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Political Freedom, Economic Freedom and Co2 Emission in Long Run: Evidence from ASEAN Countries

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Abstract

The prime objective of the current study is to investigate the impact of political freedom, and economic freedom on CO₂ emission in the ASEAN countries in the long run. The ASEAN countries, which are in southeast of ASAI are highly industrial countries and there are increasing concerns on environmental related issues in these countries. The model of the current study is based on Environmental Kuznets curve. The Carbon Dioxide has an influence at global level rather than national this research has taken Carbon Dioxide only for the measure of emission after taking into consideration different types of emissions and their contributions to the natural atmosphere. The use of CO₂ has been made for analyzing the nexus of political freedom, economic freedom and CO₂ emission. This study by using Johansen cointegration test proved political freedom and economic freedom as key determinant of CO emission in ASEAN countries. The data of 27 years from 1991-2017 is collected from the reliable databases. Overall, the findings of the study are providing support to the hypothesized results as political freedom is negative, whereas the economic freedom is in positive relation. This study will provide a guideline in environmental policy implementation.

Keywords: CO₂, political freedom, Economic freedom, Environmental Kuznets curve ASEAN

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Introduction

Currently, it is important for the global leaders to develop keeping in consideration the environment. Global warming has become a key concern for the society and environmental protectionist. Almost every country is experiencing challenges due to global warming. The policy agenda is dominated because of the political institutions. The relation between environmental emissions, indicator of development and the effects of industrialization taken by the political institution state has been investigated in this research study.

According to the Environmental Kuznets Curve (EKC) hypothesis, as a nation's level of development advances, it becomes more likely that it will take steps to lower the amount of pollution it emits and the damage it does to the surrounding environment. The U-shaped income emission curve went in the other direction (Panayotou, 2016). This theory takes into account a wide range of different considerations. There are a variety of factors that contribute to this, and one of them is the manner in which the distribution of national wealth changes as countries advances. The emphasis of developing countries is shifting more and more toward the industrial

economy and the service sector (Dryzek, 2013). Once a certain level of development has been reached, the modifications contribute to a reduction in the total quantity of emissions. Every day that passes brings with it new technological developments that are beneficial to the green earth. People's expectations of the quality of the area they occupy grow in tandem with the amount of discretionary income they have available to spend. When both national and internal goals are taken into consideration, the political institution is not quite out of the starting gate yet. In this research, an empirical investigation of the link between economic growth, democratic development, the degradation of the natural environment, and the spread of urbanization is carried out. The countries that make up the Association of Southeast Asian Nations are outlined in

Table 1.

CO2 emission in Asean countries

Years	Malaysia	Thailand	Indonesia	Singapore	Philippines
1999	4.764	2.827	1.16	12.648	0.906
2000	5.423	2.879	1.245	12.167	0.904
2001	5.723	3.062	1.375	11.972	0.892
2002	5.527	3.251	1.41	11.31	0.877
2003	6.41	3.479	1.436	7.566	0.866
2004	6.508	3.741	1.51	6.834	0.875
2005	6.8	3.782	1.508	7.117	0.8867
2006	6.415	3.829	1.502	6.998	0.771
2007	6.941	3.814	1.612	4.343	0.808
2008	7.526	3.794	1.764	7.467	0.809
2009	7.204	4.001	1.865	11.214	0.841
2010	7.772	4.195	1.768	10.96	0.905
2011	7.498	4.121	2.457	8.724	0.897
2012	7.962	4.372	2.56	6.847	0.942
2013	8.033	4.622	1.945	10.312	0.996
2014	8.096	5.02	1.819	10.306	1.055

