

Governance, Financial Development and Environmental Quality in ASEAN Countries

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Abstract

This study measures the consequences of Governance and financial development (FD), Economic activity and energy on the environmental quality of five ASEAN nations specifically Malaysia, Indonesia, Thailand, Vietnam, and the Philippines. By using the panel data covering the period from 2000 to 2018 the EKC hypothesis has been examined. The outcomes of the study exhibit that governance and FD have a substantial positive impact on the environmental quality. Whereas, the economic growth and energy are discovered to be havoc for the environmental quality. Based on the empirical outcomes, it is suggested that the ASEAN countries must improve the governance and financial development to have an improved environmental quality. Moreover, economic growth must be achieved by using the non-renewable energy sources.

Keywords: Governance, Financial Development, Environmental Quality, EKC.

Introduction

ASEAN region consists of ten member states including Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. The region is well known for its different ecological, political, and financial attributes. “Governance” refers to the methods, frameworks, and cycles that direct a country’s political processes. Financial development is another component of a country’s economic growth (EG). It describes the advancement of financial institutions and markets and the accessibility of financial services and products. However, some researchers focus on the link between FD and environmental deprivation, especially in relation to increasing CO₂ emissions.

Environmental standard plays a crucial role in the sustainable development. It describes the state of the environment in expression of pollution levels, natural resource use and overall ecological health. Environmental deprivation can have remarkable negative impacts on the human health, biodiversity, and the long-term economic activities.

ASEAN countries are well known for their natural resources, however, facing some challenges due to rapid industrialization and economic growth. In these countries, deforestation, air contamination, water pollution, and irrational resource extraction all have become serious concerns. Deforestation, day to day activities, transportation, industrialization and the production of petroleum products are the major sources of CO₂ emissions. Therefore, it is considered that industrial growth has a significant role in the sharp rise of CO₂ emissions, especially in emerging nations (Maslin, 2008; Shahbaz et al., 2013). These principle increases in greenhouse gas concentrations.

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Mensah et al. (2018) shared mixed results in terms of energy consumption and its impacts on emissions in specific ASEAN Countries. The accelerated industrial growth in these countries especially in Malaysia, Thailand, Indonesia, and Vietnam, has contributed to increase energy consumption typically from non-renewable energy sources driving CO₂ emissions. Some studies illustrate that an increase in financial development increases carbon emissions such as Shahbaz Muham-Mad et al. (2011). Some other researchers believe that financial progress can improve natural execution by igniting interest in environmentally friendly and naturally efficient innovations. It is argued that financial progress enhances a nation's environment by energizing pleasant and fresh overseas capital information exchanges, discovery, and improvement. For example, (Frankel & Romer, 1999; Shahbaz et al., 2013b; Tamazian et al., 2009). Therefore, a move toward cleaner energy sources, investments in renewable energy, and the creation of strong environmental legislation are necessary for sustainable growth in these nations. Even though the region's financial development has been a major contributor to economic progress, there is still debate over how this development interacts with the environment.

According to Grossman and Krueger (1995), there is a U-shaped connection that has been reversed between financial development and fossil fuel byproducts. Malaysia boasts a sophisticated financial system, complete with a stable legal system and growing capital-based business sectors. The country has implemented many reforms to modernize administrative frameworks and attract novel theories. Diallo and Masih (2017) argue that FD is an important factor in the EG of a country.

This study therefore, examines the influences of Governance, Financial Development, economic growth and energy on the environmental quality of selected ASEAN economies.

Literature Review

Rasiah et al. (2018), investigated the relationship between FD, energy use and carbon emissions in the five ASEAN Countries. By analyzing the short term and long term dynamics of these factors it adds to global discussion on reducing carbon emissions and promoting sustainable development. The Data type in this research is panel data covering the period from 1970 to 2016. By using panel estimation methods such as pooled mean group, fixed effect. The efficiency of the PMG method is determined using the Hausman test. Error correction terms are used in analysis to test the robustness of long run relationship. There are Long run relationship among explanatory variables and Carbon emissions. Contrary to the majority of previous research, FD was found to have no significant impact on carbon emissions. To accomplish sustainable environmental goals, ASEAN nations should work together.

