EXPLORING THE RELATIONSHIP BETWEEN INTERNATIONAL TRADE AND THE ENVIRONMENT FOR ECONOMIC GROWTH IN ASEAN-5

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Abstract. Economic growth is a measure of a country's success, characterized by an increase in the quality of life of the people, both in terms of education, health, and consumption of goods and services. Energy resources are needed to realize economic growth because many production and consumption activities involve the use of energy. However, in reality, many countries only focus on economic development, which often ignores its impact on the surrounding environment, thereby encouraging a decline in environmental quality. The current environmental degradation can hamper growth and even threaten future development and prosperity. Apart from that, this research also selected export and FDI variables to determine their influence on economic growth in 5 ASEAN countries. This research aims to determine the influence of electrical energy consumption, CO2 emissions, exports, and FDI on economic growth in ASEAN-5 for the 2000-2020 period. The best model selected in this research is the Fixed Effect Model (FEM). With the results obtained, electrical energy consumption has a significant negative influence on economic growth, while the other 3 variables (CO2 emissions, exports, and FDI) have a positive and significant influence on economic growth.

.**Keywords:** *CO2 Emissions; Economic Growth; Energy Consumption; Export; FEM.*

1 INTRODUCTION

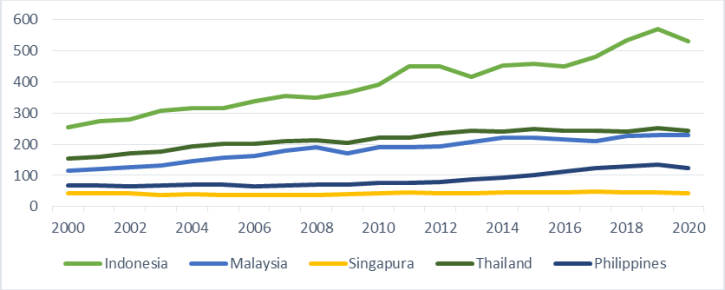
Increased environmental protection has pushed countries and companies to embark on ecological measures to reach the ultimate aim of environmental performance (Sorroche-del-Rey, Piedra-Munoz, & Galdeano-Gomez, 2022). World Business Council for Sustainable Development (2006), argues that meeting human needs and enhancing quality of life through the provision of goods and services at competitive costs is a direct result of environmental performance. Environmental performance gradually lessens resource intensity and ecological

consequences to match the earth's carrying capacity (Sorroche-del-Rey, Piedra-Munoz, & Galdeano-Gomez, 2022). Therefore, environmental performance or environmental efficiency is intended to find the most effective way of environmental improvement that translates into economic benefits.

GDP growth rate is one of the indicators that can be used to measure economic expansion (Ningrum, 2020). As a result, many countries are competing to increase economic growth by boosting the industrial sector and exploiting natural resources (especially energy) to support the acceleration of economic growth (Du, Zhang, & Han, 2022). In line with this, ASEAN's economic growth over the past few decades has experienced rapid development, which is characterized by remarkable progress in economic performance. At the world level, ASEAN is ranked 5th largest with a GDP of USD 3.36 trillion in 2021. However, it cannot be denied that ASEAN's economic growth fluctuated from 2000-2020. Meanwhile, Fanning & O'Neill (2018) state that income growth has a close relationship with an increase in carbon dioxide (CO2) emissions. Which has become an environmental issue today because it is a potential source of the greenhouse effect and depletion of natural resources (Yoro & Daramola, 2020).

Cozzi, Chen, & Kim (2023) The bottom 10% of global emitters are in the Africa and Asia region, which is dominated by developing countries. Projections for 2040 show that the share of energy consumption such as oil coal and gas will increase to 58% and grow at 3% per year in developing countries (Keho, 2016). World Resource Institute (2019), reported that countries in ASEAN contributed 7.35% of the total CO2 emissions generated from around the world with Indonesia contributing 5%. The increase in CO2 emissions increases because countries in ASEAN are in the process of industrialization which requires a lot of energy for the process. It can be seen in Figure 1 that CO2 emissions from the five ASEAN countries, Indonesia have tended to increase over the past 21 years. In contrast to Singapore which tends to be constant with the average emissions produced below 50 Mt.

