CO Emission, Population and Industrial Growth Linkages 2 in Selected South Asian Countries: A Co-Integration Analysis

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CO₂ Emission, Population and Industrial Growth Linkages in Selected South Asian Countries: A Co-Integration Analysis

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Abstract: This study investigates the impact of population & industrial growth on one of the important environmental problems i.e. CO₂ emissions in selected SAARC countries. This study covers the time period from 1980 to 2008. Four major SAARC countries were selected on the bases of their population size. Study applied panel co-integration methodology to find long run relationship among the variables. Fisher Johansen to co-integration methodology found co-integrating vectors and Pedroni panel co-integration also found co-integration in the variables of study. Results of the study show that industrialization and population both were major causes of air pollution (CO₂ emission) in these SAARC countries.

Key words: Co-integration % Environmental Degradation % CO₂ Emission % Nonrenewable resources % Ecosystem % Total fertility rate

INTRODUCTION

The possible linkage between population growth and industrial growth is generally recognized. Rising human population led to the growth of industrial sector across the world. England was the first nation to observe an industrial revolution, later on western, northern and Central Europe, Japan and Russia observed the industrial revolution. But the Asian and Latin American countries did not experience industrial growth in the same period. Both population and industrial growth caused several problems and environmental degradation is one of them. Environmental degradation means destruction of ecosystem, climate change and depletion of natural resources. Environmental problems must be addressed by policy makers to ensure the healthy survival of human life.

This paper focuses on four major SAARC countries i.e. India, Pakistan, Bangladesh and Nepal. These countries were selected on the basis of their population size in the South Asian region. SAARC was founded in 1985 with seven member countries. Afghanistan joined as a member in 2005. Among many socio-economic objectives of SAARC, one was to increase the welfare of the people of this region and quality of life as well. However environmental problem is one of the hazards in promoting welfare and improving the quality of life in this region. Many researchers linked population growth with environmental degradation as rising population indirectly affects the environment through growing consumption and production of consumer and capital goods. Rising population is a major determinant of rising demand of consumer goods, consumer durable goods and capital goods. Therefore industrialization in the SAARC countries expanded with the population growth. This has caused carbon dioxide emissions (CO₂) in the region; moreover population growth has been one of the major determinants of environmental degradation in populous SAARC countries such as Bangladesh, India, Nepal and Pakistan. According to UNEP (1999) CO₂ accounts about 82% of anthropogenic greenhouse gas in developed nations. The population growth as a determinant of CO₂ did not receive considerable attention in the past studies. This study takes a step forward to see the impact of population and industrial growth on CO₂ in populous SAARC countries using a data of most populous SAARC countries from 1980 to 2008.

Population density and high rates of consumption of nonrenewable natural resources are one of the major causes of environmental degradation [1]. Pollution has reached to the life threatening levels in several developing countries particularly air pollution [2].

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thought on the basis of some differences in assumption s
be deemed mutually exclusive among different school o f
growth, industrialization contribute to air pollution but i t
led by them [5].

Another study analyzed the impact of population growth
on CO2 emissions in European Countries and found CO2
emission more than proportional for recent accession
countries than old EU members, where it was less than
unity and insignificant. Moreover, CO2 has strong
correlation with per capita income level, intensity of
energy and, industrial structure [16].

Population growth was considered as a major driving
force in increasing CO2 emissions in the world for the last
two decades and according to estimation population
growth would contribute one half of the emissions
increased by 2025. [17, 18] also analyzed the impact of
population on carbon dioxide emissions and energy. This
study used IPAT model and found elasticity of CO2
emissions and energy with respect to population growth
was close to unit. [19] found a positive relationship
between CO2 emissions and population growth in the
panel data study of 93 countries. This study revealed
that one percent increase in population increases

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**Table 1 Population size mid-2010**

<table>
<thead>
<tr>
<th>countries</th>
<th>Population in million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>160.44</td>
</tr>
<tr>
<td>India</td>
<td>1188.8</td>
</tr>
<tr>
<td>Pakistan</td>
<td>180.48</td>
</tr>
<tr>
<td>Nepal</td>
<td>20.8</td>
</tr>
</tbody>
</table>


We have two approaches that mostly used to study
the relationship between population growth and CO2. One
research study is based on statistical models and other is
based on simulation models. Present study is based on
statistical model that covers panel co-integration analysis
to see the impact of population growth, industrialization
on CO2.

