A Quantitative Analysis of Macroeconomic Indicators and GDP Growth in India

Abstract

India is significantly influenced by macroeconomic and sectoral factors, particularly agriculture. The study examines the impact of per capita income, agricultural exports, inflation, exchange rate and agricultural GDP share on India's Gross Domestic Product (GDP) from 1990 to 2024. Secondary data is used for the present study. The dependent variable in the study is GDP component from sources such as India stat database, the World Bank and FAO, a multiple linear regression model was employed to quantify these relationships. The study addresses the problem of agriculture's declining share in GDP despite its critical role in employment and rural livelihoods. While increasing per capita income and agricultural exports are expected to drive economic expansion, macroeconomic challenges like inflation and currency fluctuations may hinder growth. The regression results show a strong model fit indicating that 96 per cent of GDP variations are explained by the selected variables. Per capita income and agricultural GDP emerged as the strongest contributors to economic growth, while inflation negatively impacted GDP. The exchange rate significantly influenced GDP, reinforcing the importance of stable foreign exchange policies. However, agricultural exports had a weaker influence, highlighting the need for improved trade integration. The findings suggest that stabilizing inflation, enhancing agricultural productivity, and improving export competitiveness are crucial for sustaining long-term economic growth. The study provides empirical evidence supporting the need for targeted agricultural and macroeconomic policies, emphasizing the importance of investments in agri-tech, infrastructure, and global market access to ensure India's continued economic resilience.

Keywords: GDP, Per Capita Income, Exchange Rate, Inflation Rate, Exports

Introduction

Agriculture has been the backbone of human civilization, dating back to the Neolithic Revolution around 10,000 BCE when early societies transitioned from hunting and gathering to settled farming (Diamond, 1997). In ancient India, agriculture flourished along the Indus Valley, with advanced irrigation and trade networks contributing to economic prosperity (Sharma, 2001). Throughout history, agrarian economies have played a vital role in shaping global trade and national wealth. The Industrial Revolution in the 18^{th} and 19^{th} centuries saw a shift from agriculture to industry leading to economic transformation in many nations. However, in

developing economies like India, agriculture continued to dominate GDP and employment well into the 20th century, underlining its enduring significance in economic stability and food security

Post-independence, India's economy was predominantly agrarian, with over 50 per cent of GDP originating from agriculture in the 1950s. The Green Revolution (1960s-70s) marked a turning point introducing high-yielding crop varieties, chemical fertilizers and irrigation advancements, leading to a substantial rise in agricultural productivity and rural income (Evenson & Gollin, 2003). The economic liberalization of 1991 shifted focus toward industrial and service sectors, gradually reducing agriculture's share in GDP which currently stands at 17-18 per cent (World Bank, 2023). Despite this decline, agriculture remains a crucial livelihood source for nearly 42 per cent of India's workforce and continues to influence economic stability through food production, rural employment and trade contributions. The recent integration of digital agriculture, agritech startups, and export-oriented policies aims to modernize the sector, making it more resilient to global market dynamics (UNCTAD, 2023).

The evolving role of agriculture in India's macroeconomic framework is critical for policymakers, economists and development planners. Despite rapid industrialization, agriculture remains deeply interlinked with economic growth, influencing inflation, exchange rates, per capita income and trade balances. With emerging global challenges like climate change, supply chain disruptions, and currency fluctuations, the sector faces new economic risks and opportunities. The study examines the impact of agricultural GDP, per capita income, inflation, exchange rate and exports on overall GDP. The study provides empirical evidence to support agricultural policy reforms, market-led interventions, and inflation-control mechanisms for sustainable economic growth (OECD, 2022). The study addresses the problem of agriculture's declining share in GDP despite its critical role in employment and rural livelihoods. While increasing per capita income and agricultural exports are expected to drive economic expansion, macroeconomic challenges like inflation and currency fluctuations may hinder growth.

2. Review of Literature

Jayachandran, G., & Seilan, A. (2010) showed that, FDI and exports are one of the elements influencing economic growth in India, but their presence does not change depending on whether economic growth is high or low.

Evans Agalega & Samuel Antwi (2013) found that there is positive relationship between GDP and inflation rate, and interest rate and GDP is inversely related to each other. That means when inflation increases GDP also increases.

(2014) examined how FDI had affected the Indian economy. Particularly following two decades of economic changes, an analysis of the difficulties in securing a favourable position in the global competitiveness of foreign direct investments is also provided. Foreign Direct Investment (FDI) directly influences economic growth through supporting fixed capital formation and indirectly supporting knowledge stocks.

