

Impact of Industrial composition on India's GDP growth rate based on multiple Regression

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Abstract:

Transformation of agricultural to industrial based after the advent of New Economic Reforms in India has changed the structure of the economy. This shift is somehow not sufficient to hasten the pace of the country. Therefore, in order to examine if Industrial sector contributes to the growth of the country, multiple regression has been employed covering the period 1960-2017, with the explanatory variables as industry, mining and quarrying and manufacturing. The result found that the secondary sector does not significantly contribute to the growth of the country. The study further tried to incorporate the impact of Service sector and agricultural sector to the impact on the country's GDP. Here, the impact of service sector was found to be significant at 10% level of significance, i.e 1% point increase in service sector leads to 0.0049 % point increase in GDP of the country. The paper concludes that industrials sector should be given priority and environment to grow as it is considered to be the backbone of the economy.

Keywords: Industry, mining and quarrying, manufacturing, service and agriculture, multiple Regression.

1. Introduction:

Industrial sector is considered pre-requisite for the development of the economy. According to IMF WEF (World Economic Forum), India is the 5th largest economy in the World and holds its position in top 10 fastest growing economies. In India, the Industrial sector is one of the most important sectors and it contributes about 29.02%, the second largest contributor to GDP next to Service Sector. Industrial sector mainly comprises of the sub-sectors, manufacturing, electricity, gas and water supply and mining and quarrying. Although manufacturing sector experienced ups and downs in their field of improvement, its contribution shows an improvement with 17.4% to GDP in 2020 from earlier trends. India holds its position in second global textile manufacturing and also holds the position in providing employment after agriculture and accounts for 26% of manufacturing output with

information technology as the fastest growing sectors contributing to one-third of the total output of services. Growth in the IT sector is attributed to increased specialization and availability of a large pool of low cost, highly skilled, educated and fluent English spoken workers of the country. Some major cities like Bangalore, Hyderabad, and Pune have established themselves as major IT hubs in the country. Introduction of economic reforms have brought new challenges by introducing India to foreign competition in industrial scenario which led to privatization of certain public sector industries, opened up sectors previously reserved for the public sector and led to an expansion in the production of fast-moving consumer goods. Many of the manufacturing sectors are now operating at global level experiencing wide variety of marketing options, research and development. However, its consideration of technologies at the atomic level and sustainability of the economy must be considered for the path of development (**Sheehan, P, 2000**).

In most developed countries the major source of Income is from Service sector and Industrial sector (**K. Sivasubramaniyan, 2017**). As such, many studies have been conducted to see the impact of different sector on GDP growth rate. Although, the economy has shifted from agricultural to industrial based since the introduction of New Economic Reforms, industrial sector has gone through many ups and downs in terms of growth and contribution. Its contribution to GVA was 25.4% in the year 1991-92, which grew marginally by mearge percentage, i.e 29.73% in the year 2018-19. Today, tertiary sector is leading in terms of its contribution and growth in India. Since, Industrial sector is considered as the backbone of the economy, its volatility is likely to affect GDP of the country. Annual change in GDP is in negative in the year 2017, i.e -1.46%, which might reflect poor functioning of the industrial sector. The populous country of the World, i.e in China, Secondary sector contributes the most, followed by tertiary and primary industries (**Xiaoyi, L, 2019**). Another study in Henan Province of China, tried to explore the relationship between the internal structure of the tertiary industry and economic growth using multiple regression model, which unveiled that retail sales of consumer goods and freight transportation volume significantly affect economic growth (**Lu, Y, 2021**). Industrial policies affect a lot in the performance of the sectoral growth. Strict policies allow low space for the sector to grow and vice-versa. Such a study was conducted in China, where they found that Industrial law and regulations affects the sector in transforming and rationalizing the structure of the economy (**Chen, J & Xie, L, 2019**). In the context of India, negligible growth was observed due to structural shift from agriculture to Industry and Industry to service sector. Negligible relationship between industrial sector and economic growth was established as well when used the data of the period 2000-01 to 2019-2020 (**Balagatha, M, 2019**). The route of interaction between economic growth and sectoral contribution was examined using VAR model using the data series 1960-2015. The study found 1% change in industrial sector leads to -3.42% changes in economic growth in the long-run (**Solanki, S, et al. 2020**). While, trying to explore the reason of slow growth of manufacturing sector in the post reform period, the author found that growth in manufacturing sector is input driven rather than efficiency driven (**Kaliranjan, K, 2014**).

