

## The Contribution of Major Indian Sectors to GDP

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### Abstract

India's GDP has been growing at a steady and high rate since independence. It is important for the policy makers to understand the GDP contribution of various sectors. Four important sectors are taken into consideration for this study. The sectors include Agriculture and allied activities; Manufacturing; Construction; and Finance, Insurance, Real Estate & Business Services. The influence of each of these four sectors is measured by various statistical tools. Increasing GDP with minimal resources was also a point of concern. The policymakers want to maximize the GDP growth year on year basis. The time period for the study is ten years, i.e., from 2004 to 2014. From the analysis, it is found that the construction sector has the strongest correlation with the GDP and the manufacturing sector has contributed maximum to the GDP. The future prediction is that India's GDP will be ₹ 22,991 billion in the year 2024.

**Key Words:** GDP, Outliers, Coefficient of Variance, Multiple Linear Regression.

### Introduction

India's GDP has been growing at a steady and high rate since independence. It is important for the policy makers to understand the contribution of each of the following sector in this growth:

1. Agriculture & Allied Activities
2. Manufacturing
3. Construction
4. Finance, Insurance, Real Estate & Business Services

To further increase GDP with minimal resources, it is important to analyze the major Indian sectors together with the Gross Domestic Product (GDP) of India. Policymakers want to maximize the GDP growth year on year basis. In this study, various statistical methods including Boxplot, Histogram, 95% Confidence

Interval, Empirical Rule, Coefficient of Variation, Scatter plot, Correlation Coefficients, Multiple Linear Regression (MLR), and Tread Analysis have been used.

### Objective

The three main objectives are:

1. Which sector has the strongest correlation with India's GDP?
2. Which sector will contribute maximum in India's GDP and by what factor?
3. What would be India's predicted GDP in the year 2024?

### Hypothesis

The hypotheses for this paper are:

- i. H<sub>10</sub>: There is no significant relationship between GDP and Agriculture & allied activities.

- ii. H<sub>2</sub><sub>0</sub>: There is no significant relationship between GDP and Manufacturing.
- iii. H<sub>3</sub><sub>0</sub>: There is no significant relationship between GDP and Construction.
- iv. H<sub>4</sub><sub>0</sub>: There is no significant relationship between GDP and Finance, Insurance, Real Estate & Business Services.

### Data Source

The data has been collected for a period of 10 years on a quarterly basis. The period includes the year 2004 to 2014 as shown in appendix A.

### Statistical tools

The tools used in the study include:

1. Minitab v18
2. Microsoft Excel Add-in – Analysis Tool Pak

### Statistical Analysis

#### 1. Detecting Outliers in Data Set

Firstly, the outliers in the data are determined. The outliers may prevent uncovering true information from the data. Boxplot (also known as Box and whiskers display) is used to identify outliers. It is constructed by using First Quartile (Q<sub>1</sub>), Median, Third Quartile (Q<sub>3</sub>) and the Inter-Quartile Range (IQR) (Calculated as Q<sub>3</sub> – Q<sub>1</sub>). Any outlier is a measurement either below the Lower Limit [Q<sub>1</sub> – 1.5(IQR)] or above Upper Limit [Q<sub>3</sub> + 1.5(IQR)] and is represented with an asterisk (\*). Figure 1, represents the Boxplot generated for the key sectors and GDP in the data set.

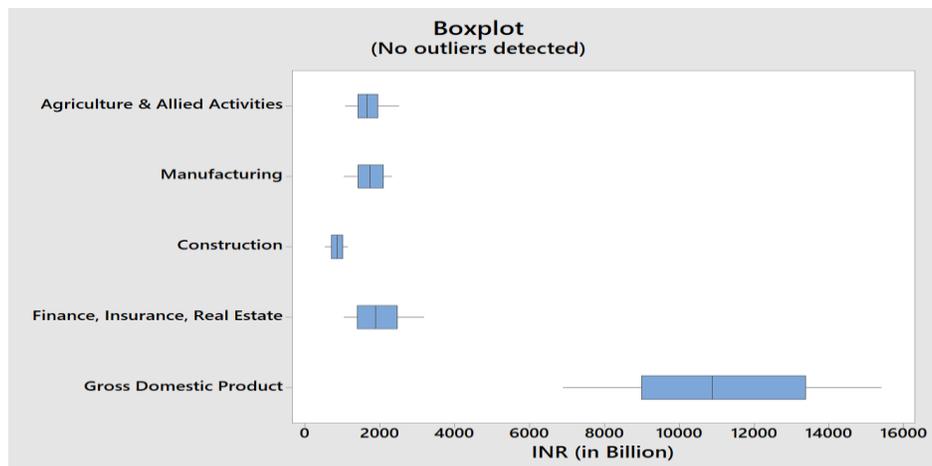


Figure 1

Clearly, there are no outliers present in the data as there is no asterisk displayed in Figure 1.

