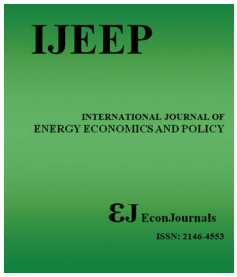

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Does CO_2 Emission Have Any Link With the Change Democratic Conditions in ASEAN Countries?

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ABSTRACT

The study which is among pioneering studies answer the question that does CO_2 emission have any link with the change democratic conditions in ASEAN countries. Great challenge in the form of global environmental problem has been faced by human society. Policy agendas for each country are governed by the political institutions. The present study aims to investigate the association among the state of political institution, environmental emission, and development indicator while taking the impact of economic conditions such as free economy, fluctuating economy, deteriorated economy and improvised economy under consideration. The study has collected the data of 10 ASEAN countries over the period from 1979 to 2014. The panel data methodology is employed to answer the question raised in study. The fixed effect estimates indicate that, economic growth is in significant positive relationship with change in democratic situation emission. It is also evident that the CO_2 emission is higher in fluctuating ASEAN economies with relatively weak democracy such as Indonesia and Thailand and negative in the improvised democracies such Singapore. The study is among the pioneering studies on the current issue. This study will provide a guideline in environmental policy implementation.

Keywords: Carbon Emissions, Democratic Conditions, ASEAN Countries
JEL Classifications: Q2, Q4

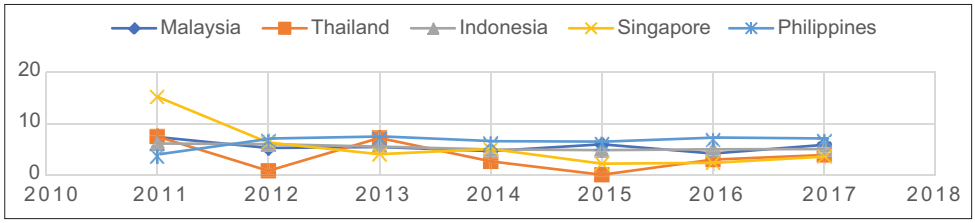
1. INTRODUCTION

The environmental Kuznets curve (EKC) proclaims that during the process of economic development, countries environmental emissions inflate contributing more towards environmental degradation, and after reaching a certain level of economic development, the emission level starts reducing and resultantly helps in restoring the environmental quality (Özokcu and Özdemir, 2017). The shape of income emission curve is an inverted U-shaped curve. The EKC hypothesis encompasses numerous factors, for instance, countries while achieving economic development alter their national income formation, i.e., they tend to advance towards services sector and industrialization (Balsalobre-Lorente et al., 2018). Moving towards industrialization then reduces the industrial emissions after a certain point. Everyday technological changes play a part in the process of green earth achievement. The demand for environmental quality increases with the improvement in per capita income. In addition, political institution is also a factor which helps in the achievement of national as well as global objectives. The current study aims to empirically analyze the relation between economic development, democracy, environmental degradation, and urbanization.

The Figure 1 shows the picture of economic turmoil in ASEAN economies, indicating an overall decline in economic growth in these countries. Meanwhile, the Figure 1 shows high economic turbulence in Thailand.

The association between environmental quality and income can only occur if the role of government policies is observed on this

Figure 1: Economic growth in ASEAN countries



Source: World Bank

relationship (Balsalobre-Lorente et al., 2018). In order to ensure quality of the environment, the political institutions practice control over the strategic environmental instruments. This phenomenon has also been discussed by several policy analysts and researchers. However, mixed empirical findings were obtained regarding EKC hypothesis (Bailey, 2017). Although, mixed findings were obtained because of different methods employed, sample size variation, and use of different variables for model formulation in order to estimate the relationship between the control variables. Being a principal component of greenhouse gases, carbon dioxide majorly contributes to the environmental degradation. It is released during various human activities. In addition, carbon naturally flows between animals, soil, atmosphere, and plants. Therefore, carbon dioxide acts as a natural element of the earth's carbon cycle and ecosystem. Thus, changes occurring in the carbon cycle of earth usually takes place due to several human activities. The carbon dioxide is released in the environment through burning of natural gas, coal, and fossil fuels, as well as during energy utilization activities. The industrial activities and land use also affects the earth's carbon cycle. Carbon dioxide particularly causes global impact as compared to local impact (Bhattacharya et al., 2017). A powerful association among democracy, income, and carbon emission is somehow complicated. Political institution affects several aspects of the relationship between environment and income. Political rights and freedom of information give rise to public awareness and environmental regulation (Oraby et al., 2018). In this regard, public interest groups can play a significant role in spreading public awareness, especially under democratic regimes. Under autocratic regime, the flow of information is censored and usually involves unilateral decision making. Contrarily, under democratic regimes the governing party tries to be more responsive. In addition, the elected government ensures the involvement of social groups during policymaking (Zhou et al., 2019). It also practices economic freedom and are inclined more towards market economies. Democratic government abides by the rule of law and follow the environmental regulations resulting in the rehabilitation of the environmental quality. The economic freedom, an economic condition involving all kinds of sub indicators i.e., market barriers, regulation, etc. The Table 1 shows the data for the top five ASEAN countries.

