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Topic: Comparative Analysis of the Relationship Between Economic Growth and GHG Emissions Among Bric Nations

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ABSTRACT

With the passage of time, the issue of climate change has gained significant attention and importance due to its severe repercussions on life forms and economy. The relation between economic growth and greenhouse gas emissions has been a vital concern in the literature as the greenhouse gas emissions (GHGs) have genuine unfavourable consequences for worldwide environmental change and human economical improvement. The BRIC countries, Brazil, Russia, India and China have been attracting exceptional consideration because of the outflows discharged into the environment by their expansive and expanding number of ventures and their overstated utilization of items. This paper aims to study and find the relationship between greenhouse gas emissions and economic growth measured by the growth in gross domestic product and population among the BRIC nations. These variables are firstly tested for unit roots (stationary) using Augmented Dickey and Fuller test (ADF). It has been found that unit root exists for greenhouse gas emissions for Brazil, India and China. In case of emissions in Russia, the unit root does not exist, implying stationary. Similarly the series of GDP (PPP) and population totals are tested and conclusions are drawn.

The secondary data on atmospheric indicators as well as economic growth indicators of the BRIC group of countries is obtained from the World Development indicators (1990-2012) This paper we have conducted time series analysis for comparative analysis. Multiple regression analysis has been used to study the relationship between total greenhouse gas emissions (kt of CO2 equivalent) and economic growth measured by GDP (Purchasing Power Parity, dollars) and population totals (in millions).

Keywords : Greenhouse gas emissions, GDP, Population, BRIC

1. INTRODUCTION

The English economist, Jim O' Neill in 2001 first compiled the acronym BRIC (Brazil, Russian Federation, India and China). According to him, "these four developing countries showed an economic growth rate that was higher than the average rate of other developed countries, such as the United States, Japan and Germany."

With the growing economic and political power at an alarming rate, an alliance of informal nature has been observed among the BRIC nations. It is indicative of the fact that an alliance, which may not be formal in nature, creates significant amount of cooperation among the nations that serve as a ground for foreign direct investment. This backs the way that the BRIC countries are thought to be the fourth biggest economies outside the Organization for Economic Cooperation and Development countries (Cheng, 2007).

According to Abramovay (2010), "It is anticipated that the economic growth happens through industrial growth which in turn uses natural resources to a great extent. The consequences underlying the BRIC nation's rapid economic growth and development have been drawing attention of several environmentalists who are concerned about the high level of emissions which are released into the atmosphere by these nations."

It is believed that not only Climate change has a significant impact on the BRIC nations but the anticipated impact of these nations on climate change is also considerable in nature. The growth rate, atmospheric emissions affecting global temperature and ever increasing demand for energy of the BRIC economies make them centre of attraction in climate related issues. (Rafael L., 2013)

As per the statistics by the United States Environmental Protection Agency, "China, Russia and India were among the top five carbon dioxide (CO2) emitters in the world by 2008, with China emitting 24%, Russia and India each emitting 6% of global emissions." Furthermore, according to International Energy Agency, "the CO2 emissions in non-Annex 1 countries (which include BRICS) rapidly increased by 5.8% in 2011 while emissions by Annex 1 countries decreased by 0.8% within the same period thereby increasing the total carbon dioxide emissions by 2.7% in 2011."

It is suggested that to combat such high profile emissions not only reductions at the level of economy are required but sector wise emissions which are determined domestically must be worked upon. (Lydia Akinyi)

This is because of the varied sources of emissions of greenhouse gases which in the study include carbon dioxide, methane, nitrous oxide, fluorinated gases including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Though it is well known that fossil fuel combustion is the most prominent source of carbon dioxide emissions but other sources such as land use by people, deforestation, soil degradation and clearing of land for agriculture activities also results in emissions of this gas. Methane emissions on the other hand accrue to biomass burnings, agriculture activities and energy usage. The use of fertilizers in case of agricultural activities serves as the primary source of nitrous oxide emissions. In contrast, the emissions of fluorinated gases accounts to industrial processes and releases from air conditioners and refrigerators. (IPCC 2014)