The association between the income and quality of environment is influenced by the government policy. The strategic instruments or policies are structured by the political institutions related to the quality of environment (Howes, 2017). Several researchers and policy makers have argued on the influence of political institutions on environmental quality. There are mixed evidence related to EKC hypothesis. The results of different research are varied because of the difference of variables involved in the study, technique or method of research employed, use of control variables and sample. The basic greenhouse gas that leads to the degradation of environment among several other pollutants is carbon dioxide (CO₂). However, a natural amount of carbon circulates in the environment, which is important for plants, animals and soil. The existence of carbon dioxide is naturally to occur in the environment, which is the part of carbon cycle of Earth. The natural carbon cycle is disturbed by human activities, which result in emission of gas. Different activities of human being result in the emission of carbon dioxide such as use of energy resources (fossil fuel combustion including oil, coal and natural gas). This consumption of non-renewable energy sources is done for the transportation, industrial activities, which use of land. The political freedom in Asean region is comparably lower than other region as it is evident from the figure that no country free rather four countries are partially free and two are not free politically (see figure 1)

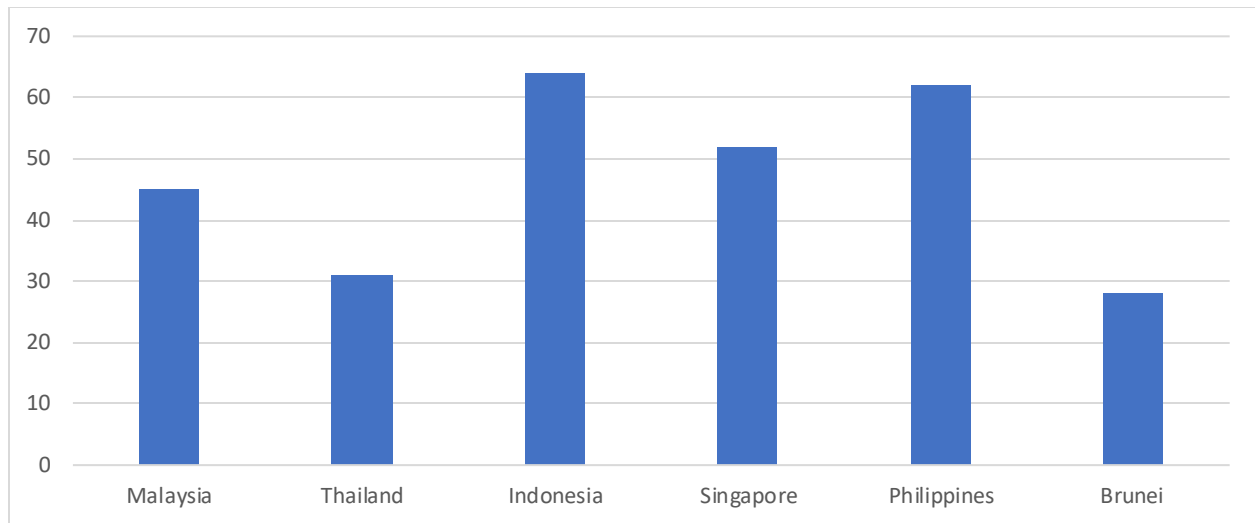


Figure 1.
Political freedom score of Asean countries
Source: freedom House

The shifting dynamics of the interaction between emissions of greenhouse gases, political liberty, and economic success are complex. It has been shown that political institutions may have both beneficial and detrimental impacts on the transmission of the environment-income nexus. Freedom of the press and political engagement have been the driving forces behind the creation of new environmental rules and increased public education. In a society that is democratic, environmental advocacy groups may be able to do more to bring environmental concerns to the attention of the general population. (Adams & Klobodu, 2017). However, when there is no democracy, flow of information is blocked, and the process of decision-making is one sided as compared with democracy. In a democratic country, the government has to be responsive towards the public interests in contrast to the non-democratic countries. The social group involvement in the development of public policy is ensured by the electoral accountability of representative government.

Market economies are preferred by the democratic government and economic freedom is given sustained. Such governments obey the rule of law and fulfill the agreements related to environment resulting in improved quality of environment.

Literature Review

In 1954, during the 67th annual meeting of American economic association, the association between income distribution and per capita income was given by Simon Kuznets (Stern, 2018). It was proposed by the Kuznets curve hypothesis that at higher level of income, the income distribution is skewed to high-income level. With the increase of per capital income, the skewness of curve is reduced and inequality of income decreases. A number of researchers have tested the feasibility of Kuznets Curve Hypothesis for implementing it to the environmental economics. The environmental degradation has been replaced by income distribution. By replacing this, it becomes environmental Kuznets curve (EKC) hypothesis. The most recognized contributions have been made by Panayotou (2016).