**Population Growth in South Asia:** South Asian is densely
populated region covering 22% of the world population.
Population size of some selected countries is reported in
the table 1. India had highest population in the region and
second highest in the world with total population of
1188.80 million in the mid-2010. Pakistan had second
highest population in the region and sixth most populous
in the world with the total population of 180.48 million in
the mid-2010. Bangladesh had third highest population in
the region and eighth highest in the world with total population of 160.44 million in the mid-2010. Nepal had
fourth highest population in the region and ranked forty
third in the world with total population of 20.8 million in
the mid-2010. The growth rate of the population of Pakistan is 2.05 percent and total fertility rate (TFR)
is 3.5 per women [3]. Population growth rate in India was
1.34 percent and total fertility rate remained stationery at
2.6 per women [4]. While population growth rate in
Bangladesh has been reported 1.56 percent by July-
2011 and total fertility rate has been 2.6 per women.

Air Pollution: Air pollution has been very serious and
growing problem in SAARC countries. This problem is
very intensive and wide spread in India and Pakistan. While for the rest of SAARC countries it is confined up to
cities.

Air pollution has several types of pollutants that
include variety of oxides such as Nitrogen Oxide, Sulphur
Oxide, Carbon Dioxide, ( NOx, SOx, CO2). Many Scientists
believe that CO2 emissions produced a gigantic upsurge
of greenhouse gas, which has caused to rise recent
temperatures [12, 13]. One of the studies in California,
found a positive impact of population growth on air
pollution through some sources of emissions [14, 15].

Pollution rises with the rises in income too, due to
increase in consumption and production activities. Air
pollution has negative effects on the human health as
reported that urban air pollution may account 2 percent of
all local deaths [11].

Rising population in SAARC region is a serious
threat to the environment and causing of atmospheric
pollution, water pollution, deforestation, loss of
oxygenation, depletion of non-renewable natural
resources and biodiversity which is essential for life on
earth. Among these dangers atmospheric pollution or air
pollution is one of the factors of environmental
degradation causes from industrialization, outdated
vehicles and use of available fuels (e.g. coal or unleded
gasoline).
the emissions by 1.28 percent. Several other studies discussed and examined environmental Kuznets curve (EKC) that CO₂ emissions and income has inverted-U Curve. In few of studies additional variable of population density was taken as explanatory variable such as in the study of [20, 21]. On contrary, [22] found nonexistence of EKC. However the study of [23] did not find the existence of EKC, when it was conducted globally but studies based on local emissions witnessed the existence of EKC.

In one study based on panel data of five South Asian countries found unidirectional causality between per capita GDP and energy consumption [24]. The results of this study indicated that one percent increase in per capita energy consumption tend to decrease in 0.13 percent decrease in per capita GDP.

**Industrialization:** Industrialization is vital to the creation and engineering & technology is central to mitigation of the pollution problems. The impact of population growth on air pollution through industrialization is obvious. Every individual in any society makes demand of some essential goods such as food, shelter, clothing water and so forth. Most of these goods in either shape are provided by industries. Therefore increase in population also increases the demand of such basic necessities and may benefit to industrial sector for achieving increasing returns to scales. An increase in population is beneficial to the growth of industrial sector indirectly. Elasticity of demand of agriculture goods with respect to population determines the demand of industrial goods such as machineries and technology. Industrialization contributes in raising welfare if degree of welfare is measured by GDP criterion. On the other hand industrialization also generates ecological disequilibrium, which in turns decreases the quality of life also.

In the view of Malthus, increasing population puts pressure on agriculture land and forcing the cultivation of inferior quality land of poorer. This environmental degradation reduces the marginal productivity of labour which in turns reduces the income of poorer and ultimately decreases the growth rate of population. According to other school of thoughts such as Neo Classical presented their perspective a far apart from Malthusian and close to the dependency theorists regarding linkages among population, industrialization and environment [25].

