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Influence of Environmental Degradation and Economic Growth on CO_2 Emissions: Evidence from Developing Countries

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Abstract

China is working to revive the ancient on the Silk road trade routes from Asia to Europe and promote the corporation of energy production with trade under its transactional megaproject the Belt and Road (BRI) initiative. We investigate the relationship between energy consumption and economic growth of regions in this paper along with BRI using panel data for 55 countries during the period of 1970-2015. By assessing Vector Error Correction Model (VECM), fully changed Ordinary Least Squares (FMOLS) and dynamic Ordinary Least Squares regression (DOLS) with first generation test. The statistical finding there is evidence from long-run bidirectional causalities among CO_2 emissions, energy use per capita, GDP per capita, manufacturing industries and fossil fuel energy consumption. Hence, there is unidirectional short-run causality running from GDP to renewable energy in South Asia BRI listed countries and bidirectional causality between consumption of energy and GDP per capita in the long run East Asia (Australia, Brunei, Indonesia, Malaysia, Myanmar, Vietnam), Europe & Central Asia (Azerbaijan, Kazakhstan. Russian, Turkmenistan, Uzbekistan) and Middle East & North Africa (Bahrain. Egypt, Iran, Iraq, Kuwait, Oman, Qatar, UAE, Yemen). The results confirm the renewable energy and fossil energy consumption and manufacturing industries. These outcomes suggest significant provision in the economies and trade of China with different countries in the Belt and Road regions.

Keywords: CO_2 emission, Economic growth, Regional classification, Belt road initiative (BRI).
JEL Classification: F43, F64, O11, Q32.

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Ethical: This study follows all ethical practices during writing.

Contents

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Contribution of this paper to the literature

This study is unique based on economic growth, likewise the prior research is not investigated the dynamic link between developing countries Energy-consumption and economic growth. Investigating economic growth and CO2 emissions by manufacturing industries. Moreover, the innovation of this study is indicated that there is evidence from long–run bidirectional causalities among CO2 emission, Energy-use per capita, Per-capita of GDP, Industrialization and remnant fuel Energy-consumption.

1. Introduction

China's Belt and Road Initiative (BRI), start emergent strategies and provides coincidental to build trade between South Asian countries and Europe, aims to build trade and infrastructure by one silk road and coordinate with African countries, the trade road has it a roadblock in seven countries and later join other countries. In Pakistan, the China is developing Baluchistan province, and an estimated $63 billion will invest in China-Pakistan Economic Corridor (CPEC), developing airports, highway and Beijing aims to link landlocked with a western region to Gwadar. This game changer does not influence; it will change the level of consumption and need for goods. Although environment effects on BRI listed countries and developing strategies will boost economy but influence on environment by pollution. The wide variety of Chinese products capture a major part of the Pakistani local market and resulted in closing down many industries while others are struggling to survive. Hence the fuel emission indicated by the fuel import, percentage of merchandise export employs that highest fuel rate was 17.40% in 2013 (Bank, 2013) in China and 35.14% in Pakistan same year. Figure 1. The problem of energy security and climate have drawn increasing attention in worldwide and International Energy Agency (IEA) have declared through global energy demand. The growth is projected to slow until 2040, and total energy need will increase 30% by China and India. The transport sector, as a main energy consumer sector and sources of greenhouse (GHG) emission, its concern for sustainable development, in 2015 there was 24% CO2 emission occurred by fuel consumption (Liu., Zhao, Liu, & Hao, 2018); (Mirza & Kanwal, 2017). The 79% developed countries are responsible for enormous CO2 emission and two fifth pollution (60% CO2) emission responsible countries are China and USA. These top polluters countries are accountable for a huge global warming, and 11 billion tons CO2 it records emission in the China with 1.36 billion population in the period of 2013. The USA is one of the top developed.

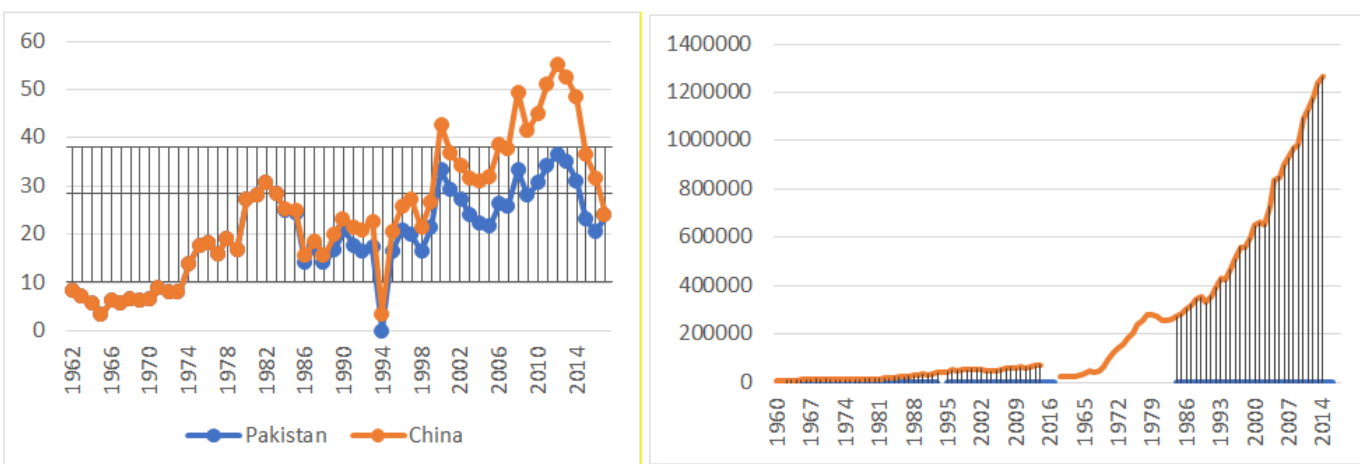

Figure-1. Fuel consumption.

Source: TM.VAL.FUEL.ZS. UN.

Country and CO2 emission from only gaseous fuel consumption is only 1.43 million kt, that account for 21.72% of all over the world CO2 emission in 2014 and China, Russia, Iran and Japan were 48.97% with 6.6 millions of fuel gaseous.

The export and infrastructure of China is promoting economic trade and great important to climate change and energy consumption (Zhang, Liao, & Hao, 2018). I vow the president of China to keep resolving climate projects. The global warming has already showed a massive change in climate cause of huge production, infrastructure, cement and steel extensive fossil energy consumption and turn to engender of CO2 emission (Zhao, Zhang, & Shao, 2016). As a result, the environment quality will improve and we accept alternative development as a real solution for lower carbon emissions. Some developing countries have enormous renewable resources and there is a large gap in the development level of energy between developing to developed countries (Schwerhoff & Sy, 2017). Noteworthy that, China-Pakistan Economic Corridor (CPEC) could serve as affective and slushy platform of economic development not only Pakistan and China, other relevant countries their economy in a different level. The more significant aim is to share CO2 emissions and reduce it by different projects. This study is unique because of economic growth, likewise the prior research papers have investigated the dynamic link between developing countries' energy consumption and economic growth (Ito, 2017; Kong & Khan, 2019; Liu. et al., 2018; Tian, Bai, Jia, Liu, & Shi, 2019).

The prior investigations have not showed the regional effects by states likes, 12 East Asia (EA), 4 South Asia (SA), 26 South Asia countries (SEC) and 13 Middle East and North Africa (MENA). The logical structure of this paper highlights the relationship between energy and economic growth of regions and causes of CO2 emissions by development change. This study promotes the use of renewable vitalities that constantly replenished not directly diminish. Environmental degradation and economic growth cause air contamination in the regions and produce a huge flow of CO2 emissions for developing countries. When countries burn fossil fuels like petroleum gas, coal, carbon dioxide and other gases released into environments so these emission trap heat to the earth and the sea

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levels have led to a higher cause of the earth's rising temperature, extreme storms that stem from a changing climate. The literature, dataset estimation, results and conclusion and recommendations in sections 2, 3, 4 and 5.

