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## Thriving or Declining? Unraveling Corruption, Environmental Quality, Energy Consumption, and Economic Growth in ASEAN Countries

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### Chronicle

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### Abstract

The current study is carried out to explore the link between Corruption, Environment quality, Energy consumption and economic growth in selected Asean countries. In addition to that, the present study aims to highlight the direct impacts of corruption upon environmental degradation, energy consumption, and economic progress. For this purpose, the analytical framework has been particularly used. Theoretically, environmental quality is expected to be directly influenced by corruption using taxation and regulations, while corruption affects economic growth which in turn affects the quality of environment. Therefore, economic growth is negatively influenced by the levels of corruptions. The higher the levels of corruption the lower will be the GDP level of an economy. This lower GDP level then influences the environmental quality, and thus confirms the EKC hypothesis. This paper has employed cointegration model for analyzing the association between environmental quality, energy consumption, corruption, and economic growth for the data involving 5 ASEAN countries i.e. Malaysia, Thailand, Singapore, Philippines, and Indonesia for the years 1960-2021. The literature review has shown no empirical study that have employed cointegration model for examining the effects of corruption on energy consumption, environmental quality, and economic growth. The findings of the study are in line with the proposed hypothesis. The study which is among the pioneering studies will be helpful for policymakers and researchers.

**Keywords:** Corruption, Environment quality, Energy Consumption, Economic Growth Asian countries

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## INTRODUCTION

Foreign Corruption (CORR) gives rise to infinite challenges in the field of social and economic sciences. Economists have been exploring the significance of CORR using several research dimensions and contributing in the stream of literature. Numerous economic analyses in past have attempted to examine how CORR directly influences the macroeconomic variables of the economy. However various researches (Huang 2016; Sekrafi & Sghaier 2016) investigated the impact of CORR on the growth or economic development (ECD). While other studies have not encouraged the empirical estimation methods that were being employed for assessing the income-pollution nexus. Therefore, CORR as well as other inefficiencies that arise in institutions are mentioned as the crucial factor in influencing the total factor productivity of a country and have been the area of concern for the government to protect environmental quality (ENQ). In comparison with the social optimal level, the non-optimal decisions of the government results in greater emission levels at per capita GDP (Keig et al., 2015). Therefore, the greater the CORR level, the more will be the emissions above the social optimum level.

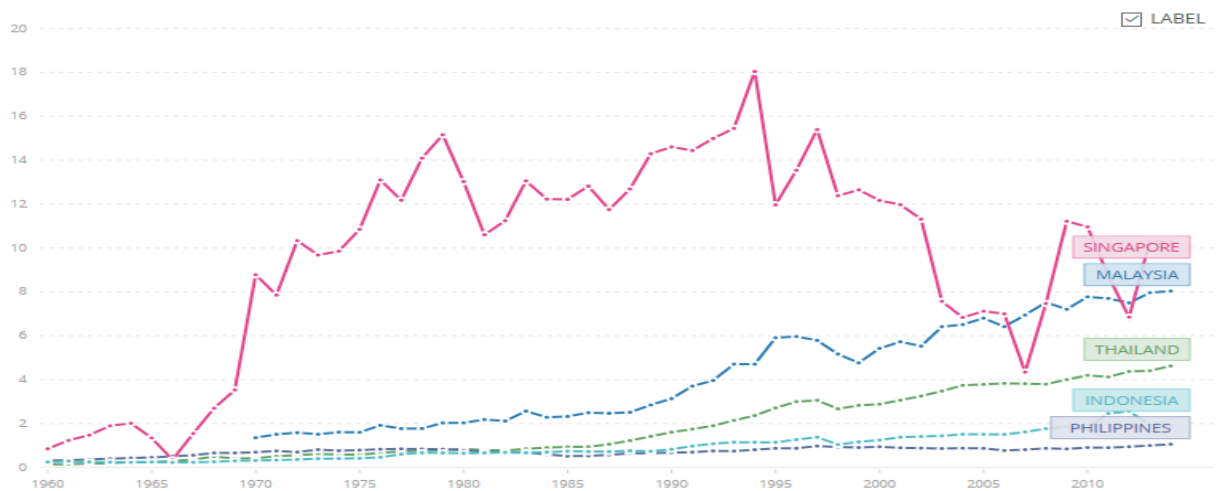
Unpredictable effects of trade liberalization are found on the environmental policy, at certain levels of CORR (Almeida et al., 2017). They found that higher CORR levels cause greater trade liberalizations effects on the environment. According to a few economists, CORR indirectly affects the natural resources and environment. However, in developing countries the pressures from the special interest groups have significantly affected the government policies which are responsible for the decisions regarding land use (McCarthy & Robinson 2016). The larger and smaller firms are chosen to assess the impacts of CORR on these firms having patents and quality certificates. The study concluded that increased CORR greatly reduces the likelihood of obtaining patents and quality certificates by these firms (Paunov, 2016). However, smaller firms are more likely to be affected by CORR as they tend to be more sensitive to the acquisition of quality certificates.