Nosheen et al. (2019) examined the relationship between FD, GDP growth, environmental deterioration, and energy use in South East Asian nations. This research used annual time series data from 1980 to 2016. By employing the ARDL Bound Testing Approach to co-integration, the financial development has a negative and significant influence on CO₂ emissions, showing its involvement in improving environmental quality over the long run. On the other hand, trade openness, GDP growth, and energy use all have a major impact on environmental degradation. The findings, which indicate an inverted U-shaped link between GDP and environmental quality, are consistent with the EKC theory. Implementing twin-purpose energy policies to lower energy consumption and increase the efficiency, enforcing financial reforms that restrict credit to polluting companies, and implementing trade policies to reduce pollution while fostering sustainable economic growth are some of the policy recommendations.

Haseeb et al. (2019) examined the relationship between market freedom, political stability, economic growth, financial development, and CO₂ emissions in ASEAN nations using data from the World Bank. The Johansen co-integration technique is used to examine long-term relationships, and CO₂ emissions are measured in kilotons. Political stability lowers CO₂

emissions, according to the results, while financial prosperity has a major impact on emissions. The study emphasizes how economic and political freedoms influence environmental quality indirectly through international agreements and regulations. It is recommended that policymakers address CO₂ emissions while promoting sustainable environmental practices by strengthening market and political stability.

Rajpurohit and Sharma (2020) analyzed the impact of EG, energy intake, FD on the carbon emissions. A panel data set for 5 ASEAN countries is used in this research from 1980 to 2014. The Research employed the pooled Mean group (PMG). Because the Panel econometrics techniques appropriate for examining the both short Run and long run relationship in heterogeneous panel. The Research finds that CO₂ emissions are increased by initial growth and decreased by exponential growth, validating EKC. In the same way, the Financial Development CO₂ emissions are increased in the early stages and decreased after the economic growth is reached to a certain level. Utilization of Energy a strong and direct relationship between emissions and the use of fossil fuels. Developing countries should try for accelerated economic and financial growth to adopt ecologically friendly tools.

Le and Ozturk (2020) studied the impact of globalization, FD, government expenditure, and institutional quality on CO₂ emissions within the EKC framework from 1990 to 2014. By using advance panel econometric approaches, it validates the existence of long-term correlations between the factors, cross-sectional dependence, and variable stationarity. The results reveal that government spending, energy use, financial development, and globalization all raise CO₂ emissions, by supporting the EKC theory. The policy recommendations place a strong emphasis on advancing green technology, energy efficiency, environmental governance, and incorporating sustainability into financial development and globalization plans.

Chienwattanasook et al. (2021) investigated how EG, GL, and financial development (FD) affect CO₂ emissions in ASEAN nations. The data type is panel data from 2004 to 2018 from WDI, KOF, and the World Bank. Using the fixed-effect model with Driscoll-Kraay standard errors, the results show that inefficient energy use causes EG, GL, and FD to have a beneficial impact on CO₂ emissions. It is recommended that policymakers adopt measures to reduce carbon emissions and use energy more efficiently while encouraging sustainable growth. Future investigations ought to look into other factors, broaden the study's focus, and incorporate different environmental quality metrics.

Nathaniel (2021) explained in their research the ASEAN countries have made significant long-term financial progress. The region is also blessed with a lot of common resources. However, regular asset overflow and financial development may contribute to ecological decline, particularly if the exploration and use of regular assets cannot be sustained. In this study, a female researcher aims to identify the strong connections between ASEAN's natural resources, human capital, economic progress, and biological influence. For experimental research covering the years 1990 to 2016, the Expanded Mean Gathering, a high level econometric assessment, is used. The findings support the adverse effects of EG and conventional asset on the quality of the environment. Although it has a negative coefficient, human capital in ASEAN is ineffective at reducing environmental corruption.

