Assessing the Contribution of Economic Indicators to GDP Growth in India: A Regression Analysis

Abstract

The study examines the relationship between GDP and key agricultural and economic variables, including agricultural GDP share, inflation rate, exchange rate, exports and per capita income, using regression analysis. The regression model demonstrates a strong predictive power, with an R^2 of 1.000, highlighting the critical role of these variables in explaining GDP variability. Statistical significance of key predictors, such as per capita income and agricultural GDP share, underscores their impact on economic growth. Regression analysis enables a quantitative understanding of these relationships, offering insights into policy-making for balanced economic development. The findings emphasize the utility of econometric models in evaluating macroeconomic and sectoral dynamics.

Keywords: GDP, Agricultural Variables, Regression Analysis, Economic Growth, Agricultural GDP Share, Per Capita Income, Exchange Rate, Inflation Rate, Exports

Introduction

Economic growth is a multifaceted process influenced by a variety of factors, including agricultural performance, trade dynamics and macroeconomic stability. Agriculture is the backbone of many developing economies that plays a vital role in shaping GDP through its contributions to food security, employment and export earnings. The agricultural sector's interplay with macroeconomic indicators like inflation, exchange rates and per capita income reflects the intricate dependencies of modern economies (World Bank, 2023). Understanding these relationships is crucial for policymakers aiming to enhance economic resilience and sustainable growth.

Regression analysis provides a robust methodological framework to investigate the relationships between dependent variables, like GDP and key predictors, such as agricultural GDP share, inflation and exports. The quantitative approach helps isolate the individual and combined

impacts of these variables, thereby offering valuable insights for targeted economic interventions. Studies have highlighted that agricultural productivity and trade are pivotal in mitigating economic shocks and fostering growth in developing regions (FAO, 2022). By quantifying these impacts, regression analysis enables evidence-based policy formulation.

The present study builds on prior research by employing regression models to analyze the linkages between GDP and agricultural variables in a comprehensive manner. By evaluating factors like exchange rates and inflation alongside agricultural exports and productivity, the research seeks to unravel their collective influence on economic output. The findings contribute to the existing literature on econometrics and development economics, offering a nuanced perspective on the role of agriculture in macroeconomic stability (UNCTAD, 2023).

3. Methodology

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 includes 25 observations, 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

Dependent Variable: GDP (Billions of US dollars)

Independent Variables:

Agricultural GDP Share
Per Capita Income (US dollars)
Agricultural Exports (Rs. crores)
Inflation Rate (%)
Exchange Rate (Rs. to USD)

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

3.3 Statistical Techniques

- **Correlation Analysis**: A correlation matrix was constructed to assess the relationships between independent variables and to check for multicollinearity.

- **Regression Analysis**: A multiple linear regression model was run to estimate the impact of each predictor on GDP.

RESULTS AND DISCUSSION

Table 1: Correlation of GDP, agriculture and economic Metrics

Variables	*GDP (Billions of US $)*	*Per Capita (US $)*	*Ag exports Rs cr*	*Inflation rate*	*Exchange rate*	*Ag share in gdp*
GDP (Billions of US $)	1					
Per Capita (US $)	0.998494	1				
Ag exports Rs cr	0.906684	0.909284	1			
Inflation rate	0.053876	0.087643	0.072815	1		
Exchange rate	0.938273	0.921899	0.83308	-0.19456	1	
Ag share in gdp	-0.75936	-0.78625	-0.7303	-0.18291	-0.61064	1

The correlation matrix in Table 1 reveals the intricate relationships between GDP, agricultural exports, inflation, exchange rates and per capita income. A near-perfect positive correlation between GDP and per capita income (0.998) highlights the significant relationship between national economic growth and individual income levels, reflecting the symbiotic nature of economic expansion and improved living standards in India (World Bank, 2023). Agricultural exports also show a positive correlation with GDP and per capita income, suggesting that as India's economy grows, export volumes, especially in agriculture, rise (Bajpai, 2023). However, inflation demonstrates minimal impact on these variables, with low correlations (0.054 for GDP and 0.073 for exports), indicating that inflation may have less immediate influence on the agricultural sector compared to other factors like exchange rates and agricultural GDP share. The negative correlation of agricultural share in GDP with GDP, per capita income, and exports (-0.759, -0.786, and -0.730, respectively) reflects the structural shift in India's economy, where services and industrial sectors increasingly drive growth, reducing agriculture's relative importance (Economic Survey of India, 2023).