2. Literature Review

In 1970, the oil and energy crisis has examined and energy consumption count as a paired factor of labor, capital production in the economic growth (Korppoo & Kokorin, 2017; Ozcan, 2013; Solow., 1974). The empirical analysis emphasis by Granger causality test between energy and economic growth and classifies the econometric method based on variable selection and data sets. The early mainstream study has been classified and determined the facts of energy and industrial development regarding GDP and per capita of GDP (Soytas, Sari, & Ewing, 2007).

Table-1. literature review of Economic growth and CO2 emission.

Study	Datasets	Econometric techniques	Period	Outcomes
Liu and Hao (2018)	69 countries	vector error correction model (VECM), fully modified OLS (FMOLS) and dynamic OLS (DOLS) approaches,	1970 and 2013.	the nexuses of the energy consumption and economic developments vary across different subgroups. For the entire group, there is evidence of long–run bidirectional causalities among carbon emissions, energy use, industry value added and GDP per capita
Cheng et al. (2017)	G6 countries	error-correction-based Granger causality	1990–2012.	that economic growth can indeed cause increases in energy consumption
Hao, Wang, Zhu, and Ye (2018)	OECD countries	The vector errors correction model (VECM)	1995-2010	causal relationship from rural GDP to rural investment and bilateral causal relationship between rural GDP and rural energy consumption in the short run.
Zhang et al. (2018)	30 individual Chinese provinces	ARDL	1970	Empirical evidence suggests the existence of energy consumption per capita in some provinces.
Kahia, Ben Aïssa, and Charfeddine (2016)	data of 429 observations for 13 MENA NOECs.	panel error-correction model	1980 to 2012	long run causality for the two samples.
Mirza and Kanwal (2017)	Pakistan	ARDL approach	2014	Dynamic causality between energy consumption, economic growth and CO2 emission.
Kohler (2013)	South African	ARDL approach, Engel Granger method.	1960-2009	Per capita has significant long positively effect in level of CO2. Find bidirectional causality between in income per capita and foreign trade.
Pao and Fu (2013)	The annual data for Brazil's real GDP, capital, labour and different types of energy consumptions	the vector error correction models reveal a unidirectional causality	1980–2010	that Brazil is an energy-independent economy and that economic growth is crucial in providing the necessary resources for sustainable development.

Countries have the different economic characteristic that may have the different direction of causality with different policies, here the study explore the relationship between emission and the growth in individual countries Table 1 and how the fuel import (% merchandise import) effects this project in different angles. The infrastructure of Pakistan divers on modern strengthen and transportation networks, with many and determined projects. CPEC project becomes operational when Chinese cargo transported overland of Gwader Port for onward Africa and West Asia by maritime shipment.

3. Data and Methodology

3.1. Sample and Variables

The data period covers 1970-2015 for a panel comprising the 55 countries. The One belt One road showed seven components of economic growth (6 economics and 1 merchant silk road), the economic corridor was consisting with 6 countries with the name of CPEC in 2013. Table 2 is an explanatory variable definition with a source of data used for analysis. We use henceforth part of preceding studies in the pragmatic analysis Figure 2. we conduct The sources of the database from the Base (2015) and Databases (2015) data. In the terms of total primary energy supply (TPES), RE represent Renewable Energy (RE) including the primary energy equivalent of hydro (excluding pumped storage), solar, geo-thermic, tide and wave sources.

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While CMIC and FFE influence the infrastructure of this mega project, high manufacturing and export development creating negative aspects on environments by CO2. per capita increase the wealth also increases CO2 emissions in different development sectors. It shows Table 3 the mean of indicators with a standard deviation.

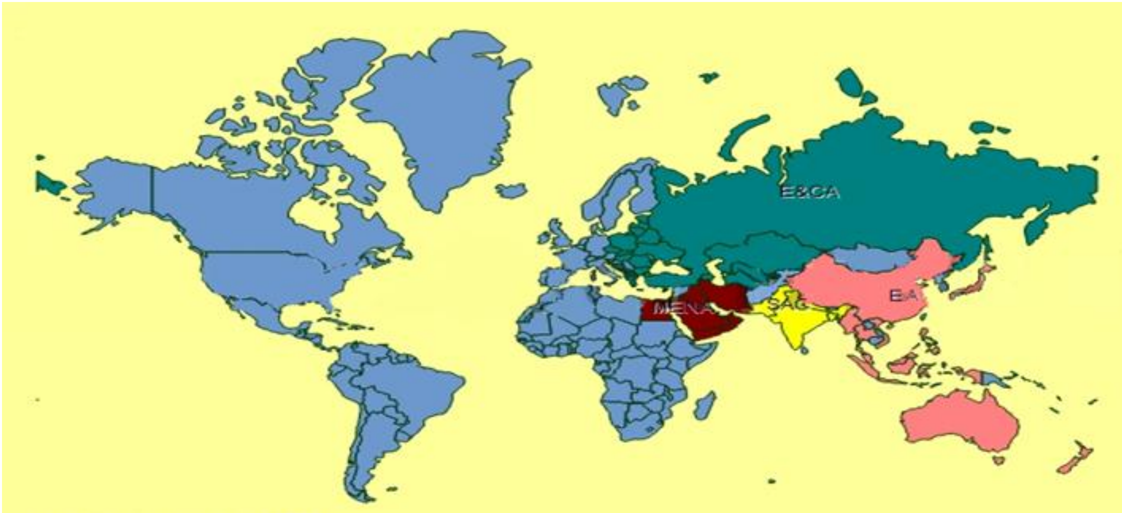

Figure-2. Region distribution of countries.
Sources: East Asia (EA), South Asia countries (SEC), Europe & Central Asia (E&CA), Middle East & North Africa (MENA).

East Asia (EA), South Asia countries (SEC), Europe & Central Asia (E&CA), Middle East & North Africa (MENA)

In this empirical method, in what we follow, we test all explanatory variables in panel data, in case of non-stationary, we investigate the long run prevailing cointegration relationship and investigate their magnitude by long-run stationary. The panel cointegration test with panel unit root test applied on all variables, which allow the serial correlation among a cross section i.e. the so-called 2nd generation test. Therefore, it is essential to estimate the stationary of each explanatory variable by a unit root test. The reliability of variables ensure by four unit root test (Levin, Lin, & Chu, 2002) which include IPS Augmented test used by cross-sectional (Im, 2003; Levin et al., 2002; Pesaran, 2007) used for panel unit root test and so far panel co-integration estimated error-correction by Westerlund (2007).

Table-2. Variables description for the analysis.

Variables	Definition	Unit measurement	Time frame availability	Data sources
RE	Renewable energy	1000 toe (tonne of oil equivalent)	1960-2017	OECD
C	CO2 emission	Metric tons per capita	1960-2014	World Bank (EN.ATM.CO2E. PC)
EP	Energy use per capita	Kilograms of oil equivalent per capita	1960-2015	World Bank (EG.USE.PCAP.KG.OE)
IVA	Industry value added	% of GDP	1994-2016	World Bank (NV.IND.TOTL. ZS)
GDPC	GDP Per capita growth	Constant 2010 US$	1960-2017	World Bank (NY.GDP.PCAP. KD)
CMIC	Co emissions from manufacturing industries and construction	% of total fuel combustion	1960-2014	World Bank (EN.CO2.MANF. ZS)
FFE	Fossil fuel energy consumption	% of total	1960-2015	World Bank (EG.USE.COMM.FO.ZS)

Table 4 shows unit root test on a level. In the level case, we cannot reject the null hypothesis, except for the GDP per capita growth, CO2 emission, arm import trend, commercial service export, and inflation GDP deflator. Table 5 shows Padroni Residual Co-Integration test with Newey-West automatic bandwidth.