Figure 1. ASEAN-5 CO2 Emission



Source: International Energy Agency

Environmental policies on international trade are often analyzed using traditional hypotheses such as comparative advantage with productivity differences and factor endowments (Porter & Linde, 1995). Menurut Zhou (2022), CO2 emitted during international trade is influenced by the characteristics of countries with diverse global climate policies. This affects per capita income, which then contributes to changes in economic activity (Kukla-Gryz, 2009). Trade openness encourages greater investment in technology, suggesting that internationalization is the beginning of ecological technology and environmental management systems (Zhou, Fu, Kong, & Wu, 2018). The new trade theory encourages

firms to export bigger, more productively, and more intensively (Bernard, Jensen, Redding, & Schott, 2012). Thus, international commerce has an impact not only on the economy but also on environmental changes and the economy (Hye, Wizarat, & Lau, 2013).

The classic theory of development economics states that the main role of FDI for developing countries is to fill the capital gap and promote technological progress (Zhou, Fu, Kong, & Wu, 2018). Helpman, Melitz, & Yeaple (2004) and Yeaple (2009) argue that only firms with the highest productivity in the industry are likely to invest in FDI. Therefore, Hale & Long (2011) and Anwar & Sun (2014) foreign firms with a good level of production technology will invest more costs in Research and Development (R&D). For developing countries such as in ASEAN, FDI becomes an important source of private external finance to facilitate production, capital formation, and technology transfer (Mallampally & Sauvant, 1999).

Because these nations have industries driving their economic systems, five ASEAN nations—Indonesia, Singapore, Malaysia, the Philippines, and Thailand—have seen relatively rapid economic expansion. In line with economic growth, the growth of CO2 emissions has also experienced growth supported by FDI. Foreign investment will increase environmental pollution when applied to countries that have weak standards and regulations against environmental pollution, because of the transfer of capital and funds that make the increase of industrial machinery (Kastratovic, 2019). However, according to Zafar, et al. (2019), foreign investment will encourage the development of more sophisticated and environmentally friendly technologies.

Based on this reasoning, the purpose of this study is to give evidence and further investigate the impact of international commerce and the environment on ASEAN-5 economic growth. Furthermore, this research contributes to the literature by providing analytical data to support sustainable economic growth, which leads to lower CO2 emissions and higher investment. It is believed that by investigating the influence of international commerce and the environment on economic growth, further areas of intervention that can contribute to a more robust and balanced economic system would be identified. Several empirical studies have studied the relationship between the variables driving economic development and growth itself. While some research focuses on energy consumption and CO2, others examine the impact of exports and foreign direct investment on economic growth. However, no one in the ASEAN-5 area has analyzed these factors across 21 years. As a result, this study is planned to provide an in-depth analysis of the impact of international commerce and the environment on ASEAN-5 economic growth.

2 LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Economic Growth

Classical economic theory states that economic growth is influenced by the factors of output growth and population growth. The greater the output produced, the greater the productivity and population. So that people's purchasing power is high which is accompanied by their consumption. Output growth in neo-classical theory is expressed as a result of factors of improving the quality and quantity of labor, increasing capital, and developing the technology used. Later, Mankiw argued that the use of human capital aspects needs to be taken into account in economic growth. Therefore, economic growth can be seen from the Gross Domestic Product (GDP) indicator. The calculation of GDP is obtained from all goods and services produced by an economy in one period of time and expressed in market prices (Mankiw, 2018).

Teori Environment Kuzets Curve

The emergence of a hypothesis stating that environmental quality will improve as the income of a country's society increases is the beginning of Kuznet's Environment Theory. This hypothesis assumes that in the early stages of the country's economy tends not to pay attention to environmental quality in encouraging economic growth. Then, at a certain income level, the economy will begin to pay attention and encourage the environment to become environmentally friendly through economic growth. This theory is then illustrated with an inverted U-curve (Yao, Zhang, & Zhang, 2019).

