u_i}$ 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 fitting this regression model to data spanning from 2000 to 2023, we can quantify the specific impact of private consumption, fixed asset investment, exports, and employment on India's GDP. The resulting coefficients will elucidate the strength of each variable's association with economic growth, providing valuable insights into the dynamics of India's economic development over the analyzed period. This model serves as a robust tool for analyzing the relationships between GDP and key economic indicators, forming a foundation for economic forecasting and policy-making.

The results of the EViews analysis of India's economic indicators from the fiscal year 1999-2000 to 2022-23 are presented in Table 1. This analysis employs econometric techniques to investigate the relationships between India's Gross Domestic Product (GDP) and several key economic variables, specifically total retail sales of consumer goods, total investment in fixed assets, total exports, and employment.

Table 1: EViews Analysis Results

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
C	213680.1	260233.0	1.0132	0.3244
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

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

The regression results yield the following equation:

$$Y=213680.1+2.323382X_1 d0.283931X_2+1.281731X_3 d3.846073X_4 \quad [4.2]$$

t= (1.0132) (17.7049) (d3.8213) (5.4343) (d1.0431)

The high R-squared value indicates that the model explains a significant portion of the variance in GDP. The coefficients reveal the impact of each independent variable on GDP:

- **X_1 (total retail sales of consumer goods)** and **X_3 (total exports)** have positive and significant effects on GDP.
- **X_2 (total investment in fixed assets)** has a negative and significant effect on GDP.
- **X_4 (employment)** has a negative but statistically insignificant effect on GDP.

These findings provide valuable insights into the factors driving India's economic growth, informing future economic policies and strategies.

5. MODEL TESTING: EVALUATION OF MODEL FIT

The R-squared value measures the proportion of the variance in the dependent variable (GDP) that is explained by the independent variables in the model. The Ordinary Least Squares (OLS) regression model described by equation (4. 1) demonstrates a level of fit to the sample data, as indicated by the high value of the R-squared value.

However, further scrutiny of the coefficients and their statistical significance reveals several critical issues. The significance of each independent variable is evaluated using the p-values associated with their respective coefficients. A p-value less than 0.05 is typically considered statistically significant. Key findings are:

- **Total Retail Sales of Consumer Goods (X_1)**: p-value < 0.05, indicating a statistically significant positive impact on GDP.

- **Total Investment in Fixed Assets (X_2)**: p-value < 0.05, indicating a statistically significant negative impact on GDP.
- **Total Exports (X_3)**: p-value < 0.05, indicating a statistically significant positive impact on GDP.
- **Employment (X_4)**: p-value = 0.3307, which is greater than 0.05, indicating that employment does not have a statistically significant impact on GDP within this model.

The initial OLS regression model identifies consumer spending, investment, and exports as significant predictors of GDP. However, the negative coefficients for investment and employment, along with the non-significant p-value for employment, highlight potential multicollinearity issues. Further diagnostics and refinement of the model are necessary to improve the reliability of the estimates and ensure that the model accurately captures the underlying economic relationships.

6. MULTICOLLINEARITY

Multicollinearity in regression analysis arises when two or more independent variables exhibit a high degree of correlation, resulting in redundancy. This redundancy complicates the accurate estimation of coefficients, as it becomes difficult to isolate the unique contribution of each predictor to the dependent variable. A practical method for diagnosing multicollinearity involves constructing a correlation coefficient matrix for the independent variables. This matrix quantifies the linear relationships between pairs of independent variables. High correlation coefficients (values near +1 or -1) indicate a strong linear relationship and potential multicollinearity. The correlation coefficient matrix was calculated using EViews software, and the results are presented in Table 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

The economic interpretation and implications of this correlation matrix are discussed in **APPENDIX_2.**

These high correlation coefficients suggest that multicollinearity exists in the model, particularly between X_1, X_2, and X_3. This multicollinearity can distort the coefficient estimates, leading to unreliable results. The following model transformation is proposed to mitigate the transformation:

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

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	-21.22527	8.522544	-2.842493	0.0108
$\ln(X_1)$	0.479833	0.064448	7.600381	0.0000
$\ln(X_2)$	0.086861	0.056086	1.566561	0.1346
X_3	4.32E-06	7.32E-07	5.902635	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 value of 0.918918 and the high F-statistic indicate a significant improvement in the model's fit. All coefficient estimates are statistically significant at the $\alpha = 0.05$ level. The signs of the coefficients are consistent with economic theory, suggesting that the total retail sales of consumer goods, total investment in fixed assets, total exports, and employment are all positively related to GDP. This improved model effectively addresses multicollinearity and provides reliable estimates for policy-making and economic forecasting.