3.2. Econometric Methods

Whether or not the panel data processes are stationary specifies in the regression's selection model, if the panel data process is non-stationary, the conformist OLS estimation method would lead and solve a spurious problem in regression. show the dependent variable where x regressed on Y to get ϵ_{it}. Equation. [1] is shows the dependent variable where x regressed on Y to get ϵ_{it} and effect showed by null hypothesis τ_i and deterministic trend is Y_{it}.

$$x_{it} = \tau_i x_{it-1} + Y_{it}\delta_i + \epsilon_{it} \qquad (1)$$

$$\Delta x_{it} = \rho x_{it-1} + \sum_{k=1}^{q} \alpha_{ij} \Delta x_{it-k} + Y_{it}\delta + \epsilon_{it} \qquad (2)$$

The Equation. [2] shows x_{it} *and* x_{it-k} a dependent variable in 1st order lag, also x_{it} i s a vector that contains all explanatory variable. ρ Is the autoregressive coefficient and variable ρ is equal to $\tau - 1$. Meanwhile, the null hypothesis H_O, ρ is equal to zero, and there is a parameter of a unit root. When an is ρ negative, so it shows that we reject the null hypothesis, implying a stationary in panel data? The panel data requires stationary or cointegration in regression. The residual of spurious regression of non-stationary examine by co-integration test in

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explanatory variables. Equation. [3] show the dependent variable where x regressed on Y to get $\in_{it}$. The individual effect showed by null hypothesis ρ_i and deterministic trend is δ_i. The null hypothesis H_O, is not co-integration, the residual value will be l(1) process, if the variables are cointegrated, the residual value of the alternative hypothesis is l(0) process.

$$x_{it} = \rho_i + \delta_i t + \alpha_i Y_{it-k} + \in_{it} \quad (3)$$

Renewable energy, we followed the approach of Cai, Che, Zhu, Zhao, and Xie (2018); Hussain, Arif, and Aslam (2017); Liu and Hao (2018); Waite (2017); Younas et al. (2016); (Yu & Lu, 2018) The long-run relationship between renewable energy, CO2 emission, Energy use per capita, Industry value added, GDP Per capita growth, Co emissions from manufacturing industries and construction and Fossil we give fuel energy consumption:

$$RE_{it} = \omega_{it} + \delta_{1i}C_{it} + \delta_{2i}EP_{it} + \delta_{3i}IVA_{it} + \delta_{4i}GDPC_{it} + \delta_{5i}CMIC_{it} + \delta_{6i}MI_{it} + \delta_{7i}FFE_{it} + +\text{U}_{it}(4)$$

Where RE shows the renewable energy and i=1,….,55 and t=1970,….,2015 reveal the country and time, respectively whereas renewable energy, which we take from the source of energy per capita, industry value added, GDP growth level, manufacturing industries, and fossil fuel consumption. ω_{it} Shows the fixed effects of country and $\delta_{1i} - \delta_{8i}$ are the long-run parameter of elasticities, related with each explanatory variable of this panel data. Kao (1999) and Pedroni (2001) tests based on two-step method implemented for data analysis in this paper. This theoretical test based on the vector error correction model, the Kao test approach showed with the Padroni test, includes cross section intercepts and homogenous coefficient of variables. The Johansen Fisher panel (Wu, Zhu, & Zhu, 2018). The long-run dynamic estimation exist among the variable after the cointegration test. The relationship leads to long-run correlation in cointegration and variables endogeneity problems, which may cause OLS estimation in asymptotic bias. This paper adopts the dynamic ordinary least square (DOLS) and panel fully changed ordinary least squares (FMOLS), which are unbiased asymptotic estimators developed by Pedroni (2001) The long-run correlation problems and endogeneity solve by FMOLS estimator a non-parametric term of correlation. The associated t-statistics constructed with panel FMOLS in Equation 4 where α_{FM} indicate the conventional (FMOLS) estimator is indicating α_{FM} in Equation (5a and 5b):

$$\alpha_{FMO} = N^{-1}\sum_{i=1}^{N}\alpha_{\text{FM}} \qquad (5a)$$

$$t_{\alpha_{MO}} = N^{-1/2}\sum_{i=1}^{N}t_{\alpha_{MO}} \qquad (5b)$$

The DOLS panel method augments the lead and lagged difference of the repressors in the cointegration equation, which helps to eliminate serial correlation and the asymptotic endogeneity from the individual model. Equation 6 shows panel DOLS regression to get the DOLS estimator. The long-run dynamic involves lead (Ki) and lags (Ki). Equation 7 shows DOLS regression with long run and Equation 8 shows the dynamic link of co-integration. If the long-run cointegration relationship exists among the variables, we can establish the vector error correction model to investigate by the two-step procedure of Engle and Granger (1987) causalities.

$$CO_{2it} = \beta_i + \alpha_{1i}R_{it} + \alpha_{2i}lnE_{it} + \alpha_{3i}l_{it} + \alpha_{4i}lnY_{it} + \alpha_{5i}(lnY)^2_{it} + \sum_{k=-K_i}^{K_i}\mu_{1ik}\,\Delta R_{it-k} + \sum_{k=-K_i}^{K_i}\mu_{2ik}\,\Delta lnE_{it-k} + \sum_{k=-K_i}^{K_i}\mu_{3ik}\,\Delta l_{it-k} + \sum_{k=-K_i}^{K_i}\mu_{2ik}\,\Delta lnY_{it-k} + \sum_{k=-K_i}^{K_i}\mu_{2ik}\,\Delta(lnY)^2_{it-k} + \text{U}_{it} \qquad (6)$$

$$\alpha_{GD} = N^{-1}\sum_{i=1}^{N}\alpha_{\text{D}} \qquad (7)$$

$$t_{\alpha_{GD}} = N^{-1/2}\sum_{i=1}^{N}t_{\alpha_D} \dots\dots [8]$$

As a bounded VAR with cointegration relationship, the VEC model handling the endogenous variable to the long-run equilibrium while allowing the short-run variable. The dynamic panel VEC model by the following Equation [9] to [16] where the first difference operator showed with Δ, the intercept of individual effects denoted with ω, the optimal lag length denoted with q by Schwarz information criterion (SC), the error correction term derived from the long-run correlation and Ʊ specify serial uncorrelated error term. In the panel vector error correction model (VCM), short-and long-run causality among the variable treated by Granger causalities. The direction of causality shows the significance of the coefficient in the equation. The direction of causality in the equation shows the significance of the coefficient.

It represents the dynamic error correction model below:

$$\Delta RE_{it} = \omega_{1j} + \sum_{k=1}^{q}\delta_{13\text{ik}}\,\Delta C_{it-k} + \sum_{k=1}^{q}\delta_{14\text{ik}}\,\Delta EP_{it-k} + \sum_{k=1}^{q}\delta_{15\text{ik}}\,\Delta IVA_{it-k} + \sum_{k=1}^{q}\delta_{16\text{ik}}\,\Delta GDPC_{it-k} + \sum_{k=1}^{q}\delta_{17\text{ik}}\,\Delta CMIC + \sum_{k=1}^{q}\delta_{18\text{ik}}\,\Delta MI_{it-k} + \sum_{k=1}^{q}\delta_{19\text{ik}}\,\Delta FFE_{it-k} + \vartheta_{1i}\epsilon_{t-1} + \text{U}_{1i} \qquad (9)$$

$$\Delta C_{it} = \omega_{2j} + \sum_{k=1}^{q}\delta_{23\text{ik}}\,\Delta C_{it-k} + \sum_{k=1}^{q}\delta_{24\text{ik}}\,\Delta EP_{it-k} + \sum_{k=1}^{q}\delta_{25\text{ik}}\,\Delta IVA_{it-k} + \sum_{k=1}^{q}\delta_{26\text{ik}}\,\Delta GDPC_{it-k} + \sum_{k=1}^{q}\delta_{27\text{ik}}\,\Delta CMIC + \sum_{k=1}^{q}\delta_{28\text{ik}}\,\Delta MI_{it-k} + \sum_{k=1}^{q}\delta_{29\text{ik}}\,\Delta FFE_{it-k} + \vartheta_{2i}\epsilon_{t-1} + \text{U}_{2i} \qquad (10)$$

$$\Delta EP_{it} = \omega_{3j} + \sum_{k=1}^{q}\delta_{33\text{ik}}\,\Delta C_{it-k} + \sum_{k=1}^{q}\delta_{34\text{ik}}\,\Delta EP_{it-k} + \sum_{k=1}^{q}\delta_{35\text{ik}}\,\Delta IVA_{it-k} + \sum_{k=1}^{q}\delta_{36\text{ik}}\,\Delta GDPC_{it-k} + \sum_{k=1}^{q}\delta_{37\text{ik}}\,\Delta CMIC + \sum_{k=1}^{q}\delta_{38\text{ik}}\,\Delta MI_{it-k} + \sum_{k=1}^{q}\delta_{39\text{ik}}\,\Delta FFE_{it-k} + \vartheta_{3i}\epsilon_{t-1} + \text{U}_{3i} \qquad (11)$$