According to Sekrafi and Sghaier (2016), the decisions that the government has made that are less than optimal have led to actual emission levels that are higher than what would be considered socially optimal at any GDP per capita income level. The degree to which one strays from the social ideal is directly proportional to the extent of one's involvement in corrupt activities. (Johari and Ibrahim, 2018) came to the conclusion that the level of CORR determines whether or not the impact of trade liberalization on environmental policy will be positive or negative. The researchers made the discovery that there is a connection between the degree of CORR and the effect that trade liberalization has on the environment. Some environmental economists are of the opinion that CORR has an effect on the quality of the environment due to the fact that it has an effect on natural resources.

Indeed, the lobbying efforts of special interest groups in a number of developing countries have had a significant influence on the policies governing land use decisions in these countries. These policies are governed by the governments of these countries. Countries like China, India, and Brazil are examples of those that fall into this category. Talvitie (2017) conducted research to investigate how bribery and other forms of CORR influence the operations of both small and large companies, particularly those that are dependent on quality certifications and patents. According to the findings of his investigation, CORR makes it less likely that these companies will obtain quality certifications. Smaller businesses, which are more susceptible to the introduction of quality certifications, are also the most common places to find instances of corrupt behaviour.

The present study aims to highlight the direct impacts of CORR upon environmental degradation, energy consumption (ENC), and economic progress. For this purpose, the analytical framework has been particularly used. Theoretically, ENQ is expected to be directly influenced by CORR using taxation and regulations, while CORR affects economic growth (ECG) which in turn affects the quality of environment. Therefore, ECG is negatively influenced by the levels of corruptions. The higher the levels of CORR the lower will be the GDP level of an economy. This lower GDP level then influences the ENQ, and thus confirms the EKC hypothesis. This paper seeks to investigate the direct association among CORR and environmental degradation, ENC, and ECD. In addition, it attempts to assess the negative association between these variables by assessing the mediating impacts poses by corruption. Therefore, the main research question of present study is:

RQ: What is the nature of association between ECG, ENC, environmental degradation, and CORR in ASEAN economies? The paper is arranged as: literature review is presented in the next section followed by the results of the empirical testing of hypotheses. The data was employed for 5 ASEAN economies. Thus, the last section includes the results and conclusion as well as implications for future studies are also presented.



**Figure 1.**  
**Economic Growth**  
**Source: The World Bank**

## LITERATURE REVIEW

### Impact of CORR on ECG

Numerous studies have been theoretically and empirically tested that whether CORR creates hindrance in the development and growth of an economy. However, no clear consensus has been found among the economists regarding the role of corruption. For Asian countries, the average rate of annual ECG was found to be 7 percent during 1986-1996, whereas a poor percentage of only 2.5 % was found for the rest of the world (Rigg, Bebbington et al. 2009) Although, during these years, Asian countries have also witnessed high CORR levels. However, this finding was inconsistent with the previous empirical studies. After the pioneering study several other studies (Dimant & Tosato 2018) have confirmed that CORR impedes the ECD and growth of a country. Therefore, the contradictory findings from the previous studies and strong coexistence between high levels of CORR and ECG in few economies have steered to reconfirm the generality of underlying researches.