Neo Classical Economists believe in free competitive market economy, where increasing population becomes the cause of market expansion, economic activity and so wealth. Their concern is about to maintain the living standard under the threat of increasing population. They are of the view that market economy is able to maintain the living standard under the condition of increasing population [26]. According to dependency theorists that people adopt new technology to protect the natural environment. This is only possible when they have industrialization and access to new technology. Different economists confirmed the rapid industrial growth as one of the stages of economic development that took place due to increase in population and this also degraded environment quality in densely-populated urban areas.

In the recent times more importance is given to environmental quality, which is measured by amount of stock of forest, absence of air, noise and water pollution. Therefore, according to this view environment is not the determinant of reducing productivity of labour as population expands. [27, 28] revealed that population growth and the development of commerce and trade led to the Industrial Revolution in Europe.

**Data and Variables:** This study uses the panel data of four SAARC countries i.e. Pakistan, India, Bangladesh and Nepal, (N=1….4) based on their population size. The variables of this study are Population Density (people per square km of land area), CO₂ emission (Kg per 2000 US $ of GDP), Industrialisation, (value added % of GDP). For this study data is taken from World Development Indicators (2008).

**Theoretical Framework:** A study attempted by [29] to capture the effect of population and affluence on CO₂ emission has been helpful one. This study made the transformation of IPAT model into a stochastic statistical model and used industry as a proxy of technology. Before this [30] proposed the idea of IPAT model to find the determinants of environment. [31] used IHA model with modification that households (H) was compared with total population levels, as the demographic unit to capture its effect on environment.

But this study follows co-integration approach to find long run relationship among population, industrialization and CO₂ emission (Air Pollution). Therefore, model is based on neoclassical production function given below;

\[
\ln CO_2 = f(\ln (\text{pop, Ind}))
\]  \hspace{1cm} (1)

Further, it is expressed in logarithm form as an additive equation instead of multiplicative and residual term makes it stochastic. Therefore equation (1) for panel version can be written as:

\[
\ln CO_{2it} = \ln_{it} + \beta_i \ln (\text{pop}_{it}) + \gamma_i \ln (\text{Ind}_{it}) + \epsilon_{it}
\]  \hspace{1cm} (2)

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Econometric Methodology: This study follows Fisher Johansen and Pedroni panel co-integration approach for empirical investigation to find long-run relationships between population, industrialization and CO₂ emission. For panel co-integration, this study in the first step attempts to find panel unit root test developed by [32-35] to check stationarity. MW-ADF (p-values test statistic) for unit root is non-parametric test and also has a chi-square distribution. After checking unit root and stationarity of variables, the question arises to check the co-integration of variables. If panel series are stationary at the same level of integration then panel co-integration can be applied. The test for [36] can be shown as

\[ Y_t = \alpha + \beta X_t + \gamma t + \epsilon_t \]

where \( t = 1, \ldots, T \) (number of observation in \( T \) Time) \( i = 1, \ldots, N \) (number of countries) and \( J = 1, \ldots, J \), (number of variables). The equation (3) is the general form of Pedroni Panel co-integration. This test allows the heterogeneity in errors and variation in co-integration vector across the cross section units. The [37] is a extended version of Engle-Granger approach. This test has two different sets of statistic, one of them is within dimension and other is based on between dimension approaches (group mean panel co-integration statistics). Further, within dimension has four test statistics i.e. panel \( -v \) statistic, panel pp type rho- statistic and panel pp type t-statistic; while between dimensions has three statistics i.e. panel group rho-statistic, pp type t-statistic and group ADF type t-statistic. This study also uses combined and individual [38] for trace statistic and P-values of maximum eigen values are aggregated for Fisher panel test.

FMOLS Panel Estimates: Once co-integration is established in the model, then rationale of Fully Modified Least Square (FMOLS) panel estimates is valid [39]. FMOLS regression, for the very first time was originated and used by [40]. The application vector auto regression (VAR) does not remove endogeneities in regressors of non stationary series. FMOLS least squares look into the endogeneity in regressors arises from existence of cointegration. FMOLS is a non-parametric approach, which takes into account the corrections of serial correlation between regressors at first difference and error term [41].

