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Impact of Sub-Indices of GCI on GCI: Indian Evidence

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ABSTRACT
Competitiveness has become one of the important factors for economic growth Nowadays, Nations place more emphasis on increasing their competitiveness. This study aims to measure the effect of GCI sub-indices on GCI in India over the most recent 10 years, starting in 2008 and ending in 2017. The analysis first examines the data's normality and stationarity. multiple regression method is used to measure the effect of GCI sub-indices on GCI. A correlation matrix, VIF, and TOL are used in the study to check for multicollinearity issues. The study also uses the Cusum test to determine whether the regression parameters are stable and several residuals' tests to determine the model's validity. The investigation shows that the variable is not stationary. However, the first difference operator's ADF and PP tests make it stationary, the parameters of the model are stable and the coefficients of the regression equation are statistically significant. This indicates that the GCI score depends on its sub-indices. Additionally, it notes that there is no serious multicollinearity issue but there is an autocorrelation and heteroscedasticity issue in the residuals.

Key Words: GCI, BR, EE, IS, India, Multiple regression, sub-indices.

INTRODUTION:

One of the main concerns for both developed and emerging nations is competitiveness. (Porter, 1990), and thus, lawmakers raise grave worries about it. (Lall, 2001). Xavier Sala-i-Martin and Elsa V have established the Global Competitiveness Index (GCI), which was first proposed by Klaus Schwab in 1979. World Economic Forum releases a global competitiveness index every year and index ranks the countries according to their competitiveness. highly competitive countries get higher rank high in the index, according to their competitiveness. The GCI is computed by considering 114 indicators and these indicators are important for the productivity or long-term prosperity of the countries. These 114 indicators are grouped in 12 pillars of competitiveness namely, (1) institutions, (2) infrastructure, (3) macroeconomic environment, (4) health and primary education, (5) higher education and training, (6) goods market efficiency, (7) labor market efficiency, (8) financial market development, (9) technological readiness, (10) market size, (11) business sophistication, and (12) innovation (GCI report,2008). Again these 12 pillars are categorized into 3 sub-indices, basic requirement, Efficiency enhancers, and innovation & sophistication (). These three sub-indices are given different weights for the calculation of GCI score. GCI divides countries into 3 stages, factor-driven stage, efficiency-driven stage and innovation-driven stage. When an economy adopts the first four pillars for its growth, it is said to be in the factor-driven stage. The factors that matter for nations in the factors-driven stage are among the efficiency enhancers. Additionally, those factors that are significant for nations in the innovation-driven stage are included in innovation and sophistication. This study attempts to find out. Is there any impact of sub-indices of GCI on GCI for India or to Analyze the relationship of sub-indices of GCI on GCI? The study uses time series data for ten years from 2008-2018 to find out the results? It is important to check the impact of these three sub-indices on GCI. Because the overall GCI score is computed by taking these three sub-indices. A country like India a developing country can see the factors which are important for competitiveness and how they are related to each other. Competitiveness determines the productivity and prosperity of a county. A highly competitive country is having high level of productivity which lead to long-term prosperity of a country.

LITERATURE REVIEW.

The goal of the literature review is to search for studies related to global competitiveness and how it affects India. It seeks to investigate the connection between factors that influence global competitiveness**.** Ciocanela et al. (2015) investigate the relationship between competitiveness and innovation. Verifying a cause-and-effect relationship between innovation and competitiveness is the goal of the economic analysis. Panel-type regression with fixed effects for 29 European nations was employed in the study. It has been noted that raising innovation performance raises national competitiveness. Increasing