In a seminal paper Rafiq et al. (2016) presented the nature of association between income and environmental degradation. It has been argued that environmental quality deteriorates during the early stages of development but after achieving a certain income per capita level, the quality of environment gets better and starts improving. However, the turning point differs for every country (Ouyang and Lin, 2017). For most countries the turning point is set at $8000. Environmental quality aspects such as quality of air and water were also examined. Model estimation is done using short equations and panel data (Zhang et al., 2018). Therefore, a negatively sloped inverted U-shaped curve is presented by naming it as an EKC. Following this proposition, several other researchers attempted to reanalyze this EKC hypothesis.

The aim of this study is to focus primarily upon the theoretical and empirical literature regarding EKC hypothesis. The study also considered another series of literature to assess how democracy affect the relation among environment and emission.

2. LITERATURE REVIEW

Therefore, meta-analysis can be helpful to get a clear view of a rich literature in this area. Wehkamp et al. (2018) performed a meta-analysis, involving 67 researches and 547 regressions, in order to analyze the variations that deforestation cause in the EKC outcomes. The study reported that the more the extensive research conducted in this area the higher the susceptibility of EKC hypothesis rejection. The results suggest that the probability of EKC association largely depends upon the choice of control variables. Since, the probability of achieving EKC in terms of deforestation has found to be negatively affected by the trade. As trade redirect the transmission of macro variables and environmental degradation as a control variable. This research finding has given potential direction to the researchers for future studies in this area.

Choumert et al. (2013) have attempted to assess the theoretical dimensions of EKC hypothesis. For the EKC debate the static and dynamic classification have been adopted. As a result, several researchers disagree with this hypothesis, and few of the researchers were doubtful about the data and applying of methodology for explaining the EKC hypothesis. Those econometric issues were also inspected that arise during EKC hypothesis testing. These issues were observed in a study involving data for 132 countries for the years 1992-2012. The study employed CO_2 emissions from burning of fuel. For the purpose of EKC hypothesis testing, cross-sectional regression is done using each year's panel data set and simple t-test (Charfeddine and Mrabet, 2017).

During economic development, the financial sector has gone through a remarkable change and gained considerable attention among the researchers and analysts. Tiba and Omri (2017) conducted an empirical analysis to observe how financial development and economic growth affect the deteriorating

condition of environmental quality. For this purpose, the study employed the data for BRIC i.e., Brazil, Russia, India, and China, during the time period 1980-2007. They used panel data cointegration for data analysis, and the study concluded that EKC hypothesis is supported by the findings of the analysis. The results indicated that for a given gross domestic product (GDP), CO_2 emissions were found to be elastic for GDP and energy consumption but inelastic for the FDI. Therefore, the findings suggested that higher the elasticities the greater will be the responsiveness, i.e., changes in the energy consumption and output greatly influence the quality of environment, although it does not directly affects the foreign direct investment (Charfeddine and Mrabet, 2017).

Numerous researchers have attempted to analyze how urbanization, trade openness, GDP, financial development, and energy consumption influence the EKC. Al-Mulali et al. (2015) explored the EKC through ecological footprints of a country by employing the data for 93 countries, for the time period 1980-2008. Besides GDP and financial development, energy consumption, urbanization, and trade openness have also been added as the independent variables. The study categorized the cross-sectional data into low-income, lower-middle income, upper-middle income, and high-income economies. Thus, the findings suggested that EKC hypothesis applies to upper-middle income, and high income countries but is not feasible for low-income and lower-middle income countries. The fixed effect model (FEM) and generalized method of moments (GMM) were used for the data analysis. Apergis and Ozturk (2015) test the EKC hypothesis for 14 Asian countries spanning the period 1990-2011. The GMM methodology using panel data is employed in a multivariate framework to test the EKC hypothesis. The multivariate framework includes: CO_2 emissions, GDP per capita, population density, land, industry shares in GDP, and four indicators that measure the quality of institutions. In terms of the presence of an inverted U-shape association between emissions and income per capita, the estimates have the expected signs and are statistically significant, yielding empirical support to the presence of an EKC hypothesis.