#### 2. Analyzing Histogram

Histograms help in analyzing frequency distribution for qualitative data. For the data set, it will create multiple classes (of equal width and non-overlapping) for INR(₹) in billion on X-axis and then plot each measurement (the data set has total 42 measurements) on the Y-axis. Figure 2, represents the histogram generated for all five variables in the data set.

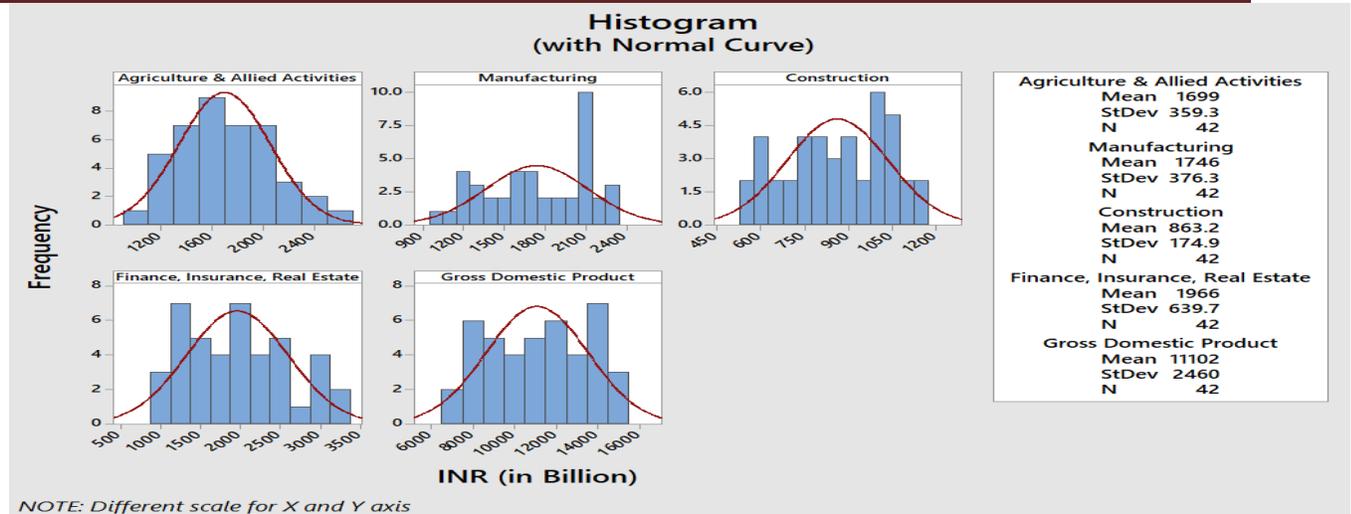


Figure 2

It can be interpreted that each of these five elements nearly follows Normal Distribution since all have mound shaped (single peaked) that are not very skewed to the right or left (skewness is only between -0.4 and 0.4). Further, the coefficient of variance (CV) for all sectors is calculated by using the formula:

$$\text{Coefficient of Variance (CV)} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

$$\text{CV for Agriculture \& Allied Activities} = \frac{359.3}{1699} \times 100 = 21.15\%$$

$$\text{CV for Manufacturing} = \frac{376.3}{1746} \times 100 = 21.55\%$$

$$\text{CV for Construction} = \frac{174.9}{863.2} \times 100 = 20.26\%$$

$$\text{CV for Finance, Insurance \& Real Estate} = \frac{639.7}{1966} \times 100 = 32.54\%$$

$$\text{CV for Gross Domestic Product} = \frac{2460}{11102} \times 100 = 22.16\%$$

CV helps to compare the variance in measurements for all the four sectors. It can be deduced that the Finance, Insurance &

Real Estate sector has the highest variance relative to mean ₹ among all four elements.