Industrial sector need a big push in the economy as it holds the major position to gear up the economy. As such, the question arises as of how different composition affects the economy? The paper is an attempt to examine the impact of Industrial sector as a whole and in parts on the country's GDP growth rate.

2. Data sources and objective of the study

For the study purpose only secondary sources of data have been used from sources like; RBI handbook, statistictimes.com and macro trends, etc. For the analysis 57 years annual country level data of India covering the period 1961-2017 have been used.

The primary goal of this paper is:

- i) To examine the impact of industrial sector including manufacturing, mining and quarrying on GDP growth of the country.

3. Methodology:

Multiple linear regressions have been used in various studies to examine the impact of various independent variables on dependent variable. To examine the impact of industrial sector on economic growth, tertiary sector on economic growth, industrial policies on economic growth multiple linear regressions have been used (Xiaoyi, L, 2019; Lu, X, 2019; Chen, J & Xie, L, 2019). In order to examine if Industrial sector, manufacturing and mining and quarrying significantly affect GDP growth of India, multiple linear regression have been used. The model framed using statistical data from 1961 to 2017 stands as follow:

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \varepsilon$$

Y represents GDP growth rate, X_1 , X_2 , X_3 stands for the contribution of industry, mining and quarrying and manufacturing respectively. α_1 , α_2 & α_3 represents the contribution of each of the composition on the economy's GDP. ε is the error term.

4. Results and discussion:

Table.1 shows the GDP growth rate of India from 1961-2015. The growth rate of GDP and % change in GDP along with sectoral contribution is shown in Table 2.

Table. 1			Table. 2		
Year	GDP Growth (%)	Annual Change	Industry	Mining and quarrying	Manufacturing
1961	3.72%	-0.79%	19.93	1.04	14.33
1965	-2.64%	10.09%	18.78	1.04	12.43
1970	5.16%	-1.38%	21.23	1.03	14.29
1975	9.15%	7.96%	21.47	1.15	15.56
1980	6.74%	11.97%	25.12	2.6	16.25

1985	5.25%	1.43%	25.7	2.64	15.98
1990	5.53%	-0.41%	26.49	2.6	16.16
1995	7.57%	0.92%	26.6	2.15	16.94
2000	3.84%	-5.00%	25.08	2.21	14.64
2005	7.92%	0.00%	28.13	2.79	15.39
2010	8.50%	0.64%	27.16	2.83	14.8
2015	8.00%	0.59%	29.8	2.6	16.8

If we compare Table 1 and Table 2, we can notice that although the growth rate might show positive number in percentage, annual change has been degrading since 1980. Adjusted to growth rate over a period of 15 years, i.e from 1961 to 2015, growth of GDP is about 3.9% Comparing Table 1 to Table 2 we can see that the growth rate of Industry to GVA is not promising as well, with annual adjusted growth for 55 Years stood at 2.682%. For manufacturing it is 2.1% and mining and quarrying at 4.5%. So, Mining and quarrying is in a better position in terms of years adjusted growth rate. However, the picture is not clear in determining if the compositions are affecting positively or negatively. Therefore, we use multiple regression analysis to examine the same.

4.a Model Estimates:

Number of observations: 57

F(3,53)= 4.55

Prob. F=0.0005

R-Squared= 0.2049

Adj.R Squared= 0.1599

Table. 1

Variables	Coefficient	Standard Error	t	Prob.
C	-0.0540957	.0613864	-.88	0.382
X₁	.00402992	.003441	1.17	0.247
X₂	.0019755	.0131805	0.15	0.881
X₃	.0001578	.0044604	0.04	0.972

Table 2.

