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Green growth a pathway to sustainable growth in developed countries

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Abstract

The quest by countries to drive to maturity stage of development especially by industrialize nations continued to impact on green economy despite policy framework and strategy implementation to curtail the activities. Emissions endanger the existence of secured environment. It is in the light of this literatures have concentrated on the area. This study seeks to investigate the determinants of green growth in 13 developed countries spanning 2010 to 2020. This study employed the ordinary least square regression with robust option, country specific effect and time fixed option, fixed effect and random effect estimation with time varying effect estimation options. This study also employed the generalized square regression technique with several robust option and post estimation test. The result of the study posit that CO_2 emissions from gaseous fuel consumption which is (% of total) has a positive and significant relationship with green growth indicating that the consumption of this energy increases green growth. The coefficient Renewable energy consumption (% of total final energy consumption) revealed a positive effect on green growth. The coefficient Fossil fuel energy consumption (% of total energy) revealed a negative effect on green growth. In addition, Combustible renewable and waste (% of total energy) posit a negative relationship on green growth. A caveat for policy shows that in spite strategies and deliberate policy reform put in place to mitigate the effect on green growth, much is needed in terms of investment in clean energy. No doubt deliberate policy reform need to strengthen and enforced in this respect cannot be underscored

Keywords: Green growth; Renewable energy; CO_2 emission

1. Introduction

Green growth is sustainable transition into green and clean energy associated with low carbon. The increasing demand for energy to drive economies to prosperity plays significant cause for high rate of emissions emanating from carbon dioxide CO_2, fuel, fossils and combustion emission which are reasons behind slow pace achievement in green growth globally despite policy framework and regulations. Development and human existence are threatens side by side coupled with worsening of sustainable development goal of 2030 (IPCC, 2018). Friedrichs and Inderwildi (2013) a substantial emission of gaseous substance in the rich oil producing countries and of those whose energy demand and industrial activities are in large scale contributes to high emission.

Mott, Razo and Hamwey (2021) reported that emission threatens green growth and USA, China and India are top there carbon emitters which account for about 50 percent rate of global carbon emission. However, oil producing countries especially the developing countries also have share contribution to global carbon flaring. Although less regulatory framework to reducing carbon flaring in developing nations as a result of rising poverty index and infrastructural decay. The share contribution of these regions cannot be underscored.

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Considering the trend of carbon rise in developed economies, the share of emission varies across the globe. For instance, United State carbon emission stood at 5.41GT 2018, it rose to 0.8% (or 36 Mt) to 4.7 Gt in 2022. Japan alone had 1.16GT and Canada 0.56GT in 2018. It is clear that among all countries, United State ranks highest in share contribution of emissions. The Organization for Economic Cooperation and Development (2020) stressed the importance of agenda 2030 for sustainable development. The significant rise in emission depletes and jeopardizes the norms of agenda 2030.

In addition, global energy associated with CO_2 emissions grew significantly by 0.9% or 321 Mt in 2022, although Emissions emanating from natural gas significantly fell by about 1.6% or 118 Mt(IEA, 2022). Similarly, it was also reported that emissions emanating from oil significantly rose far more than emissions emanating from coal, rising by averagely 2.5% or 268 Mt to 11.2 Gt (IEA, 2022). The motivation for this study is the context at which the issue of carbon emission strives highly in developed countries as a result of industrial activities and rise in energy demand especially during the Covid pandemic period. The persistent rise in the emission also calls for continuous research in the area to send signals on the dangers which is inimical to green growth and sustainable development.

Jing and Yongfu (2013) used data on OECD countries and applied ordinary least square regression test but this technique is biased and inconsistency. This paper is structured into five sections including this introduction. Section two covers the review of empirical literature, section three looks at the research methodology, section four deals with data analysis and interpretation and lastly, section five looks at conclusion and policy implications of the study.

2. Review of empirical literature

Ali (2020) estimated the nexus between green growth and low carbon emission in G7 countries cointegration test and causality test approach spanning 1991 to 2017, the result of the study indicates a long run relationship between green growth and carbon emission. Ouissein and Zahia (2021) used data on Algeria to examine the role of renewable energy on green growth, the authors report a positive relationship between renewable energy and green growth in Algeria.