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$$\triangle IVA_{it} = \omega_{4j} + \sum_{k=1}^{q} \delta_{43ik}\, \Delta C_{it-k} + \sum_{k=1}^{q} \delta_{44ik}\, \Delta EP_{it-k} + \sum_{k=1}^{q} \delta_{45ik}\, \Delta IVA_{it-k} + \sum_{k=1}^{q} \delta_{46ik}\, \Delta GDPC_{it-k} + \sum_{k=1}^{q} \delta_{47ik}\, \Delta CMIC + \sum_{k=1}^{q} \delta_{48ik}\, \Delta MI_{it-k} + \sum_{k=1}^{q} \delta_{49ik}\, \Delta FFE_{it-k} + \vartheta_{4i}\epsilon_{t-1} + \mho_{4i} \qquad (12)$$

$$\triangle GDPC_{it} = \omega_{5j} + \sum_{k=1}^{q} \delta_{53ik}\, \Delta C_{it-k} + \sum_{k=1}^{q} \delta_{54ik}\, \Delta EP_{it-k} + \sum_{k=1}^{q} \delta_{55ik}\, \Delta IVA_{it-k} + \sum_{k=1}^{q} \delta_{56ik}\, \Delta GDPC_{it-k} + \sum_{k=1}^{q} \delta_{57ik}\, \Delta CMIC + \sum_{k=1}^{q} \delta_{58ik}\, \Delta MI_{it-k} + \sum_{k=1}^{q} \delta_{59ik}\, \Delta FFE_{it-k} + \vartheta_{5i}\epsilon_{t-1} + \mho_{5i} \qquad (13)$$

$$\triangle CMIC_{it} = \omega_{6j} + \sum_{k=1}^{q} \delta_{63ik}\, \Delta C_{it-k} + \sum_{k=1}^{q} \delta_{64ik}\, \Delta EP_{it-k} + \sum_{k=1}^{q} \delta_{65ik}\, \Delta IVA_{it-k} + \sum_{k=1}^{q} \delta_{66ik}\, \Delta GDPC_{it-k} + \sum_{k=1}^{q} \delta_{67ik}\, \Delta CMIC + \sum_{k=1}^{q} \delta_{68ik}\, \Delta MI_{it-k} + \sum_{k=1}^{q} \delta_{69ik}\, \Delta FFE_{it-k} + \vartheta_{6i}\epsilon_{t-1} + \mho_{6i} \qquad (14)$$

$$\triangle MI_{it} = \omega_{7j} + \sum_{k=1}^{q} \delta_{73ik}\, \Delta C_{it-k} + \sum_{k=1}^{q} \delta_{74ik}\, \Delta EP_{it-k} + \sum_{k=1}^{q} \delta_{75ik}\, \Delta IVA_{it-k} + \sum_{k=1}^{q} \delta_{76ik}\, \Delta GDPC_{it-k} + \sum_{k=1}^{q} \delta_{77ik}\, \Delta CMIC + \sum_{k=1}^{q} \delta_{78ik}\, \Delta MI_{it-k} + \sum_{k=1}^{q} \delta_{79ik}\, \Delta FFE_{it-k} + \vartheta_{7i}\epsilon_{t-1} + \mho_{7i} \qquad (15)$$

$$\triangle FFE_{it} = \omega_{8j} + \sum_{k=1}^{q} \delta_{83ik}\, \Delta C_{it-k} + \sum_{k=1}^{q} \delta_{84ik}\, \Delta EP_{it-k} + \sum_{k=1}^{q} \delta_{85ik}\, \Delta IVA_{it-k} + \sum_{k=1}^{q} \delta_{86ik}\, \Delta GDPC_{it-k} + \sum_{k=1}^{q} \delta_{87ik}\, \Delta CMIC + \sum_{k=1}^{q} \delta_{88ik}\, \Delta MI_{it-k} + \sum_{k=1}^{q} \delta_{89ik}\, \Delta FFE_{it-k} + \vartheta_{8i}\epsilon_{t-1} + \mho_{8i} \qquad (16)$$

The direction of causality by the significance of the coefficient in the equation. The δ denotes the short-run casualty of the change coefficient. The long-run causality.

4. Result

4.1. Descriptive Statistics and Unit Root

Figure 3 explored the value of a box plot element, the median is 95% of confidence with a fixed width, lower and upper whisker. RE lower whisker shows minimum far outliers in lower whisker FFE, EP and GDPC, register the highest mean value with nearest neighbor fit line and it concluded that all predictor with renewable energy integrated with the countries along Belt and Road.

Figure 4 states dispersal has computed in renewable energy (RE), the Middle East and North Africa are embarking, that will require more than $200 billion in investment on a massive program to develop renewable energy and sustain socio-economic development of the region, with ripple effects of renewables development throughout society by economic growth. Figure 5 showed the residual sign of renewable energy in different countries by regions.