In the early stages of the economy, the country is still based on the massive use of natural resources that create waste. However, at this stage, it can still be properly regenerated. In the next stage, when the economy is relatively advanced, industrialization increases with the use of agricultural land and resource extraction. The high level of resource exploitation results in the high ability of nature to regenerate and problems such as waste accumulation and pollution arise. The final stage is when economic development reaches its maximum, and the structure of the economy changes to a capital-intensive one that relies on technology and industry. Technological advances are getting higher which makes people realize that environmental sustainability is important to pay attention to. Therefore, the state begins to pay attention to environmental improvement with policies and capital allocation for conservation gradually and evenly.

Economic Growth and International Trade

International trade is considered a tool to stimulate economic growth, through creating jobs and promoting development. Economic growth driven by international trade through exports of goods and services can increase national income. The opening of trade is a catalyst for development that encourages technological progress and knowledge transfer. Thus, countries gain new ideas, innovations, and practices that boost the productivity and efficiency of economic development.

In line with this, Mamingi & Martin (2018), Purnama & Yao (2019), Lubis, Hidayatulloh, & Zakiyyah (2024), Engin & Konuk (2022), Abendin, Duan, & Nsiah (2021), A'yun & Khasanah (2022) Mohsen (2020), Iyke (2017), Xu (2016) and Solarin & Shahbaz (2015) explains the relationship between international trade and economic growth in various countries. The conclusion is that international trade has a positive effect on economic growth. Then, Vardari (2015), Panta, Devkota, & Banjade (2022) Zhu, Ahmad, Draz, Ozturk, & Rehman (2022), Suripto, Setiawan, Istianti, & Mustofa (2022), Mensah & Okyere (2020) and Ma, et al. (2022) all came to the same conclusion: exports boost economic expansion. However, other research has found a positive causal association between exports and economic growth (Hye., 2012) which is evident in many Asian countries (Safdari, Mahmoodi, & Mahmoodi, 2011).

H1: Exports have a positive and significant effect on economic growth

On the other hand, trade also facilitates foreign investment, which is an important element in economic growth. By attracting foreign direct investment (FDI), a country can obtain much-needed capital for development projects, increase employment, and stimulate economic growth. Through the FDI mechanism, many companies have invested in several countries. The improvement of the investment ecosystem has an impact on the production of goods and

services which then affects economic growth (Sbia, Shahbaz, & Hamdi, 2014). The better the country's absorption of FDI will affect the country's GDP (Borensztein, Gregorio, & Lee, 1998).

Numerous nations have carried out studies investigating the connection between foreign direct investment (FDI) and economic expansion. Some of these studies include Sbia, Shahbaz, & Hamdi (2014), Gazi, Nahiduzzaman, Shaturaev, Dhar, & Halim (2022), Sari, Wahyudi, & Nabella (2023), Nasir, Wibowo, & Yansyah (2021), Fauzel (2016), Sunde (2017), Kurniawan & A'yun (2022) and Bayar & Gavriletea (2018) found that FDI has a positive effect on economic growth. In line with this research, Hossain, Roy, & Akter (2022) FDI contributes to economic growth in the short and long term. The same thing is also shown from research conducted by Muhammad & Khan (2019), FDI has a significant direct positive effect on economic growth. The same thing with research conducted by Banday, Murugan, & Maryam (2021) The results show that FDI has a positive impact in the long run and has a two-way causality on economic growth.

H2: FDI has a positive and significant effect on economic growth.

Economic Growth and the Environment

Environmental and economic performance ought to coexist. The environment is essential to economic activity and growth because it supplies the resources required to generate goods and services and absorbs and processes the waste and pollution left over from production. The local climate, flood danger, clean water supplies, and other resource maintenance are just a few ways that the environment can help manage economic and social activity. The environment and economic growth have a complicated relationship. There are multiple drivers involved in the relationship. Therefore, the effects of production and consumption may be mitigated by changes in technical advancement and economic structure.