In a recent study by Tawiahn, Zakari and Adedoyin (2021) used data on 123 developed and developing countries to estimate the determinants of green growth for the sample period 2000 to 2017 applying system GMM technique of estimation, the renewable energy has a positive and statistically significant relationship with green growth indicating that renewable energy consumption increases green growth. The authors also reported that economic development has a positive effect on green growth while the coefficient trade openness has a negative effect on green growth. In addition, this study overlooked the importance of AR(2) and AR(1), Hansen statistics and Sargen test, instruments and number of groups as well as well as estimating the system GMM on second lag to ensure that the first and second lag value of the green growth have significant effect on the current green growth.

Piłatowska, Geise and Włodarczyk (2020) employed the Granger causality and non-linear impulse response function to investigate the nexus between renewable and nuclear energy consumption, carbon dioxide emissions and economic growth using data on spain spanning 1970 to 2018. The study revealed that there exist bidirectional causality between CO_2 emissions and economic growth. There is a unidirectional relationship running from nuclear energy consumption to CO_2 emissions.

3. Materials and Methods

3.1. Type of Data

This study used panel data set of thirteen 13 countries to estimate the effect of carbon emission on green growth in developed countries span 2010 to 2020. This study applies the fixed effect and random effect estimation approach. We test for serial correlation and heteroskedasticity patents. By including the vce(robust) options and also included the time varying effect option, testparm i.year also to test whether the time fixed effect is required in the fixed effect test. This study applied the covariates and performs Baltagi–Wu LBI test and other post estimation test such as Covariance matrix of coefficients and estat summarize option (Stata, 2019) The list sample of countries covered in this study includes (Australia, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Poland, Spain, Sweden, Switzerland, United Kingdom, and United States).

Model specification

$$gg_{it} = \beta_0 + \beta_1 \mathrm{co_2} + \beta_2\, renew_{it} + \beta_3\, \mathrm{co_2}\, fuel_{it} + \beta_4\, gdp_{it} + \beta_5\, \mathrm{co_2}\, fossil_{it} + \beta_6\, conburst_{it} + \beta_7\, \mathrm{tradop_{it}} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (3.1)$$

Technique of Data Analysis

Consider the fitting models of the form

$$y_{it} = \propto\ + \propto_{it}\ \beta +\ v_i + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$i = 1 \ldots \ldots .. n$ and each for i, t =1…………..T of which T period are actually observed

v_t+ μ_{it} is the error term that is as we want to estimateβ, v_i is the unit specific error term since it differ between units. μ_{it} is the error term with usual properties (mean 0 uncorrelatedwith itself, uncorrelated with x, uncorrelated with v_i and homoskedastic. although in a more thorough development, we could decompose $\mu_{it} = v_i + w_{it}$, assume that $w_{it}$is a conventional error term, and better describe v_i Before making the assumptions necessary for estimation, let's perform some useful algebra on (1). if (1) Whatever the properties of v_i and v_i and μ_{it} if (1) is true, it must also be true that

$$y_i^- = \alpha +\ x_i^-\beta + v_i\ + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where y_i^-=$\mu_i, y_{it}/T_i$, $x_i^-\ = \mu_t, x_{it}/T_i$, and μ_i^-= $\mu_i, \mu_{it}/T_i$ Substituting equation 3 from 2 it should be equally true that

$$(y_i - y_i^-) = (x_{it}\text{ - }x_i^-)\beta + (\mu_{it} - \mu_i^-) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

These three equations provide the basis for estimating In particular, xtreg, fe provides what is known as the fixed-effects estimator also known as the within estimator and amounts to using OLS to perform the estimation of (3) xtreg, be provides what is known as the between estimator and amounts to using OLS to perform the estimation of (2). xtreg, re provides the random-effects estimator and is a (matrix) weighted average of the estimates produced by the between and within estimators (Stata, 2019). In particular, the random-effects estimator turns out to be equivalent to estimation of