innovation performance can increase the competitiveness of the country. The resulting model validates that an increase in competitiveness can result from implementing an innovation growth strategy. According to Herciua et al. (2015), a country's main goals are to increase its wealth, competitiveness, and intellectual capital. This leads to the conclusion that a nation must simultaneously raise its GDP per capita, level of national competitiveness, and level of national intellectual capital to achieve and sustain economic development. In 2016, Petrylė wanted to know if nations with higher levels of competition have longer-term, more robust rates of economic growth than nations with lower levels of competition. Using the graphical analysis method, the relationship between the countries' economic development from 2005 to 2015 and the Global Competitiveness Index is analyzed to test this claim. The global competitiveness index and the GDP growth of nations are shown to be little correlated, if at all. The standard deviation of a nation's GDP growth and the global competitiveness index are negatively correlated. The global competitiveness index is not able to predict a nation's future rates of GDP growth. Trifu et al. (2016) seeks to determine whether national competitiveness of nations and company performance are related. Using information from the European State Database, it makes use of the World Competitiveness Index and turnover per enterprise. In this work, 28 cross-sections representing the 28 EU member states from 2008 to 2011 are used in ordinary least square regression analysis. The two sub-indices, in particular, basic requirements and efficiency enhancers, are found to have a significant influence on the expansion of the Enterprises' performance over time, though not to the same degree of confidence as business innovation and sophistication. In 2018, Roy applied the panel data regression technique to investigate the effects of three sub-indices on the global competitiveness index of South Asian Region countries. Based on several statistical tests, the study shows that FEM is better than CCM. However, India outperforms other South Asian nations in the Global Competitiveness Index rating. Roy (2018) looks at how the global competitiveness index is affected by basic requirements, efficiency enhancers and innovation & sophistication factors. Regression modeling and the matrix technique are used in the investigation. It has been discovered that the global competitiveness index does not correlate linearly with basic requirements, efficiency enhancers and innovation and sophistication variables**.** Placido, et al., (2019) try to evaluate the economic development of the Philippines. The study uses data from the environmental performance index, human development index, and global competitiveness index to provide an overview of the Philippines' economic growth plan. The study uses both qualitative and quantitative measures. It is discovered that every development indicator has a substantial variance. In 2019, Nangoy demonstrates the factors that have an impact on sustainability and long-term competitiveness. Indonesia ranks fourth among Asian nations in 2016. it claims that its economy is efficiency-driven. Corruption, inefficient government bureaucracy, and inadequate infrastructure supply are the factors that need to be addressed to maintain Indonesia's competitiveness. In 2020, Shah examines India's performance from 2014-19 from the Global competitiveness index report. This study carefully analyses each indicator for India's sustained growth and overall macroeconomic development. In this paper, a comparison is made between India, BRICS countries, and major developed countries. It has been assessed that India needs to make investments more in business dynamism, social capital, ICT adoption, and skill development. Ibrahim et al. (2013) investigate how education and information and communication technology (ICT) can improve the technological readiness of the United Arab Emirates (UAE). The study describes the UAE's position using a situational analysis and comparative approach. The evidence shows that the UAE is moving toward an innovation-driven stage due to its high-performing macroeconomic environment and high-quality infrastructure, but there are still several issues that need to be addressed, such as low investment in research and development and education, as well as its inability to absorb, adopt, and build new knowledge and technology. In 2009, Saboniene plans to investigate Lithuania's industry's competitive advantage in the commodities category from 2001 to 2007 when compared to Estonia and Latvia. Revealed comparative advantage (RCA) index is used to determine a country's comparative advantage. It is discovered that the majority of Lithuania's exports are made up of conventional industrial export commodities. Akhtar et al., (2009) examine the global competitiveness of Pakistani fruits exports with four world's largest exporters of selected fruits from 1995-2005 by adopting the revealed comparative advantage method. The outcome suggests that, relative to other nations, Pakistan has acquired a comparative advantage. Bezic et al., (2010) emphasize the factors that affect export competitiveness for only the period of 2009. The export intensity of the selected transition economy is tested empirically in this study. Furthermore, larger businesses operate in the global market more intensely, as shown by Tobit data. Amar et al. (2012) use panel data evaluation for a sample of 23 African nations from 2004 to 2009 to examine economic growth in African countries. The study uses the methodology established by Demetriades & Law (2004) and Mankiw, Romer & Weil (1992). The study reveals that economic growth is driven by the global competitiveness index. Erkan et al. (2014) aim to evaluate Turkey's export competitiveness in science-based commodities between 1993 and 2012 with that of the EU+13 nations. Turkey's export competitiveness in science-based commodities is consequently relatively low in foreign markets, as determined by calculating multiple revealed comparative advantage (RCA) indices for each of the relevant countries. Turkey should boost exports and manufacturing. Turkey has to raise its educational standards and enhance its human capital to solve this issue. Amorós et al., (2011) measure competitiveness in Latin American countries for the period 2001-2006 and how it is related to entrepreneurial activity. Discriminant analysis is used in the study to determine the competitiveness of different nations. It has been discovered that Latin American nations must enhance their economic development and