According to Silajdzic and Mehic's (2015) research. Furthermore, according to the conventional view, FDI has a direct impact on economic expansion. Even if FDI is having an impact on economic growth, it will also have an impact on the lack of domestic investment and investment shortages. The study also demonstrates that foreign direct investments contribute favourably to economic expansion.

Mishra & Kumar, (2016) investigated that since FDI is an essential avenue for knowledge transfer and financing, it is seen as a major factor in advancing the economic development of emerging nations. Additionally, multinational corporations (MNCs) view FDI as a crucial tool for reorganizing cross-border manufacturing activities in accordance with their corporate objectives and the competitive advantage of host nations.

Further research by Alvara, *et.al.* (2017) revealed that FDI has a favourable influence on the product, particularly in high income countries, but that the effect is unequal and insignificant in upper-middle income countries.

Singh, (2019) highlighted that according to the Planning Commission, FDI is typically chosen over other forms of external funding since it does not generate debt, is stable, and depends on the performance of the projects it funds.

3. Methodology

The data used in the study is secondary of India ‘s macroeconomic variables that affect GDP and is collected from India stat, FAO and other reports. The study period spanned from 1990 to 2024. There is no problem of multicollinearity between the independent variables i.e. inflation rate and other variables used in the study.

3.1 Data Collection

Secondary data were collected from reputable sources such as the World Bank, Food and Agriculture Organization (FAO) and national government statistical reports. The dataset is from 1990 to 2024 covering variables like GDP (in billions of US dollars), agricultural GDP share, per capita income, agricultural exports, inflation rate and exchange rate.

3.2 Variables and Model Specification

$Y=\beta_0+ \beta_1(X1) + \beta_2(X2)+\beta_3 (X3)+ \beta_4(X4)+\beta_5(X5)+ \epsilon….(1)$

$GDP=\beta_0+ \beta_1(AGGDP) + \beta_2(PRCTA)+\beta_3 (EXPORTS)+ \beta_4(INFLAT)+\beta_5(EXCHGRT)+ \epsilon$

Y: GDP (Billions of US dollars)

X_1: Agricultural Gross Domestic Product Share
X2: Per Capita Income (US dollars)
X_3 : Agricultural Exports (Rs. crores)
X_4 : Inflation Rate (%)
X_5 : Exchange Rate (Rs. to USD)
ϵ : error term

3.3 Statistical Techniques

- **Correlation Analysis**: A correlation matrix was constructed to assess the relationships between independent variables
- **Regression Analysis**: A multiple linear regression model was run to estimate the impact of each predictor on GDP.

4. Results and Discussion

Table 4.1: The Correlation analysis of GDP, Per Capita Income, Agricultural Exports, Inflation, Exchange Rate and Agricultural Share in GDP (1990-2024)

Correlations

		gdp	prcpta	agexprts	inlftn	exchnge	agsgare
gdp	Pearson Correlation	1	.999**	.940**	-.265	.931**	-.832**
	Sig. (2-tailed)		.000	.000	.119	.000	.000
	N	36	36	36	36	36	36
prcpta	Pearson Correlation	.999**	1	.941**	-.251	.923**	-.846**
	Sig. (2-tailed)	.000		.000	.140	.000	.000
	N	36	36	36	36	36	36
agexprts	Pearson Correlation	.940**	.941**	1	-.237	.869**	-.805**
	Sig. (2-tailed)	.000	.000		.164	.000	.000
	N	36	36	36	36	36	36
inlftn	Pearson Correlation	-.265	-.251	-.237	1	-.466**	.345*
	Sig. (2-tailed)	.119	.140	.164		.004	.039
	N	36	36	36	36	36	36
exchnge	Pearson Correlation	.931**	.923**	.869**	-.466**	1	-.833**
	Sig. (2-tailed)	.000	.000	.000	.004		.000
	N	36	36	36	36	36	36
agsgare	Pearson Correlation	-.832**	-.846**	-.805**	.345*	-.833**	1
	Sig. (2-tailed)	.000	.000	.000	.039	.000	
	N	36	36	36	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Authors calculation based on Indiastat data

The table 1 of correlation analysis indicates a strong positive relationship between GDP and several key economic indicators. GDP and per capita income (prcpta) exhibit a near-perfect correlation ($r = 0.999$, $p < 0.01$), suggesting that economic growth directly translates to higher income levels. Agricultural exports (agexprts) also show a significant positive correlation with GDP ($r = 0.940$, $p < 0.01$), highlighting the sector's contribution to overall economic performance. The exchange rate (exchnge) is positively correlated with GDP ($r = 0.931$, $p < 0.01$), implying that currency valuation plays a role in economic expansion. Conversely, agricultural share in GDP (agsgare) exhibits a strong negative correlation with GDP ($r = -0.832$, $p < 0.01$),

indicating a structural shift away from agriculture as economies grow. Inflation (inlftn), however, does not show a statistically significant relationship with GDP.