Positive impact of CORR is found on ECG (Rose-Ackerman & Palifka 2016) it also acts as a driver of ECG during strict government regulations and bureaucratic delays which encourages private agents to find solutions for the political inefficiencies. CORR improves the economic efficiency (Hanousek et al., 2017) and poses positive influences over ECD (d'Agostino et al. 2016). Contrarily, several researches have highlighted CORR as a key contributor of instable growth. The corrupt political officials tend to mispend public

resources, such as by directly filling their pockets with the collected taxes, or granting contracts to the highest bribe offering agents than the efficient ones (Significant negative impact of financial openness and political institutions' CORR on ECG was found, using data for 109 economies (Takuma et al., 2014) indicating that negative impact of CORR on the ECD is maximized by the financial openness. Economic efficiency can only be enhanced through corruption, if the government size exceeds the optimum level (Dzhumashev, 2014). The study indicated that the rate of CORR decreases with the lowering of ECG. As ECD increases the wage rates and the cost of private rent-seeking also increases, resulting in low levels of CORR (Sekrafi & Sghaier, 2016).

A few studies have shown that during uncertainty CORR may results in improved ECG, thus supporting the grabbing hand theory through empirical evidences. A study was conducted to examine the effects of transmission mechanism on ECG, following the cross-sectional researches that were conducted during 1970-1985. Two distinct periods are taken i.e. data for 54 economies for the years 1960-1995, and sample of 49 economies during 1996-2000, using Ordinary Least Square and 2-stage least square regression for estimating the model sustainability and to overcome the problem of endogeneity. The results indicated a negative influence of human capital and investment through transmission mechanism on ECD, whereas, a significant positive impact of transmission mechanism was found on political instability. A total of 1002 researches have explored the nature of CORR (Nurudeen et al., 2015).

The study exhibited the empirical evidence of the association among ECG and corruption, administering the data sources, countries panel, and effect type. It incorporated countries with the grouping of high-income economies and low-income economies. The results exhibited the negative impact of CORR on the overall growth of GDP per capita, whereas in mixed economies it has more detrimental effects as compared to low-income economies and poses indirect impacts on ECG which are comparatively greater than the direct effects. Furthermore, a one unit decline in CORR index is likely to increase the growth rate of GDP per capita by 0.59 percentage points, for low-income economies, whereas group of economies involving non-LICs and LICs have a higher effect on the growth of GDP per capita i.e. -0.86 percentage points. The effects of CORR were analyzed on the quality of governance and investment & growth, for a data of 71 countries during 1970-1998 (Mendoza, Lim et al. 2015) Variables for the CORR are taken from the Transparency International and the World Bank.

The study concluded that besides the effect of CORR over investment, it also negatively influences the growth. However, these effects differ with the type of the governance. It has also explained that reduction in the accumulation of capital is not the sole channel for affecting the growth, rather it is also affected by other means which needs to be explored further. Particularly, corruptions' marginal effect on growth is found to be positive for less political institutions. Otherwise, positive association exists among efficiency and CORR in countries having ineffective political institutions (Nguyen et al., 2017; Basheer et al., 2019). Using a sample of 73 underdeveloped and developed economies, the study attempted to explore whether CORR acts as an impulse to entice foreign direct investment, as the prevalence of CORR encourages firms to avoid mismanaged or disorganized administrative constraints and regulations.

It is somehow generalized that CORR helps to make beneficial transactions which are not healthy for the economy. Consequently, the economic efficiency improves by making private sector individuals to eliminate or correct failures of the government. A theoretical model was formulated showing how CORR affects ECG under different institutional structures (Thach et al., 2017). Particular countries and regimes are responsible for the nature of the influence of corruption. Therefore, these regimes are classified, based on the quality of institutions. Negative effect of CORR is found on growth, for countries having better institutional quality, whereas less negative or positive effect is found for countries having poor institutional quality.