The researchers have proposed a relation between environmental degradation and income in a seminal paper. It has been argued by Wu et al. (2018). that with development, the quality of environment is disturbed at initial level. However, with the increase of per capital income after a certain level, the quality of environment starts improving. Different countries have different turning point for this. Most of the countries reach this point when they are at \$8000 income level. Countries reaching this level take into consideration the water and air quality along with other aspects of environmental quality. For research, Howes (2017). employed panel data using short-term equations for model estimation. In this way, an inverted U-shaped environmental Kuznets curve is

defined, which is negatively sloped. The EKC hypothesis has been evaluated through literature review. The focus of this research is on the theoretical findings related to EKC and empirical literature, which has been done over recent years. After conducting literature review on EKC hypothesis, further researches have been reviewed related to its contribution to the influence of democracy on nexus of environment-emission.

A meta-analysis was conducted by Belbasis et al. (2018), which was based on 69 studies. The research involved almost 547 regressions and the variations in the EKC hypothesis results were investigated by incorporating deforestation to be the indicator of environmental degradation. It was found that the probability of declining EKC is greater with greater research. It was concluded that there is a significant impact of control variables (selection) on the occurrence of EKC relationship. The chance of EKC result regarding deforestation is negatively influenced by the use of trade as a control variable.

It was argued that because of variables such as trade, the transmission channel of environmental degradation and macro variables is changed. A good direction is given to the researchers by this finding. This provides future research implications for EKC hypothesis. Several researchers have explored the theoretical aspect of EKC hypothesis. Among several researchers, the theoretical aspect of EKC model was studied by Özokcu and Özdemir (2017). The researchers made use of changing and static classification aspect among various classifications related to theoretical discussion of EKC.

It was found that several researchers have not agreed with the hypothesis. There is doubt shown by them related to the use of research method and data for EKC curve. Some alternatives were proposed by Wang, et al. (2018). After the analysis of basic econometric issues related to the traditional estimation method of environmental Kuznets curve. For resolving the issue of time effect problem and cross-sectional dependency, it was proposed to adopt a between estimator. The variations of technology cannot be resolved through time dummies, as indicated by Stern, and it can result in this may lead to the contemporary association between the residual errors, country effects and regressor. The important econometric issues were analyzed by Chow and Li (2014), which exist in the testing of EKC hypothesis. For the analysis, data from about 132 countries over the period 1992-1994 was used. Carbon dioxide emissions from combustion of fuel were used. For every year, cross sectional regression with panel data was done. For testing EKC hypothesis, t-test was used.

With the use of ecological footprint, Al-Mulali et al. (2015) analyzed the environmental Kuznets curve of a country. Almost 93 countries were used in the study for exploring the relation for the time of 1980-2008. In addition to the financial development and GDP, the researchers used urbanization, energy consumption and trade openness as independent variables. The cross-sectional data was used in the research study, which was classified as low income, upper income, lower middle income and upper middle-income countries. It was found that the validity of Environmental Kuznets Curve is only for high income and upper middle-income countries. However, it is not valid for the other two income groups used in the study. The results were found through use of Generalized Method of Moments and fixed effect model.

Some researchers were doubtful about the employed research methodology for testing EKC hypothesis. They presented the use of tipping band rather than tipping point as a solution for policy instruments. The EKC hypothesis was examined by Bernard et al. (2015) and it was argued that the use of tipping band is easier for policy makers related to Environmental Kuznets Curve. EKC was analyzed with three control variables include emission of CO₂ in kilograms, GDP and use of energy from fossil fuels by a country in percentage form. Over the time of 1960-2007, the data for almost 114 countries was taken for the research. The countries involved were using SO₂ and CO₂. It was concluded by Bernard et al. (2015) that it is difficult to identify tipping point, which is plausible economically. Moreover, it is uncertain to analyze it through use of parametric and non-parametric baseline alternatives.