Variables	X₁	X₂	X₃
Parameter estimates	0.0044918	.0178562	0.0080295
t-statistics	3.76	3.45	2.32
R²	0.2045	0.1776	0.08910
Adjusted R²	0.1901	0.1620	0.0726

4.b F-Test

For $H_0: \alpha_1 = \alpha_2 = \alpha_3 = 0$, given the significance value, $\alpha=0.05$, the critical value $F(3, 53)=4.55$, with d.o.f $k-1=3$ and $n-k=53$. As the calculated value of F-statistics is 13.656, we reject the null hypothesis and accept the fact that industry a, mining and quarrying and manufacturing affects GDP growth of the country.

4.c Correlation matrices:

The correlation matrix shows that there is high correlation between the pair of variables. as such, there are high chances for the presence of multicollinearity. Table 3, shows correlation matrix.

Table.3				
	Y	X₁	X₂	X₃
Y	1.000			
X₁	0.4523(0.0004)	1.000		
X₂	0.4214(0.0011)	0.1960(0.0000)	1.0000	
X₃	0.2986(0.0241)	0.6588(0.0000)	0.5458(0.0000)	1.0000

Univariate regression result estimates of Y on X₁, X₂ and X₃. As R² of variable X₂ is highest, i.e 20.45% explained the dependent variable.

4.d Test of Heteroscedasticity

To see if the explanatory variables are white noise, we check the heteroscedasticity. Since, the F statistics value is less than the Probability value; we conclude that the variables are not white noise.

F statistics= 1.67

Prob> F= 0.1971

4.e Findings:

According to the model used, India's GDP grow by .004, .0019 and .00015 % point when Industry, mining and quarrying and manufacturing increases by 1% point respectively.

From the regression model and other relative tests, we can conclude that India's economy is dependent on the Secondary sector. However, the level of dependency was not found to be significant. As service sector contributes the most to the country's GDP, the model fails to capture the impact of Secondary sector on India's GDP. Therefore, we run univariate regression of Y on X₁, where X₁ is service sector, in the presence of X₂ i.e Industrial contribution and X₃ is Agricultural sector

In table 4, we can see that R square value is higher than that of the model framed earlier with Secondary sector as dominating explanatory variable. After the inclusion of X₂ and X₃, i.e Service sector and agricultural sector, the value of R square has increased depicting better fitting of the model for the study. Table. 4, shows that 1% point increase in Service sector, industry and agriculture contribution, India's GDP is likely to grow by .0049611, .0037405

and .0023158 percent point respectively. However, only Service sector was found to be significant at 10% level. This can be justified as Service sector is the leading sector in terms of its contribution in the country. .

Number of observations: 57

F(3,53)= 5.62

Prob. F=0.0020

R-Squared= 0.2414

Adj.R Squared= 0.1985

Table. 4

Variables	Coefficient	Standard Error	t	Prob.
C	-.293188	.2309789	-1.29	.202
X ₁	.0049611	.0026847	1.85	0.070
X ₂	.0037405	.0026847	1.37	0.176
X ₃	.0023158	.0023107	1.00	0.202

5. Conclusion:

Industrial development is considered prerequisite for development of the economy. Classical economist, suggested the transition should follow from agricultural to industrial and then to service based economy. Although, India has experienced transition from agricultural to industrials based after the easing Industrial policies, delicensing, decentralizations the economy, its contribution to GDP has not been up to the mark. Today, service sector is the leading sector and its contribution has surpassed than that of the growth of agricultural and industrial sector. Many studies have been conducted to see the impact of industrial sector on economic growth. Such an attempt was made to study the compositional impacts of industrial sector including industry, mining and quarrying and manufacturing on India's GDP growth rate using multiple regression analysis for a period of 57 years (1961-2017). The study found that Industrial sector does not contributed significant impact in increasing GDP growth of the country. When added Service sector and agricultural sector under study, the findings reflected the impact of service sector to be significant at 10% level of significance. The study suggests that efforts should be made to encourage growth of industry from efficiency based rather than domestic based. Further, service sector growth should be more efficient in order to increase its contribution to retrieve the economy from falling.

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