### **CORR and ENQ**

Recently, environmental and economic impacts of CORR have been proposed by a rapidly increasing literature. However, mixed results have found for these studies. A few of the researches reported a negative impact of CORR on ENQ. Moreover, CORR also influences the dysfunctional system of environmental governance which usually found to be responsible for the over-exploitation of natural resources, extinction of species, destitution of local wildlife stakeholders, invasive species, degradation of wildlife habitats and ecosystem, pollution, and spreading of diseases. Thus, CORR influences minimal ENQ control (Thach et al., 2017). Thus, CORR tends to break the already established rules as well as play its role in reducing environmental regulations. According to (Chakraborty & Mukherjee, 2013) higher CORR generally benefits those actors which can offer highest bribes at the cost of socially optimal outcomes.

However, lower levels of CORR leads to more effective and strictly imposed policies regarding ENQ (Abid, 2017). In addition, CORR also influences the environment (Halkos et al., 2015) via informal economic sectors. Moreover, strict environmental regulations enable firms to move closer to the informal economy for profit maximization. Under informal economy, production level is expected to steer pollution and environmental degradation, particularly if the firms are allowed to avoid environmental regulations (Sterner & Coria 2013) have rationalized the positive impact of CORR on the quality of environment. He suggested that through corruptions' negative impact on economic progress, it indirectly results in the improvement of ENQ. Therefore, slow ECG results in the decline in the pollution emissions. have first attempted to investigate the indirect impact of CORR upon ENQ. Indeed, ECG and PIB per capita have found to be negatively affected by corruption.

### **CORR and ENC**

The energy sector is susceptible to corruption, involving the mixed private and public actors as well as frequently embodied center with monopoly power. Considering the CORR perceptions index, 32 prominent economies of mining were considered, which undertakes the extraction of uranium, oil, coal, and natural gas. According to (Lambsdorff, 2015) nine of these countries scored greater than 5 while the rest of the countries obtained a score of 4.8 or less.

The study concluded that oil dependent economies are generally identified by their poor governance and corruption. (Hansen & Flyverbom 2015) proposed three axes through which CORR can influence the policy making related to energy. Firstly, higher CORR levels reduce the strictness or severity of energy policy. (Sovacool & Andrews 2015)

suggested that increased costs of bringing bribery together results in the more strictness of energy policy, and thirdly, the political pressures of capital owner lobby's and workers is largely dependent upon how policy influences the income of the members of lobbies. A sample of dynamic panel of OECD countries was taken on the energy use per unit of value added, during 1982-2016 (Zoundi, 2017). The findings of the study have supported and confirmed a number of predictions. Such as in OECD countries, strong correlation is found among higher CORR and lower efficiency of energy. Higher costs of coordination cause reduction in the effect of capital lobby.

In addition, the influence of coordination costs on the policy of worker and capital lobbies are in fact associated. Particularly focusing on the sectors related to energy, opposite effects of coordination costs have been found for the policy influence of these two groups. In fact, the U-shaped association is found among the coordination costs for capital owner lobby and policy success. Whereas, an inverted shaped curve was also found for worker's lobby. The relation among state stability, corruption, and oil rents have been also analyzed (Sekrafi and Sghaier 2016). The results indicated that a significant increase in CORR occurs as a result of increase in the oil rents.

### **ECG and ENC**

(Bhattacharya et al., 2016) have studied the relation among ECG and ENC for the first time, and time ended enough attention by the researchers in the area of energy economics. Numerous research studies have confirmed the strong correlation among ECG and ENC. Most of the empirical studies (Shahbaz et al., 2017), reported that economic progress leads to the increase in ENC. The empirical studies in the literature regarding this relationship are divided into further categories, i.e. the first group involves studies providing evidences for the bidirectional or unidirectional association. In this context, a unidirectional causality is reported, i.e. from ENC to the ECG.