A number of researchers have put forward a tipping band technique for taking into account those policy instruments which could be helpful in testing of EKC hypothesis. Al-Mulali and Ozturk (2016) have re-examined the EKC hypothesis, and claimed that employing tipping band is somehow appropriate for the policymakers, especially by the more EKC concerned researchers. The energy proportion obtained from the fossil fuels, country's industrial share in GDP, and carbon dioxide in kilograms, per kg of oil were taken as control variables. The data for 114 countries on CO_2 and SO_2 were obtained for the years 1960-2007. It has been argued that spotting economically reasonable tipping points is quite difficult and uncertain, particularly by using parametric baseline and non-parametric spline-based substitute (Al-Mulali and Ozturk, 2016).

Although mixed findings were obtained on how democracy affect the EKC hypothesis from the literature review. There are three schools of thought, one claims that environmental quality improves with democracy while the other one claims that environmental quality deterioration occurs due to the nature of political institutions (Nguyen et al., 2018). On the other hand, there is this third group which suggests that environmental quality is not directly affected by democracy.

Edelenbos et al. (2017) conducted a study to empirically observe the nature of association between environment and democracy using a political systems' stressful impact on those human activities that cause environmental degradation. They included five such activities which are responsible for degrading the environmental quality, such as organic water pollution, deforestation, land degradation, and carbon dioxide and nitrogen dioxide emissions (Salahodjaev, 2018). The data is used for 105 countries including 143 variables. The variables such as trade openness, population density, per capita GDP, and squared GDP per capita have been used as control variables, whereas the variable of democracy has been employed as both continuous and dichotomous variable in the model (Obydenkova and Salahodjaev, 2016). The study reported that environmental degradation reduces through democracy, however its impact may vary in case of variations in the environmental indicators. Clulow (2019) suggested that environmental quality also improves by reducing those human activities which are responsible for environmental degradation.

Polity IV is not the only democracy indicator. However, observing variations in outcomes with the changing indicators seems interesting (Escher and Walter-Rogg, 2018). Siakwah (2018) revisited the EKC hypothesis by employing the indices of freedom political rights, polity II, and civil liberties as democracy indicators, to investigate the effects of democracy and trade openness on the environmental degradation. Quantile regression methods have been employed for the cross-sectional data, for the time period 1985-2005. In the study of Yildirim et al. (2014), the conservation hypothesis is supported for Indonesia, Malaysia and the Philippines. Although a bidirectional relation is found in the case of Thailand, since there is no positive effect of energy consumption on GDP, the conservation hypothesis is supported. In the pattern of Singapore, the neutrality hypothesis is supported.

In addition, Galarraga et al. (2016) also attempted to observe the economic and demographic structure of the economies by incorporating three variables i.e., population size, trade openness and industrial share in GDP which are expected to influence pollution. Where, population size is the total population of a country, and trade openness is the proportion of annual exports plus imports in terms of GDP. Across different quantiles, heterogeneous impact of democracy is found on the CO_2 emissions. Jabeur and Sghaier (2018) have argued that in most economies, CO_2 emissions start reducing under greater democracy, however, these emissions do not tend to decline in case of improved financial openness.

Moreover, the sample size selection greatly influences the empirical analysis of EKC hypothesis. In order to assess the relation between democracy and environmental quality Mak Arvin and Lew (2011) conducted a study and 141 developing economies data have been collected for the years 1976-2003. Water pollution emissions, CO_2 emissions and deforestation were taken as the indicators for environmental qualities. The ratings for the political rights and civil liberties which is determined by the detailed examination

of country situation and lower values, represented freer societies as the freedom indicator. Besides per capita GDP, Wangler and Al Doyaili-Wangler (2017) incorporated urban population and population per square kilometer into the model. Another study used generalized least square method having fixed effect for a country per year (Böhmelt and Butkutė, 2018). The study concluded that democracy plays a positive role in improving the environmental quality. However, the improvement level differs with the selection of the environmental quality estimator. Such variations may be exceptional along different sub-units. Although, the study (Spilker and Koubi, 2016) failed to found any consistent correlation between democracy and environmental situation.

The freedom associated along the democratic system allows considering and practicing their individual environmental quality preferences, under autocratic regime. Li et al. (2016) employed a polity IV project, which is a quantitative research system of the political institution. Whereas, polity IV dataset plus ten has been taken as the independent variable, representing a political government. Any increase in this indicates more freedom between nations under democratic regime. The empirical findings supported the formulated hypothesis that democracy improves environmental quality. It has been reported that interaction of societal preference indicators and political regime attributes result in the formulation of inverted EKC.