Further, Empirical Rule can also be applied to the data set to determine tolerance intervals (the percentage of measurements falling in a certain range). Calculations for Gross Domestic Product are as follow:

**68.26 percent (1 standard deviation)** → X-axis range is [8642, 13562]. 24 out of 42 measurements are in this range for Gross Domestic Product.

**95.44 percent (2 standard deviations)** → X-axis range is [6182, 16022]. All 42 measurements are in this range for Gross Domestic Product.

**99.73 percent (3 standard deviations)** → X-axis range is [3722, 18482]. All 42 measurements are in this range for Gross Domestic Product.

### 3. Descriptive Statistics Summary of GDP Measurements

GDP is studied here and various observations are found by using descriptive statistics. Figure 3, shows the descriptive statistics for GDP.

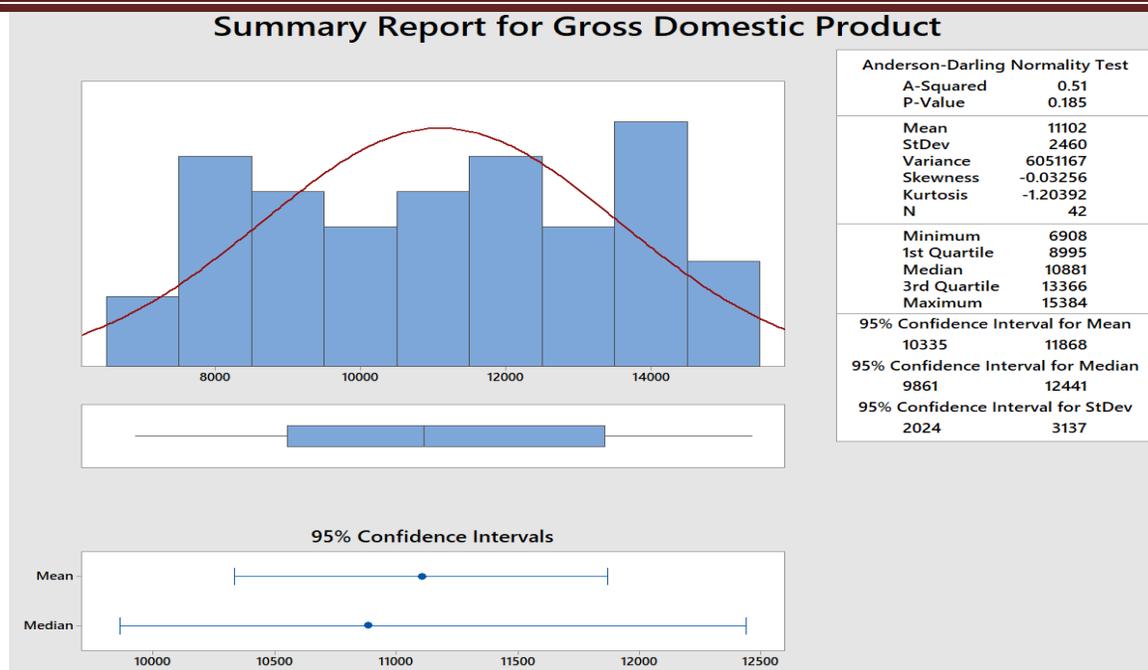


Figure 3

The descriptive statistics show that middle 50% of GDP measurements are in the range of [8995, 13366]. Left whisker and right whiskers are almost of equal length (approx. 2020 units) indicating that first 25% measurements and last 25% measurement are spread over a similar range.

Further, with 95% confidence, the population of GDP measurements will have its mean between [10335, 11868] and standard deviation between [2024, 3137].

#### 4. Identify the Relationship between GDP and each Sector

Scatter plot graph is used to identify the linear relationship between two variables graphically. It is used here to determine the existence of any relationship between Gross Domestic Products and each of the four sectors. Figure 4, represents the Scatter plots generated for each sector vs GDP.