Another study (Shahbaz et al., 2017) also reported a one-way causality between ENC and ECG. A study involving G6 countries have analyzed the relation among ECG and ENC, the study concluded that negative causality exists among the variables. A positive two-way causality is found among CO<sub>2</sub> emissions, ECG, and ENC in the long run for Latin America and Caribbean countries (Al-Mulali et al., 2015). The second study (Shahbaz et al., 2017) have failed to find any causality among these two variables. which are grouped on the basis of time period and methods employed, which can influence the direction of relation between the variables.

### **ECG and ENQ**

Due to the extreme worsening of air quality, numerous studies have attempted to analyze the relation among ENQ and ECG, based on the EKC hypothesis. This theory states that the augmented growth results in increased carbon emissions, and these emissions starts declining while reaching a certain level of output. A large number of studies have shown interest in exploring the EKC hypothesis. Thus, it can be classified as a set of cross-sectional researches (Jebli et al., 2016) and a set of panel researches (Jebli & Youssef, 2015). In order to consider the statistical relation among ENC, ECG and carbon emissions, 12 MENA countries were employed. The study reported a U-shaped curve and confirmed the existence of hypothesis for UAE, Lebanon, and Egypt.

## ENC and ENQ

A few EKC hypothesis related studies have examined the income elasticity for clean environment. Engel's law states that the share of expenditures of low-income people for basic necessities and food is comparatively higher as compared to the expenditures of high-income societies for similar commodities. As the level of income and standard of living improves with increase in ECG, the society tends to demand more for the clean environment. Policy makers often get pressure to make policies and new regulations for preserving the ENQ. Therefore, clean environment can be considered as a luxury, having its elasticity of demand greater than unity. A few EKC studies have considered the impact of foreign trade on the quality of environment. Two arguments are found in this context. The first argument is that free trade positively influences ENQ, in addition, it also compels firms to make efficient use of the available resources, with increased level of competition.

Foreign trade tends to improve the level of communication between the countries and allow developing economies to adopt cleaner technologies. Therefore, it results in the reduction of environmental pollution in the long run. The other argument states that the environmental degradation in developing economies increases as a result of increase in the volume of foreign trade. In developed economies, the establishment of the international trade structure assures the transformation from heavy to light industry, whereas, in developing countries, the heavy industry is rapidly boosting in the industrial sector. Manufacturing of heavy industrial items involve more usage of energy which in turn contributes to environmental degradation. Hence, as developed countries lower their level of population as a result of free trade, the developing countries in turn raises their level of pollution. The demand for the energy related to fossil fuel has been growing since decades and touched the exponential growth rate.

Therefore, this exceptional increase resulted in catastrophic environmental damages and disasters. Indeed, non-renewable ENC tends to enhance ECG so as the carbon emission levels. Numerous studies (Song et al. 2016) exhibited the ENC's negative impact on ENQ. A database of ASEAN countries were employed to assess the association among trade openness, urbanization, political stability, industrial output, and ENC on environmental degradation (Al-Mulali, Saboori et al. 2015) Outcomes from using the fully modified ordinary least square method, have shown that industrial development, urbanization, ENC, and trade openness increases the level of environmental destruction or exploitation in the MENA economies. Furthermore, the study also exhibited the bidirectional causality among ENQ and ENC both in the long and short run. The relation among ENQ and ENC have been verified using data for 14 economies MENA economies (Omri, Daly et al. 2015). The outcomes of the analysis have confirmed the one-way causality i.e. from ENC to the carbon emissions.