$$(y_{it} - \theta y_i^-) = (1\text{- }\theta) \propto +(\ x_{it}\ - \theta x_i^-)\ \beta + (1 - \theta)\ v_i\ + (\mu_{it} - \theta\mu_i^-)) \ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Where θ is a function of σ_v^2 and σ_ϵ^2 if $\sigma_v^2\ = 0$ meaning that v_i is always 0, θ = 0 and (1) can be estimated by OLS directly. Alternatively, if $\sigma_v^2\ = 0$meaning that μ_{it} is 0, $\theta\ = 1$ and the within estimator returns all the information available (which will, in fact, be a regression with an $R^2$of 1). For more reasonable cases, few assumptions are required to justify the fixed-effects estimator of (3). The estimates are, however, conditional on the sample in that the v_i are not assumed to have a distribution but are instead treated as fixed and estimable. This statistical fine point can lead to difficulty when making out-of-sample predictions, but that aside, the fixed-effects estimator has much to recommend it.

$$y_{it}\ = \propto +x_i\ \beta_i + (x_{it}\text{ - }x_i\ )\beta_2 + v_i\ + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1')$$

More is required to justify the between estimator of (2), but the conditioning on the sample is not assumed because$v_i\ + \mu_{it}^-$ is treated as an error term. Newly required is that we assume that v_i and x_i^- are uncorrelated. This follows from the assumptions of the OLS estimator but is also transparent: were v_i and x_i^- correlated, the estimator could not determine how much of the change in y_i^-, associated with change in x_i^- to assign to β versus how much to attribute to the unknown correlation. (This, of course, suggests the use of an instrumental-variable estimator, z^- which is correlated with x_i^- uncorrelated with v_i The random-effects estimator of (4) requires the same no-correlation assumption. In comparison with the between estimator, the random-effects estimator produces more efficient results, albeit ones with unknown small-sample properties. The between estimator is less efficient because it discards the over-time information in the data in favor of simple means; the random-effects estimator uses both the within and the between information (Stata, 2019).

All of this would seem to leave the between estimator of (2) with no role (except for a minor, technical part it plays in helping to estimate $\sigma_v^2 and\ \sigma_\epsilon^2$ which are used in the calculation of θ on which the random-effects estimates depend). Let's, however, consider a variation on (1')

$$y_i^- = \propto + x_i^-\beta_i + v_i + \mu_i^- \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2')$$

In this model, we postulate that changes in the average value of x for an individual have a different effect from temporary departures from the average (Wooldridge 2020)In an economic situation, y might be purchases of some item and x income; a change in average income should have more effect than a transitory change. In a clinical situation, y might be a physical response and x the level of a chemical in the brain; the model allows a different response to permanent rather than transitory changes. The variations of (2) and (3) corresponding to (1') are

$$(y_{it}^{-} - y_i) = (x_{it} - x_i^{-})\beta_2 + (\mu_{it}\text{-}\mu_i^{-}) \text{……………………………..(3')}$$

That is, the between estimator estimates β_i and the within β_2 and neither estimates the other. Thus even when estimating equations like (1), it is worth comparing the within and between estimators/ Differences in results can suggest models like (1'), or at the least some other specification error. Finally, it is worth understanding the role of the between and within estimators with regressors that are constant over time or constant over units. Consider the model

$$y_{it} = \propto + x_i\,\beta_i + s_i\beta_2 + \sum\beta_3 \quad + v_i \; + \; \mu_{it}^{-} \text{…………………………………..(1'')}$$

This model is the same as (1), except that we explicitly identify the variables that vary over both time and i (x_{it} , such as output or FEV); variables that are constant over time (s_i and variables that vary solely over time (z_i, The corresponding between and within equations are

$$(y_{it}^{-} = \propto + x_i\,\beta_i + s_i\beta_2 + \sum\beta_3 \quad + \mu_{it} \text{…………………………………………..(2'')}$$

$$(y_{it} - y_i^{-}) = (x_{it} - x_i^{-})\beta_1 + (z_i\text{-}z^{-})\beta_3 + (\mu_{it} - \mu_i^{-}) \text{…………………………..(3'')}$$

In the between estimator of (2), no estimate of$\beta_3$is possible because$z^{-}$is a constant across the I observations; (Baltagi 2013) the regression-estimated intercept will be an estimate of $\propto + z^{-}\beta_3$. On the other hand, it can provide estimates of β_1 and β_2It can estimate effects of factors that are constant over time, but to do so it must assume that v_i uncorrelated with those factors.