The findings suggest that GDP growth is strongly associated with rising per capita income, increased agricultural exports, and exchange rate appreciation, reinforcing the importance of trade and macroeconomic stability. The negative correlation between agricultural share and GDP aligns with the economic transition theory, where industrialization and services gain dominance over agriculture in developing economies. However, the weak association between GDP and inflation indicates that other macroeconomic variables may be influencing price stability. The negative correlation between exchange rate and agricultural share (-0.833, $p < 0.01$) suggests that currency depreciation could potentially impact agricultural competitiveness. These insights highlight the need for balanced economic policies that promote trade, maintain currency stability, and support agricultural modernization while ensuring sustainable economic growth.

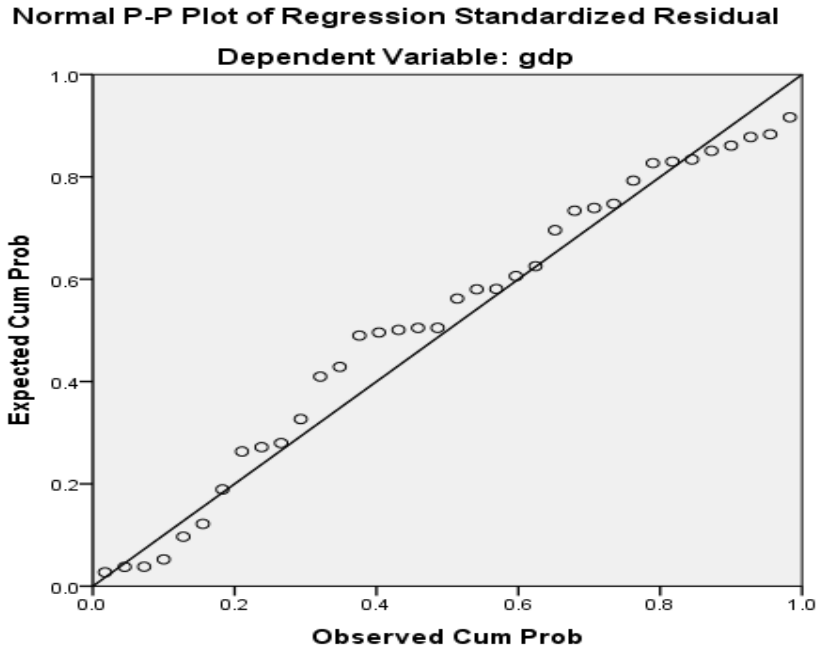

Fig. 1 Normal P-P (Probability-Probability) Plot of Regression Standardized Residuals for GDP.