entrepreneurial dynamism. Xia et al., (2012) seek to analyze economic growth by using the global competitiveness index or global competitiveness index needs to be upgraded. The study makes use of GDP growth rate data over five years for 40 nations. It becomes clear that national culture should be included in the World Economic Forum since it is a far stronger indicator of economic growth. The index needs to incorporate both national culture and entrepreneurial activity. Kordalska et al., (2015) test the relationship between economic growth and GCI from 2006-2014. The study considers 114 countries which are divided into five groups on an income basis. Panel Granger causality test is used to empirically test the relationship. It is concluded that global competitiveness is correlated with GDP growth. However, GCI is unable to forecast economic growth for the majority of the countries except large economies. Mahmood (2000) measures the export specialization of the Malaysian manufacturing sector and how AFTA (Asian Free Trade Agreement) affects it. Revealed comparative advantage and Spearman's rank correlation have been used to measure the export competitiveness between Malaysia and ASEAN countries. A visionary leadership, deregulation and privatization of the domestic economy, investment in human and physical infrastructure, sound macroeconomic management, sound industry policy, and a shift in political stability have all contributed to Malaysia's economy becoming competitive.

Research gap:

It is observed from the above extensive literature survey that the most of studies have dealt with particular aspects of GCI. It may be inferred that those studies are not able to highlight the effect and causal relationship of particular countries like India. Therefore, by applying some theoretical and empirical models, the present study seeks to explore the gaps that will surely add value to the existing literature.

OBJECTIVE:

The study is designed to achieve the following objectives:

1. To examine the impact of sub-indices of GCI on the Global Competitiveness Index (GCI)

Data & Study period:

This study considers annual Indian data of GCI and its sub-indices over a period from 2008 to 2017 that is obtained from the official website of WEF (World Economic Forum). Then the annual data is converted into quarterly form and then in log form.

Hypothesis Formulation:

To examine the above stated objective, the study formulated the following hypothesis:

H_0: There is no significant impact of GCI 's sub-indices

H_a: There is significant impact

Methodology:

The study uses various statistical tools to examine the above objective. The study uses J-B test statistic to check the normality of the time series distribution as below:

J-B TEST $= n\left(\frac{S^2}{6} + \frac{(K-3)^2}{24}\right)$ (1)

Where n = Number of observations

S = Skewness of the residuals

$\left(S = \frac{\mu_3}{\sigma^3} = \frac{\mu_3}{(\mu_2)^{3}/_{2}}\right)$ (2)

K = Kurtosis of the residuals

$\left(K = \frac{\sigma_4}{\sigma^4} = \frac{\mu_4}{(\mu_2)^2}\right)$ (3)

Then unit root test is also used to check the stationarity of the time series data as given below:

$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{m} \gamma_i \ \Delta Y_{t-i} + e_t$ (4)

The study uses multiple regression equation to estimate the regression coefficients by using OLS estimator and thus the following regression equation is used as below:

$LGCI(1) = \alpha + \beta_1 LBR(1) + \beta_2 LEE(1) + \beta_3 LIS(1) + e_i$ (5)

Where, α represents intercept

β indicates slope coefficient

e_i is the disturbance term with 0 mean and constant standard deviation.

The study uses Durbin-Watson d-statistic to check the autocorrelation problem in the regression residuals as below:

$d = \frac{\sum_{t=2}^{t=n}(\hat{\mu_1} - \hat{\mu_{t-1}})^2}{\sum_{t=1}^{t=n} \hat{\mu_1^2}}$ (6)

The study uses various residuals test like autocorrelation, heteroskedasticity and normality to examine the model validity by considering the regression residuals.

Finally, the study applies recursive residuals test (CUSUM test) to check the parameter stability of the regression equation.

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Result & Analysis:

The outcome of the descriptive statistics is given in table 1. The value of skewness and kurtosis should be 3 and 0 for a normal distribution. If the distribution is not normal, they are converted in log form to make them normal distribution. The study considering 4 random variables (LGCI, LBR, LEE, LIS). And the outcome is presented in table 1. The probability value of JB TEST for LGCI, LBR and LEE is less than 5% it shows that these variables are not normally distributed.