Empirical Results: Table 2 shows the results of unit root test for the panel data. All the variables at level series with or without trend show the presence of unit root in IPS, LLC and ADF Fisher tests.

While in table 3 all the variables depict rejection of null hypotheses of unit root problem. The results of all variables at their first difference show their stationarity or integrated of order one, \( I(1) \). Therefore we can check the co-integration in the model through [37, 38] maximum likelihood method and [42] maximum likelihood –panel test.

Fisher Johansen test to co-integration reported in Table 4 supports presence of co-integration by rejecting null hypotheses of no co-integration at 5% and 10% significance level. Results in table also show at least one co-integrating vector is present. Therefore long-run relationship also exists.

Results in table 5 showed the rejection of null hypotheses of no co-integration in panel pp type rho-statistic at 5% significant level without trend and 10% significant level with trend in within dimension.

### Table 2: IPS LLC and ADF Fisher Unit Root Tests Results

<table>
<thead>
<tr>
<th>Test</th>
<th>Variables</th>
<th>Intercept</th>
<th>P-values</th>
<th>Trend &amp; Intercept</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPS LnCO₂</td>
<td>-0.72386</td>
<td>0.2346</td>
<td>0.55199</td>
<td>0.7095</td>
<td></td>
</tr>
<tr>
<td>Lnln</td>
<td>1.43170</td>
<td>0.9239</td>
<td>1.73002</td>
<td>0.9582</td>
<td></td>
</tr>
<tr>
<td>Lnpop</td>
<td>-0.70601</td>
<td>0.2401</td>
<td>5.88627</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>LLC LnCO₂</td>
<td>-4.05244</td>
<td>0.0000</td>
<td>-0.03019</td>
<td>0.4880</td>
<td></td>
</tr>
<tr>
<td>Lnln</td>
<td>0.76104</td>
<td>0.7767</td>
<td>1.90293</td>
<td>0.9715</td>
<td></td>
</tr>
<tr>
<td>Lnpop</td>
<td>-3.34178</td>
<td>0.4514</td>
<td>0.81526</td>
<td>0.79250</td>
<td></td>
</tr>
<tr>
<td>ADF-Fisher LnCO₂</td>
<td>11.9949</td>
<td>0.1514</td>
<td>6.01127</td>
<td>0.0640</td>
<td></td>
</tr>
<tr>
<td>Lnln</td>
<td>3.38058</td>
<td>0.9083</td>
<td>2.19466</td>
<td>0.9745</td>
<td></td>
</tr>
<tr>
<td>Lnpop</td>
<td>9.46967</td>
<td>0.3042</td>
<td>0.04728</td>
<td>1.0000</td>
<td></td>
</tr>
</tbody>
</table>
Table 3: IPS LLC and ADF Fisher Unit Root Tests Results

<table>
<thead>
<tr>
<th>Test</th>
<th>Variables</th>
<th>Intercept</th>
<th>P-values</th>
<th>Trend &amp; Intercept</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPS</td>
<td>LnCO₂</td>
<td>-5.48794</td>
<td>0.0000</td>
<td>-5.69539</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>LnIn</td>
<td>-3.83787</td>
<td>0.0001</td>
<td>-3.90076</td>
<td>0.0010</td>
</tr>
<tr>
<td></td>
<td>Lnpop</td>
<td>3.14856</td>
<td>0.0350</td>
<td>-2.01397</td>
<td>0.0220</td>
</tr>
<tr>
<td>LLC</td>
<td>LnCO₂</td>
<td>-5.23008</td>
<td>0.0000</td>
<td>-5.21778</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>LnIn</td>
<td>-3.05833</td>
<td>0.0011</td>
<td>-2.43363</td>
<td>0.0075</td>
</tr>
<tr>
<td></td>
<td>Lnpop</td>
<td>-1.81172</td>
<td>0.0350</td>
<td>-5.71717</td>
<td>0.0000</td>
</tr>
<tr>
<td>ADF-Fisher</td>
<td>LnCO₂</td>
<td>43.5723</td>
<td>0.0000</td>
<td>42.0559</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>LnIn</td>
<td>29.3968</td>
<td>0.0003</td>
<td>23.0529</td>
<td>0.0033</td>
</tr>
<tr>
<td></td>
<td>Lnpop</td>
<td>27.0102</td>
<td>0.0951</td>
<td>28.2560</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