Sadiq et al. (2022) studied in their research economic growth and environmental, social, and governance (ESG) factors are crucial to ASEAN nations' attainment of the SDGs. The study uses the Panel ARDL technique to test the relationship between ESG and SDGs, using secondary data from SDG reports and WDI form 1986 to 2020. The results show that ED and corporate, social, and environmental governance all favorably impact the achievement of the SDGs. SDG advancement is facilitated by efficient corporate governance, which guarantees the best possible resource allocation and stakeholder welfare. Nevertheless, the study's limitations its emphasis on ESG issues and a certain time period highlight the necessity of

thorough and multifaceted assessments. To accomplish the SDGs over the long run, policy suggest supporting improved ESG practices and stakeholder involvement.

Adeel-Farooq et al. (2022) investigates the impact of FD, economic growth, energy consumption, and urbanization on the Environmental Performance Index (EPI) in five ASEAN countries (Malaysia, Indonesia, Thailand, Vietnam, and the Philippines) from 2003 to 2016. By employing fixed effect, random effect, NW, and GLS estimation methods. The findings show that while urbanization and energy use deteriorate environmental performance, financial development and economic expansion improve it. To achieve sustainable development and enhance environmental performance in ASEAN and other developing nations, the results support the EKC hypothesis and recommend supporting energy-efficient technology, renewable energy, and green project subsidies.

Çitil et al. (2023) used advance panel data approaches to investigate causality, long-term correlations, and variable stationarity using a thorough econometric framework. The results showed that while economic growth and the use of fossil fuels decrease air quality, green finance investments, institutional quality, and political stability improve it. Tests of causality showed that energy use, political stability, and green financing all have a unidirectional relationship with air quality, while institutional quality and air quality have a bidirectional relationship. It suggests that improving institutional structures can help reduce pollution and promote sustainable development. In conclusion, political stability is necessary to achieve long-term environmental sustainability and enforce effective environmental regulations.

Theoretical Framework

The theoretical background of the association concerning governance, FD, and environmental quality in ASEAN nations can be analyze by employing the Environmental Kuznets Curve (EKC) hypothesis.

The EKC hypothesis was introduced by Grossman and Krueger in 1995. Environmental Kuznets Curve theory proposes a non-linear association concerning economic growth and ecological degradation. The theory proposes that as per capita revenue rises, environmental degradation firstly worsens, but then finally declines. This relationship is represented by an inverted U-shaped curve. The basic assumption of the EKC Is that economic growth results in increased pollution until a certain level of development. After reaching this threshold, environmental concerns start to take priority, leading to a decline in pollution levels. This occurs as societies become more affluent and have the financial means to invest in cleaner technologies and practices. The EKC theory has received extensive review and discussion. A few studies have supported the existence of an EKC in clear-cut situations, including air pollution in developed countries. The concept' applicability to other natural indicators, such as biodiversity decline or ozone depleting chemical outflows, is still debatable.

For instance, Adeel-Farooq et al., (2020) provided the motive research to examine the Environmental Kuznets curve (EKC) concept within the financial development nexus of methane (CH₄) discharge across the six countries that make up the relationship of Southeast Asian Nations (ASEAN) among 1985 – 2012. Plan/strategy/approach: The review makes use of pooled mean gathering (PMG) and mean gathering (MG) methodologies, among other dynamic board information assessment approaches. The outcomes show that the EKC conjecture regarding the CH₄ expulsion in these markets turns out to be accurate. Overall, monetary progress causes a decrease in CH₄ emissions. When all is said and done, these countries' increased CH₄ emissions are causing climate change due to energy consumption. Inventiveness/esteem: Over the past several years, the ASEAN region has experienced notable economic growth. Additionally, pollution has multiplied greatly in this area.

Research Methodology

Research Design

This research estimates the influence of governance and FD on the environmental quality. Environmental quality is proxied by the CO₂ emissions. We observe the influence of governance indicators and FD on the CO₂ emissions in five ASEAN emerging nations for the period 2000 to 2018. Table 2 displays statistics utilized based on their availability, all of which are from the World Development Indicators (WDI). The following are some of the variables that are included in our dataset:

- Carbon dioxide emissions, Measured in metric tons per capita
- FD measured in domestic credit to private sector
- Governance measured in time spent dealing with the requirements of Government regulations
- Economic growth measured in GDP constant 2015 US\$
- Energy use