## ANALYTICAL FRAMEWORK

Using the cointegration model, the authors of this study investigated the relationship between ECG, levels of corruption, ENC, and ENQ from 1960 to 2021 in Malaysia, Thailand, Singapore, the Philippines, and Indonesia. The Association of Southeast Asian Nations is comprised of these countries as its members (ASEAN). Based on a review of the relevant literature, it appears that the cointegration model has not been utilised in any actual world studies to investigate the connection between corrupt practises and the

consumption of energy, the quality of the environment, or the rate of economic expansion. This holds true despite the fact that the model has been applied in a variety of different settings in the past. Using a structural model with three equations, this research investigated the effects of corruption, ECG, and CO2 emissions on ENC; the effects of CORR and ECG on ENQ; and the effects of CO2 emissions, ECG, and CORR on ENC. The results of this research were documented and presented in a paper that was subsequently published in the journal Environmental Research Letters. The following functional forms were employed to investigate the potential effects of varying degrees of CORR on ENQ. Co-integration is the phenomenon that occurs when two or more time series are coupled to create a long-lasting equilibrium relationship. According to these researchers, R2 will be reliable but insufficiently explain the actual estimation result. Co-integration testing has evolved into a crucial practise due to the following factors: Time series variables with either deterministic or stochastic trends were chosen as the variables to be analysed. Co-integration must be investigated because detrending does not resolve the issue of spurious regression. For trending time series, the R2 statistic used to evaluate the adequacy of regressions produces significantly misleading results. The Johansen cointegration method permits the expansion of an error correction model's single equation into a multivariable equation. Let's say ECG is  $L_t$ , ENQ is  $M_t$ , ENC is  $N_t$ , and CO2 emissions are  $T_t$

$$L_t = [M_t, N_t, T_t] \dots \dots \dots (1)$$

The AR model of equation can be

$$L_t = B_1 L_{t-1} + B_2 L_{t-2} \dots B_k L_{t-k} + \epsilon_t \dots \dots \dots (2)$$

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

$$\Delta L_t = \Phi_1 \Delta L_{t-1} + \Phi_2 \Delta L_{t-2} \dots \Phi_{k-1} \Delta L_{t-k-1} + \Gamma L_{t-k} + \epsilon_t \dots \dots \dots (3)$$

$$\text{Where, } \Phi_k = [I - B_1 - B_2 - \dots B_k], i=1,2,3,\dots,k-1$$

$$\Gamma = -(I - B_1 - B_2 - \dots B_k)$$

Because it is assumed that there are three variables, the result is a matrix  $\Pi$  that is 3 by 3. This is represented as the equal sign  $\Pi = \alpha\beta$ , where  $\alpha$  represents the rate at which the equilibrium adjusts.

An error correction term is denoted by  $\beta Z_{t-1}$  while the long run coefficient is denoted by  $\beta$ . To illustrate this point with a straightforward illustration, the equation (3) can be written as follows:

$$\begin{bmatrix} \Delta M_t \\ \Delta N_t \\ \Delta T_t \end{bmatrix} = \Gamma_t \begin{bmatrix} \Delta M_{t-1} \\ \Delta N_{t-1} \\ \Delta T_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \end{bmatrix} \begin{bmatrix} \Delta M_{t-1} \\ \Delta N_{t-1} \\ \Delta T_{t-1} \end{bmatrix} + \epsilon_t \dots \dots (4)$$

THE ECT equation (2) can be written as

$$\Gamma_t Z_t = [\alpha_{11}\beta_{11} + \alpha_{21}\beta_{21}][\alpha_{21}\beta_{12} + \alpha_{22}\beta_{22}][\alpha_{31}\beta_{13} + \alpha_{32}\beta_{23}] \begin{bmatrix} M_{t-1} \\ N_{t-1} \\ T_{t-1} \end{bmatrix} \dots \dots \dots (5)$$

The equation can be transformed into yield equation as



$$\Gamma_i L_{t-1} = \alpha_{11}(\beta_{11}M_{t-1} + \beta_{21}N_{t-1} + \beta_{31}T_{t-1}) + \alpha_{12}(\beta_{12}M_{t-1} + \beta_{22}N + \beta_{32}T_{t-1}) \dots (6).$$

According To Enders (2004)  $\alpha_{11}$  and  $\alpha_{12}$  are speed of adjustment terms.