Table 1: Descriptive Statistics

Var.	observations	Mean	Median	Std. Dev.	min	max	Skew.	Kurt.	J-B Stat.	P - Value
LGCI	**40**	**1.4698**	**1.4620**	**0.0255**	**1.4374**	**1.5260**	**1.2029**	**3.3088**	**9.8066****	**0.0074**
LBR	**40**	**1.4678**	**1.4480**	**0.0386**	**1.4303**	**1.5475**	**1.1600**	**2.7930**	**9.0425****	**0.0108**
LEE	**40**	**1.4828**	**1.4906**	**0.0266**	**1.4327**	**1.5085**	**-1.1598**	**2.8024**	**9.0334****	**0.0109**
LIS	**40**	**1.4010**	**1.3812**	**0.0415**	**1.3506**	**1.4586**	**0.3159**	**1.3325**	**5.2994**	**0.0706**

*****indicates 5% level of significance***

The outcome of unit root test is given in table 2. It is observed from the table that the variables are non-stationary at their level forms. When, first difference operator is used the variables become stationary that means rejection of the null hypothesis based on two tests (ADF & P-P)

Table 2: Unit root test.

	ADF				PP TEST			
VAR.	**LEVEL**		**1ST DIFFERENCE**		**LEVEL**		**1ST DIFFERENCE**	
	t-stats	**prob**	**t-stats**	**Prob**	**t-stats**	**prob**	**t-stats**	**prob**
LGCI	**-0.1138**	**0.9408**	**-6.1649**	**0.0000**	**-0.0902**	**0.9435**	**-6.1649**	**0.0000**
LBR	**0.2246**	**0.9708**	**-6.3861**	**0.0000**	**0.3438**	**0.9777**	**-6.4112**	**0.0000**
LEE	**-1.5117**	**0.5172**	**-6.0001**	**0.0000**	**-1.5861**	**0.4800**	**-6.0001**	**0.0000**
LIS	**-1.3823**	**0.5810**	**-6.0000**	**0.0000**	**-1.4134**	**0.5659**	**-6.0000**	**0.0000**

****Significant at 5 percent level.***
Source: author's own calculation

Table -3 shows the results of multiple regression test run by E- views GCI is dependent variable and BE, EE and IS are independent variables. BE, EE and IS are having significant impact on GCI because p value of all independent variables is significant i.e., less than 5 %. If basic requirement, efficiency enhancers, and innovation and sophistication increase by 1% the GCI also increases by 0.58 %, .033%, 0.06% respectively. Adjusted R square is 0.998 it shows that 100 % of variation in GCI is due to BR, EE and IS. F-Statistic value is also significant to prove that the model is fit. The value of Durbin Watson test is 0.780751 it means problem of autocorrelation exists.

$LGCI = \alpha + \beta_1 BE_+ \beta_2 EE + \beta_3 IS + e$ (7)

$LGCI = 0.050865 + 0.577679BR + 0.326848\ EE + 0.061660\ IS + e_i$ (8)

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Table.3: Multiple regression test

VARIABLES	COEFF	T-STATS	PROB	R^2	F STATS	DUR WAT
LBR	0.577679	141.7424	0.0000	0.999014		0.780751
LEE	0.326848	46.39899	0.0000			
LIS	0.061660	12.49481	0.0000		12160.76	
C	0.050865	5.233769	0.0000		(0.0000)	

***Significant at 5 percent level.**
Source: author's own calculation

Table 4 shows the results of multicollinearity. Here, the values of VIF are less than 10 meaning that absence of multicollinearity issue among the variables. It is shown in the table most of the relationship between variables are significant and positive except relationship between LBE & LEE and LEE & LBR. The values of TOLs (TOLERANCE) are more than 0.10 showing presence of multicollinearity problem.

$$VIF = 1/(1 - R^2) \quad (9)$$
$$BR = \alpha + \beta_1 EE + \beta_2 IS \quad (10)$$
$$EE = \alpha + \beta_1 BR + \beta_2 IS \quad (11)$$
$$IS = \alpha + \beta_1 BR + \beta_2 EE$$

Table.4: Multicollinearity test.

Variables	LBE	LEE	LIS	VIF	TOL
LBR	1	-0.0073	0.4003	1.386429	0.7283
LEE	-0.00730	1	0.6411	1.976623	0.5059
LIS	0.4003	0.6411	1	2.353874	0.4248

Significance at 5 percent level
Source: author's own calculation

Table 5 shows the outcomes of the residual test (i) Breusch-Godfrey test for serial correlation BGLM (ii) Breusch-Pagan-Godfrey test for heteroskedasticity and (iii) Jarque-Bera test for normality). It is observed that the probability value of the corresponding observed R^2 is statistically significant and the probability value of BGLM test is less than 5%. It shows that autocorrelation exists in the residuals. HAC Test can be used to remove the autocorrelation problem. It is also found from the heteroskedasticity test that the probability value of the corresponding observed R^2 is statistically significant, and the values are lower than five percent that means rejection of the null hypothesis it shows heteroskedasticity problem exists in the residuals of the regression equation. HAC test can be also used here to remove the heteroscedasticity. It is observed that the probability values corresponding to the J-B statistics are not significant and thus the null hypothesis is accepted meaning that the residuals are normally distributed which is desirable.