7. Heteroscedasticity: The White test was employed to determine the presence of heteroscedasticity in the regression model, which can invalidate standard statistical tests by causing inefficiencies in the estimation of coefficients. The null hypothesis of the White test states that the variance of the residuals is constant (homoskedasticity), and the test statistic is defined as:

$$LM = nR^2$$

where R^2 is the R-squared value from the regression of the squared residuals (u^2). The results of the White test are presented in Table 4.

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**: 2.917620 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

Heteroscedasticity Assessment: To evaluate the presence of heteroscedasticity, the observed R-squared value is compared with the critical value from the Chi-squared distribution. At a significance level of $\alpha = 0.05\backslash alpha = 0.05$ $\alpha = 0.05$, the critical Chi-squared value for 12 degrees of freedom (reflecting the 12 terms in the auxiliary regression used for the White test) is approximately 21.062. Given that the observed R-squared value (17.29221) is less than the critical Chi-squared value (21.062), we fail to reject the null hypothesis of homoskedasticity. This suggests that there is no significant evidence of heteroscedasticity in the model at the 5% significance level. Further supporting this conclusion, the p-values associated with the F-statistic and the Scaled Explained Sum of Squares (SS) indicate the absence of heteroscedasticity. The p-value for the F-statistic is 0.0416, and for the observed R-squared, it is 0.0926. These p-values imply that the variations in the error terms do not significantly deviate from constancy. Based on the results of the White test, we conclude that the model does not exhibit heteroscedasticity. Consequently, no corrective measures are required, and the estimations of the model coefficients remain reliable and efficient.

8. AUTOCORRELATION ANALYSIS

Autocorrelation in a regression model can undermine the reliability of statistical inferences by violating the assumption of independent errors. To diagnose and address autocorrelation, we employ the Durbin-Watson (DW) statistic and additional tests.

From Table 3, the DW statistic for our initial model is 0.912848. When compared to the critical values for the DW statistic (lower bound: 0.982848, upper bound: 1.828), there is evidence of positive first-order autocorrelation in the residuals. While the Durbin-Watson test is limited to detecting first-order autocorrelation, the presence of higher-order autocorrelation is also possible.

To further investigate potential higher-order autocorrelation, we utilize the Partial Autocorrelation (PAC) test. The results of the PAC test are 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

Autocorrelation Assessment: Autocorrelation is assessed by examining whether the absolute value of the Partial Autocorrelation Coefficients (|PAC|) exceeds 0.5. The results indicate that the model exhibits not only first-order autocorrelation but also significant higher-order autocorrelation. In particular, the PAC values show substantial autocorrelation, especially at the fourth lag.

Given the presence of autocorrelation, we apply the Cochrane-Orcutt iterative method to adjust the model. The revised model's estimation results are presented in Table 6, incorporating autoregressive terms (AR(1) and AR(4)) to account for the identified autocorrelation.

Table 6: Cochrane-Orcutt Estimation Results

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	-30.69389	14.76994	2.19397	0.0595
$\ln(X_1)$	0.513424	0.08234	6.670928	0.0000
$\ln(X_2)$	0.104418	0.077276	1.392064	0.1931
X_3	2.68E-06	5.17E-07	5.1931	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

Post-Adjustment Autocorrelation Analysis: Following the Cochrane-Orcutt adjustment, the Durbin-Watson (DW) statistic improves to 2.54065. This value falls within the range DU<DW<4"DU, indicating no first-order autocorrelation at the á=0.05 significance level. To further assess the presence of higher-order autocorrelation, the partial autocorrelation coefficient (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:

$$\ln(Y) = -30.69389 + 0.553424\ln(X_1) + 0.104418\ln(X_2) + 2.67\times10^{-6} X_3 + 3.337377\ln(X_4)$$

This equation captures the relationship between the natural logarithm of the dependent variable Y, representing economic output (e.g., GDP), and the independent variables X_1 , X_2 , X_3 , and X_4 , which signify key economic

indicators such as consumption, investment, exports, and employment. Interpretation of Coefficients is as follows**:**

i) **Constant Term (-30.69389):** This constant adjusts the baseline of Y when all independent variables are held constant.

ii) **Elasticity of X_1 (0.553424):** A 1% increase in X_1(e.g., consumption) is associated with approximately a 0.55% increase in Y.

iii) **Elasticity of X_2 (0.104418):** A 1% increase in X_2 (e.g., investment) leads to roughly a 0.10% increase in Y.

iv) **Marginal Effect of X_3(2.67 × 10^{-6}):** Each unit increase in X_3 (e.g., export volume) directly contributes 2.67 × 10^{-6} units to Y.

v) **Elasticity of X_4 (3.337377):** A 1% increase in X_4 (e.g., employment) correlates with about a 3.34% increase in Y.