Carbon Emissions and Political Freedom

For quality of environment in a country, the demand for quality of environment by individuals is crucial in a civil and political system. The positive relation between quality of environment and CO₂ emission is discussed by Hart et al. (2018). According to the researcher, the reason for the positive association among these is non-provision of public goods in a non-democratic country including environmental quality in contrast to the democratic economies.

The income share received by the political elite is disproportionate and for this, they have to incur the cost associated with the regulation of environment. A proportionate share in the form of benefits associated with control of pollution is received by this group. A model similar to the one presented by Deacon was proposed by Spilker et al. (2017). It had the similar arguments with the addition of a short horizon of planning possessed by less democratic regimes. The model did not confirm a positive relation between the environment and political freedom. The role of social groups with interest in the environment is promoted by a system having representative legislature. Through provision of subsidies for industries, the carbon emissions can increase with political freedom, in case the effect is biased because of unfriendly environmental solutions. When there is environmental issue of CO₂ emissions across the globe, the impact of political freedom on environment can be insignificant as any country have the option to free ride. There can be association among the emission of global pollutants with some other problems linked with environment. Political freedom can create an influence in this way Fankhauser et al. (2015). Due to the instability risks across the globe, a country's preferences for global quality of environment can become high. For instance, the indication can be in the form of increase in number of climate conferences.

There is mixed literature available on the influence of democracy on Environmental Kuznets Curve. It has been argued by some researchers that the quality of environment is enhanced through democracy while another group of analysts has said that the quality of environment is deteriorated with the involvement of political institutions. A third group of researchers claims that there is no direct influence of democracy on the quality of environment. The debate was taken into account by Beeson (2018) and the relation was explored. The use of empirical evidence with key concern on the impact of political regime and social activities resulting in the destruction of quality of environment were taken into account. The researchers employed five environmental degradations, which were the result of human activities such as deforestation, emissions of CO₂, water pollution, degradation of land and emissions of Nitrogen oxide. Almost 105 countries were studied in the research and 143 variables. The control variables involved were population density, trade openness, per capital GDP and per capita GDP squared. The dichotomous variable was Democracy, also used as continuous variable. It was found that environmental degradation is reduced by democracy and there are variations in its effects. By restricting human activities through government policies, the degradation of environment can be controlled in some ways. It is interesting to know about the changes in results because of using different variables. The only indicator for democracy is not Polity IV index. Other indicators that can be used for democracy can be Civil Liberties, Freedom House Political Rights Index and Polity measure. The EKC hypothesis was re-studied by Al-Mulali et al. (2015). for analyzing the influence of trade openness and democracy on environmental quality. The method of Quantile regression was used. Cross-section data over the time of 1985-2005 was used in the study. The demographic structure of different countries is likely to impact their pollution levels. For studying their structures, size of population, trade openness and industrial share in GDP of the country were the variables involved in the research.

The ratio of total imports per year plus total exports per year to GDP is called Trade openness. The total population of a country is the size of its population. The influence of democracy on carbon emissions is varied over quantiles. Emissions are lower for the economies where there is high democracy. It is not reduced through more financial openness. The environmental pollution is affected by the political institutions in different ways taking into consideration the current pollution level of the countries.

The selection of sample affects the EKC empirical analysis. The Environmental Kuznets Curve can only be explained by the developing countries. The relation between quality of environment and democracy was explored by Fakhfakh, and FitzRoy (2018), using data of almost 141 developing countries for time 1976-2003. The variables used as the measure of environmental quality were emissions of water pollution, emissions of CO₂ emissions and deforestation. The detailed analysis of the circumstances of every country was done for numerical ratings for civil and political liberties of Freedom House. It was indicated that freedom indicator is the society with lower values. Moreover, population per square kilometer, urban population as ratio of total population were used in the research model along with GDP per capita in order to study the influence of population growth and urbanization on the environmental quality. Method of Generalized Least Squares was used with fixed effect for every country and year. It was analyzed that improvements in the environment are supported by democracy. The degree of improvement is varied based on the environmental quality measure. Different samples have variables for these variables. Any reliable relation between the environment and democracy cannot be concluded by the research.