## RESULTS

Table 1 shows the Pearson correlation coefficients used in this study to assess the strength of correlations among the independent variables. No correlation coefficients among the independent variables show value greater than 0.80, as shown in Table 1. According to Gujarati and Porter (2009), a benchmark of 0.8 level of correlation is adopted to detect the presence of Multicollinearity. The results of the analysis of the correlation between the variables are presented in Table 1. According to the correlation coefficient, all of the variables that were considered in this investigation have a strong connection to one another. The data presented in Table 1 illustrates the relationship between carbon dioxide emissions (CO2), ENC (EC), levels of CORR (CORP), and ECG (EG) (EQ).

**Table 1.**  
**Correlation**

|      | 1 | 2       | 3       | 4       | 5       | 6      |   |
|------|---|---------|---------|---------|---------|--------|---|
| CO2  | 1 | 1       |         |         |         |        |   |
| EC   | 2 | -0.1830 | 1       |         |         |        |   |
| CORP | 3 | -0.5257 | 0.6483  | 1       |         |        |   |
| EG   | 4 | -0.7810 | 0.6188  | 0.8929  | 1       |        |   |
| EQ   | 5 | 0.6456  | -0.4363 | 0.8129  | 0.7579  | 1      |   |
| POLT | 6 | 0.7308  | -0.7847 | -0.7828 | -0.7674 | 0.6882 | 1 |

In the vast majority of economic studies, estimating the lag length of an autoregressive process for a time series is one of the most important econometric exercises. The information criteria should be the initial measures considered when analysing a time series, in order of importance. However, when these criteria are applied, the "lag length" yields inconsistent results. In the context of Johansen cointegration, David and Juselius (2001) proposed that the lag length be set in such a way that the VAR residuals have no autocorrelation, even if this necessitates longer lags than those recommended by the information criteria.

This is the case even if it is necessary for longer lags than those recommended by the information criteria. This was among their contributions to the Johansen cointegration context. Prior to beginning the procedure for estimating the value of the Johansen cointegration model, either the lag length will be chosen or determined. The most essential aspect of the analysis is determining the appropriate lag period for the Johansen cointegration test. In an ideal universe, the delay would be long enough to produce white noise.

**Table 2.**  
**Lag Length Selection Criterion**

| Lag | LogL     | LR      | FPE       | AIC     | SC      |
|-----|----------|---------|-----------|---------|---------|
| 0   | -430.918 | NA      | 5.04e+13  | 45.155  | 47.342  |
| 1   | -427.667 | 42.043* | 6.22e+11* | 43.349  | 44.539* |
| 2   | -455.543 | 45.428  | 6.54e+11  | 43.463* | 46.126  |

The Vector Autoregressive Model is used to determine the optimal lag length for achieving the best Johansen cointegration results (VAR). The lag order is then determined by applying the information criteria (Enders, 2004). The results of these analyses are shown

in Table 2, which illustrates how different information criteria suggested different optimal lags for cointegration. The Schwartz Information Criterion (SIC) recommended only one lag, whereas the Akaike Information Criterion (AIC) recommended two lags. AIC's recommendations for two delays were implemented. The goal is to achieve the best results while minimising expenses as much as possible. Cointegration is concerned with the long-term relationships that exist between at least two nonstationary variables. To conduct the cointegration test properly, the variables must be integrated in the same order each time. Using the trace test and the maximum eigenvalue test, which are both components of the Johansen test, one can determine the number of cointegrating equations. The findings of the cointegration analysis are displayed in Table 3.

**Table 3.**  
**Johansen cointegration test**

| Dependent Variable: | Model 1 (EG)         |
|---------------------|----------------------|
| CO2 <sub>t-1</sub>  | 0.0177***<br>(0.010) |
| EC <sub>t-1</sub>   | 0.0198**<br>(0.027)  |
| CORP <sub>t-1</sub> | 0.0254**<br>(0.014)  |
| EG <sub>t-1</sub>   |                      |
| EQ <sub>t-1</sub>   | 0.0222**<br>(0.176)  |

This paper particularly employed a co-integration involving three equations that allow to consider the effects of i) corruption, CO<sub>2</sub> emissions, and ENC on ECG; ii) CORR and ECG on the quality of environment; and iii) CO<sub>2</sub> emissions, ECG, and CORR on the ENC, simultaneously. Following functional forms have used to explore theoretical impacts of CORR levels on the quality of environment. The all models have provided support to the proposed relations.