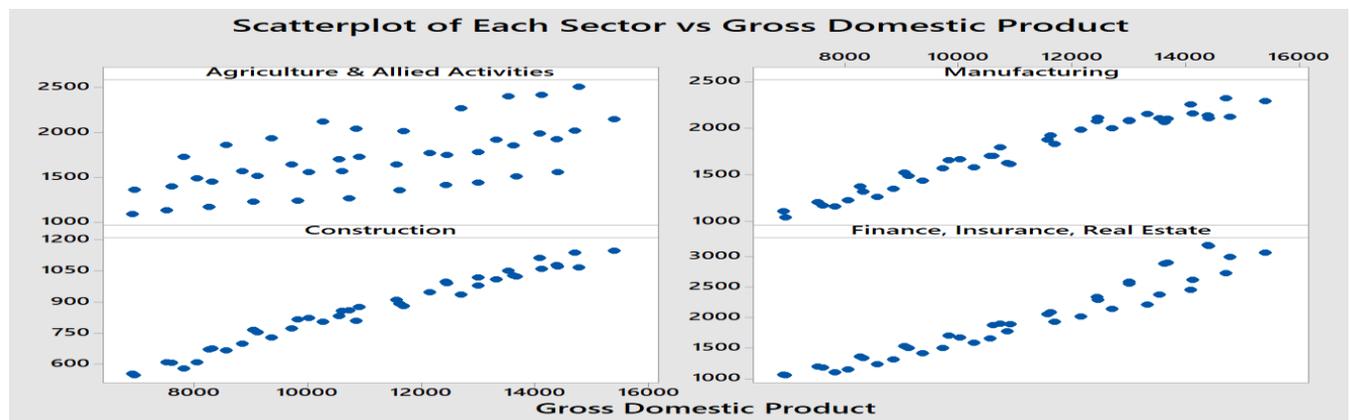


Figure 4

Figure 4, depicts that all the sectors have a linear relationship with GDP with a positive slope. GDP is least related to Agricultural & Allied Activities sector. And, GDP is most related to the Construction sector. Further,

for validation of the observations with numerical values, the Correlation Coefficients are used. Figure 5, displays the correlation coefficients for each of the pair generated.

Sector Name/GDP	Agriculture & Allied Activities	Manufacturing	Construction	Finance, Insurance, Real Estate	Gross Domestic Product
Agriculture & allied activities	1				
Manufacturing	0.541971	1			
Construction	0.577064	0.989431	1		
Finance, Insurance, Real Estate	0.499401	0.931004	0.951636	1	
Gross Domestic Product	0.632848	0.977810	0.988433	0.966584	1

**Note:** Calculated in Excel 2018. All figures (< 1) have been reduced to 6 decimal places.

*Figure 5*

The correlation between construction and GDP is very high with a correlation coefficient of 0.988433. The manufacturing sector is in second position with a Correlation Coefficient of 0.977810. The agriculture & allied activities sector has the least relationship with GDP with a Correlation Coefficient of 0.632848.

### 5. Quantify Effect of Each Sector on GDP

In order to quantify the effect of each sector on GDP, Multiple Regression Model is used. It will help in determining the change in the various sector outputs, i.e., how much GDP output will change. Figure 6, shows the regression outputs.

Regression Statistics	
Multiple R	0.997890814
R Square	0.995786077
Adjusted R Square	0.995330517
Standard Error	168.094673
Observations	42

ANOVA					
	df	SS	MS	F	Significance F
Regression	4	247052374.3	61763093.58	2185.853944	2.21308E-43
Residual	37	1045465.306	28255.81908		
Total	41	248097839.6			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	246.7844659	207.4904462	1.189377489	0.241868010	-173.6311123	667.2000442	-173.6311123	667.2000442
Agriculture & Allied Activities	0.953983919	0.095887646	9.948976288	0.000000000	0.759697093	1.148270746	0.759697093	1.148270746
Manufacturing	2.486785632	0.520321434	4.779325761	0.000027838	1.432514265	3.541057	1.432514265	3.541057
Construction	2.243045734	1.396081525	1.606672457	0.116628115	-0.58568413	5.071775598	-0.58568413	5.071775598
Finance, Insurance, Real Estate	1.503668126	0.142893132	10.52302587	0.000000000	1.214139139	1.793197114	1.214139139	1.793197114

*Figure 6*

An equation for the Multiple Regression Model can be written as:

$$Y = B_0 + B_1.X_1 + B_2.X_2 + B_3.X_3 + B_4.X_4 + e$$

Where:

$$Y = \text{GDP}$$

$X_1$  = Agriculture & Allied Activities

$X_2$  = Manufacturing

$X_3$  = Construction

$X_4$  = Finance, Insurance & Real Estate

$B_0, B_1, B_2, B_3$  &  $B_4$  =Regression Parameters

$e$  = Error Term

In Figure 6, the manufacturing sector has the biggest contribution to the GDP by a factor of 2.4868 ( $B_2$ ). It means for every ₹ 1,000 billion contributions from the manufacturing sector, there will be an increase of ₹ 2,486.8 billion in GDP. Similarly, for every ₹ 1,000 billion contributions from the Construction sector, there will be an increase of ₹ 2,243 billion in GDP.