With the progression of time the social generation and living are ending up noticeably intensely reliant on the utilization of natural resources for sustenance and additionally development. The utilization of these resources is subject to quicken the creation of greenhouse gas outflows, which antagonistically influence the adjusted advancement of territorial economies and the reasonable utilization of natural resources. (Madlerner, 2011)

In accordance to the previous researches, the emission sources and predictors vary significantly depending upon the geographical location as well as on the economic progress of the nation. (Abdullah, 2015)

It is therefore evident that there are number of predictors of greenhouse gas emissions out of which this paper aims to study the economic growth of the nation.

Thus, the objective of this paper is to study the trend of greenhouse gas emissions in the BRIC nations and therefore explore the cause and effect relationship between the greenhouse gas emissions and economic growth of the nations, here reflected by the gross domestic product and population totals through the means of regression analysis.

2. VARIABLES AND DATA SOURCES

The study uses three variables namely, total greenhouse gas emissions (kilo tonne of carbon dioxide equivalent), Gross Domestic Product (Purchasing Power Parity) in international dollars and population totals which are firstly tested for stationary so as to comply with the assumption of multiple linear regression models. The multicollinearity tested was found within the required limits in case of each country.

The data for the variables has been extracted from the World Bank's Development Indicators (WDI) over the period of 1990 to 2012 for the four countries (Brazil, Russia, India and China) in the concerned study. Due to unavailability of data on Russian Federation's GDP from 1970 the time span of the study could not be increased.

The total greenhouse gas emissions in kilo tonnes of carbon dioxide equivalent are composed of carbon dioxide totals which include the agriculture waste burning and Savannah burning as well as other biomass burning such as forest fires, post burn decay, peat fires and decay of drained peat lands and all anthropogenic methane sources and nitrous oxide sources and F-gases (HFCs, PFCs and SF6).

GDP (PPP, international $) is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. Gross domestic Product is defined as the sum of gross value added by all resident producers in the economy plus any product taxes and subtracting any subsidies not included in the value of the products. The inability of the exchange rate in reflecting the price level differences between the economies calls for the conversion of gross domestic product per capita's conversion into international dollars with the use of purchasing power parity.

PPP rates provide a standard measure allowing comparison of real levels of expenditure between countries, just as conventional price indexes allow comparison of real values over time as they are calculated by simultaneously comparing the prices of similar goods and services among a large number of countries. Therefore this variable is used as the predictor in the analysis.

According to the World Bank, "Population (total**)** is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates. It is considered that increases in human population, as a result of immigration or exceeding birth rates over death rates is liable to place pressures on the country's sustainability through impacts on the existing natural resources and social infrastructure. A significant increase in population will negatively impact availability of land for agricultural production, and will put increased demands on resources, energy, water, social services, and infrastructure." Therefore it is interesting to study the effect of this explanatory variable on the response variable of the econometric model.

The Wold bank uses the following sources to give the population estimates –United Nations Population Division, World Population Prospects, Census reports and other statistical publications from national statistical offices, Eurostat: Demographic Statistics, United Nations Statistical Division. Population and Vital Statistics Report (various years), U.S. Census Bureau: International Database, and Secretariat of the Pacific Community: Statistics and Demography Programme. (World Bank database 2015)

3. METHODOLOGY

3.1. Augmented Dickey Fuller (ADF) Test

In order to incorporate multiple linear regression analysis in the study it is necessary to verify some important assumptions of the multiple linear regression model. The time series of variables which are to be incorporated in the model must satisfy the assumption of stationary which implies non existence of unit root in the series. A stationary time series is one whose statistical properties such as mean, variance and autocorrelation are all constant over time. The most widespread and prominent test used for testing stationary is the Augmented Dickey Fuller (ADF) test. Thus, in order to check for stationary in series the null hypothesis (H_0) follows that variable is not stationary i.e containing a unit root. The alternative hypothesis (H_a) follows that the variable is stationary and doesn't contains a unit root.