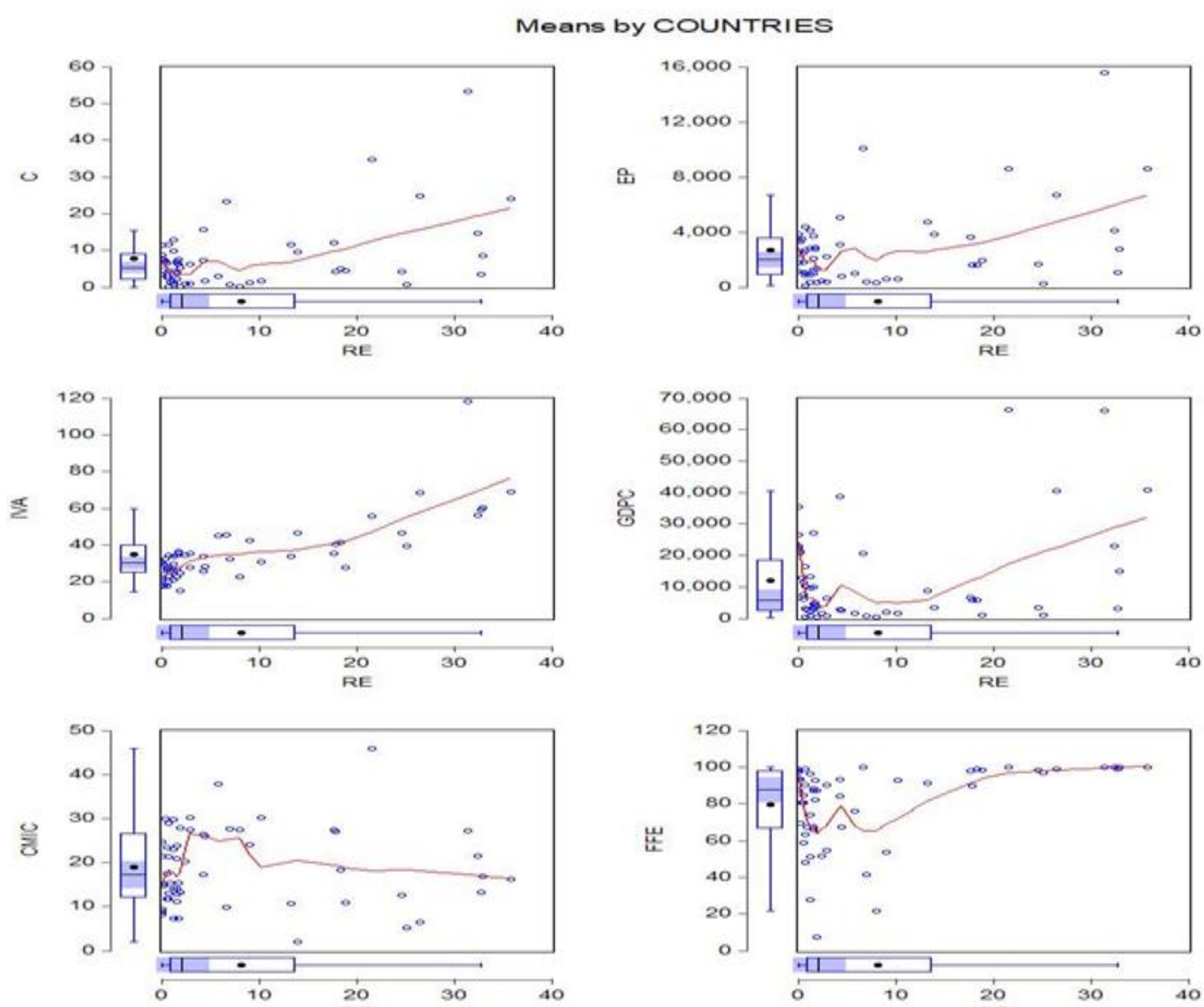

Figure-3. Categorical means of countries by boxplot.

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Table 4 shows the panel unit root test of the LLC, IPS, ADF, PP, and Hadri in individual and trend intercept, both in level and 1st difference, and an order to remove inconvenience, stationary test rendering to cross-sectional in 1st generation unit root test Table 5 with a common root, afterward, Table 6 we computed the cointegration test by Pedroni, Kao from Engle-Granger based and Fisher performed before empirical valuation of FMOLS and DOLS.

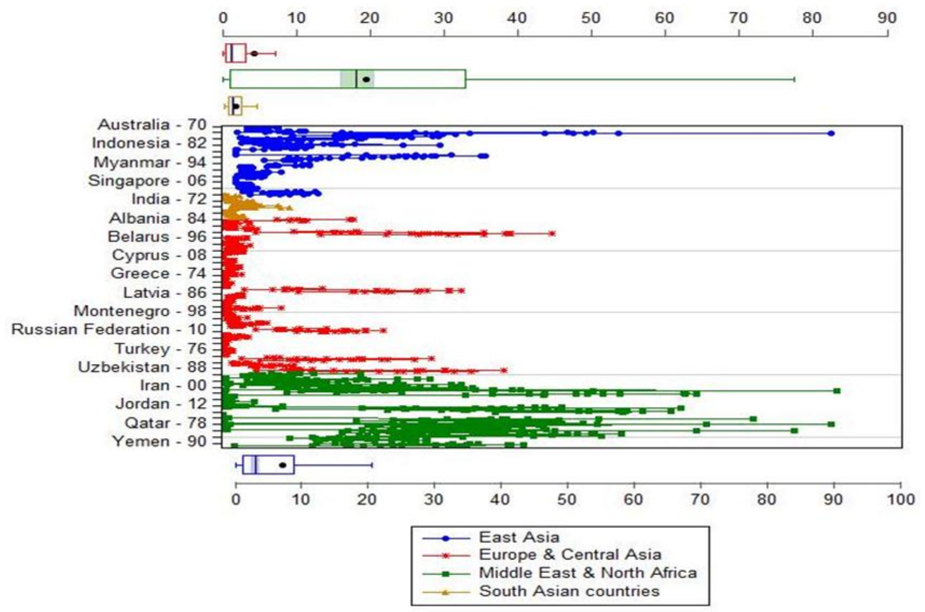

Figure-4. Dispersal of States.

Table-3. Descriptive statistics.

Variables	Mean	Median	Max	Min	Sta.Dev.	Obs
RE	8.198	2.050	89.596	0.000	12.455	1551
C	6.428	4.403	67.106	0.016	7.712	1551
EP	2307.542	1571.034	21959.440	86.879	2495.740	1551
IVA	33.776	30.555	213.690	6.064	15.729	1551
GDPC	11387.490	4781.851	113682.000	237.814	15294.990	1551
CMIC	19.659	18.639	56.604	0.000	10.476	1551
FFE	78.096	86.045	100.000	1.654	23.276	1551

4.2. Panel Regression Analysis

The endogenous explanatory variables do not contain any past value of variables in the static model, the term of error serially and mutual independent, therefore need to construct the dynamic model in form of endogenous lagged variables and serially correlated error (Gourieroux & Monfort, 1997) . The dynamic model can construct for the endogenous variables in form of lagged and DOLS and VECM estimations the lag of dependent variables are present as explanatory variables of the regression equation; therefore, the dynamic relationship shows the dynamic model.

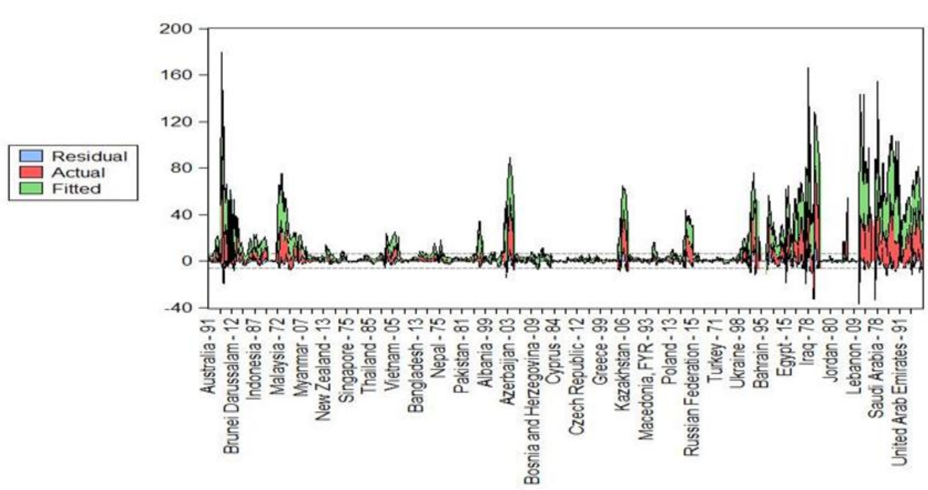

Figure-5. Residual indication of Renewable energy.

In fact, these methods have become mainstream dynamic approaches of relevant studies (Emirmahmutoglu & Kose, 2011; Herrerias, Joyeux, & Girardin, 2013; Liddle & Lung, 2013; Nazlioglu & Karul, 2017). It should account for the dynamic relationship between the variables for when analyzing different individual variables. 1st variation of time matters in investigating the Granger causality among variables. 2nd the lagged effects of the policy or past information have a direct impact on changes of variables. 3rd the relationship among variables differ in long-run and short-run, which requires long and short-run estimations dynamic.

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Table-4. Unit root of individual variables (Level).

Variable les	Individual intercept					Individual intercept and trend					
	CR	Individual root			Hadri	CR		Individual root			Hadri
	LLC	IPS	ADF	PP		LLC	Breitung	IPS	ADF	PP	
RE	-45.080***	-14.656***	277.840***	319.731***	8.521***	-41.624***	-1.614***	-11.936***	474.523***	262.236***	8.89***
C	3.794	3.368	112.996	174.445***	14.834***	-0.059	6.723	0.135	146.777***	223.552***	14.865***
EP	0.810	-1.926***	246.709***	170.106***	22.294***	-8.443***	7.479	-4.857***	487.042***	508.001***	17.986***
IVA	-3.237***	-2.356***	130.172**	148.074***	16.551***	1.608	1.533	1.143	93.607	100.323	14.221***
GDPC	7.899	10.047	65.194*	44.285	28.143***	2.296*	5.101	3.532	105.382*	88.320	12.065***
CMIC	-4.590***	-2.781***	165.828***	198.960***	20.745***	-0.893	0.579	-0.661	138.003***	161.444***	13.219***
FFE	-23.219***	-6.324***	143.533***	173.255***	27.012***	-41.316***	5.086	-7.893***	380.635***	396.642***	16.267***

Note: *** specifies the significance levels at 1% ** specifies the significance levels at 5% * specifies the significance levels at 10%.