4. Result and Discussion

This section of the study considers the summary of result and interpretations. It shows the results of pooled ordinary least square regression and some of the robust options to confirm the robustness of the results.

Table 1 Pooled OLS with robust options

	ols	**Ols(c.id)**	**Ols(i.yeari.cid)**
logCO_2gas	0.094*** (0.03)	0.101*** (0.02)	0.126*** (0.02)
logrenew	0.085*** (0.04)	0.174*** (0.02)	0.146*** (0.02)
log CO_2fuel	-0.761*** (0.05)	-0.110*** (0.04)	-0.121*** (0.05)
loggdp	0.928*** (0.08)	0.703*** (0.04)	0.827*** (0.08)
logfossil	-0.864*** (0.07)	-1.041*** (0.11)	-0.982*** (0.10)
logcombust	-0.093*** (0.04)	-0.078*** (0.02)	048*** (0.02)
logtradeop	0.127*** (0.05)	0.066*** (0.03)	0.102*** (0.03)

Source: Authors computation using STATANotes: *** ** * denotes 1% 5% 10% statistical significance. Z statistics (in parenthesis)

The result in table 1 shows that the coefficients co2gas emission, renewable energy, gdp and trade openness have positive and significant relationship with green growth. However, co2fuel, fossils and combust substance emission have a negative and significant relationship with green growth across all models with country specific effect and time varying effect options in developed countries.The variances that are evident are in the standard errors of coefficients across all models with OLS, OLS with country id option and time varying effect/cid) option as well.

Table 2 Fixed effect, Random effect models with robust options

loggreeng	Fixed effect	random Effect	Fe(vce) robust
log CO_2gas	0.101*** (0.02)	0.116*** (0.02)	0.101** (0.06)
logrenew	174*** (0.02)	0.180*** (0.02)	0.174*** (.05)
log CO_2fuel	-0.110*** (0.04)	-0.163*** (0.05)	-0.110** (0.09)
loggdp	0.703*** (0.04)	0.690*** (0.05)	0.703*** (0.07
logfossil	-1.041*** (0.11)	-1.002*** (0.11)	-1.041*** (0.18)
logcombust	-0.078*** (0.02)	-0.089*** (0.02)	-0.078** (0.05)
logtradeop	0.066*** (0.03)	0.101*** (0.03)	0.066** (0.07)

Source: Authors computation using STATANotes: *** ** * denotes 1% 5% 10% statistical significance. Z statistics (in parenthesis).

In the fixed effect model, the error term is correlated regressors in the model with -0.6491. In addition, .99701021 indicating that 99.7 of the variance is due to differences across panels. More so, the probability p value is significant at 1% indicating that the model is ok. All coefficients have significant effect on green growth. Applying the Hausman specification test, the result shows that the fixed effect estimation is most appropriate. Thus this study included the robust option vce(robust) and surprisingly, only renewable energy posit a positive and significant effect on green growth at 1% level of significance. The coefficient emission from fossil has a negative and significant effect on green growth while the co2 emission and trade openness have positive effect on green growth at 5%, CO_2fuel and combust emission has a negative effect on green growth at 5% level of significance.

Table 3 Including time varying effect in fixed effect estimation

Variables	Coefficients/standard errors
log CO_2gas	0.126*** (0.06)
logrenew	0.146*** (0.06)
log CO_2fuel	-0.121*** (0.07)
loggdp	0.827*** (0.09)
logfossil	-0.982*** (0.15)
logtradeop	-0.048*** (0.05)

Source: Authors computation using STATANotes: *** ** * denotes 1% 5% 10% statistical significance. Z statistics (in parenthesis).

This study test whether or not it is necessary to include the time varying effect option in the fixed effect estimation and the result shows that Prob > F =0.0000 indicating that inthis case, time fixed effect is needed. Including the time fixed option in the fixed effect model,

The result of the study indicates that Co2 emission, renewable energy and gdp have a positive effect on green growth. However, the coefficients Co_2 fuel, fossil and trade openness have a negative effect on green growth at !% level of significance.