Other variables such as corruption control, total area of land, income, education and rural population can influence the impact of democracy on Environmental Kuznets Curve. It is interesting for some researchers to study the role of democracy in environmental degradation. The definition of EKC was broadened by Fredriksson and Neumayer (2013) through use of democracy index for the explanation of income-emission nexus. The influence of land area, corruption control, education, deforestation, rural population and education was studied. The average rate of change in forest per year for over 177 countries was taken into study for 1990-2000. The level of democracy was used as the primary variable and it was selected from the Polity index. The range of polity measure was -10 to +10 (autocratic to democratic). According to Mol (2014) there is an inverse U-shaped association between democracy and deforestation. By making comparison of democratic countries and non-democratic countries, the deforestation rates are high in democratic transition. In defining the rates of deforestation, the income factor has low explanatory power as compared with democracy. The focus should be on the reduction of deforestation through democratization rather than just on economic development.

In early development stages, income equality distribution is not ensured through economic development. EKC hypothesis can be influenced through continuous income inequality. The relation between economic development, political powers, degradation of environment, income inequality was analyzed by Policardo (2015). The majority of consumers buying goods related to environment were taken into account as well. The researcher classified the individuals of the society in two categories, having different exposure level to the pollution. It was expected that the most exposed individual group would be used as decisive voter. It was found that environment is benefited through democratization when the difference in income between the two decisive actors is high.

Some researchers have claimed that the quality of environment is negatively influenced by this inequality. The influence of democracy on quality of environment is overcome by this effect. The process through which democratic institution influences the quality of environment was examined by You et al., (2015). The researcher used data of 122 countries for time 1960-2008. Two indicators for quality of environment were considered. It was found by the researcher that an opposite impact is created by democratic institution on environmental quality. This is resulted from the positive impact on quality of environment and negative effect on income inequality and investments (indirect). The one-step and two-step GMM system was used for the study with fixed effect estimators. The regressor econometric model was generated by residuals.

The effects of democracy are under discussion. The analysis can be affected by the individual factor of democracy. The effects of democracy and some control variables have been analyzed on environmental pollution in some literature studies. The traditional relation between environmental quality and economic growth has been doubted by Sugiawan and Managi, (2016). They have used the data of time 1986-1999. The control variables used in research included

population density, governance control, economic activity causing pollution and vulnerability and per capita income. According to Mol (2014), in a number of cities in the developing country, there is some effect of geographic vulnerability and governance on air pollution levels.

It has been argued by Fredriksson and Neumayer (2013) that the quality of environment in a country is affected by its political institution history. The capital stock of democracy creates influence on environmental quality more than the current democracy state. The stock is referred to be the accumulation of social and civic right developed from the history. Institutions, Climate Laws and Measures Index (CLIMI) have been used as the dependent variables. According to Mukherjee and Chakraborty (2013), a crucial role is played by economic growth in the relation of democracy and environment. An important role is played by the preferences of voters, political will and relative strength in the development of Environmental Kuznets Curve. EKC hypothesis has been explained from different perspectives in the previous research studies. The quality of environment is influenced by the stock of democratic capital, individual democracy and the different elements of democracy.

Carbon Dioxide and Economic Freedom

The effective or optimal use of resources can be done through an important component, which is the Economic freedom. Different variables of economic freedom are important for economic growth and affect the emission of carbon dioxide. Three hypotheses have been developed to study the effects. The first one is related to the Efficiency Effect. It is assumed in this that the result of economic freedom is competitive and efficient market (Mironiuc & Huian, 2018). However, a negative relation can exist between the emissions of CO₂ and economic freedom. The optimal use of resources is done because of liberalization. However, the resources have price and it can be influenced through economic policies such as taxation for externality. The political regulations and consumer demands can be dealt in a better way, when the market is efficient. Firms develop products with innovations in order to survive in the competitive markets. When there is consumer demand for clean production or environmental regulations, this influence is relevant. Due to the free-riding chances for individuals or countries, the emissions of carbon dioxide are not expected to happen through resource efficiency because of the global public good character of CO₂ emissions (you et al., 2015). However, reduced emissions are resulted because of the direct relation of CO₂ emissions with the efforts of Cost minimization and energy consumption.