Table-5. Padroni Residual Co-Integration Test.

	Individual intercept		Individual intercept and individual trend		No intercept or trend	
	Statistic	Weighted Statistics	Statistic	Weighted Statistics	Statistic	Weighted Statistics
Panel v-Statistic	0.008*	-3.086*	-1.631*	-5.501	0.070*	-3.046*
Panel rho-Statistic	1.96*	2.228*	3.348*	5.065	2.174*	1.214*
Panel PP-Statistic	-4.021***	-6.899***	-4.824***	-6.202***	-2.898***	-6.858***
Panel ADF-Statistic	-0.389*	-4.415***	-1.056*	-5.302***	-0.424*	-3.354***
Alternative hypothesis: individual AR coefs. (between-dimension)						
	Individual intercept	Individual intercept and individual trend		No intercept or trend		
roup rho-Statistic	5.809	7.890		4.518		
Group rho-Statistic	-13.954***	-12.480***		-12.698***		
Group rho-Statistic	-9.239***	-8.119***		-4.733***		

Note: Specified with lag ength 1 with Newey-West automatic bandwidth (Bartlett Kernel). Kao Residual Co-integration (t-Statistics) are -8.199*** (ADF), 16.393 (Residual variance) and 10.111 (HAC Variance).

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Table-6. Johansen fisher panel co-integration test.

Intercept in CE and VAR			Intercept and trend in CE-no trend in VAR	
No. of CE(s)	**(from trace test)**	**(from max-eigen test)**	**(from trace test)**	**(from max-eigen test)**
None	890.7***	857.2***	985.1***	542.1***
At most 1	995.8***	649.4***	1505***	2358***
At most 2	697.4***	608.4***	820.5***	600***
At most 3	581.5***	434.5***	547.9***	3481***
At most 4	424***	309.9***	498***	375.6***
At most 5	209.7***	176.8***	356.3***	282.6***
At most 6	155.4***	155.4***	148.7***	148.7***

Note: The variable's definition stated in Table 2 *** specifies the significance levels at 1% ** specifies the significance levels at 5% * specifies the significance levels at 10%.

The cointegration regression: Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS), emphasized by the maximum likelihood approach (Johansen, 1991). The nonstationary estimation specified the basic cointegration method in the triangular system of equation, the linear trend specification by a trend variable assumption. Fully changed OLS uses a semi-parametric correction to eliminate the problem caused by the long run correlation between the stochastic repressors and the integration equation. Hence, asymptotically unbiased by FMOLS and fully efficient mixture normal asymptotic allowing for standard Wald test using asymptotic statistically Chi-Square inference. Table 6 shows panel (FMOLS) liner trend specification, the cointegration regression estimate using by differenced data in an additional trend. The pool panel method specifies the long run variance computed by Bartlett in the Andrews Automatic Bandwidth method. Table 7 showed an Individual coefficient of Fully Modified Ordinary Least Squares (FMOLS) & Dynamic Ordinary Least Squares regression (DOLS) has computed with (@trend) specification. The Bartlett and Andrew automatic in long run covariance individually categorize countries by different regions. The ordinary least squares coefficient covariance using an estimation of the long run variance of FMOLS & DOLS residual in different regions and use a sandwich-style HAV (Newley-West) covariance. The individual coefficient examined the trend coefficient for each cross-section in individual regions.

The Vector Error Correction (VEC) model explore seven variables, the cointegration equation (CoinEq), RE statistically significant coefficient related at -6.86 in cointegration term, the coefficient relating to Error Correction Term (ECM), its negative at 2.49% Table 8 implies that previous year errors will be correct in the following year at the change rate of 2.49%, the other difference operator it represents short-run coefficients, the co-integration equation or ECT capture the long-run equilibrium, it signified conversion to long-run equilibrium at -0.024, therefore show convergent to long run equilibrium so it analyzing that that in the short run relationship there is no significant coefficients in RE except EP (lag -1).

The short-run coefficient of is significant showing that short-run will exhibit reduction it's on by self because its log representation every order relationship and transept are not significant. The contribution of C, EP, IVA, GDPC, CMIC, and FFE is strongly exogenous, and it implies that they have a very weak influence on predicting RE. The long-run period influence of RE on itself is the further remove while the influence of predictor variables is increasing as further remove, it means predictor are exhibiting strong endogenous influence on RE on a remove, strong endogenous influence while RE exhibiting weak endogenous influence on itself. In FFE the short run RE focus arrow variance, while C is 0.71% Figure 6 of focus arrow variance in FFE, both variables RE and C are exhibiting strong exogeneity, and they have a weak influence on predicting FFE short-run, we show that FFE is 98.53% as we go in future the influence of predictor variables (increasing) are very strong while the influence of FFE is decreasing the further removed.

Figure 7 East Asia countries except for Australia, Japan, and Newzeland is a positive effect in high economic growth regime but forming negative effect on CO_2 emission. These countries with weak infrastructure and limited financial resources will struggle to adapt and sustain their economic growth in the face of a changing climate, like Singapore showed high economic growth with less CO_2 emission and Brunei showed emission from the above median line, India and China need to binding emission limit cause of climate catastrophe in Asia also in several decades to occur in developing countries.[1] The United Arab Emirates and Qatar (2nd highest ecological footprint globally) are increasing CO_2 emission in the middle East, and Romania gradually decreased by 14.6% from fossil fuel combustion in 2012, Turkmenistan increased CO_2 emission from 19 to 100 million from 1997 to 2016 with the 10.20% annual rate, Hungary and Ukraine are slightly going down in Europe and central Asia.

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Table-7. Individual coefficient by regions.

East Asia	FMOLS	DOLS	South. A	FMOLS	DOLS	Europe	FMOLS	DOLS	Middle.E	FMOLS	DOLS
Australia	-27.27 (-0.43)	-0.21(0.67)	Bangladesh	2.79 (.24)	7.22(0.17)	Albania	1.03 (-0.20)	-14.82(-0.15)	Bahrain	-177.27 (0.01)	
Brunei Darussalam	-16.83 (-0.06)		India	4.70 (.19)	8.72(0.19)	Armenia	-19.47(0.28)	-31.42(0.21)	Egypt	-136.18 (-0.62)	-170.43(-1.09)
China	5.73 (-0.27)	13.97(-0.36)	Nepal	-2.46 (-0.04)	-1.57(-0.02)	Azerbaijan	-6.20 (0.51)	25.01(-1.02)	Iran	-165.92 (0.28)	-216.18(0.20)
Indonesia	5.79 (-0.16)	12.98(-0.16)	Pakistan	2.36 (0.13)	5.95(0.07)	Belarus	-6.42 (-0.10)	-54.67(0.18)	Iraq	-171.60 (0.75)	-217.02(0.47)
Japan	-37.16 (-0.15)					Bosnia H.	-11.65(0.09)		Israel	-168.00 (0.21)	
Malaysia	29.12 (-0.88)	33.36(-0.62)				Bulgaria	-16.63 (0.29)	-26.16(0.06)	Jordan	-164.51 (0.04)	-220.36(0.12)
Myanmar	34.70 (-0.79)					Cyprus	-13.90 (0.23)	-35.46(-0.33)	Kuwait		
New Zealand	-19.59 (-0.28)	5.90(0.07)				Czech P	-11.47 (0.12)		Lebanon	-161.52 (0.24)	
Philippines	-1.55 (-0.03)	3.97(-0.10)				Estonia	-0.11 (-0.00)		Oman	-164.39(0.19)	
Singapore	-8.41 (-0.86)	7.05(0.13)				Georgia	-9.74 (0.06)	-42.83(0.63)	Qatar		
Thailand	-1.41 (-0.13)	1.11(0.09)				Greece	-12.16 (0.18)		Saudi	-169.26(0.47)	-233.74(0.64)
Vietnam	-0.35 (0.11)	11.67(-0.79)				Hungary	-11.44 (0.10)		UAE	-177.09(0.22)	-261.56(1.15)
						Kazakhstan	-17.24 (0.76)	5.54(-0.40)	Yemen	-116.61(-1.0)	-91.83(-2.93)
						Latvia	-6.68 (0.03)				
						Lithuania	-4.418 (-0.06)				
						Macedonia,	-19.17(0.34)	-33.16(0.28)			
						Montenegro	-4.880 (-0.00)				
						Poland	-12.74(0.11)				
						Romania	-8.23 (-0.01)	-28.86(0.01)			
						Russian F	-10.27 (0.45)	-92.43(3.38)			
						Serbia	-8.71 (0.39)				
						Slovak R	-10.91 (0.09)				
						Slovenia	-12.87 (0.20)				
						Turkey	-8.82(-0.031)	-25.68(-0.24)			
						Turkmenistan					
						Ukraine	-17.52(0.37)	-32.50(0.30)			
						Uzbekistan	-22.57 (0.95)	86.74(-4.69)			