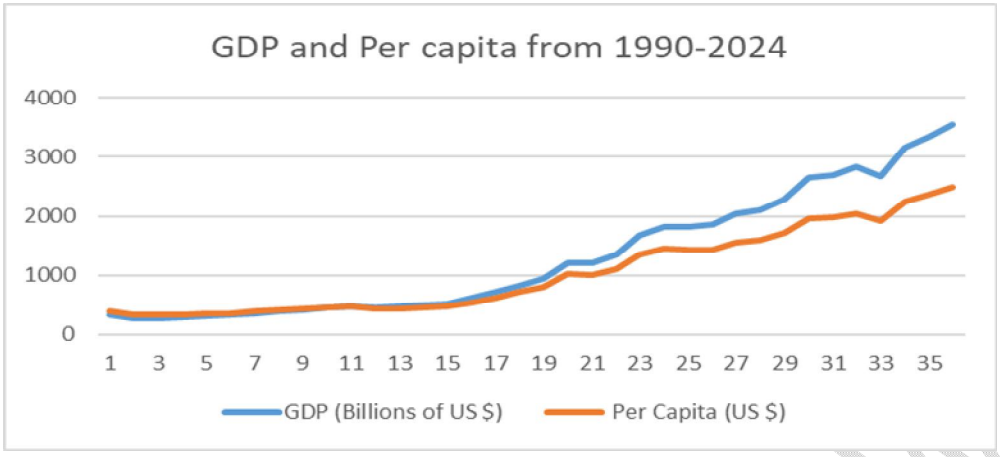

Fig. 2 GDP and per capita income relation from 1990-2024

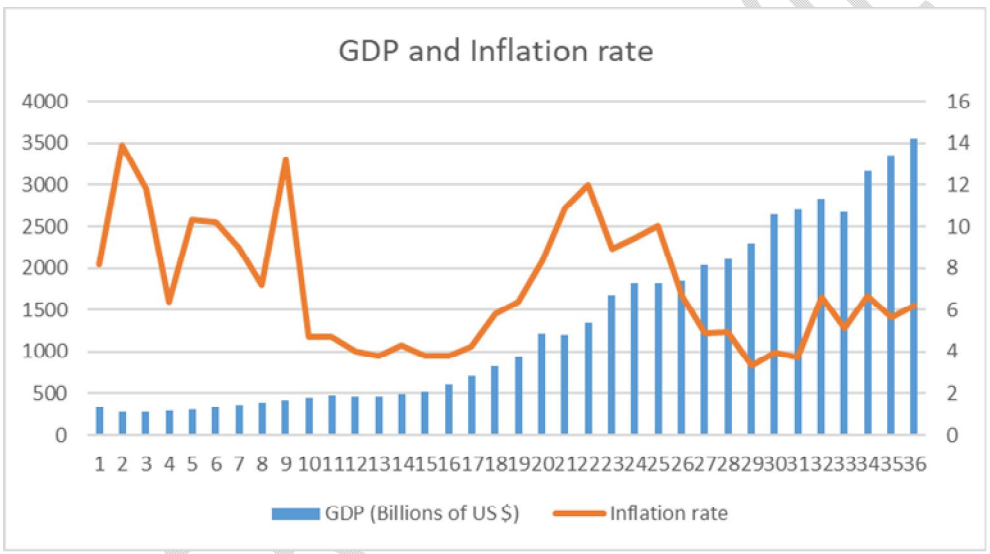

Fig. 3 GDP and inflation rate relation from 1990-2024

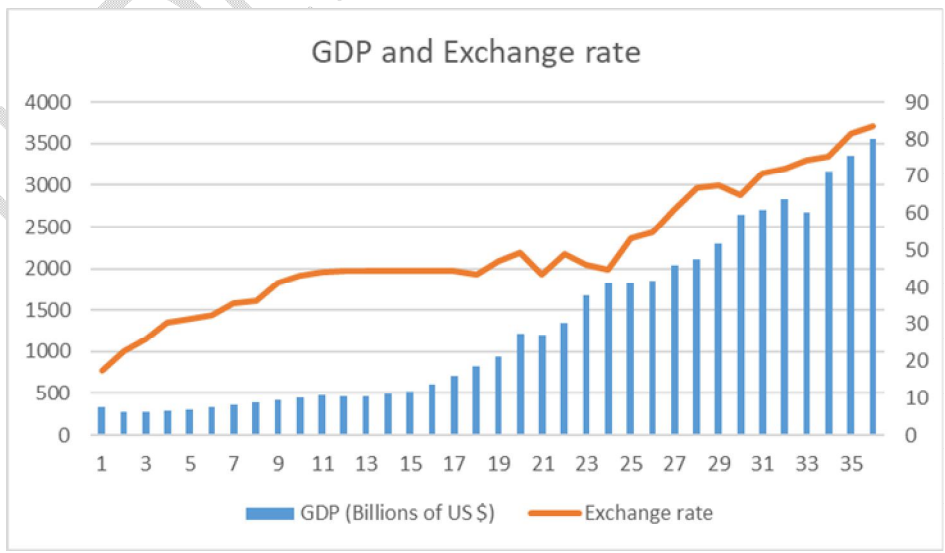

Fig. 3 GDP and Exchange rate relation from 1990-2024

Table 4.2: Model Summary of Regression Analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	1.000[a]	.96	.96	20.66663	1.912

a. Predictors: (Constant), aggdp, infltion, exports, exchgrate, Prcpta

b. Dependent Variable: gdp

Source: Authors calculation

The regression analysis in Table 2 reveals a strong fit, with an R-squared value of 0.96, meaning that 96% of the variation in GDP is explained by the independent variables per capita income, agricultural exports, inflation, exchange rate and agricultural GDP share. The adjusted R-squared value remains high at 0.96, confirming the model's robustness even after adjusting for the number of predictors. The standard error of the estimate is 20.67, suggesting a relatively small deviation of the observed GDP values from the predicted ones. The Durbin-Watson statistic of 1.612 indicates no severe autocorrelation in the residuals, ensuring the reliability of the regression results.

India's current economic conditions underscore the relevance of these findings. The agricultural sector remains a cornerstone of rural livelihoods and contributes around 17-18 per cent to GDP. Policies targeting higher agricultural productivity and market efficiency are essential to sustaining economic growth. Meanwhile, the significance of per capita income reflects the need for inclusive growth strategies to boost individual purchasing power. While the model highlights strong statistical associations, real-world complexities like global trade dynamics, inflationary pressures and currency fluctuations must also be considered for holistic policy formulation.