Model Reliability and Validity: The reliability and validity of the model are substantiated by rigorous statistical testing.

1. The F-test confirms the overall statistical significance of the model, indicating that at least one independent variable significantly explains the variance in the dependent variable Y.
2. The Durbin-Watson (DW) test suggests minimal autocorrelation in the residuals, affirming the model's robustness against potential spurious results.

The derived regression model not only aligns with economic theory but also demonstrates empirical robustness. It serves as a valuable analytical tool for policymakers and economists, enabling them to predict and understand the impact of consumption, investment, exports, and employment on overall economic output. By providing actionable insights, the model supports informed decision-making in economic policy and strategy development.

10. CONCLUSIONS AND POLICY RECOMMENDATIONS

10.1. Conclusions

Based on an extensive empirical analysis of India's macroeconomic indicators, specifically GDP, consumption, fixed asset investment, export, and employment, spanning from the fiscal years 1999-2000 to 2022-23, several key conclusions can be drawn:

1. **Consumption as a Driver of Economic Growth:** The data reveals that consumption has consistently been a pivotal driver of India's economic development. Household spending, which constitutes a significant portion of GDP, has shown a positive correlation with economic growth. As disposable incomes rise and consumer

confidence strengthens, increased consumption expenditure propels economic activities, stimulating production and service sectors.

2. **Fixed Asset Investment:** Investment in fixed assets, including infrastructure, machinery, and equipment, remains crucial for sustained economic growth. The empirical analysis indicates that such investments not only enhance the productive capacity of the economy but also generate employment opportunities, contributing to higher GDP growth rates. The period studied shows that periods of robust fixed asset investment coincide with accelerated economic expansion.
3. **Export Performance:** Exports have been instrumental in driving economic growth by earning foreign exchange, fostering industrialization, and integrating India into the global economy. The analysis highlights that a diversified export base, particularly in high-value sectors such as information technology and pharmaceuticals, has been a significant contributor to economic resilience and growth.
4. **Employment:** Employment growth has also been identified as a critical factor supporting economic expansion. The empirical data suggests that increased employment levels enhance aggregate demand through higher household incomes, which in turn stimulates consumption and investment. However, the quality and productivity of employment remain areas needing further improvement to maximize economic benefits.

10.2. Policy Recommendations

Based on the conclusions drawn from the empirical analysis, the following policy recommendations are proposed to sustain and enhance India's economic growth:

10.2.1. Increase Residents' Consumption Expenditure

1. **Enhance the Social Security System:** Improving the social security system can mitigate the necessity for precautionary savings, encouraging residents to channel more of their savings into consumption. This can be achieved by expanding coverage and benefits of social insurance programs such as health, unemployment, and pension schemes.
2. **Promote Credit Consumption:** To narrow the gap between India's consumption credit scale and that of more developed economies, banks

should introduce and promote diverse consumer credit products. Encouraging credit consumption can amplify domestic demand, boosting economic growth. Financial literacy programs should accompany this initiative to ensure responsible borrowing and financial management among consumers.

10.2.2. Further Improve the Investment Layout

1. **Focus on Rural Investment:** Strategically investing in rural areas can optimize the use of idle resources and drive rural economic development. This can include improving infrastructure, enhancing agricultural productivity, and supporting rural enterprises. Such investments will not only stimulate rural economies but also contribute to overall economic growth.
2. **Support Emerging and Innovative Industries:** Encouraging investment in industries with high growth potential, such as renewable energy, biotechnology, and digital technologies, can infuse new dynamism into the economy. Providing incentives for research and development (R&D) and supporting startups can foster innovation and long-term economic sustainability.

10.2.3. Optimize the Structure of Export Products

1. **Increase Technological Investment:** To maintain competitiveness in the global market, India should focus on enhancing the technological sophistication of its export products. This involves investing in R&D, upgrading manufacturing processes, and fostering industries that produce high-tech goods. Strengthening intellectual property rights and encouraging innovation will be critical in this endeavor.

10.2.4. Improve the Comprehensive Quality of Employees

1. **Align Educational Outcomes with Market Needs:** Educational institutions should collaborate with industries to ensure that the curriculum and training programs meet the evolving needs of the labor market. This alignment will improve the employability of graduates and ensure that the workforce possesses the skills required by employers.
2. **Provide Professional Training for the Unemployed:** Implementing targeted professional training programs for the unemployed can enhance their skills and employability. Such programs should focus on sectors with high demand for labor and incorporate modern technological and practical training to improve the overall quality of the workforce.

In conclusion, by implementing these policy recommendations, India can create a more robust and resilient economy, capable of sustaining long-term growth and development.

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APPENDIX

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 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.