Table 1: Variable list

SR No	Variables	Notation	Unit of measurement	Data source
1	Carbon dioxide	CO ²	Metric tons per Capita	World development indicator (WDI)
2	Financial development	FD	Domestic credit to the private sector(% of GDP)	World development indicator (WDI)
3	Governance	GOV	Time spent dealing with the requirement of government regulation (% of senior management time)	World development indicator (WDI)
4	Economic growth	EG	GDP constant 2015 US \$	World development indicator (WDI)
5	Energy consumption	EC	Energy use (kg of oil equivalent)	World development indicator (WDI)

Estimation Method

This research uses fixed effect and random effect model i.e., panel data models to meet the data needs (REM). According to Gujarati (2003), if the size of data/sample is not big enough then analytical estimations can be performed using aforementioned models. Added that selection of model to be employed for analysis can be performed using Hausman specification test. The fixed effect model is preferred if the P-value of the Hausman specification test is less than 0.05 (p 0.05). When this is not then the random Effect Model is the best option. With small sample panel data, such as the one used in this research (Five developing Countries, 2000-2018), conventional fixed and random effect models can perform well.

Panel Data Model

Panel data is mixture of time series and cross section data. It also indicates to as longitudinal data. Using panel data can help in two big ways. First, panel data provide accurate estimation of the parameters. The second aid of panel data is that it is possible to find and measure effects. There are many ways to look at it but fixed effect and Random Effect Models are more discussed. This research model has been estimated by using different panel data estimation methods.

Descriptive Statistics

Basic details about the data, including the mean, median, mode, standard deviation, and range, are provided by descriptive statistics. The distribution, variability, and central tendency of the data may all be understood with the help of this information. Patterns and trends in the data, such as variations over time or between groups, can be found using descriptive statistics. It is possible to use this data to develop research hypotheses. By offering a succinct synopsis of the main features of the data, descriptive statistics can facilitate comprehension and interpretation of the data. Both researchers and others who are reading the research study may find this useful. Researchers might create benchmarks for their data or compare their findings to those of other studies using descriptive statistics. Analyzing descriptive statistics from several studies or datasets can highlight trends, parallels, and other features that shed light on the larger picture of the study.

Correlation Analysis

A popular statistical method for determining the trend and power of a linear connection concerning two variables is correlation analysis. A measure of the degree of association concerning two variables is provided by correlation analysis. As two variables have a positive association, it means that as one variable rises, the other variable also rises. While negative link means that as the one variable rise the other variable declines. In order to find possible links between variables, correlation analysis is frequently employed as the first stage in exploratory data analysis. This can assist researchers in developing theories regarding the nature and degree of correlations between different variables. Finding variables that could be helpful for forecasting and predictive modeling can be done with correlation analysis. Researchers can find potential predictors of future outcomes by analyzing the strength of correlations between factors. Potential confounding variables, or those that can alter the connection concerning the autonomous and dependent variables, can be determined using correlation analysis. Causal inference requires careful consideration of confounding variables. Although correlation between variables does not necessarily indicate causation, it might offer insights into possible causal linkages. Robust correlations may imply that changes in one variable are influencing changes in the other. The results of correlation analysis are easily interpretable and accessible to a broad audience, making it a very straightforward statistical technique. Because of this, it's a useful tool for both novices and researchers.

Panel Data Model

View the basic linear model

$$Y_{it} = \alpha + \beta X_{it} + u_{it}$$

Where $I=1 \dots N$ and $t=1 \dots T$

It assumes that error term u_{it} is divided into two parts.

$$u_{it} = u_i + v_{it}$$

In this certain specifications one component of u_i is not change over time but v_{it} change. This not a time affix connected with the phrase u_i . It is evocative of elements that cannot be witnessed and do not change for the person throughout the time. It is feasible that elements such as congenital characteristics of the environment in early life, the history of the parents, particular personality characteristics, and so on are involved. In this case, u_i denotes the impact that is particular to the cross section (country).