It is well known that electricity increases the productivity of capital, labor, and other factors of production (Yoo & Kim, 2006). Electrical energy is the main key that has an important role in the economic growth of a country as evidenced in large companies, household consumption, and factories that make electrical energy the main axis in the success of the output produced (Rasha, Masbar, & Jamal, 2022). This is in line with research conducted by Prastika (2023), Xie, Zhu, Hu, & Huang (2023), Shabbir, Kousar, & Kousar (2020), and Thaker, Thaker, & Pitchay (2019) The study found that the electrical energy consumption variable has a significant positive influence on the economic growth variable

H3: Electricity consumption has a positive and significant effect on economic growth.

Emissions of carbon dioxide will rise in tandem with economic expansion. This is due to the fact that the primary source is the exhaust fumes generated from the burning of fossil fuels like coal and oil in power plants and automobiles (Umair, 2015). The relationship between economic growth and carbon emissions is caused by the quantity of carbon-incentivized energy consumed in conducting economic activity in diverse sectors (Bano, 2018). In line with this, Alabed, Said, Karim, Zaidi, & Alshammary (2021), Shabbir, Kousar, & Kousar (2020), Gazi, Nahiduzzaman, Shaturaev, Dhar, & Halim (2022), Adebayo, Awosusi, Kirikkaleli, Akinsola, & Mwamba (2021), Mitić, Fedajev, Radulescu, & Rehman (2023), Osobajo, Otitoju, Otitoju, & Oke (2020) dan Abdullah (2023) examined the relationship between CO2 and economic growth with the estimation results showing a significant effect and two-way

causality in the long run. Meanwhile, Jiang, Kim, & Woo (2020) state that CO2 emissions are more influential in non-metropolitan areas than in metropolitan areas

H4: CO2 has a positive and significant effect on economic growth

3 RESEARCH METHODOLOGY

The use of secondary data in this study comes from various sources. The World Bank provided data on GDP growth, exports, and FDI, while the International Energy Agency (IEA) supplied data on CO2 emissions and power use. The period used was from 2000-2020 in 5 ASEAN member countries. Descriptive quantitative analysis was performed using the panel data regression approach. Regression analysis is a useful tool for determining how two or more independent variables relate to or affect a dependent variable. (Gujarati & Porter, 2008). The regression equation for this investigation is as follows:

$$〖GDPGrowth〗_it=α_0i+β_1 〖export〗_it+〖lnβ〗_2 〖FDI〗_it+lnβ_3 〖Cons\_electric〗_it+β_4 〖CO2〗_it+ϵ_it$$

The equation represents the model for the study's variable relationships. GDP growth is the yearly percentage rate of GDP growth in a certain national economy during a given time period, based on constant market prices in local currency, represented as a percentage. Export is the circulation of goods and services originating from a country to foreign markets expressed in percent (%). FDI as international capital flows expressed in percent (%). CO2 emissions are the result of burning fossil fuels expressed in Metric tons (Mt). Meanwhile, electrical energy consumption is expressed in terawatt hours (TWh).

Based on this, the Chow Test and Hausman Test are used to choose the optimal model. The Common Effect Model (CEM) and the Fixed Effect Model (FEM) are compared using the Chow test. In the meanwhile, the Hausman Test examines how the Fixed Effect Model and the Random Effect Model (REM) compare. Classical assumption testing in the form of heteroscedasticity is carried out to fulfill linear and unbiased regression analysis. The benefit of using panel data is that more observations should result in higher degrees of freedom, Positive population parameter estimates, and a lower risk of collinearity among independent variables. The error disturbance in the linear regression equation model is always defined as homoscedastic, serially uncorrelated. Therefore, the best linear and unbiased estimates will be obtained by applying the Ordinary Least Square (OLS) approach. On panel data, however, these presumptions are not applicable. As a result, each country's life satisfaction variable is estimated using the OLS method independently.