The second hypothesis is related to the Trade Regulation Effect. Economic freedom is reduced because of restriction on trade or high taxes. Because of the pressure associated with international competition, effective allocation of resources could be the result of trade liberalization. A so-called effect of 'Pollution Haven' can exist (Dalby, 2015). Economies having production, which is capital intensive and low environmental regulation structure are expected to have specialization in industries with dirty activities (more emissions). Increased specialization is resulted through trade. Some countries work to reduce their emissions while some strive to increase. However, the global pollution remains constant. Trade liberalization is results in two effects. The two effects include Pollution Haven effect and the efficiency effect. The final effect is not clear. It is expected that the carbon emissions will decrease with the increase in efficiency. The structure of a country demonstrates whether the pollution haven effect is negatively/positively related with the emissions.

The third hypothesis is related to the Stability Effect. Better decisions related to consumption and investment can be made when the price stability is high. Long investment horizons are supported through a macroeconomic environment, which is stable. Several investments related to environment are made with the surety that the economy will remain stable unless profits are retained. The level of emissions can be reduced when the macroeconomic environment is stable. The structure of property rights is a crucial factor of stability effect. In literature, there has been great emphasis on the importance of contracts viability and security of property rights (Andersson, 2018). Long-term investments to improve efficiency can be made when there are secure property rights. Increased level of consumption and investment can be resulted with secure property rights. It is less likely to happen that investments are related to the decrease in CO₂ emissions because

of public good character of CO₂ emissions. Investment changes related to energy consumption can affect the emissions.

Data

The data has been sourced from the World Development Indicators CD-Rom (Buchanan et al. 2018). The data related to emissions of carbon dioxide has been taken from the Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center and Environmental Sciences Division. The standard measurement of CO₂ emissions has been done in metrics tons per capita. These emissions are because of the fossil fuel consumption and cement manufacturing. The emissions include the carbon dioxide from flaring of gas, liquid fuels, and gas fuels and sold fuels. Through purchasing power parities, the data of GDP has been converted into international dollars. The source of economic freedom data is Economic Freedom of the World: Annual Report (Howes, 2017). Freedom of exchange, property protection and personal choice are the main components of economic freedom index. Seven categories of economic freedom index have been made. The measurement of every index is done on the 0-10 (0-lowest and 10-highest) scale. Section 2 presents the hypothesis and categories used. The efficiency effect is represented by the category of Economic structure and market use. The share of government allocation and production is measured in this category. The international exchange category is representing the Trade Regulation, which involves the Freedom to trade with foreigners. The stability effect is represented by the average of price stability and monetary policy along with Legal Structure (E, Property Rights and Price Stability). The money protection as store of value is measured by the price stability and monetary policy category. The property right security is measured by the property rights and legal structure along with contracts viability. Since 1970, the data of economic freedom is reported after every five years. However, not all the countries are included in the report.

The measures of political freedom variables are dependent on the civil and political freedom indices of Freedom House (Fiedlschuster, 2018). It is measured through the political freedom index that the government has come to power in a democratic way or through use of strength. Moreover, it involves the analysis of elections to be fair and free as well as the existence of opposition. The media or press freedom constraints and individual rights to express debate and establish organizations are measured in the index of civil freedom. These include the pressure groups as well as political parties. The average value of the two indices is used because of high degree of association among these. The average index is called POL (Political Freedom). This index is measured on the scale of 1-7 (1-lowest and 7-highest).

Methodology

The Johansen cointegration analysis has been used in order to investigate and assess the link throughout the course of a longer period of time. This technique is ascribed to Johansen and Juselius, who worked together to create it (1990). The method by which we estimate the long-term and short-term connections involving multivariate equations was dramatically transformed by this procedure. The method of computing the cointegrating vectors and the number of cointegrating vectors between the variables is an improvement over the method that Engle and Granger used to test for cointegration (1987). In order to circumvent the ergogeneity problem, this method treats all of the variables as if they were endogenous latent variables. This is accomplished for the same reason as the Johansen and Juselius method circumvents the problem. The Johansen-Juselius model may also be used to offer estimates for the connection between variables. This is possible due to the fact that causality estimation is included into the VECM. In the last step of the calculation, maximum eigenvalue and trace statistics are used in order to determine the number of cointegrating relationships as well as the expected signs of their coefficients. When determining whether or not there is cointegration, the stationarity of the residual is what is examined using the Engle and Granger approach.