The impact of democratic regime on the EKC can somehow also be influenced by other factors like corruption control, land area, income, education, and rural population. The researchers intended to observe how much difference income causes to the environmental degradation, in comparison with democracy. Therefore, in order to estimate the broadening scope of EKC hypothesis, income level as an economic development indicator, democracy index as well as set of other independent variable were incorporated into the model (You et al., 2015). In addition, corruption control, income, land area, and rural population were also added in order to examine the impact of these variables on the rate of deforestation, which is the average annual rate of change in forest. The data has been taken for 177 economies for the years 1990-2000. Polity index, is taken as a primary independent variable to observe democracy level. The range of its measure lies between −10 and 10, here −10 shows autocratic regime and 10 shows democratic regime. The study found a U-shaped relation between deforestation and democracy. A comparison has been done among the non-democratic economies, and mature democratic economies. The result has shown that highest deforestation rate is found in democratic economies. Moreover, deforestation rate is largely explained through democracy than income. Therefore, in order to decline the rate of deforestation, emphasis must be given to democratization than economic development. The initial economic development stage do not guarantee distributional income equality. Although, continuous income inequality levels may influence the EKC hypothesis. Shafik and Bandyopadhyay (1992) analyzed the relation between economic development, environmental degradation, income inequality and the political strength of environmental based purchasers. The study reported that democracy caused varied impacts on the environmental quality depending on the price and income effects on the demand of environmental goods. The study concluded by assuming that two kinds of individuals exist in the society, i.e., the ones having certain pollution exposure levels, and the other having different thinking. Moreover, it is expected that the decisive voter is likely to belong to the exposed group. Thus, it is found that democratization is favorable to improve the environmental quality indicating that greater the positive effects on the environmental development the more will be the difference between politically decisive actors. A few researchers suggested that such inequality poses negative impacts on the quality of environment, resulting in the equalized impact of democracy on the environmental quality.

The impact of democratic institutions' transmission channel on the quality of environment was analyzed (Shafik and Bandyopadhyay, 1992), using two environmental quality indicators for 122 economies, for the years 1960-2008. The study indicated that opposite impact of democratic institution has been found on the environmental quality, arising from the direct positive impact on the environmental quality and indirect negative impact on the investment and income inequality, through applying FEM, one-and two step GMM, and generating error terms. The findings have shown that each democracy component has the potential to individually affect the analysis. Some of the researches, also analyzed the impact of certain control variables on the environmental pollution. Batterbury and Fernando (2006) have put forward their reservations and doubts about this association by investigating a traditional association between economic growth and environmental quality. Data for air monitoring is obtained for the time period 1986-1999. Population density, governance, vulnerability, pollution-intensive activities, and per capita income were added as the explanatory variables in the study. The results indicated that governance and geographic vulnerability have considerable impacts on the air pollution of developing economies. However, political institutions' history also influences the environmental quality of a country. The environmental quality is found to be affected more by the democratic capital stock as compared to the current democracy situation (Fredriksson and Neumayer, 2013; Basheer et al., 2019). The democratic capital stock is referred as the collection of civic and social rights obtained from the prior experience. Therefore, institution and measures index, and climate laws have been incorporated in a study as dependent variables. Although, the relation between democracy and environment causes uncertain impact on the economic growth (Obydenkova and Salahodjaev, 2016). Furthermore, the comparative power of voters and political preferences and organized interest will play an essential part in the EKC hypothesis development.

3. ECONOMETRIC MODEL

The EKC hypothesis indicates a reverse association between income per capita and emission per capita, with an inverted U-shaped curve. EKC hypothesis has the following functional form:

$$E_{it} = f(Y_{it}, Z_{it}, F_i, F_t, u_{it}) \quad (1)$$

Here, the E_{it} represents per capita emission, where i is the country and t represents the year. Furthermore, Y_{it} indicates a country's

income, Z_{it} indicates a controlled set of those variables which may influence the EKC hypothesis development, F_{it} denotes the impact of cross-sectional data, F_t denotes the time effects, and μ_i indicates the residual or the error term in the model.

Considering the relationship between income and emissions, adding the quadratic equation having negative squared per capita income coefficient and positive per capita income coefficient is more preferable. For the formulation of the empirical model, the study by Bende-Nabende (2018) has been considered. Therefore, the EKC hypothesis in an equation form is presented as follows:

$$E_{it} = \beta_1 + \beta_2 Y_{it} + \beta_3 \left(Y_{it}\right)^2 + \beta_4 Z_{it} + \mu_{it} \quad (2)$$

In order to develop a quadratic equation, incomes' square is added after analyzing the structure of EKC. This form is presented by Fredriksson and Neumayer (2013). However, researchers usually prefer a cube of income to derive the n-shaped curve. In addition, taking first order derivative of above equation provides the tipping point, having correlation with the error term, i.e.,

$$\delta = -\beta_2 / 2\beta_3 \quad (3)$$

For the purpose of obtaining computational and methodological benefits, it is preferable to take log of variables. Moreover, effects of elasticity change can also be measured through the coefficients. Therefore, the model is stated as:

$$lnE_{it} = \beta_1 + \beta_2 \ln Y_{it} + \beta_3 \left(\ln Y_{it}\right)^2 + \beta_4 Z_{it} + \mu_{it} \quad (4)$$