4. RESULT AND DICUSSION

There are three options for selecting the best model based on the panel data regression test. Where Hausman and Chow's tests are used to make the selection during this test. Regression model specification test on the Chow test estimation, the fixed effect model is decided to be the best model in this study because based on the test results above, the probability value of the Chow test is 0.0069. Then, in the Hausman test, it is concluded that the fixed effect model

is the best model for the research conducted this time because the probability in the Hausman test in the table has a value of 0.0013 or less than alpha of 5 percent. So, it is concluded that the best model used is FEM.

Table 1. Best Model Selection

Test	value	α	Result
Chow	0.0069	0.05	FEM
Hausman	0.0013	0.05	FEM

Source: Processed data, 2024

To check for problems with the data and regression results of each research model, classical assumption testing was conducted after selecting the research estimation method. The multicollinearity test shows that there is no strong correlation between the independent variables, according to the VIF value of each variable and its mean, where the VIF value is <10 so it can be concluded that there is no multicollinearity between the independent variables. Then, the heteroscedasticity test results show a prob value < 5% alpha of (0.0098), which we know that if the prob value < 5% alpha then in this model there is a heteroscedasticity problem. So, it needs to be corrected with Robust standard error.

Table 2. Classical Assumption Test Results

Test	**Value of**		**Result**
Multikolinearitas	Mean VIF	4.65	Free of Multikolinearitas
Heterokedastisitas	Prob>chi2	0.0098	Heterokedastisitas is proven

Source: Processed data, 2024

Simultaneous statistical testing shows that all dependent variables (economic growth) are significantly influenced by all independent variables (electrical energy consumption, CO2 emissions, exports, and FDI) simultaneously or collectively. Meanwhile, the coefficient of determination (R^2) test results in the table above resulted in an R-squared value of 0.1976. Thus, it can be concluded that 19.76% of the economic growth rate in 5 ASEAN member countries can be explained by the variables of electrical energy consumption, CO2 emissions, exports, and FDI. While the remaining 80.24% is explained by other variables and factors outside the model. Although the R-squared value obtained in this study is relatively small, it is still within normal limits because it is still between 0 and 1. This happens because the selected independent variables are not too dominant in influencing the dependent variable (economic growth), there are still many other factors and other variables whose contribution to economic growth is much greater. So for future research, it can add new independent variables that are thought to contribute greatly to economic growth.

Table 3. Robust FEM Test Results

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Exports	0.072327	*.0304457*	2.38	0.076
FDI	0.3021966	*.1137535*	*2.66*	0.057

KonsumsiList~k	-0.0436298	*.0136049*	*-3.21*	0.033
emisiCO2	0.0291871	*.0132402*	*2.20*	0.092

Source: Processed data, 2024

Economic growth will increase by 0.076 percent if exports increase by 1 percent. The results of this study are consistent with research conducted by Subhan, Harthi, Alam, Thoudam, & Khan (2021), Gazi, Nahiduzzaman, Shaturaev, Dhar, & Halim (2022), Sari, Wahyudi, & Nabella (2023), Fauzel (2016), Sunde (2017) and Bayar & Gavriletea (2018) The results obtained in the study show that exports have a significant and positive impact on economic growth and other long-term economic activities. Exports play an important role in economic growth by encouraging countries to be more productive, technically advanced, and efficient. These results are in line with the theory of international trade, if the amount of goods or services exported abroad is more, the more goods and services that must be produced domestically.

A 1% increase in FDI will result in a 0.057 percent boost in economic growth. FDI directly helps to growth by increasing capital stocks and introducing new technologies, while indirectly improving human capital, infrastructure, and institutions. Increased FDI will increase economic growth. Single capital investment can replace lower production functions in industrial countries that include technological expertise, management and marketing expertise, market information, organizational experience, inventions of new products and production methods, and worker training, especially for multinational companies. Sbia, Shahbaz, & Hamdi (2014), Gazi, Nahiduzzaman, Shaturaev, Dhar, & Halim (2022), Sari, Wahyudi, & Nabella (2023), Fauzel (2016), Sunde (2017) and Bayar & Gavriletea (2018) found that FDI has a positive effect on economic growth. In line with this research, Hossain, Roy, & Akter (2022) FDI contributes to driving economic growth in the short and long term.