Table 4. 3: Regression Statistics of Gross Domestic Product And Interest Rate Of India During the Period of 1990 To 2024

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41768252.938	5	8353650.588	10863.278	.000[b]
	Residual	23069.419	30	768.981		
	Total	41791322.357	35			

a. Dependent Variable: gdp

b. Predictors: (Constant), aggdp, infltion, exports, exchgrate, Prcpta

Source: Authors calculation

The table 3 reveals a highly significant regression model, demonstrating that key macroeconomic variables agricultural GDP, inflation, exports, exchange rate and per capita income strongly influence overall GDP. The high F-statistic and the negligible residual sum of squares indicate the model's robustness and accuracy in explaining GDP variations. With a p-value of 0.000, the results confirm that these predictors are crucial determinants of economic growth.

The finding is highly valuable to the scientific community, particularly economists and policymakers, as it provides empirical evidence on the interplay between macroeconomic factors and GDP. It can aid in developing targeted economic policies, optimizing trade strategies, and improving market stability, ultimately contributing to more informed decision-making in economic and agricultural planning. The model developed for GDP and interest rate for India using data spanned these variables from 1990 to 2024 is significant.

Table 4.4. Regression Analysis of Macroeconomic Factors Influencing GDP in India

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-733.700	77.127		-9.513	.000		
	Prcpta	1.518	.025	1.017	60.545	.000	.105	6.333
	exports	3.581E-5	.000	.004	.357	.723	.136	7.332
	infltion	-7.589	2.647	-.016	-2.867	.008	.599	1.670
	exchgrate	3.128	1.039	.038	3.010	.005	.115	6.683
	aggdp	17.056	2.124	.073	8.031	.000	.225	4.451

a. Dependent Variable: gdp

Source: Authors calculation

The regression analysis indicates that per capita income (B = 1.518, p = 0.000), exchange rate (B = 3.128, p = 0.005), and agricultural GDP (B = 17.056, p = 0.000) have a significant positive impact on GDP, while inflation (B = -7.589, p = 0.008) negatively affects it. The high t-values for per capita income (60.545) and agricultural GDP (8.031) emphasize their strong role in economic expansion. The variance inflation factor (VIF) values, particularly for per capita income (6.333) and exchange rate (6.683), indicate some degree of multicollinearity but remain within acceptable limits. These findings reinforce the critical role of income levels and agricultural performance in driving economic growth while highlighting the adverse impact of inflation.

The Indian economy has experienced rising per capita income, supported by urbanization, digitalization, and improved employment opportunities, significantly contributing to GDP. Agricultural GDP remains a major driver, reflecting the sector's resilience despite climate variability and policy challenges. Inflation, however, continues to be a pressing issue due to fluctuating commodity prices, supply chain disruptions, and rising input costs, necessitating strong monetary and fiscal measures. The exchange rate's significant impact on GDP suggests that currency fluctuations influence trade competitiveness and capital flows, reinforcing the need for stable foreign exchange policies. The weak influence of exports implies that India must enhance its trade policies and global market integration to maximize economic gains. These insights emphasize the importance of stabilizing inflation, strengthening agricultural productivity, and boosting export competitiveness to sustain long-term economic growth. The study conducted by Sabitha (2020) in line with results that data collected from 2009 to 2013 the contribution to GDP is approximately 2.5% and declined much in 2014. But there was an increase in 2014-15 of 2.3% and suddenly the growth % is declined to 1.53% in 2017-18 and increased to 2.7% in 2018-19.

Conclusion

The study examines the impact of key macroeconomic factors agricultural GDP share, per capita income, agricultural exports, inflation rate, and exchange rate—on India's GDP. The regression analysis reveals that agricultural GDP and per capita income significantly contribute to overall economic growth, underscoring the importance of the agricultural sector and rising income levels in driving national prosperity. While inflation negatively affects GDP, highlighting the need for stable price levels, exchange rate fluctuations also play a crucial role in shaping economic performance by influencing trade competitiveness. The weak statistical significance of

agricultural exports suggests that India's export sector requires stronger policy interventions to enhance its global market presence.

The findings emphasize the need for balanced policy measures that promote agricultural development, stabilize inflation, and strengthen trade policies to ensure sustained economic growth. Future research can explore sector-specific strategies and incorporate additional structural factors to refine the model further. Overall, this study provides valuable insights for policymakers, economists in designing effective macroeconomic strategies for India's long-term economic stability and growth.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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