Fixed Effect Model

Fixed Effect is type of model in which the model parameters are fixed and non-random quantities. It is regularly employed to panel data in order to adjust any individual specific

characteristics that do not change over time. This is done with the purpose of analyzing the panel data. In this model, the assumption sanction for:

$$E[v_{it} | X_{i1} \dots X_{iT}] \neq 0$$

Here the elements that are not observed are constant across time and dependent of the X variables for all time period. Fixed Effect may still estimate casual impact even if this specific offense of the zero conditional mean assumption is allowed:

$$Y_{it} = \alpha + \beta X_{it} + u_i + v_{it}$$

Fixed Effect statistics models have parameters. Unlike Random Effect and Mixed Effect Models, which have unpredictable model parameters? Econometrics and Biostatistics regression model with fixed group means are called fixed effects models. Each grouping's means may be set or random. A variance part model uses Random variables as model parameters in statistics.

Random Effect Model

A panel data estimated in two ways: in random effect models or fixed effect model effects. $E[v_{it}|X_{i1} \dots X_{iT}]$ is observing to be zero in the Random Effect Model. It refers to unmeasured variables that are constant across time and do not depends on the values of the X variables at any point in time. The assumption of random effect is quite close to a zero conditional mean assumption. Capability, preference, and parental framework are examples of time invariant elements that are assumed to be unrelated to any of the X variables. If Y is income and X is years of schooling, then this means that unobserved variables effecting on income do not depend on education.

Husman Test

Hausman test, while doing panel analysis, the may be used to make a distinction between different models i.e., which model best suits for investigation. Under the alternative null hypothesis, the fixed effect (FE) model is chosen because it is at least as consistent as the null Hypothesis, while under the null hypothesis, the random effects (RE) model is favored because it is more efficient. The models are put to the test using Hausmans specification test (Hausman, 1978), which helps identify which of the model should employed for the research. The standard fixed and random effect of the models should be employed for the study. The standard fixed and random effect models are the best appropriate ones to use, particularly if sample panel data is limited, as is the case with this research that covers 2000 to 2018 for five different developing countries.

Results and Discussion

A panel of five selected ASEAN Nations over eighteen years is applied on the study. Following the fixed effect and random effect estimation methods used for the empirical estimation and Hausman's test is employed to choose between FE and RE estimators are shown in table 3. The outcomes of Hausman's test ($p=0.00$) show that FE estimators are valid. However if the data contains the issues of serial correlation and heteroscedasticity for that reason the results through FE method are not valid are shown in 4.

Table 5 Reboost least Square show that FD has a significant positive effect, with a highly significant Z-statistic and a probability value of 0.0000. Governance (GOV) is statistically insignificant, as indicated by its high p-value (0.9773), showing no influence on the environmental quality. Economic growth (EG) has a negative effect, nearing significance at the 10% level, while its squared term (EG^2) indicates a significant nonlinear relationship with economic growth, suggesting diminishing or accelerating effects over time. Energy consumption (EC) appears statistically insignificant in this model. The outcome shows the validity of the EKC hypothesis in these selected ASEAN countries.

Table 2: Descriptive statistics

Variables	CO ²	FD	GOV	EG	EG ²	EC
Mean	2.866554	70.13400	0.414737	3.878816	3.25E+11	85.59241
Median	1.891428	79.94309	0.000000	4.179340	2.71E+11	101.5801
Maximum	7.719436	127.2322	9.100000	6.793960	9.99E+11	141.2430
Minimum	0.648189	18.15570	0.000000	-3.443300	9.35E+10	0.000000
Std.Dev	2.160500	37.14372	1.518326	1.845630	200E+11	48.92306
Observation	95	95	95	95	95	95

Table 3: Results of fixed and random effect**CO₂ emissions (Dependent variable)**

Variables	FEM	FEM	REM	REM
	Coefficient	P-value	Coefficient	P-value
FD	0.010193	0.0068	0.045555	0.0000
GOV	0.017224	0.5005	0.017603	0.5054
EG	-0.015885	0.5030	-0.148155	0.0000
EG ²	1.58E+12	0.0045	2.82E,+12	0.0000
EC	-0.00178	0.1606	0.003384	0.0001
C	1.718460	0.0000	-0.050689	0.7431

Table 4: Husman Test

Test summary	Chi-sq. Statistic	Chi-sq. d.f.	Prob.
Cross-section Random	941.554513	5	0.0000

A test summary with multiple statistical metrics is given in the table. There appears to be a significant link among the independent and dependent variables, as indicated by the Chi-sq statistic of 941.554513. Four degrees of freedom, or Chi-sq. d.f., indicate that the study includes four independent variables. The table indicates that the chance is 0.0000. A probability of 0.0000 implies that the observed results are extremely unlikely to occur by chance alone, which suggests that the link among the independent variables and the dependent variable is statistically significant.