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Table-8. Panel causality results of all countries.

Countries	Dependent variable	Independent variables							Long run	
		Short run								
		ΔRE	ΔC	ΔEP	ΔIVA	$\Delta GDPC$	$\Delta CMIC$	ΔFFE	ECM	ContEq
All countries	ΔRE		2.949***	-0.287*	12.110***	2.305**	1.768**	-1.185*	-6.863***	-0.024
	ΔC	2.692***		-1.256*	3.769***	4.331***	-0.577*	1.080*	11.885***	
	ΔEP	-0.924*	-2.267***		0.401*	-4.119***	2.642***	2.409***	-7.648	
	ΔIVA	10.884***	2.803***	-1.198*		5.168***	0.346*	3.499***	-0.3113***	
	$\Delta GDPC$	2.800***	5.900***	-4.732***	6.284***		0.646*	0.293*	-0.569	
	$\Delta CMIC$	1.805**	-0.784*	3.088***	1.025*	0.729*		-0.449*	2.407***	
	ΔFFE	-0.630*	0.858*	2.194***	3.092***	0.492*	-0.841*		0.310***	
East Asia	ΔRE		5.614***	-0.126*	2.174***	5.482***	0.761*	-0.227*	0.363***	0.000
	ΔC	6.461***		0.289*	1.903***	0.065*	-1.755**	-0.176*	-2.211***	
	ΔEP	-0.909*	-0.304*		1.262*	0.060*	-3.087***	0.213*	4.200***	
	ΔIVA	3.424***	1.873**	0.785*		2.219**	-1.478*	1.509*	4.430***	
	$\Delta GDPC$	7.265***	-0.841*	-0.397*	2.594***		3.20***	-0.691*	5.551*	
	$\Delta CMIC$	-0.295*	-1.209*	-2.692***	-1.350*	3.638***		-0.256*	-1.462***	
	ΔFFE	-0.196*	-0.195*	0.053*	1.663**	-0.780*	-0.685*		-0.7199***	
South Asia	ΔRE		-1.359*	1.591*	0.441*	-0.181*	1.179*	-2.548***	-3.922***	-0.130
	ΔC	-1.233*		5.333***	1.608*	4.753***	-0.430*	2.262***	0.129***	
	ΔEP	1.815**	5.110***		-2.685***	3.844***	1.300*	4.259***	0.624*	
	ΔIVA	0.416*	1.639*	-3.136***		0.798*	-3.082***	1.277*	-1.800***	
	$\Delta GDPC$	0.870*	-0.496*	1.062*	-3.586***		0.189*	-0.405*	3.533*	
	$\Delta CMIC$	-2.641***	1.664**	3.929***	1.188*	-7.829***		-0.561*	3.332*	
	ΔFFE	-2.641***	1.664**	3.929***	1.188*	-7.829	-0.561*		-0.358***	
Europe	ΔRE		0.036*	-0.323*	3.968***	-0.810*	-0.580*	2.021***	-0.117***	-0.000
	ΔC	0.249*		33.200***	3.368***	2.246***	-1.141*	0.313*	3.602***	
	ΔEP	-0.571*	32.046***		-1.767**	1.830**	2.974***	-0.128*	1.931*	
	ΔIVA	5.035***	3.944***	-1.858**		0.226*	1.293*	2.086***	4.853***	
	$\Delta GDPC$	-0.636*	1.853**	2.457***	0.392*		-1.785**	1.772**	-1.032	
	$\Delta CMIC$	-0.675*	-1.595*	2.874***	1.005*	-1.828**		0.816*	0.386***	
	ΔFFE	1.752**	1.083*	0.353*	2.416***	1.712**	1.712**		2.086***	
Middle east	ΔRE		0.168*	0.876*	8.147***	0.686*	0.249*	1.534*	-5.003***	-0.113
	ΔC	-1.572*		-2.652***	3.723***	2.766***	-1.233*	0.426*	6.883***	
	ΔEP	0.153*	-3.915***		-0.930*	-2.083***	2.384***	0.282*	-4.547*	
	ΔIVA	7.107***	1.840**	-1.775**		2.085***	2.166***	-0.845*	-0.757***	
	$\Delta GDPC$	0.064*	3.214***	-1.593*	3.778***		-1.212*	0.103*	0.604	
	$\Delta CMIC$	-0.184*	0.378*	3.620***	3.569***	-0.802*		0.024*	2.100***	
	ΔFFE	1.365*	0.265*	0.349*	-0.880*	0.077*	-0.109*		0.351***	

Note: *** specifies the significance levels at 1% ** specifies the significance levels at 5% * specifies the significance levels at 10%.