$IMPDEM_i$ denotes those economies which are seeking to improve their democracy level over time i.e., the improved economies, and $FLUCDEM_i$ denotes those economies which are facing deterioration in their democracy level with time, or the fluctuated countries are taken as dependent variables. The CO_2 emissions per capita is taken as the explanatory variable representing the environmental emission variable. The GDP per capita is added as an explanatory variable. Thus, basic model consists of only income and emission variables, with no other variables except GDP as a control variable.

$$\ln IMPDEM_{it} = \beta_1 + \beta_2 \ln CO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(\ln GDP_{it}\right)^2 + \mu_{it} \quad (5)$$

$$lnFLUCDEMi = \beta_1 + \beta_2 lnCO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDPit\right)^2 + \mu_{it} \quad (6)$$

To represent industrial aspect, the industrial share of GDP is incorporated into the model. Following is the functional EKC form of the model:

$$lnIMPDEM_{it} = \beta_1 + \beta_2 lnCO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDP_{it}\right)^2 + \beta_5 lnIND_{it} + \mu_{it} \quad (7)$$

$$lnFLUCDEM_i = \beta_1 + \beta_2 lnCO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDP_{it}\right)^2 + \beta_5 lnIND_{it} + \mu_{it} \quad (8)$$

Democracy level is also added into the model to assess the structural change in political institution of a country. Therefore, the final model is stated as follows:

$$lnIMPDEM_{it} = \beta_1 + \beta_2 lnCO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDP_{it}\right)^2 + \beta_5 lnIND_{it} + \beta_6 PRDEM_{it} + \mu_{it} \quad (9)$$

$$lnFLUCDEM_i = \beta_1 + \beta_2 lnCO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDP_{it}\right)^2 + \beta_5 lnIND_{it} + \beta_6 PRDEM_{it} + \mu_{it} \quad (10)$$

Here, $InCo_2it$ indicates log of emissions per capita, and where i representing as the country and t as the year. Moreover, $\ln GDP_{it}$ denotes log of GDP per capita of a country at purchasing power parity, $lnIND_{it}$ indicates log for industrial share of GDP, $_{it}$ indicates country's level of democracy. In addition, the error term is correlated with the tipping point.

$$\delta = \exp.(-\beta_2 / 2\beta_3) \quad (11)$$

For another category of democracy is added to capture the more detailed insight termed as the fluctuating democracy

$$lnIMPDEM_{it} = \beta_1 + \beta_2 lnCO_2 it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDP_{it}\right)^2 + \beta_5 lnIND_{it} + \beta_6 PRDEM_{it} + \beta_7 FLUCOEM_i + \mu_{it} \quad (12)$$

$$lnFLUCDEM_i = \beta_1 + \beta_2 lnCO2it + \beta_3 lnGDP_{it} + \beta_4 \left(lnGDP_{it}\right)^2 + \beta_5 lnIND_{it} + \beta_6 PRDEM_{it} + \beta_7 FLUCOEM_i + \mu_{it} \quad (13)$$

Where, *FRDEMi* and *PRDEMi* indicates consistent completely free countries and consistent partially free countries, respectively whereas, however, for a reference group the consistently not free countries are taken in a group. Different parameters were used for the last three models estimation. The residual term i.e., $\delta = \exp.(-\beta_2/2\beta_3)$ is correlated with the tipping points of every model. Consideration of the methodological aspects are important during the model specification and obtaining restricted sample.

Transferring the effects of political institutions on the relationship between income and environment is multi-dimensional and complex. For a period of 35 years, the panel data for 10 ASEAN economies were employed. The objective of this study is to empirically analyze the way democracy influence the relationship

Table 1: Economic freedom index

Country	Score
Singapore	8.84
Philippine	7.34
Indonesia	7.16
Malaysia	6.92
Thailand	8.85

Source: Fraser institute

Table 2: Correlation

Variables	1	2	3	3	4	5	6	7	8
CO_2	**1.00**								
GDP	0.25	**1.00**							
GDPS	0.25	0.17	**1.00**						
IND	0.29	0.17	0.21	**1.00**					
FREDM	0.15	0.19	0.10	0.17	**1.00**				
PRDEM	0.16	0.15	0.15	0.21	0.01	**1.00**			
MPDEM	−0.04	−0.07	−0.11	0.19	−0.06	0.02	**1.00**		
DETDEM	−0.02	0.04	0.10	0.14	0.11	0.21	−0.16	**1.00**	
FLUCDEM	−0.52	0.16	−0.07	−0.33	0.17	−0.25	−0.18	0.47	**1.00**

between pollution and income. The study concluded that country's political institutions consistency and democracy level greatly affect the tipping point for EKC. Therefore, political rights and freedom of information give rise to public awareness and laws for the environmental regulation. Environmental interest groups tend to promote public awareness under democratic regime. The civic and social rights that are developed on the basis of historical experience facilitates in maintaining stable and responsive environmental policy. The improvement of complete democracy and perfect democracy pose heterogeneous effects on the policy agenda, economic structure, social group's bargaining power, and capability of economies. The outcomes obtained from this research lies within the scope of the limitations. Considering the present study's limitations, the particular regimes' stability and political consistency were found to be intuitive in case of EKC. The tipping point for consistently full democratic economies occurs at the lower GDP per capita levels, than in case of full democratic economies.