Electrical energy consumption is not significant to economic growth, where economic growth will slow down by -3.21 percent if electrical energy consumption increases by 1%. This is caused by excessive energy use by the industrial sector which is unproductive towards economic expansion. Electrical energy consumption hurts economic growth, according to research (Bildirici & Kayikci, 2012) which supports energy conservation policies. In addition, the neutrality hypothesis proposed by (Navarro, Alvarez-Quiroz, Sampi, & Sanchez, 2023) that the absence of a causal relationship between electrical energy consumption and economic growth is due to the consequences of electricity consumption because it is a small part of GDP. The existence of policies to maintain or expand electricity consumption will not affect economic growth and vice versa (Mighri & Ragoubi, 2020); Yoo. & Kwak, 2010; Tamba, Nsouandele, Lele, & Sapnken, 2017)

CO2 has a positive and significant influence on ASEAN-5 economic growth. When CO2 emissions increase by 1 percent, this is followed by an increase in economic growth of 0.092 percent. The same results were also obtained in the study Alabed, Said, Karim, Zaidi, & Alshammary (2021), Shabbir, Kousar, & Kousar (2020), Gazi, Nahiduzzaman, Shaturaev, Dhar, & Halim (2022), Adebayo, Awosusi, Kirikkaleli, Akinsola, & Mwamba (2021), Mitić, Fedajev, Radulescu, & Rehman (2023), Osobajo, Otitoju, Otitoju, & Oke (2020) dan Abdullah (2023). Sari, Wahyudi, & Nabella (2023), explained that increasing CO2 emissions in environmental degradation have a close correlation with economic activity. This is caused by

the dense economic activity that occurs, such as industrial processes, electricity consumption, and car use. Car use, electricity consumption, and industrial processes all contribute to CO2 emissions. This shows that very fast economic and industrial activity is occurring. So regulators in ASEAN-5 are needed to be able to align economic activity and productivity programs with environmental sustainability programs. The findings of this study are consistent with EKC theory, which states that environmental degradation can result from the extensive exploitation of resources necessary to support high-output production in the early stages of economic growth. Rao & Bear (2012) show that increased energy use and emissions are necessary to provide a decent standard of living for the people of the country.

5 CONCLUSION & RECOMENDATION

Increased environmental protection has motivated nations and businesses to launch ecological initiatives in order to reach the ultimate aim of improved environmental performance. The GDP growth rate is one way to quantify economic expansion. In keeping with this, income growth is strongly linked to rising carbon (CO2) emissions. The presence of trade openness fosters increased investment in technology, implying that internationalization marks the birth of ecological technology and management systems. According to the FEM model, electrical energy use has no substantial impact on GDP growth. Meanwhile, the hypothesis suggests that CO2, exports, and FDI have a substantial positive association with GDP growth. The findings of this study contribute to the type of analysis needed to promote long-term economic growth. The findings of this study contribute to the type of analysis used to promote sustainable economic growth, which leads to lower CO2 emissions and more investment. The goal of researching the influence of international trade relations and the environment on economic growth is to uncover alternative areas of intervention that can help to a more robust and balanced economic system.

The limitation of this research is that the method used is only limited to looking for the influence between variables. So, we have not yet reached the point of comparing the estimation results between ASEAN-5 countries. Another limitation is that the discussion is still general in describing the variables used in their influence on economic growth. There is no discussion from the standpoint of each country when looking at the link between international commerce and the environment on economic growth, thus the direction of discussion is restricted. Therefore, it is necessary to carry out more comprehensive estimates by making comparisons between countries to see the relationships, policies, and programs that are being pursued towards a sustainable economy

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