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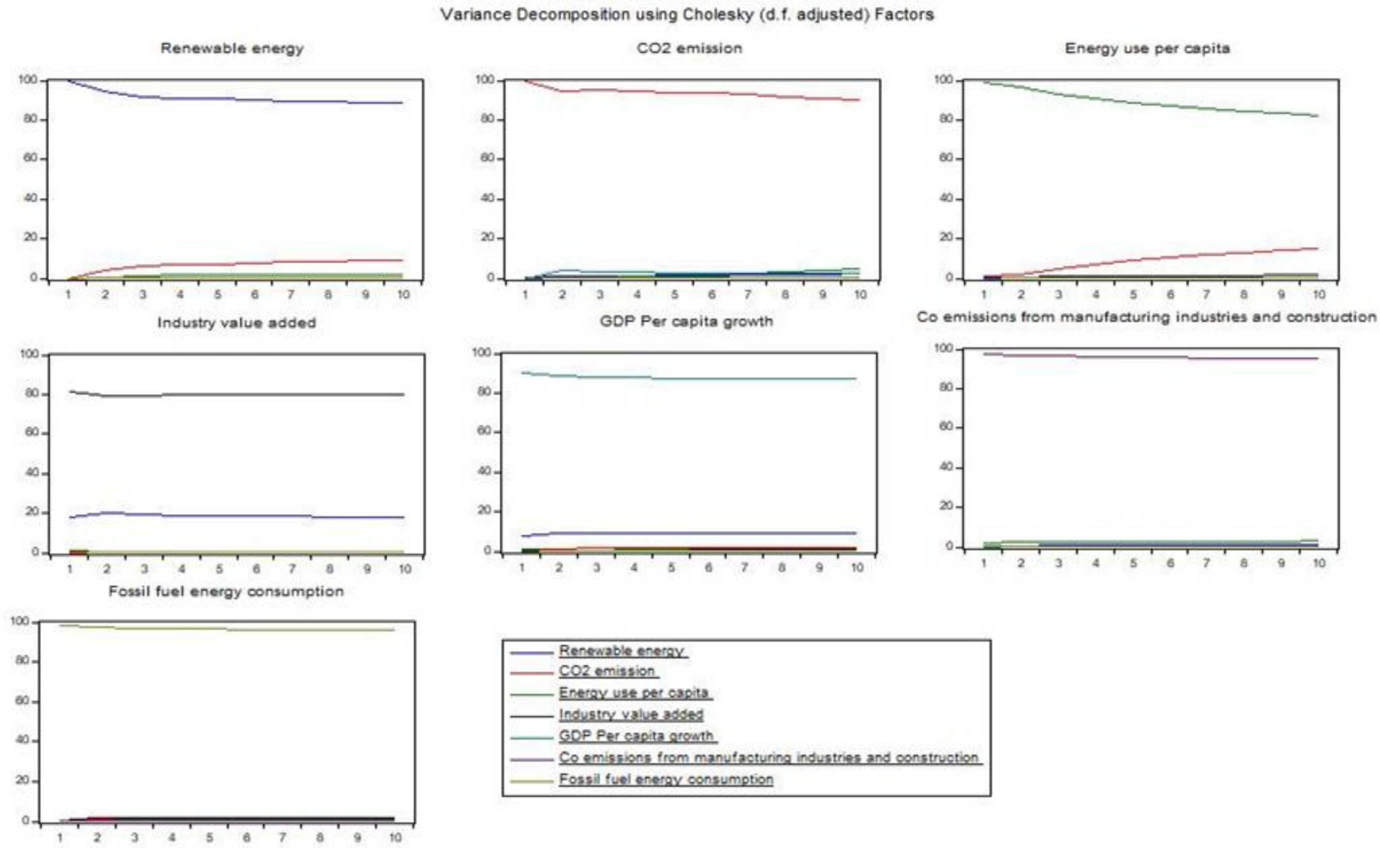

Figure-6. Variance decomposition (Cholesky).

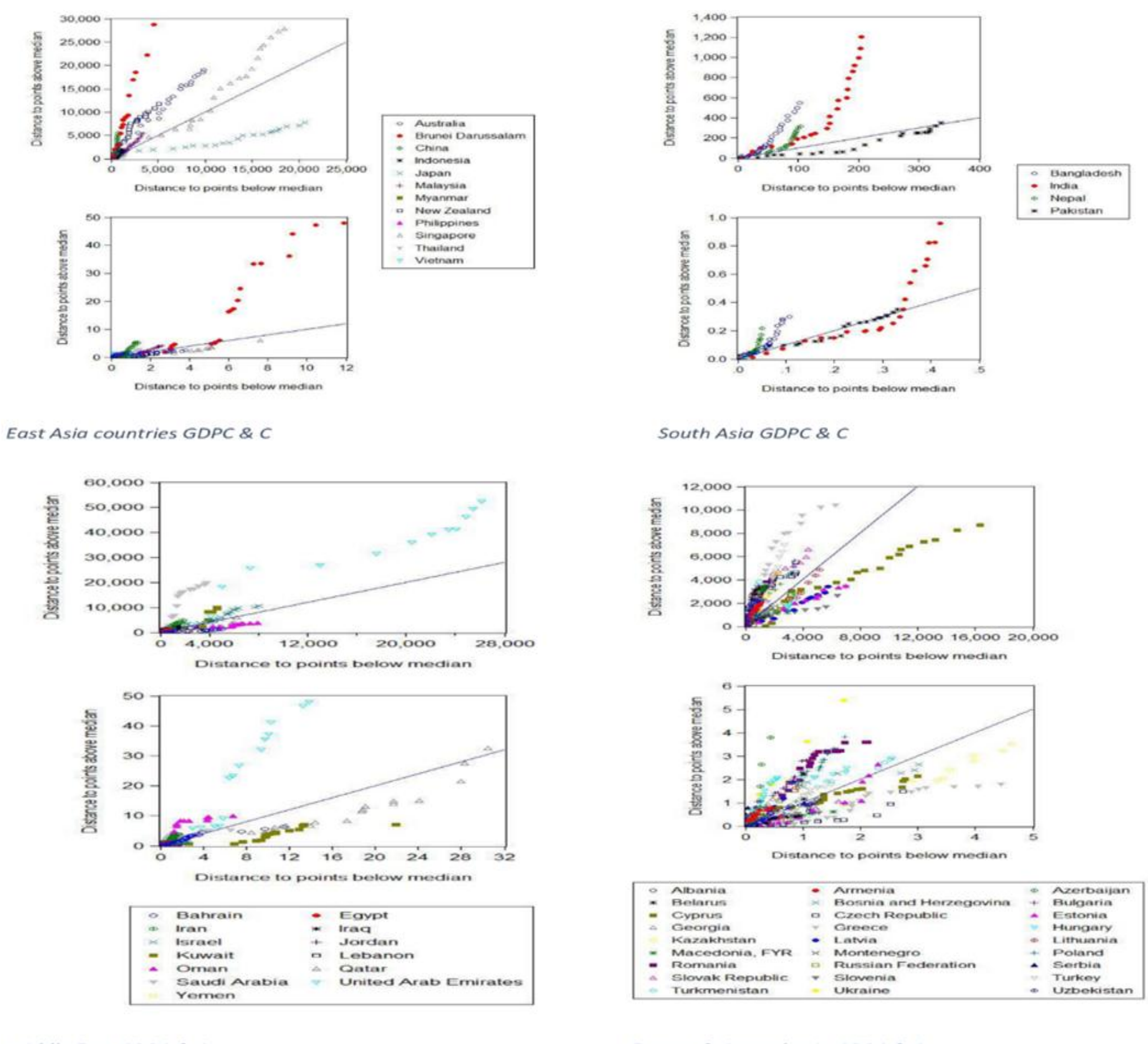

Figure-7. Distribution of region.

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5. Conclusions

The mega project Belt and Road is a precisely re-presenting economic corporation, and it is a huge plan of development of 4 regions. In the 21stcentury it connected with the Maritime Silk Road from the China to Europe via Central Asia and then rapidly in-touch with other states as well for pure economic corridor. This paper panel data analysis implies that economic growth of 55 countries and their influence on energy consumption, renewable energy, manufacturing industry and construction with industry value added, fossil fuel and GDP per capita. The regional individualities of countries are different within BRI on behave economic contribution, the policies and recommendation of energy discussed separately in regions. It shows EA countries' positive and high economic growth, and there is a causality running from GDP per capita, industry value added and renewable energy.

In addition, Chinese enterprises have undertaken over 3,100 projects in Belt and road likes nuclear, hydraulic and biomass and also the country region-specific factors should be carefully finding the energy development approach for renewable energy such as hydropower projects in South Asia. Regarding South Asia-countries, the relationship between renewable energy consumption and economic growth is not the signification, there are causality running from GDP and likes India have created a negative impact on global warming. The United Arab Emirates (UAE) and Oman is less causality running from GDP and energy consumption is not significant in Europe and the central east.

The Middle East & North Africa (ME&NA) region has undergone a significant transformation because of economic development and increase diversification of energy sources in an economic factor like Belt and Road project. The result implies that most import sources of economic development are traditional fossil energy rather than renewable energy and the global energy demand growing by an average 1% per year from 2010 and through 2040.

The most important source of energy meet future demand growth is natural gas expected to largest absolute economic growth, and it became a key fuel in meeting future. BRI project may also reduce transit risk of energy sources by Pakistan via the Iran-Pakistan pipeline in Middle East and import natural gas to Western China through Pakistan and maintaining oil and gas pipelines and other transport routes. Construction of cross-value-added industries, power supply network, power-transmission routes can further promote 55 country's economy in BRI project. Besides, in addition, the relationship got from the empirical study could investigate from a theoretical framework could help us understand and provide policymakers to a more comprehensive and wide-ranging adjust relevant policies.

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