The equation of the unit root test is expressed as:

$$DR_t = \alpha_0 + \alpha_2 t + \sum_{i}^{k} \beta_i + \varepsilon_t$$

According to the theory, in order to reject the null hypothesis the calculated test statistics must be greater than the critical values corresponding to different level of significance which are 1%, 5% and 10%. Thus, MacKinnon's (1996) critical one sided p values are used to determine the significance of the test statistics associated with the coefficient to be estimated

4. RESULTS

4.1. For Total Greenhouse gasses emissions series

The results of ADF test revealed that the greenhouse gas emissions are stationary at different levels for BRIC nations (Results shown in appendix table 2). In case of Brazil, the null hypothesis stating greenhouse gas emissions have a unit root is convincingly rejected when first difference of the series is taken into account. The P value of 0.0022 is less than 0.05 and the *t* –statistics of -5.2742 is less than the values at 1%, 5% and 10% level of significance. Therefore the emissions are stationary at their first difference in case of Brazil.

In case of Russian Federation, the null hypothesis stating greenhouse gas emissions have a unit root is convincingly rejected at level of the series. The P value of 0.0052 is less than 0.05 and the *t* –statistics of -4.7599 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the emissions are stationary at level in case of Brazil.

In case of India, the null hypothesis stating greenhouse gas emissions have a unit root is convincingly rejected at first difference of the series. The P value of 0.0011 is less than 0.05 and the *t* –statistics of -5.5510 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the emissions are stationary at first difference of the series in case of India.

In case of China, the null hypothesis stating greenhouse gas emissions have a unit root is convincingly rejected at second difference of the series. The P value of 0.0054 is less than 0.05 and the t –statistics of -4.8088 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the emissions are stationary at second difference of the series in case of China.

For GDP, PPP (current international $) series: In case of Brazil, the null hypothesis stating GDP (PPP) has a unit root is convincingly rejected at first difference of the series. The P value of 0.0064 is less than 0.05 and the t –statistics of -4.6903 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the series of GDP (PPP) is stationary at first difference in case of Brazil.

In case of Russian Federation, the null hypothesis stating GDP (PPP) has a unit root is also convincingly rejected at first difference of the series. The P value of 0.0198 is less than 0.05 and the t –statistics of -4.2023 is also less than the corresponding values at 5% and 10% level of significance. Therefore the series of GDP (PPP) is stationary at first difference in case of Russia.

In case of India, the null hypothesis stating GDP (PPP) has a unit root is convincingly rejected at second difference of the series. The P value of 0.0096 is less than 0.05 and the t –statistics of -4.5520 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the series of GDP (PPP) is stationary at second difference in case of India.

In case of China, the null hypothesis stating GDP (PPP) has a unit root is also convincingly rejected at second difference of the series. The P value of 0.0074 is less than 0.05 and the t –statistics of -4.6924 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the series of GDP (PPP) is stationary at second difference in case of China.

For population (totals) series: In case of Brazil, the null hypothesis stating population (total) has a unit root is convincingly rejected when first difference of the series is taken into account. The P value of 0.0012 is less than 0.05 and the t –statistics of -5.5224 is less than the values at 1%, 5% and 10% level of significance. Therefore the series of total population is stationary at their first difference in case of Brazil.

In case of Russian Federation, the null hypothesis stating population (total) has a unit root is convincingly rejected at level of the series. The P value of 0.0210 is less than 0.05 and the t –statistics of -4.1426 is also less than the corresponding values at 5% and 10% level of significance. Therefore the population (total) is stationary at level in case of Russia.

In case of India, the null hypothesis stating population (total) has a unit root is convincingly rejected at second difference of the series. The P value of 0.0001 is less than 0.05 and the t –statistics of -7.1145 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the series of total population is stationary at second difference in case of India.

In case of China, the null hypothesis stating population (total) has a unit root is convincingly rejected level of the series. The P value of 0.0000 is less than 0.05 and the t –statistics of -10.3946 is also less than the corresponding values at 1%, 5% and 10% level of significance. Therefore the series of population is stationary at level of the series in case of China.