4. DATA AND METHODOLOGY

The data is collected for 10 ASEAN economies for the time period 1979-2014. In order to address the research questions panel data is employed. The random effect model (REM) is usually used when the dependent variable is influenced by the differences among the individuals, countries, or entities. However, the REM presumes that the differences across countries are random and have no correlation with the independent variables (Basheer et al., 2019). Putting differently, the error term of the entity is expected to have no correlation with the independent variables, in addition it allows to add time-variant variables into the model, i.e., culture, race, ethnicity, etc. However, such variables would then be immersed by the constant term under the FEM. While using REM, it is assumed that the individual characteristics will be specified, that may or may not influence the independent variables. In case of unavailability of some variables in the model, the omitted variables bias emerges. However, REM allows to generalize conclusion beyond the employed sample of the model. Thus, REM is stated as follows:

$$Y_{it} = \beta_{it} \sum_{i=1}^{k} X_{it} + \mu_{it} + \varepsilon_{it} + ... \quad (14)$$

The panel data provides the advantage of controlling the unobserved heterogeneity. In order to observe time-specific and country effects, the above equation can be written as:

$$Y_{it} = \mu_i + \theta_t + \beta_i \sum_{i=1}^{k} X_{it} + \varepsilon_{it} + ... \quad (15)$$

Table 3: Regression results of improving economic condition (IMPDEM)

Variable	Coefficient	Standard error	t-value	P-value
Fixed effects				
Constant	12.754	2.952	4.82	0.000***
GDP	0.033	0.068	4.72	0.000***
GDP2	0.508	0.773	3.66	0.000***
IND	−2.806	0.758	−3.70	0.000**
FREDM	0.178	0.046	3.88	0.000***
PRDEM	0.025	0.046	3.55	0.000***
CO_2	0.153	0.734	3.37	0.000***
FLUCDEM	0.456	0.002	2.34	0.000***
Diagnostic statistics				
R^2				
Within	0.123			
Between	0.351			
Overall	0.201			
Wald χ^2 (7)	32.89			
Prob. (χ^2)	0.000			
Multicollinearity	1.43			
Heteroskedasticity	4.0e+04			
Serial correlation	5.523			
F-Statistics	*F*(46,370) =24.02			

The unobservable heterogeneity existing across time and countries arises from the FEM accounts, allowing the value of intercept to be different across time-periods and countries. This procedure involves adding dummy for each time and country in those time-variant factors which may have some influence on the dependent variable (Kirkpatrick and Parker, 2007; Basheer et al., 2019). The benefits of FEM specification is that it allows the linkage among the explanatory variables and time-specific or individual effects. While choosing between FEM estimation or unrestricted model, and pooled ordinary least squares (OLS) or restricted model having zero country and time effect, F-test can be performed to assess the joint significance for the country coefficients relative to the pooled OLS panel.

5. RESULTS

The results of the Spearman correlation are shown in the Table 2 results of CO_2 and other explanatory variables. The correlation between CO_2 and IND is strong since the value of correlation is 0.49, which is close to 0.50. However, the correlation between CO_2 and FLUCDEM is strong above average that is 0.52 but negative relationships. Their correlation is significant at one percent level of significant. Other variables have weak correlation with CO_2 since their correlation values are low.

Table 4: Regression results of fluctuating economic condition (DETDEM)

Variable	Coefficient	Standard error	t-value	P-value
Fixed effects				
Constant	14.754	2.952	6.87	0.000*
GDP	0.033	0.068	−4.48	0.030**
GDP2	0.508	0.773	−3.66	0.012**
IND	−2.806	0.758	−3.70	0.000*
FREDM	0.178	0.046	3.88	0.000*
PRDEM	0.025	0.046	3.55	0.000***
CO2	0.185	0.785	−3.24	0.000**
FLUCDEM	0.456	0.002	2.34	0.000***
Diagnostic statistics				
R^2				
Within	0.101			
Between	0.343			
Overall	0.192			
Wald χ^2 (7)	24.89			
Prob. (χ^2)	0.00			
Multicollinearity	1.23			
Heteroskedasticity	5.0e+05			
Serial correlation	6.673			
F-Statistics	*F*(45,360) =23.02			

The regression results of the current study are shown in Table 3. After the diagnostic tests, the fixed effect methodology is appeared as most appropriate methodology in the current study, The impact of economic growth economic freedom carbon dioxide emission on the improving democratic situation situation is shown in the Table 3.