In the current scenario, these findings align with global and Indian trends. India, as a rapidly developing economy, has seen its agricultural share in GDP shrink due to diversification

into services and industry, despite robust agricultural export growth driven by digital platforms and policy reforms. The strong correlation between GDP and exchange rates underscores the role of a stable rupee in supporting economic growth and export competitiveness. However, the weak relationship between inflation and agricultural performance highlights the need for policy measures to curb inflationary pressures while enhancing price stability for farmers. Addressing the declining share of agriculture in GDP requires sustained investments in digital platforms like eNAM and agritech startups, which can improve market access and transparency, ultimately supporting inclusive growth.

Table 2: Model Summary of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	1.000[a]	1.000	1.000	20.66663	1.932

a. Predictors: (Constant), AGGDP, INFLAT, EXCHGRT, EXPORTS, PRCTA

b. Dependent Variable: GDP

The regression analysis in Table 2 reveals that the selected predictors per capita income, agricultural GDP share, inflation rate, exchange rate, and agricultural exports together explain nearly all the variation in GDP, with an R^2 value of 1.0. This high R^2 suggests a robust fit of the model, with significant positive impacts of per capita income and agricultural GDP share on GDP. As India continues to develop, the economic importance of both agriculture and income levels remains critical for sustained growth (Jha & Singh, 2023). The Durbin-Watson statistic (1.932) supports the validity of the model by showing minimal autocorrelation in residuals, reinforcing the model's reliability. However, the less significant effects of inflation and exports in the short term point to a more indirect influence of these variables on GDP, in line with recent trends where structural shifts dominate economic performance (Reserve Bank of India, 2023).

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 3: ANOVA Results for the Regression Model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23189114.498	5	4637822.900	10858.620	.000[b]
	Residual	8115.086	19	427.110		
	Total	23197229.584	24			

a. Dependent Variable: GDP

b. Predictors: (Constant), AGGDP, INFLAT, EXCHGRT, EXPORTS, PRCTA

Table 4: Coefficients of Predictors in the Regression Model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-713.383	61.453		-11.609	.000
	PRCTA	1.462	.035	.977	41.190	.000
	EXPORTS	-1.297E-5	.000	-.002	-.159	.875
	INFLAT	-4.362	2.523	-.011	-1.729	.100
	EXCHGRT	4.600	1.313	.064	3.503	.002
	AGGDP	14.314	2.610	.045	5.485	.000

The ANOVA results in Table 3 demonstrate that the model is statistically significant ($F = 10858.620$, $p < 0.001$), confirming that the selected predictors collectively have a strong explanatory power for GDP. In Table 4, the coefficients of predictors such as per capita income (1.462) and agricultural GDP share (14.314) show that these variables exert significant positive effects on GDP. Exchange rate also positively influences GDP (4.600), suggesting that currency stability enhances economic performance. These findings align with India's focus on increasing agricultural productivity and improving income distribution through targeted policies. However, agricultural exports and inflation appear to have a more subdued effect, implying that in the current economic environment, their role is less direct in driving GDP growth. This reflects

India’s shift toward a more diversified economy, where industrial and service sectors play a larger role in GDP growth than agriculture (Sharma & Tiwari, 2023).

Table 5: Residuals Statistics for the Regression Model

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	461.9883	3530.0044	1732.7469	982.96140	25
Residual	-52.39782	24.30454	.00000	18.38827	25
Std. Predicted Value	-1.293	1.828	.000	1.000	25
Std. Residual	-2.535	1.176	.000	.890	25

a. Dependent Variable: GDP

The residuals statistics (Table 5) reveal a relatively normal distribution with a mean residual of 0.000 and a standard deviation of 18.388, indicating that the model's predictions are generally unbiased. The minimum and maximum residuals of -52.398 and 24.305, respectively, suggest that while most predictions are close to the actual values, some data points exhibit larger deviations. The standardized predicted values range from -1.293 to 1.828, and the standardized residuals vary between -2.535 and 1.176, with a mean close to zero, implying that the model fits well for most observations. The relatively low magnitude of the standardized residuals supports the model's adequacy and suggests no significant outliers, further validating the robustness of the regression analysis in explaining GDP variability.

Conclusion

The regression analysis reveals that key economic indicators, including per capita income, agricultural GDP share and exchange rates, are crucial in explaining GDP variation in India, with a high R^2 value of 1.000. Per capita income and agricultural GDP share are the most significant contributors, emphasizing their role in economic growth, while inflation and agricultural exports have weaker effects. The model underscores the importance of currency stability for GDP growth, with exchange rates showing a strong positive impact. These findings highlight the need for policies focused on enhancing agricultural productivity and inclusive growth, especially through digital platforms and agritech, to sustain India's economic expansion.

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