Utilizing the Johansen cointegration approach allows for the single equation that is found in an error correction model to be enlarged into a multivariate equation. Let's say that CO_2 is the

amount of emissions, Z_t is the amount of political freedom, X_t is the amount of economic freedom, and Y_t is the amount of increase in GDP.

$$Z_t = [Y_t, X_t, W_t] \dots (1)$$

The AR model of equation can be

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} \dots A_k Z_{t-k} + \varepsilon_t \dots \dots \dots (2)$$

Equation (2) may be altered to VECM as given in equation (3)

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} \dots \Gamma_{k-1} \Delta Z_{t-k-1} + \Pi Z_{t-k} + \varepsilon_t \dots \dots \dots (3)$$

Where, $\Gamma_1 = [I - A_1 - A_2 - \dots A_k]$, $i=1,2,3,\dots,k-1$

$$\Pi = -(I - A_1 - A_2 - \dots A_k)$$

The Π matrix has to be of the type since there are three variables that may be considered independent (3 x 3). The pace of convergence to equilibrium either quickens or slows down depending on the value of the variable being studied. This can be broken as $\Pi = \alpha\beta$ where α contains the speed of adjustment towards equilibrium. The long-run coefficient is denoted by β and βZ_{t-1} , which is also an error-correcting word. Consider the situation in which $k = 2$ as an illustration of a more straightforward form of the third equation.

$$\begin{bmatrix} \Delta Y_t \\ \Delta X_t \\ \Delta W_t \end{bmatrix} = \Gamma_t \begin{bmatrix} \Delta Y_{t-1} \\ \Delta X_{t-1} \\ \Delta W_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ X_{t-1} \\ W_{t-1} \end{bmatrix} + \varepsilon_t \dots \dots (4)$$

THE ECt equation (2) can be written as

$$\Pi_t Z_t = [\alpha_{11}\beta_{11} + \alpha_{21}\beta_{21}][\alpha_{21}\beta_{12} + \alpha_{22}\beta_{22}][\alpha_{31}\beta_{13} + \alpha_{32}\beta_{23}] \begin{bmatrix} Y_{t-1} \\ X_{t-1} \\ W_{t-1} \end{bmatrix} \dots \dots \dots (5)$$

The equation can be transformed into yield equation as

$$\Pi_t Z_{t-1} = \alpha_{11}(\beta_{11}Y_{t-1} + \beta_{21}X_{t-1} + \beta_{31}W_{t-1}) + \alpha_{12}(\beta_{12}Y_{t-1} + \beta_{22}X_{t-1} + \beta_{32}W_{t-1}) \dots (6).$$

According To Enders (2004) α_{11} and α_{12} are speed of adjustment terms

RESULTS

The findings of the correlation test that was done on the different variables are shown in Table 1. The correlation coefficient demonstrates that there is a robust relationship between all of the variables in this investigation. The correlation between economic freedom (EF), market freedom (MO), pricing stability (PRS), housing supply growth (HDP), and political stability (POLT) is shown in Table 1.

Table 1.

Correlation		1	2	3	4	5	6
CO_2	1	1					
TO	2	-0.1830	1				
MR	3	-0.5257	0.6483	1			
PRS	4	-0.7810	0.6188	0.8929	1		
GDPG	5	0.6456	-0.4363	0.8129	0.7579	1	
POLT	6	0.7308	-0.7847	-0.7828	-0.7674	0.6882	1

The Johansen cointegration test begins with the selection of the appropriate lag period for the analysis. The perfect lag time is one that is sufficiently lengthy that it cannot be distinguished from background white noise. The Vector Autoregressive Model determines the best lag length to use in order to achieve Johansen cointegration (VAR). Following that, the information criteria are used in order to establish the lag order (Enders, 2004). The results of these analyses are shown in Table 2, which shows how different information requirements suggested different acceptable latencies for cointegration. The Akaike Information Criterion (AIC) was used in order to arrive at the conclusion that two-lag was optimal, whereas the Schwartz Information Criterion led to the conclusion that one-lag was optimal (SIC). The AIC has suggested that two delays be established,

and those delays have already been implemented. The objective is to find a solution that is both straightforward and successful.