4.2. Multiple Regression Analysis

The multiple regression analysis is considered to be the most prominent method of describing the relationship between a response or dependent variable and several predictors or independent variables. In case of multiple linear regressions, more than one predictor denoted by $X_1, X_2 \ldots\ldots X_n$, are utilized to explain the variability and prediction of the dependent variable usually denoted by Y.

The commonly expressed descriptive form of the multiple linear equations is represented in equation 1 where the number of independent variables is represented by n, which can take value of any positive integer.

$$Y' = a + b_1X_1 + b_2X_2 + b_3X_3 + \ldots\ldots + b_nX_n \quad (1)$$

In this equation the intercept term is denoted by *a,* which is represents the value of the dependent variable when all the explanatory variables equal to zero.

b_n represents the change brought in the dependant variable, when one of the explanatory variable increases by one unit with all other explanatory variables held constant.

Following the empirical models, multiple regression analysis is incorporated in this paper in order to study the relationship between economic growth and greenhouse gas emissions.

Out of the many predictors that could explain the economic growth of a nation, GDP in purchasing power parity and total population are taken into account in order to explain the response variable.

This can be represented by the given equation:

$$GHG_t = b_0 + b_1GDP_t + b_2POP_t + e_t \quad (2)$$

Where

GHG_t is the response or dependent variable and refers to the total greenhouse gas emissions

GDP_t is one of the independent variables which can be used to explain the response variable with the help of slope $b_1$which refers to the amount by which GHG_t changes when GDP_t increases or decreases by one unit, provided the other predictors are held constant.

POP_t is the independent variable which can be used to explain the response variable with the help of slope b_2 which refers to the amount by which GHG_t changes when POP_t increases or decreases by one unit, provided the other predictors are held constant.

e_t represents the error term.

The model follows the assumption of not undertaking the spatial and spill over effects of the greenhouse gas emissions.

5. FINDINGS

Regressing the above mentioned variables for each country lead to estimation of regression equations which vary significantly among the BRIC nations. The underlying reasons for variability are the geography, economic structure, policy measures undertaken and contribution of sectors of economy in the gross domestic product of the nations.

Table 17.1

Country	*R square*	*F Significance*
Brazil	0.4758	0.0015
Russia	0.1204	0.2772
India	0.9886	0.0000
China	0.9863	0.0000

Table 17.1 reflects the values of R squares thus obtained along with their F significance.

R square is also known as the coefficient of determination. It shows how many points fall on the regression line. It expresses the proportion of the variation in dependent which is explained by variation in independent variables. The F significance values denote the overall F test with null hypothesis. It denotes the associated P-Value.

After the multiple regression analysis for the four nations it is noted that the value of R square differs sharply for the countries.

In case of Brazil, the value of coefficient of determination shows that 47.45% of the variability in the greenhouse gas emissions is explained by the gross domestic product and population growth. The corresponding value of F significance is 0.0015 which is less than 0.05. Here 47.45% indicates that 47.45% of the variation of y-values (greenhouse gas emissions) around the mean is explained by the values of independent variables (GDP and Population). In other words 47.45 % of the values fit the model. The literature reveals that Brazil experiences high emissions on account of Land Use, Land Use Change and Forestry (LULUCF). Therefore GDP and population total explains only 47.45% variability in greenhouse gas emissions.

In case of Russian Federation, the value of coefficient of determination shows that only 12.04% of the variability in the greenhouse gas emissions is explained by the gross domestic product and population totals. This is the lowest R square among all the countries. The corresponding value of F significance is 0.2772 which is more than 0.05. In this case 12.04% indicates that 12.04% of the variation of y-values (greenhouse gas emissions) around the mean are explained by the values of independent variables (GDP and Population) . In other words only 12.04% of the values fit the model. The reason for a low R square could be the misspecification of variables as well as other explanatory variables which should be taken into consideration that affects the greenhouse gas emissions in Russian Federation.