Table 4 Post estimation test

Variable	Mean	Std. Dev.	Min	Max
loggreeng	1.552415	479727	.732368	2.68512
log CO_2gas	3.03433	6317025	1.20538	3.98182
logrenew	2.182286	.8577623	-.15923	3.96824
log CO_2fuel	11.8009	1.098748	10.183	14.7101
loggdp	27.9395	.9777064	26.5108	30.4471
Logfossil	4.289166	.3025153	3.22355	4.58551
Logcombust	1.083935	.8296501	-1.59518	2.92054
Logtradeop	-23.71745	1.355603	-27.1237	-21.7766

Source: Authors computation using STATA

Table 5 Generalized Least Square estimation and post estimation

variables	xtgls	xtglsnoconstant	xtgls panels(iid)	xtglscorr(independent)	xtglsigls
ln CO_2gas	0.098^{***}(0.04)	0.057^{**}(0.04)	0.098^{***}(0.04)	0.098^{***}(0.04)	0.098^{***}(0.04)
lnrenew	0.129^{***}(0.04)	0.162^{***}(0.04)	0.129^{***}(0.04)	0.129^{***}(0.04)	0.129^{***}(0.04)
ln CO_2fuel	-0.811^{***}(0.05)	-0.755^{***}(0.04	-0.811^{***}(0.052)	-0.811^{***}(0.052)	-0.811^{***}(0.052)
lnfossil	-0.859^{***}(0.07)	-0.907^{***}(0.07)	-0.85^{***}(0.07)	-0.859^{***}(0.07)	-0.859^{***}(0.07)
lncombust	-0.117^{***}(0.04)	-0.165^{***}(0.04)	$-.117^{***}$(0.04)	-0.117^{***}(0.049)	-0.117^{***}(0.049)
lngdp	1.351^{*}(5.30)	-13.25^{***}(1.97)	1.351^{*}(5.30)	1.351^{*}(5.30)	1.351^{*}(5.30)
lnexport	-0.627^{*}(2.58)	6.478^{***}(0.96)	-0.627^{*}(2.58)	-0.627^{*}(2.58)	-0.627^{*}(2.58)
lnimport	0.328^{*}(2.78)	7.854^{***}(1.14)	0.328^{*}(2.78)	0.328(2.78)	0.328(2.78)
lntradeop	0.507^{*}(5.31)	-14.07^{***}(2.02)	0.507^{*}(5.31)	0.507^{*}(5.31)	0.507^{*}(5.31)
Num of obs	206	206	206	206	206
Wald chi2(9)	1182.03	15137.25	1182.03	1182.03	1182.03
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

This study employs the xtgls technique with different robust options

The properties in panels (heteroskedastic) option specify analysis of heteroskedastic error structure with no cross-sectional correlation. We employed the approach because the variance for each of the countries or panels differs. Similarly, igls for instance, requests an iterated GLS estimator instead of the two-step GLS estimator for a non auto correlated model or instead of the three-step GLS estimator for an auto correlated model. The iterated GLS estimator converges to the MLE for the corr(independent) models but does not for the other corr() models. From the result, renewable energy consumption and co2 emission has a positive effect on green growth. However, fuel consumption, fossils and combust energy have negative effect on green growth. When we included the xtgls options, the standard errors became efficient with significant p values across all models.

5. Conclusion and policy implication

This study employs the panel data to investigate empirically the determinants of green growth in thirteen 13 developed countries spanning 2010 to 2020. The period under study is characterized with so much economic and environmental policies to reduce the threat of predictors on green growth. The fixed and random effect test are employed couple with the generalized least square test with several robust options and the result shows that CO_2emissions from gaseous fuel consumption (% of total) has a positive and significant relationship with green growth indicating that the consumption of this energy increases green growth.. In the same vein, Renewable energy consumption (% of total final energy consumption) also has a positive effect on green growth. This finding conforms with findings by Ouissein and Zahia (2021) and Tawiahn, Zakari and Adedoyin (2021.The coefficient Fossil fuel energy consumption (% of total) has a negative effect on green growth. In addition, Combustible renewable and waste (% of total energy) posit a negative relationship with green growth. Several studieson the determinants of energyhave emerged but do not account for individual country specific effectand time effect that are inherent problems in panel series. for instance, Ahmed and Shimada (2019) used data on emerging and developing economies and applied the Pesaran cross-section dependence (CD) test, unit root test, e.g., cross-sectional augmented IPS test (CIPS), panel co-integration test, fully modified ordinary least square (FMOLS) and dynamic ordinary least square (DOLS). Although some of the recommendations by these studies are useful, the findings are subject to scrutiny considering the classical linear assumptions.