Table 4: Fisher-Johansen Cointegration results

<table>
<thead>
<tr>
<th>Country</th>
<th>Null Hypotheses</th>
<th>Alternative Hypotheses</th>
<th>Trace Statistic</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>Ho: r=0</td>
<td>H1: r&gt;0</td>
<td>43.9911*</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td>Ho: r=1</td>
<td>H1: r&gt;1</td>
<td>14.2220*</td>
<td>0.0770</td>
</tr>
<tr>
<td></td>
<td>Ho: r=2</td>
<td>H1: r&gt;2</td>
<td>5.4126*</td>
<td>0.0200</td>
</tr>
<tr>
<td>India</td>
<td>Ho: r=0</td>
<td>H1: r&gt;0</td>
<td>25.2680*</td>
<td>0.0152</td>
</tr>
<tr>
<td></td>
<td>Ho: r=1</td>
<td>H1: r&gt;1</td>
<td>13.3069</td>
<td>0.1040</td>
</tr>
<tr>
<td></td>
<td>Ho: r=2</td>
<td>H1: r&gt;2</td>
<td>5.3192*</td>
<td>0.0211</td>
</tr>
<tr>
<td>Nepal</td>
<td>Ho: r=0</td>
<td>H1: r&gt;0</td>
<td>38.9812*</td>
<td>0.0033</td>
</tr>
<tr>
<td></td>
<td>Ho: r=1</td>
<td>H1: r&gt;1</td>
<td>19.3816*</td>
<td>0.0123</td>
</tr>
<tr>
<td></td>
<td>Ho: r=2</td>
<td>H1: r&gt;2</td>
<td>5.4501*</td>
<td>0.0196</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Ho: r=0</td>
<td>H1: r&gt;0</td>
<td>41.3994*</td>
<td>0.0015</td>
</tr>
<tr>
<td></td>
<td>Ho: r=1</td>
<td>H1: r&gt;1</td>
<td>16.3726*</td>
<td>0.0368</td>
</tr>
<tr>
<td></td>
<td>Ho: r=2</td>
<td>H1: r&gt;2</td>
<td>2.6816</td>
<td>0.1015</td>
</tr>
</tbody>
</table>

Table 5: Padroni panel Cointegration Results

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Without Trend</th>
<th>With Intercept and Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel v-statistics</td>
<td>-1.050880 (0.8533)</td>
<td>-0.329406 (0.6291)</td>
</tr>
<tr>
<td>Panel pp type roh- statistics</td>
<td>-2.928672 (0.0017)</td>
<td>-1.770082 (0.0384)</td>
</tr>
<tr>
<td>Panel pp type t-statistics</td>
<td>4.183788 (0.0000)</td>
<td>-3.126424 (0.0009)</td>
</tr>
<tr>
<td>Panel ADF type t-statistics</td>
<td>-2.955176 (0.0016)</td>
<td>-1.965985 (0.0247)</td>
</tr>
</tbody>
</table>

Note:* denotes rejection of null hypothesis at 5% and 10% significance level.
### Table 6: Long run elasticity coefficients from panel FMOLS

<table>
<thead>
<tr>
<th>Countries</th>
<th>Intercept (LCO2)</th>
<th>Lpop (LCO2)</th>
<th>Lind (LCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNG</td>
<td>-3.6915 (0.000) ***</td>
<td>1.4294 (0.000) ***</td>
<td>0.3278 (0.0183) *</td>
</tr>
<tr>
<td>IND</td>
<td>-1.9225 (0.000) ***</td>
<td>0.9980 (0.0000) ***</td>
<td>0.1394 (0.0485) **</td>
</tr>
<tr>
<td>NEP</td>
<td>-5.6041 (0.000) ***</td>
<td>1.6762 (0.000) ***</td>
<td>1.0594 (0.000) ***</td>
</tr>
<tr>
<td>PAK</td>
<td>-1.0920 (0.000) ***</td>
<td>0.44995 (0.000) ***</td>
<td>0.22208 (0.020) **</td>
</tr>
<tr>
<td>Panel Group</td>
<td>-6.2174 (0.000) ***</td>
<td>0.083184 (0.0245) **</td>
<td>4.4353 (0.000) ***</td>
</tr>
</tbody>
</table>

Note: The number of lag is 1.