In India, the value of coefficient of determination shows that 98.86% of the variability in the greenhouse gas emissions is explained by the gross domestic product and population totals. The corresponding value of F significance is 0.0000 which is less than 0.05. Here 98.86% indicates that 98.86% of the variation of *y*-values (greenhouse gas emissions) around the mean is explained by the values of independent variables (GDP and Population). In other words 98.86% of the values fit the model.

Similarly in China, the value of coefficient of determination shows that 98.63% of the variability in the greenhouse gas emissions is explained by the gross domestic product and population totals. The corresponding value of F significance is 0.0000 which is less than 0.05. Here 98.63% indicates that 98.63% of the variation of *y*-values (greenhouse gas emissions) around the mean is explained by the values of independent variables (GDP and Population). In other words 98.63% of the values fit the model.

In order to further explain the variability that greenhouse gas emissions experience at the hands of the explanatory variables, the P values of the two predictors are taken into consideration where a P value lower than 0.05 indicates the significant impact of the predictor on the dependent variable. Table 17.2 illustrates the corresponding P values which are then compared by the value of level of significance i.e. 0.05

Table 17.2

	P Values of Predictors	
Country	*GDP (PPP)*	*Population(Total)*
Brazil	0.1109	0.0151
Russia	0.5150	0.1911
India	0.0000	0.0524
China	0.0000	0.4612

In case of Brazil, the p value corresponding to the predictor GDP is 0.1109 which is more 0.05 while the p value corresponding to the predictor, population totals is 0.0151 is less than 0.05. This indicates that the variability in the independent variable POP_t accounts for most of the variability in the greenhouse gas emissions. Since, land-use is the major sources of Brazil's emissions, due to increased deforestation and the expansion of agriculture which is directly affected by the population totals in the economy.

The results of for Russian Federation have been inconsistent as the p values of 0.5150 and 0.1911 exceeds 0.05 which indicates that much of variability in the greenhouse emissions is not explained by the variability in gross domestic product and population totals in the economy. As per the literature, the major sources of emissions accrue to the energy industries and solid waste disposal on land. This can be the reason why the predictors considered in the study are unable to explain the variability in emissions in Russian federation.

In case of India, the p value corresponding to the gross domestic product is significantly lower than 0.05 which indicates that the predictor GDP_t explains much of variability in the dependant variable (greenhouse gas emissions). The p value corresponding to the population totals is 0.0524 which is slightly higher than 0.05 indicating that some amount of variability in population can explain variability in emissions. But overall it is the gross domestic product (GDP_t) that explains the variability better in case of India

Similarly in China, the p value corresponding to the gross domestic product is significantly lower than 0.05 which indicates that the predictor GDP_t explains much of variability in the response variable (greenhouse gas emissions). The p value corresponding to the population totals is 0.4612 which is higher than 0.05 indicating that of variability in population cannot explain the variability in emissions much significantly. In China, it is the gross domestic product (GDP_t) that explains the variability in emissions than the population totals in the economy.

6. DISCUSSION

The contribution of greenhouse gas emissions in increasing the global temperature and leading to global warming varies significantly among the BRIC nations where China is considered the world's largest greenhouse gas emitter since 2006. The sharply increasing trend in the greenhouse gas emissions since 2003 shows that the industrial production and construction account for 31% of China's 8.2 gig tonnes

(or 8.2 trillion kilograms) of CO2 emissions which is far above the world average (International Energy Agency). It is also characterised by excessive carbon consumption by the economy and unrelenting coal mining plans in the North-western Provinces of the country. The statistics is therefore compliant with the findings of the study which tells that variability in the gross domestic product of the nation explains about 98.63% variability in the greenhouse gas emission.

Carbon emissions are mainly the result of fossil fuel combustion (90%) and cement production (10%). Manufacturing and power generation are the major sectors contributing to China's carbon emissions, together these sectors accounted for 85 percent of China's total carbon emissions in 2012.