5.1. Implication for Policy

This study has important lessons and way forward for SDG Goals, millennium development goals and policy reports on energy. The following are implication for findings. Firstly, the positive nexus between renewable energy and green growth indicate that the developed countries have achieved significant progress by complying with the regulation of global sustainable development targets. However, this should be intensified. In addition, this finding is suitable explaining the growth and conservation hypothesis that renewable energy has a tendency increasing green growth. However, that is not sustained where regulatory framework and institutions to ensure compliance and investment in renewable energy are use or applicable.

The coefficient CO_2 fuel, CO_2 gas and fossils have a negative effect on green economy which shows that despite policy measures and strategy to mitigate the effect of energy sources on green growth, the green growth is threatened thus require intensive investment in energy source and regulations in the excessive use of energy that might reduce the outcome of green economy thus a caveat for policy. This will therefore, require policy framework on how best this problem can be ameliorated to safeguard economies of developed world.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Ahmed, M. M. and Shimada, k (2019).The effect of renewable energy consumption on sustainable economic development: Evidence from Emerging and Developing Economies Energies, 12, 2954 2-15

[2] Baltagi (2013). Econometric Analysis of Panel Data. 5th ed. Chichester, UK: Wiley

[3] Chin, M ., Puah,C, Teo3, C andJoseph, C (2018) The Determinants of CO2 Emissions in Malaysia: A New Aspect International Journal of Energy Economics and Policy 8(1), 190-194.

[4] Çınar, S. & Yılmazer, M. (2021). Determinants of green technologies in developing countries. İşletmeveİktisat ÇalışmalarıDergisi, 9(2), 155-167.

[5] Friedrichs, J.and Inderwildi, O. R(2013). The carbon curse: Are fuel rich countries doomed to high CO2 intensities? Energy Policy 62 (2013) 1356–1365

[6] Hao, L. N., Umar, M., Khan, Z and Alim W. Green growth and low carbon emission in G7 countries: How critical the network of environmental taxes, renewable energy and human capital is? Science of the Total Environment

[7] IPCC (2014), 'Drivers, trends and Mitigation', ch. 5 of the Fifth Assessment Report (WGIII AR5), Geneva, Intergovernmental Panel on Climate Change

[8] Jing Y and Yongfu H (2013) Green-to-Grey China: Determinants and Forecasts of its Green Growth. MPRA paper no: 58101 1-52

[9] Mott, G. Razo, C and R. Hamwey (2021) Carbon emissions anywhere threatened development everywhere global carbon project.

[10] Piłatowska, M Geise A and Włodarczyk, A. (2020). The effect of renewable and nuclear energy consumption on decoupling Economic Growth from CO2 emissions in Spain Energies 2020, 13, 2124; doi:10.3390/en13092124 2-18

[11] Samad, G and Manzoor, R (2015) Green gtrowth: importantdeterminants The Singapore Economic Review, 60(2),1-15

[12] Stata, p. (2019) Longitudinal data/ Panel data referencemanual Release 16 A StataCorp LLC College Station, Texas Published by Stata Press, 4905 Lakeway Drive, College Station, Texas 77845 ISBN-10: 1-59718-302-4

[13] Tawiah, V.,Zakari,A. andAdedoyin, F. F. (2021). Determinants of green growth in developed and developing countries Environmental Science and Pollution Research Springer https://doi.org/10.1007/s11356-021-13429-0

[14] Wooldridge, J. M. 2020. Introductory Econometrics: A Modern Approach. 7th ed. Boston: Cengage.

[15] Zaman K., Abdullah, A. B., Khan, A.,Mohd Nasir, M. R., Hamzah, T. A. A. T.and Hussain, S. (2016) Dynamic linkages among energy consumption, environment, health and wealth in BRICS countries: Green growth key to sustainable development Renewable and Sustainable Energy Reviews 56 1263–1271