As for the accuracy of constant coefficients, the standard error is also considered. For Manufacturing,  $B_2$  value can be in between [1.9664, 3.0071]. The R-squared value indicates that this regression model explains 99.58% variance in the GDP data.

### Hypothesis Testing

If any of the regression parameters have zero value then it justifies that there is no relationship between the corresponding Sector and GDP.

So,  $H_0: B_0 = 0, B_1=0, B_2=0, B_3=0, B_4=0$

$H_a: B_0 < 0, B_1 < 0, B_2 < 0, B_3 < 0, B_4 < 0$

At 0.05 level of significance,

- $H_{10}$ : There is no significant relationship between GDP and Agriculture & allied activities.  
Rejected:  $H_{10}: B_1=0$  since p-value is 0.00 ( $< 0.05$ ).
- $H_{20}$ : There is no significant relationship between GDP and Manufacturing.  
Rejected:  $H_{20}: B_2=0$  since p-value is 0.00 ( $< 0.05$ ).
- There is no significant relationship between GDP and Construction.  
Accepted:  $H_{30}: B_3=0$  since p-value is 0.12 ( $> 0.05$ ).
- $H_{40}$ : There is no significant relationship between GDP and Finance, Insurance, Real Estate & Business Services.  
Rejected:  $H_{40}: B_4=0$  since p-value is 0.00 ( $< 0.05$ ).

There is strong evidence that GDP is significantly related to agriculture & allied activities; Manufacturing; and Finance, Insurance & Real Estate. Although, no significant relationship is found between GDP and Construction.

### 6. Forecast Future Values for GDP

The Trend Analysis technique is used to predict future values of GDP. It works on the idea that past pattern will be maintained. Figure 7, represents the forecasted value for GDP for 2024.

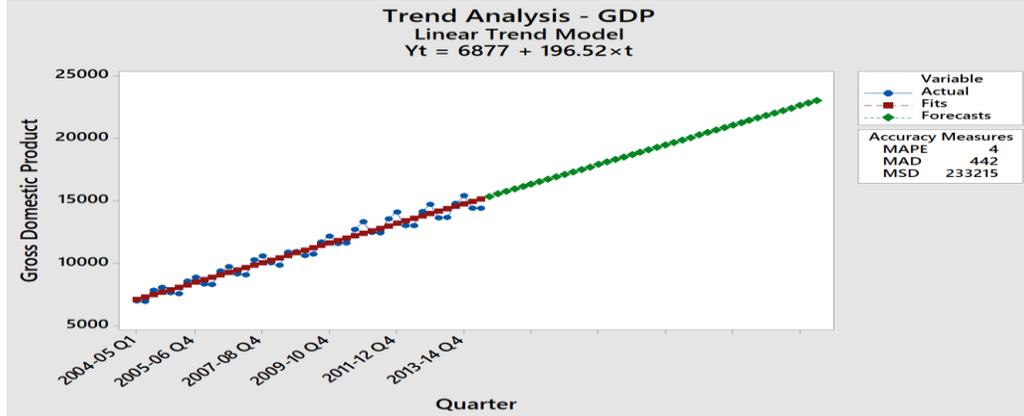


Figure 7

Forecasts predict that India's GDP will be ₹ 22,991 billion in the year 2024 if the same pattern continues as in 2004-2014.

### Conclusion

From the statistical analysis, three important facts are found.

- i. The Construction sector has the strongest correlation with the GDP.
- ii. The Manufacturing sector has contributed maximum to the GDP and with a factor in the range of [1.9664, 3.0071].
- iii. India's GDP is predicted to be ₹ 22,991 billion in the year 2024.

### References:

Minitab Tool, <http://www.minitab.com>

*Summary of Estimates of GDP and Disposable Income at Current Prices (1993-94 Base year)*, Central Statistics Office, Ministry of Statistics and Program Implementation, <http://www.mospi.gov.in/data>