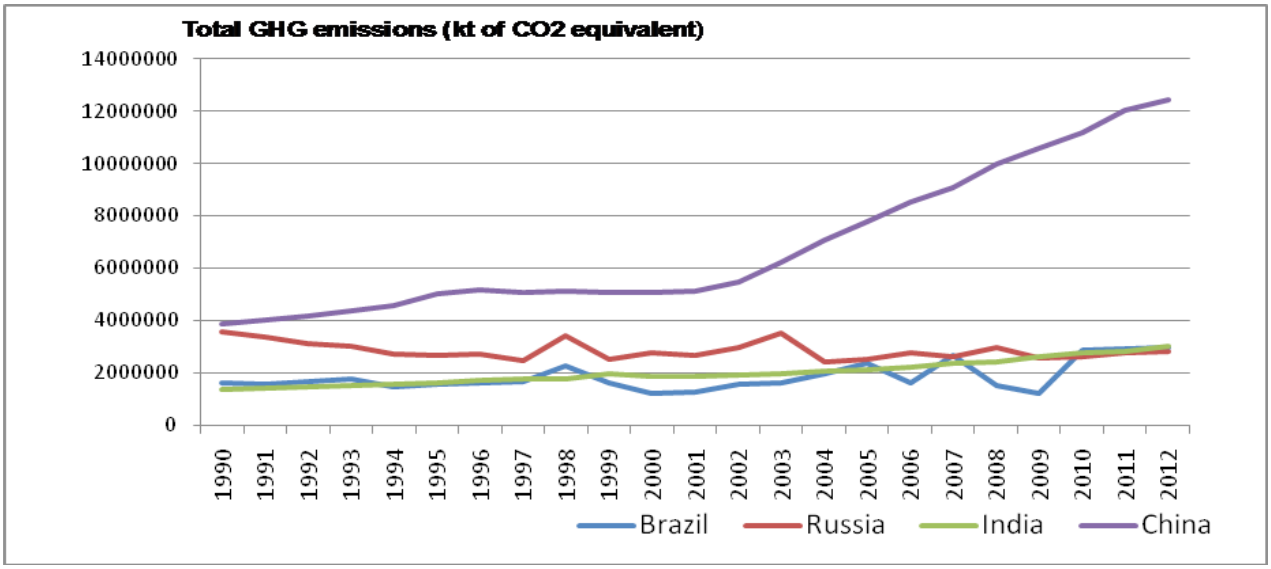

Figure 17.1: Total GHG emissions (*kt* of CO2 equivalent) 1990-2012 (Source: World Bank)

In late, 1990s the blast in the quantity of multinational businesses setting up undertakings in China happened which prompt expanding the nation's wellspring of income. Thus of this expansion, the purchasing power expanded and empowered the general population of China to have simple access to methods for transportation and obtain more sturdy merchandise that included stoves and vehicles, which thus are in charge of carbon dioxide outflows.

The trend takes attention towards Russian Federation, where the time series shows some rise and fall in the emission levels over the years**.** The sharp drop in Russia's greenhouse gas (GHG) emissions from 1990s till 1998 accrues to collapse of Soviet-era smokestack industries. In contrast the emissions have been steadily rising ever since as the emissions are contributed by many sources in the economy. Within the energy sector the energy industries contribute approximately 48.61% of the greenhouse gas emissions while the metal production within industrial processes sector contributes to 50.69% of the emissions. It is also noted that agriculture soil accounts for 51.05% of the greenhouse gas emissions within the agriculture sector. The statistics for solid waste disposal on land and wastewater handling stands at 63.74% and 36.26% respectively accounting for emissions within the waste sector. (United Nations Climate Change secretariat) Thus the literature supports that the low value of R square which is 12.04% indicating that the variations in greenhouse gas emissions are not significantly contributed by the variations in gross domestic product and population totals. Also, the low significance of the predictors shows that the model needs additions of predictors which contribute to greenhouse gas emissions.