Table 2.

Lag Length Selection Criterion

Lag	LogL	LR	FPE	AIC	SC
0	-730.929	NA	4.05e+12	46.058	46.332
1	-624.659	166.047*	5.24e+10*	41.667	43.590*
2	-585.566	46.418	5.58e+10	41.473*	45.046

Note: LR: sequence modified LR test statistics; FPE: final prediction error AIC: Akaike information criterion; SC: Schwarz information criterion HQ: Hannan-Quinn information criterion. * denote choice of lag

Cointegration is a statistical technique that analyzes the long-term connections that exist between at least two non-stationary variables. For the cointegration test to be considered valid, it is necessary for both variables to be integrated in the same direction. The Johansen test makes use of the trace test and the maximum eigenvalue test. By using these two tests, it is possible to determine how many cointegrating equations are present in a system. The results of the cointegration analysis are shown in Table 3.

The regression results of the model 1, 2, and 3 which explains the impact of political instability on the saving of the ASEAN countries are explained the table 1. The findings of the study are showing consistency with the prior finds. The results of the model 1 indicates that the economic freedom variables ha significant impact on CO emission. Because of the results of the political freedom model, countries that have a history of political stability often have low levels of carbon emissions. A variety of scholarly investigations have been carried out on the topic of the correlation between the state of the environment and political freedom.

Table 3.

Johansen cointegration test

Dependent Variable: CO_2	Model 1	Model 2	Model 3
TO_{t-1}	0.0177*** (0.010)		0.0089** (0.244)**
MR_{t-1}	0.0198** (0.027)		0.0170 (0.149)
PRS_{t-1}	0.0254** (0.014)		0.0243** (0.071)
$GDPG_{t-1}$	0.0222 (0.176)	-0.0313* (0.074)	0.0284* (0.075)
$POLT_{t-1}$		-0.0488** (0.094)	-0.0633** (0.098)

The vast majority of studies have shown a positive link; however, these findings do not take into consideration the impact of carbon emissions. There is a direct connection between the amount of political space that is available and the possibility of participants at international conferences on the subject of lowering the levels of global pollution coming to an agreement with one another. According to the findings of this study, the implementation of these agreements has only just started, indicating that it is too soon to come to any definitive conclusions on the relationship between political freedom and emissions.

Conclusion

The political regulations and consumer demands can be dealt in a better way, when the market is efficient. Firms develop products with innovations in order to survive in the competitive markets.

When there is consumer demand for clean production or environmental regulations, this influence is relevant. Due to the free-riding chances for individuals or countries, the emissions of carbon dioxide is not expected to happen through resource efficiency because of the global public good character of CO₂ emissions. However, reduced emissions are resulted because of the direct relation of CO₂ emissions with the efforts of Cost minimization and energy consumption For quality of environment in a country, the demand for quality of environment by individuals is crucial in a civil and political system. The positive relation between quality of environment and quality of environment is discussed by Hart, (2018). According to the researcher, the reason for the positive association among these is non-provision of public goods in a non-democratic country including environmental quality in contrast to the democratic economies. The role of social groups with interest in the environment is promoted by a system having representative legislature. Through provision of subsidies for industries, the carbon emissions can increase with political freedom, in case the effect is biased because of unfriendly environmental solutions. When there is environmental issue of CO₂ emissions across the globe, the impact of political freedom on environment can be insignificant as any country have the option to free ride. There can be association among the emission of global pollutants with some other problems linked with environment. Political freedom can create an influence in this way Fankhauser, et al, (2015). Due to the instability risks across the globe, a country's preferences for global quality of environment can become high. For instance, the indication can be in the form of increase in number of climate conferences. This study by using Johansen cointegration test proved political freedom and economic freedom as key determinant of CO₂ emission in ASEAN.

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