* *, ** and *** show level of significant at 10%, 5% and 1% respectively.

This means long run relationship exist in panel pp type roh-statistic, while in between dimension Group type roh statistic did not find long run relationship. On the other hand in between dimension, Group panel pp type t-statistic and Group panel ADF type t-statistic showed the rejection of null hypotheses of no co-integration at 1% and 5% significant level against alternative hypotheses which found long run relationship. Panel pp type t-statistic and panel ADF type t-statistic also rejected null hypotheses of no co-integration at 1%, 5% and 10% significant level showed in with and without trend. This means long run relationship exist through both statistic. GMP statistic of between dimensions also showed no co-integration in Group pp type roh-statistic and did not reject the null hypotheses of no co-integration at at 1% 5% and 10% significant level. However three statistics within dimensions and two statistics between dimensions showed the existence of long run relationships. Therefore, this approach found co-integration and long run relationship among the concerned variables.

Results reported in table 6 shows the long-run elasticity coefficients from FMOLS of four cross sections and panel group. In Bangladesh 1% increase in population causes the environmental degradation (CO₂ emission) about 1.4%. The population and industrialization all together effect natural environment or air pollution (CO₂ emission). Industrialization coefficient is 0.32 in Bangladesh show 1% increase in industrialization cause air pollution to increase by 0.32%. In India 1% increase in population causes the air pollution through other factors by 0.99%, while industrialization increases air pollution by 0.13%. Nepal has rather severe situation as 1% increase in population and industrialization increase air pollution by 1.6% and 1.05% respectively. The situation in Pakistan is not much different as compared to other countries. In Pakistan 1% increase in population and industrialization increase air pollution (CO₂ emission) by 0.44% and 0.22% respectively. Panel group shows the situation of this region partially as selected countries of SAARC were taken in study. However, in this region altogether population and industrialization cause air pollution significantly. Industrialization coefficient is 0.4 shows 1% increase in industrialization in these countries altogether increase air pollution (CO₂ emission) by 0.4%.

### CONCLUSION

As this study followed panel co-integration approach to check the long run relationship between air pollution and population & industrial growth. Four major SAARC countries were selected on the basis of their population size in the region. For panel co-integration study used Fisher Johansen and Pedroni co-integration approaches. Results found in both studies depicted strong long run relationships and existence of co-integration. To estimate the elasticity coefficients, study applied Fully Modified Phillips Hansen approach. Results obtained through this approach showed that in Bangladesh population and industrialization were the cause of air pollution (CO₂ emission) at 1%, 5% and 10% significant level. The case of India was not much different where population caused air pollution (CO₂ emission) at 1%, 5% and 10% significant level while industrialization caused the air pollution at 5% and 10% significant level respectively. Environment in Nepal is immensely affected by rising population and industrialization in the region as its coefficient considerably affected at 1%, 5% and 10% significant level. Pakistan also could not desist herself from environmental degradation problem that was aggravated due to growing population and industrialization in the region. The long run coefficients obtained through FMOLS showed that in Pakistan, population and industrialization significantly caused air pollution (CO₂ emission) at 10%, 5% and almost at 1% significant level too.
Overall in the region it was found industrialization and population were major causes of CO2 and environmental degradation.

To combat this environmental problem of CO2 emission, individual countries are required to undertake some measures to reduce CO2 emission. In this respect, there could be different causes of this CO2 emission in different countries such as increase in energy production; household’s activities, industrial growth, transportation, agriculture and food system, forestry etc. Behind all these problems the major cause is huge size of population and their increasing demands for the consumption of variety of goods These SAARC countries should make and implement on command and control policies like other developed nations. New technology and emission standards should be made and revised for example corporate average-fuel economy (CAFE) standards in United States. Further incentive based policies may be advocated such as carbon taxes to give incentive to reduced fuel consumption. Moreover there should be shift in such forms of energy that may reduce carbon. To the industrial end such means and technology should be followed that increase energy efficiency of production processes.

REFERENCES