The impact of economic growth economic freedom carbon dioxide emission on the deteriorating democratic situation is shown in the Table 4.

The findings of the study indicate that, economic growth is in significant positive relationship with the economic situation emission. It is also evident that the CO_2 emission is higher in fluctuating ASEAN economies such as Indonesia and Thailand and negative in the improvised economies such Singapore. The results are in line with the hypothesized results.

6. CONCLUSION

According to the hypothesis of EKC, with the level of development, countries are involved in the activities for reducing their emission level along with the degradation of environment through pollutant emissions. The curve in the income emission panel has inverted U shape. Different factors are being considered for this hypothesis. The factors being considered involve the change in national income composition when countries develop. The countries move towards service sector and industrialization. After reaching a specific point of development, the changes support in reducing the level of emissions. With every passing day, technology is changing that is adding to green earth. With the increase in income level of people, the demand for quality of environment increases as well. When goals of national and internal level are considered, the political institution is not out of the block. The association among economic development, democracy, environmental degradation and urbanization has been empirically investigated through this research. The dynamic relationship between economic growth, economic conditions, carbon emission, and democracy is a complex phenomenon. The impact of political institution on the connection of income and environment is multi-dimensional. Freedom of information and political rights give rise to environmental regulation and public awareness. More awareness can be advanced by environmental interest groups particularly in democratic regimes.

The process of decision making becomes unilateral and flow of information also get censored in autocratic system as compared to democratic governments, who acts to be more responsive towards public. Accountability of the elected government representative guarantees to include social groups while making policies. The government under democratic system gives preference to the market economies and also approves economic freedom. The democratic government obeys the rule of law as well as expected to comply with environmental legislations resulting in restoration of environmental quality. The changes in the relation of carbon emissions, democracy and income are rather complicated. There are different sides of the impact of political institutions on the transmission process of environment-income nexus. The freedom of information and political rights has resulted in the development of environmental policies along with awareness for public. In a democratic situation, the groups having interest in environment can create more awareness.

REFERENCES

Al-Mulali, U., Ozturk, I. (2016), The investigation of environmental Kuznets curve hypothesis in the advanced economies: The role of energy prices. Renewable and Sustainable Energy Reviews, 54, 1622-1631.

Al-Mulali, U., Saboori, B., Ozturk, I. (2015), Investigating the environmental Kuznets curve hypothesis in Vietnam. Energy Policy, 76, 123-131.

Apergis, N., Ozturk, I. (2015), Testing environmental Kuznets curve hypothesis in Asian countries. Ecological Indicators, 52, 16-22.

Bailey, I. (2017), New Environmental Policy Instruments in the European Union: Politics, Economics, and the Implementation of the Packaging Waste Directive. Abingdon, United Kingdom: Taylor and Francis.

Balsalobre-Lorente, D., Shahbaz, M., Roubaud, D., Farhani, S. (2018), How economic growth, renewable electricity and natural resources contribute to CO2 emissions?. Energy Policy, 113, 356-367.

Basheer, M.F., Ahmad, A., Hassan, S. (2019), Impact of economic and financial factors on tax revenue: Evidence from the Middle East countries. Accounting, 5(2), 53-60.

Basheer, M.F., Helmi, M., Waemustafa, W. (2019), Impact of bank regulatory change and bank specific factors upon off-balance-sheet activities across commercial banks in South Asia. Asian Economic and Financial Review, 9(4), 419-431.

Batterbury, S.P., Fernando, J.L. (2006), Rescaling governance and the impacts of political and environmental decentralization: An introduction. World Development, 34(11), 1851-1863.

Bende-Nabende, A. (2018), FDI, Regionalism, Government Policy and Endogenous Growth: A Comparative Study of the ASEAN-5 Economies, with Development Policy Implications for the Least Developed Countries. United Kingdom: Routledge.

Bhattacharya, M., Churchill, S.A., Paramati, S.R. (2017), The dynamic impact of renewable energy and institutions on economic output and CO2 emissions across regions. Renewable Energy, 111, 157-167.

Böhmelt, T., Butkutė, E. (2018), The self-selection of democracies into treaty design: Insights from international environmental agreements. International Environmental Agreements: Politics, Law and Economics, 18(3), 351-367.

Charfeddine, L., Mrabet, Z. (2017), The impact of economic development and social-political factors on ecological footprint: A panel data analysis for 15 MENA countries. Renewable and Sustainable Energy Reviews, 76, 138-154.

Choumert, J., Motel, P.C., Dakpo, H.K. (2013), Is the environmental Kuznets curve for deforestation a threatened theory? A meta-analysis of the literature. Ecological Economics, 90, 19-28.

Clulow, Z. (2019), Democracy, electoral systems and emissions: Explaining when and why democratization promotes mitigation. Climate Policy, 19(2), 244-257.

