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Impact of Economic Growth, Industrial Value Added, and Population on Carbon Dioxide Emissions in the Asean Region

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Abstract

Carbon dioxide emissions contribute to environmental deterioration, so this factor is cause for concern. This study aims to determine how economic growth, industrial value added, and population affect carbon dioxide emissions in the ASEAN region. This study's sample consists of the five ASEAN nations with the highest carbon emission growth rates. Indonesia, the Philippines, Malaysia, Brunei Darussalam, and Vietnam were selected as sample countries for the period 2000 to 2018. The research data consists of panel data, which is a combination of time series and cross-section data, and is analyzed using static panel regression analysis via the Stata program, which passed the model selection tests, namely the Hausman test and the Lagrange-Multiplier (LM) test. In this study, the Random Effect Model was found to be the most appropriate model (REM). The findings of the study indicate that economic and population growth influence the increase in carbon emissions. This study was unable to demonstrate the effect of value added to industry on carbon dioxide emissions.

Keywords: Economic growth, Industrial Value Added, Population, and Carbon dioxide emissions.

1. Introduction

Because it induces environmental deterioration, global warming causes complex problems for all life forms on Earth. According to Abdullah (2015), an increase in greenhouse gas emissions, such as carbon dioxide emissions, is one of the side effects of environmental deterioration. This condition can exacerbate the dry season, which has implications for achieving food and water needs, rising sea levels, alterations in the earth's geography, an increase in fires, and desertification (Solomon et al., 2009). Earth System Research Laboratory (2015) research demonstrates that carbon dioxide emissions have continued to rise for the past 36 years, by an average of 1.4 ppm per year (1979-1995) and 2.0 ppm per year since 1996 to 2014. The results of this study are supported by the World Resources Institute, which reports that global carbon dioxide emissions in 2018 increased by 17.04 percent from 2009, or it increased from 31.10 Gt to 36.40 Gt.

The world's carbon dioxide emissions are divided into seven regions: Asia Pacific, Europe and Central Asia, North America, South Asia, the Middle East and North Africa, Latin America and the Caribbean, and Sub-Saharan Africa. According to the World Bank (2021), the Asia Pacific Region has the highest amount of carbon dioxide emissions in the world, with total carbon dioxide emissions in 2018 of 14.99 Gt, a 29.56 percent increase from 2009, which amounted to 11.57 Gt. Moreover, Vietnam, Indonesia, Malaysia, and Brunei Darussalam are among the top

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five countries with the highest growth in carbon dioxide emissions, with 16.09 percent, 9.42 percent, 7.51 percent, and 7.51 percent growth, respectively. Meanwhile, in the ASEAN region, Cambodia, Thailand, and Singapure signifigantly decreased its carbon dioxide emissions with the reduction of 1.85%, 1.07%, and 0.15%, respectively.

It is believed that the increase in carbon dioxide emissions in five ASEAN countries, which are Vietnam, Indonesia, Malaysia, Brunei Darussalam, and Philippines, is due to a rise in economic growth, industrial value added, and population; data on the rise in economic growth, industrial value added, and population can be found in Table 1.

Table 1. Economic Growth, Population, and Industrial Value Added

No	Country	Gross Domestic Product			Industry (including construction), Value Added			Population		
		Million USD		Growth	Million USD		Growth	People		Growth
		2009	2018	%	2009	2018	%	2009	2018	%
1	Indonesia	539,580	1042,271	93.16	257,121	414,091	61.05	238,620,554	267,670,549	12.17
2	Philippines	176,131	346,842	96.92	55,521	1,060,079	90.93	92,414,161	106,651,394	15.41
3	Malaysia	202,257	358,715	77.36	82,860	1,373,679	65.78	27,735,038	31,528,033	13.68
4	Brunei D.	10,732	13,567	26.42	70,195	85,804	22.24	383,902	428,960	11.74
5	Vietnam	106,014	245,213	131.30	396,369	839,424	111.78	87,092,250	95,545,959	9.71

Source: World Bank (2021)

Table 1. provides information that regarding economic growth as measured by Gross Domestic Product (GDP), industrial value added, and population in countries that are in the top five with the highest growth in carbon emissions in the ASEAN Region. Vietnam was the country with the highest percentage increase in GDP in 2018 which was 131.30% compared to 2009, followed by the Philippines at 96.92%, Indonesia at 93.16%, Malaysia at 77.36%, and Brunei Darussalam at 26., 42%. In industrial value added, Vietnam was ranked first with a growth of 111.78%, followed by the Philippines at 90.93%, Malaysia at 65.78%, Indonesia at 61.05%, and Brunei Darussalam at 22.24%. While in population growth, the Philippines is ranked first with a growth of 15.41%, followed by Malaysia at 13.68%, Indonesia at 12.17%, Brunei Darussalam at 11.74%, and Vietnam at 9.71%.

The increase in carbon dioxide emissions is a result of population growth, which encourages more human activity. Humans will use fuels (oil, gas, and fossils), burning activities, and deforestation in their activities. These activities allow them to fulfill their social and economic

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needs. According to Islam et al. (2020), once they begin their activities, they will disregard environmental concerns. This condition influences global warming, which can contribute to environmental degradation.

A study conducted by Hundie (2018) demonstrates that an increase in population can lead to an increase in carbon dioxide emissions as a result of the human activities of the occupants of the environment. According to Poku (2018), for every 1 percent increase in the total population in 45 Sub-Saharan African (SSA) countries, carbon dioxide emissions can increase by 0.76 percent. While the findings of Sarkodie and Uwusu (2016) research show that in the long run, every 1% increase in Ghana's population increases carbon dioxide emissions by 1.72%. Furthermore, Boopen and Vinesh (2011) argue that the significant increase in carbon dioxide emissions over the past century is attributable to human actions.