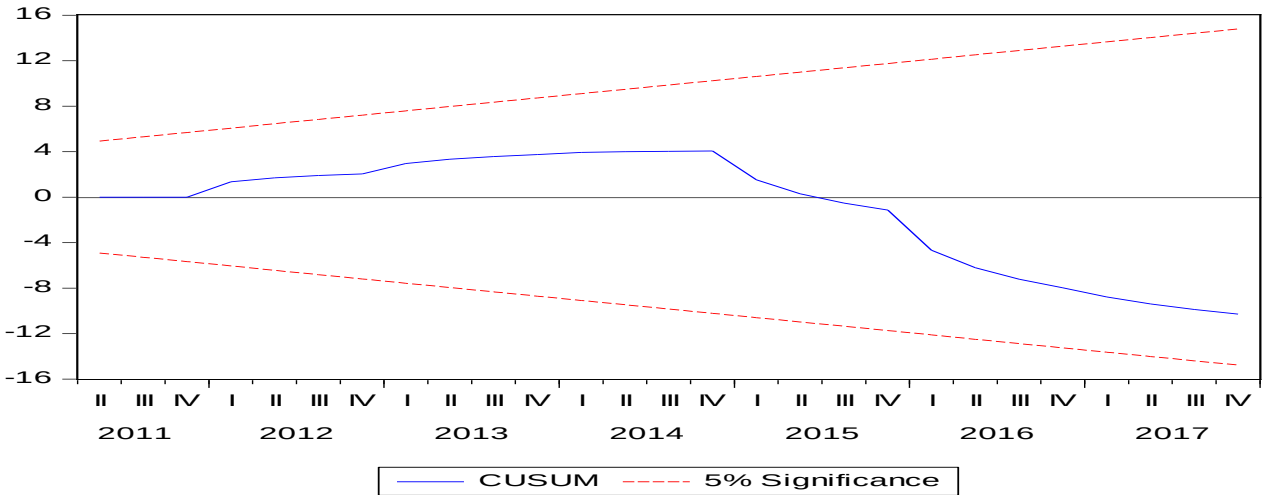
Table 5: parameter tests

BGLM TEST		BPG HET. TEST		NORMALITY TEST	
Obs*R-squared	**Prob**	**Obs*R-squared**	**Prob.**	**J.B TEST**	**Prob**
14.21548	0.0001	3.087289	0.0413	3.4230	0.1805

****Significant at 5 percent level.***
Source: author's own calculation

Figure 1 shows the outcome of CUSUM test. Here, the plots of the CUSUM test of the recursive residuals lies in between two red lines that means the parameters of the regression equation are stable.

Figure 1: CUSUM test



Conclusion:

The study investigates to see how the GCI's sub-indices affect the GCI for India. It is found that the variables are stationary at their first differences. Multiple regression result shows that there is significant relationship between sub-indices of GCI with Global competitiveness index of India. it demonstrates that GCI is very much dependent on its sub-indices such as basic requirement, efficiency enhancers and innovation and sophistication. India needs to raise its sub-index scores in order to become more competitive internationally. The study's null hypothesis is that the sub-indices of the GCI have no significant influence on the GCI of India. However, the null hypothesis can be rejected based on the results of the multiple regression test. It is observed that there is no severe multicollinearity problem among independent variables. the outcome of the BGLM Test demonstrates the autocorrelation problem. BPG (Breusch-Pagan-Godfrey) test is used to check the heteroscedasticity problem and it is found that p value of the corresponding R^2 is significant. it displays the problem of heteroscedasticity problem. HAC Test can be used to remove the heteroscedasticity problem and autocorrelation problem. but in this study HAC is not used. However, the residuals are normally distributed. Finally, the parameters of the estimated regression equation are stable based on CUSUM test. Thus, it may be said from the above analysis that India is doing well in all aspects set by World Economic forum gradually and establishes her presence in the world stage.

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