Analysing the Indian economy which is among the fastest-growing major economy in the world is also the fourth largest greenhouse gas emitter and accounts for 5.8 percent of global emissions. During 1990 to 2012, India's emissions increased by 67.1, and are projected to grow 85 percent by 2030 (Centre for Climate and Energy Solutions)

The rise in occurrence of industry area outflows have been evaluated from assembling of minerals, metals, chemicals, other particular businesses, and from non-energy product use. The outflows discharged by the business division incorporate fossil fuel burning related emissions alongside the procedure based outflows. The concrete business contributed around 32% of the aggregate carbon dioxide outflows from the Industry area. With the progression of time India is working thoroughly to take care of developing vitality demand by securing reasonable supplies and pulling in framework interest in the economy. Complying with the statistics, the findings suggested that 98.86% variations in emissions is brought by the variations in gross domestic product and population totals of the nation. (Indian Network for Climate Change Assessment, Ministry of Environment and Forests)

The Brazilian discharges profile is essentially not quite the same as the created nations, where copying fossil powers for energy and transportation contributes the most to the totals of greenhouse gas emissions. In 1994, simply 17% of Brazil's aggregate emissions began from energy generation. However if there should be an occurrence of Brazil the discharges from horticulture, land use and forestry and LULUCF emissions were together responsible for 81 per cent of the total emissions. Historically, it has been the land use and forestry sector that are the largest source of greenhouse gas emissions in Brazil. Though, this picture has changed significantly and positively over the past decade.

Brazil emission's profile is thus considered to be atypical as the LULUCF emissions, originating notably from deforestation in the Amazon, are among the main sources of domestic greenhouse gas emissions. The underlying reason is the scale of deforestation, and also, unlike many countries, a significantly large part of Brazil's power traces its roots from renewable energy sources. Peculiarly, the emissions from cattle contribute as much as energy sector emissions, in part because of the enormous number of cows accounting to almost one per Brazilian citizen in the economy. Despite the unique emissions profile Brazil is among those nations which are stringently taking policy measures on the issue of climate change and therefore contributing the least to emissions among the BRIC nations.

7. CONCLUSION

This paper targeted to study the relationship between the greenhouse gas emissions and economic growth measured by the variables of gross domestic product and the population growth. The resulting findings vary significantly among the four nations of concern which are apparently different from each other not only in terms of geography and economic structure but also by their total contribution in the greenhouse emissions. It was found that in the fast paced growing economies of India and China the variability in gross domestic product explains the variability brought in the greenhouse gas emissions with 98.86% and 98.63%. Though it is also found the variability is better explained by gross domestic product and not the population totals of the concerned countries as indicated by the high p values of the predictors. It is also concluded that in case of Russia and Brazil, the variability in emissions has to be explained by the explanatory variables, other than population totals and gross domestic product. This is due to the fact that the sources and sector wise contribution of emissions vary significantly among the economies in the study. However it was only in case of Brazil that population totals are significantly explaining the variability in emissions.

The time series analysis of the greenhouse gas emission series however reveals that rising trend in observed in all the four nations which are projected to increase with the passage of time. Therefore adoption of stringent policy measures is the need of hour. The international level incentives from the recent Paris agreement till the Kyoto Protocol provides with much required directions to the government. However the implementation and execution of the policies associated with climate change must be worked upon by the government of these nations.

8. APPENDIX

Table 17.3
Results of Augmented Dickey Fuller Test

Variables	*T-Statistics*	*Critical ValueS*
Brazil's GHG emissions	-5.274213	-4.498307* -3.658446
Russia's GHG emissions	-4.759938	-4.440739* -3.632896
India's GHG emissions	-5.551804	-4.467895* -3.644963
China's GHG emissions	-4.808894	-4.498307* -3.658446
Brazil's GDP (PPP)	-4.690307	-4.467895* -3.644963
Russia's GDP (PPP)	-4.202390	-4.571559 -3.690814
India's GDP (PPP)	-4.552049	-4.532598* -3.673616
China's GDP (PPP)	-4.692453	-4.532598* -3.673616
Brazil's Population (totals)	-5.522438	-4.467895* -3.644963
Russia's Population (totals)	-4.142684	-4.532598 -3.673616
India's Population (totals)	-7.114585	-4.532598* -3.673616
China's Population (totals)	-10.39466	-4.532598* -3.673616

*critical values at 1% significance

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