Table 5: Robust least Square**Method: M-estimation**

Variables	Coefficient	Std.Error	Z-static	Prob.
FD	0.041575	0.003639	11.42455	0.0000
GOV	0.002574	0.090631	0.028400	0.9773
EG	-0.144287	0.075900	-1.901030	0.0573
EG ²	2.68E+12	6.99E+13	3.830986	0.0002
EC	-0.004070	0.002852	1.427027	0.1536
C	0.041494	0.530815	0.078170	0.9377

According to the outcome a rise in financial development of one percent is ilinked with an increase in CO₂ of 0.04 percent. According to the coefficient of 0.002, there is a very slight correlation between a one-unit rise in governance and CO₂. This link is not statistically significant, though, as indicated by the modest coefficient and low z-statistic (0.02) (p-value = 0.97). According to the coefficient of -0.14, there is a 0.14 percent drop in CO₂ for every one

percent rise in economic growth. The z-statistic of -1.90 and the p-value (0.0573) shows that this link is not statistically significant, despite the negative sign suggesting an inverse relationship. The coefficient value of 2.68 indicates a slight correlation between CO₂ and economic growth squared. This link is statistically significant, nevertheless, as evidenced by the nearly zero coefficient and high z-statistic (3.83) (p-value of 0.000). According to the coefficient of -0.004070, there is a 0.004070 unit drop in CO₂ for every unit increase in energy use. This link is not statistically significant, as indicated by the p-value of 0.15 and the z-statistic of 1.42.

Conclusion and Recommendations

Overall, this study focused specifically on 5 selected nations to study the association concerning governance, financial development, and ecological quality in ASEAN countries. A few significant findings have been made after examining relevant writing and observational data. First and foremost, in ASEAN states, there is a strong connection between excellent governance and natural quality. A good administration is one that promotes economic development plans and procedures that advance environmental preservation and is characterized by openness, strong institutions, and law and order. Better-run countries typically have lower rates of contamination, more prominent protection of common assets, and a more reasonable manner to deal with economic growth. Additionally, the advancement of ecological quality in ASEAN countries depends heavily on economic growth. Better access to resources and resources for initiatives and ventures that are safe for the ecosystem is made possible by a developed financial system. It encourages growth, ingenuity, and the acceptance of cleaner creation methods, all of which contribute to improved natural outcomes. Additionally, financial institutions can create incentives and frameworks to support practical actions like green bonds and advances. Additionally, the exploration proposes that there is a beneficial association between ecological quality and financial turn of events. As the financial sector develops and becomes more active, governments are better equipped to distribute resources effectively and divert money toward eco-friendly causes. This is demonstrated by Indonesia's recent progress in adopting reasonable monetary systems and implementing green finance strategies. In addition, Vietnam and the Philippines have started to understand the relevance of ecological maintainability despite facing significant challenges with relation to administration and financial developments. These countries are consistently taking steps to improve their monetary systems, administrative practices, and environmental protection. In general, this research paper emphasizes the importance of an all-encompassing and coordinated approach to administration, monetary progress, and ecological quality in ASEAN states. To achieve the best results, policymakers should concentrate on further improving administrative structures, promoting economic and monetary developments, and implementing persuasive ecological measures. Future research should also look into additional variables and contextual studies to further our understanding of these connections in the context of ASEAN. ASEAN countries should establish and approve effective natural governance frameworks that include unambiguous rules, ecological principles, and oversight mechanisms. This would ensure that ecological norms and recommendations are enforced and approved with force. ASEAN countries should promote developing useful auxiliary commodities like green bonds and green security measures. These financial tools would pique interest in environmentally friendly enterprises and aid in the shift toward a tenable course of action. ASEAN member states should improve regional cooperation and information exchange on natural systems and best practices. This would function in conjunction with information exchange, collaborative investigation, and coordinated efforts to address common ecological problems.

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