## CONCLUSION

The primary objective of this empirical study is to examine the effect of CORR on ENC, ECG, and carbon dioxide emissions in five ASEAN countries from 1960 to 2014. This study covers the time period from 1960 to 2014. In addition, the study examined how varying levels of CORR affected carbon emissions, ECG, and ENC. In fact, the majority of studies have focused on the direct relationship between CORR and ENQ or pollution. However, only a handful of studies have examined the indirect effects of CORR by analysing factors such as ECG or ENC as indicators of pollution. This study will hopefully shed light on the indirect effects that CORR has on environmental degradation, ENC, and ECD. The analytical framework served this purpose remarkably well and was extremely useful. On the basis of how the model variables are affected by corruption's effects, these effects have been classified as either indirect or direct.

CORR is anticipated to have direct effects on ENQ in the areas of taxes and regulations. In addition, CORR influences ECG, which in turn influences ENQ. As a result, the levels of CORR have a negative impact on the expansion of the economy. CORR has a negative correlation with a nation's gross domestic product. The EKC hypothesis is supported by

the impact of this lower GDP level on the quality of the environment. As a result, under most conditions the EKC for CO<sub>2</sub> is almost always a monotonous straight line. Alternatively stated, increased economic activity does not result in a cleaner environment in terms of carbon dioxide emissions. In addition, it is stated that the linear correlation between income and CO<sub>2</sub> emissions can be attributed to CO<sub>2</sub>'s pervasiveness as a pollutant. As a direct result, countries have not yet made a significant effort to reduce their CO<sub>2</sub> emissions. An older study presented a very similar argument to this one (Oraby et al., 2018). They note that as income rises, there is a proportional decrease in local pollutants due to the increased local benefits of pollution control. On the other hand, global emissions of pollutant gases such as CO<sub>2</sub> will continue to increase. Because CO<sub>2</sub> is a global pollutant, it would appear that the inverted U relationship is less theoretically possible in the case of CO<sub>2</sub> emissions.

This is because the inverted U relationship necessitates a local pollutant. Nevertheless, empirical studies have demonstrated that the evidence for the EKC hypothesis regarding CO<sub>2</sub> emissions is currently mixed. It has been established that this is the case. Multiple types of relationship patterns have become apparent. Despite the fact that some studies find a linear relationship between CO<sub>2</sub> emissions and income, other studies assert that the relationship is U-shaped with illogical turns. In addition, research indicates that the relationship between the two variables resembles the letter N. The purpose of the present study is to investigate the relationship between corrupt practises and ENQ. Several Asean nations' ENC and rates of economic expansion are correlated. In addition, the purpose of this study is to highlight the direct relationship between CORR and environmental degradation, ENC, and ECD. The analytical framework served this purpose remarkably well and was extremely useful. CORR is anticipated to have direct effects on ENQ in the areas of taxes and regulations.

In addition, CORR influences ECG, which in turn influences ENQ. As a result, the levels of CORR have a negative impact on the expansion of the economy. CORR has a negative correlation with a nation's gross domestic product. The EKC hypothesis is supported by the impact of this lower GDP level on the quality of the environment. This study utilised the cointegration model to examine the relationship between ENQ, ENC, levels of corruption, and ECG rates for Malaysia, Thailand, Singapore, the Philippines, and Indonesia utilising data collected between 1960 and 2012. The study spanned the years 1960 to 2021. No empirical studies have utilised the cointegration model to investigate the effects of CORR on ENC, ENQ, or ECG, according to a review of prior research. The study's findings lend support to the proposed hypothesis, as evidenced by their findings. Those responsible for policy formulation and those conducting research will find this study's findings useful.

## DECLARATIONS

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