Edelenbos, J., Van Buuren, A., Roth, D., Winnubst, M. (2017), Stakeholder initiatives in flood risk management: Exploring the role and impact of bottom-up initiatives in three 'room for the river' projects in the Netherlands. Journal of environmental planning and management, 60(1), 47-66.

Escher, R., Walter-Rogg, M. (2018), Does the conceptualization and measurement of democracy quality matter in comparative climate policy research? Politics and Governance, 6(1), 117-144.

Fredriksson, P.G., Neumayer, E. (2013), Democracy and climate change policies: Is history important? Ecological Economics, 95, 11-19.

Galarraga, I., Gonzalez-Eguino, M., Rübbelke, D.T. (2016), Environmental economics, climate change policy and beyond: A tribute to Anil Markandya. Environmental and Resource Economics, 63(2), 219-224.

Jabeur, S.B., Sghaier, A. (2018), The relationship between energy, pollution, economic growth and corruption: A partial least squares structural equation modeling (PLS-SEM) approach. Economics Bulletin, 38(4), 1927-1946.

Kirkpatrick, C.H., Parker, D., editors. (2007), Regulatory Impact Assessment: Towards Better Regulation? Chicago: Edward Elgar Publishing.

Li, T., Wang, Y., Zhao, D. (2016), Environmental Kuznets curve in China: New evidence from dynamic panel analysis. Energy Policy, 91, 138-147.

Mak Arvin, B., Lew, B. (2011), Does democracy affect environmental quality in developing countries? Applied Economics, 43(9), 1151-1160.

Nguyen, C.P., Ai Nhi, N., Schinckus, C., Su Dinh, T. (2018), The ambivalent role of institutions in the co2 emissions: The case of emerging countries. International Journal of Energy Economics and Policy, 8(5), 7-17.

Obydenkova, A., Salahodjaev, R. (2016), Intelligence, democracy, and international environmental commitment. Environmental Research, 147, 82-88.

Oraby, T., Bauch, C.T., Anand, M. (2018), The environmental Kuznets curve fails in a globalized socio-ecological metapopulation: A sustainability game theory approach. In: Handbook of Statistics. Vol. 39. Amsterdam: Elsevier. p315-341.

Ouyang, X., Lin, B. (2017), Carbon dioxide (CO_2) emissions during urbanization: A comparative study between China and Japan. Journal of Cleaner Production, 143, 356-368.

Özokcu, S., Özdemir, Ö. (2017), Economic growth, energy, and environmental Kuznets curve. Renewable and Sustainable Energy Reviews, 72, 639-647.

Rafiq, S., Salim, R., Nielsen, I. (2016), Urbanization, openness, emissions, and energy intensity: A study of increasingly urbanized emerging economies. Energy Economics, 56, 20-28.

Salahodjaev, R. (2018), Is there a link between cognitive abilities and environmental awareness? Cross-national evidence. Environmental Research, 166, 86-90.

Shafik, N., Bandyopadhyay, S. (1992), Economic Growth and Environmental Quality: Time-series and Cross-country Evidence. Vol. 904. Washington, DC: World Bank Publications.

Siakwah, P. (2018), Actors, networks, and globalised assemblages: Rethinking oil, the environment and conflict in Ghana. Energy Research and Social Science, 38, 68-76.

Spilker, G., Koubi, V. (2016), The effects of treaty legality and domestic institutional hurdles on environmental treaty ratification. International Environmental Agreements: Politics, Law and Economics, 16(2), 223-238.

Tiba, S., Omri, A. (2017), Literature survey on the relationships between energy, environment and economic growth. Renewable and Sustainable Energy Reviews, 69, 1129-1146.

Wangler, L., Al Doyaili-Wangler, S. (2017), What drives compliance with international environmental agreements? A political economy analysis of international and national determinants. In: Economics of International Environmental Agreements. New York: Routledge. p15-34.

Wehkamp, J., Koch, N., Lübbers, S., Fuss, S. (2018), Governance and deforestation-a meta-analysis in economics. Ecological Economics, 144, 214-227.

Yildirim, E., Aslan, A., Ozturk, I. (2014), Energy consumption and GDP in ASEAN countries: Bootstrap-corrected panel and time series causality tests. The Singapore Economic Review, 59(2), 1450010.

You, W.H., Zhu, H.M., Yu, K., Peng, C. (2015), Democracy, financial openness, and global carbon dioxide emissions: Heterogeneity across existing emission levels. World Development, 66, 189-207.

Zhang, B., Wang, Z., Wang, B. (2018), Energy production, economic growth and CO2 emission: Evidence from Pakistan. Natural Hazards, 90(1), 27-50.

Zhou, T., Hu, W., Yu, S. (2019), Characterizing interactions of socioeconomic development and environmental impact at a watershed scale. Environmental Science and Pollution Research, 26, 1-13.