Population growth has a negative effect on the environment. On the other hand, a number of industries utilize this condition because it presents lucrative business opportunities. Both goods and services can provide added value in the form of profits to the business as a result of rising activity and human needs. This circumstance can motivate a number of businesses to fulfill their goals by expanding their production capacity or creating new profitable business opportunities. This circumstance will result in carbon dioxide emissions and global warming, both of which have a negative impact on environmental degradation. The research conducted by Ranelovi et al. (2020) demonstrates that an increase in industrialization's added value can lead to an increase in carbon dioxide emissions.

According to Khan et al. (2020), positive economic growth influences industrialization-induced increases in carbon dioxide emissions in developing nations. Economic expansion can impact the environment by increasing economic activity, altering the industrial structure, and increasing production (Grossman & Krueger, 1995). The expansion of a number of these companies' external activities has resulted in the overexploitation of natural resources and environmental damage. Hundie (2018) and Begum et al. (2015) have conducted empirical research demonstrating that economic growth can increase carbon dioxide emissions. Referring to the description, it is very interesting to examine the issue of carbon dioxide emissions that have an impact on environmental degradation, particularly in the five ASEAN countries with the highest increase in carbon emissions in 2018.

This research examines the three proposed hypotheses, which are depicted in Figure 1's framework model.

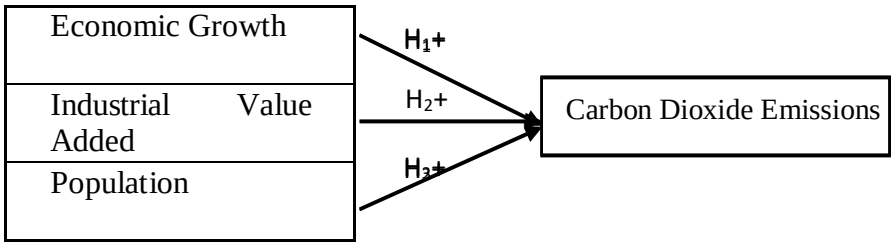

Figure 1. Framework Model

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Referring to the framework model in Figure 1, the research hypothesis is as follows.

H1: economic growth has a positive effect on carbon dioxide emissions

H2: industrial value added has a positive effect on carbon dioxide emissions

H3: population has a positive effect on carbon dioxide emissions.

2. Method

This study is a causality study to investigate the relationship between research variables that were statistically tested using stata. The sampling technique utilized a method of purposive sampling or was based on a set of criteria. The countries studied in this study are among the top five in the ASEAN region for the highest growth in carbon emissions in 2018. The following countries are included in the sample criteria: Vietnam, Indonesia, Malaysia, Brunei Darussalam, and the Philippines. The sampling criteria are as follows.

Table 2. Sampling Criteria Result

No	Kriteria Sampel	Jumlah	Negara
1	ASEAN region member	10	Vietnam, Indonesia, Malaysia, Brunei Darussalam, Philippines, Thailand, Singapore, Cambodia, Laos, Myanmar
2	Not provide the data completely from 200-2018	(0)	-
3	Not include in top 5 highest carbon dioxide emissions in 2018	(5)	Thailand, Singapore, Cambodia, Laos, dan Myanmar
	Total Sample	5	Vietnam, Indonesia, Malaysia, Brunei Darussalam, dan Philippines.

The research data employs panel data, which is a combination of cross-section and time series data (between individuals and spaces) (between time). The research period for the cross-sectional data in this study spanned 2000 to 2018, or 19 years, and included five ASEAN countries. The research variable consists of three independent variables: economic growth, industrial value added, and population; the dependent variable is carbon dioxide emissions. Methods for measuring research variables are as follows.

Table 3. Measurement of Research Variables

	Variable	Source	Unit	Symbol
	Dependent Variable			
1	Carbon Dioxide Emissions	World Bank	Kilo tonne	lnCo2
	Independent Variable			
1	Economic Growth	World Bank	USD	lnGDP
2	Industrial Value Added	World Bank	USD	lnIDS
3	Population	World Bank	People	lnPOP

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This study employs a static panel in two stages. The first stage is a model selection test using the Hausman and Lagrange-Multiplier (LM) tests to choose between the Common Effect Model (CEM), Random Effect Model (REM), and Fixed Effect Model (FEM). The second stage involves testing the research hypothesis proposed from the best model chosen with the criteria if the Probability Level 0.01 (1%) and 0.05 (5%) for the one tailed test can be accepted.

3. Results

3.1 Recruitment

This test employs panel data evaluated via static panel regression analysis. Before testing the research hypothesis, the author conducted a model selection test to identify the best model for this study. In this study, there are three stages of model selection testing to determine the best model: the Chow test aims to determine which of CEM and FEM is superior, the Hausman test, which seeks to determine the best model among FEM and REM models, and the Lagrange-Multiplier test, which seeks to determine the best model among CEM and REM models. This study's model selection test yielded the following results.

3.1. Chow Test

This study examines the influence of economic growth, industrial value added, and population on carbon dioxide emissions in Vietnam, Indonesia, Malaysia, Brunei Darussalam, and the Philippines from 2000 to 2018. This study employs the Chow Test to determine the superiority of the CEM and FEM models. The following are the findings of the study:

Table 4. Chow Test Result

Chi Square	Probability
2.07	0.5588
142.81	0.000

Table 4. provides evidence that the level of probability is 0.000<0.05. These results indicate that FEM is the optimal model, hence the Hausman test must be conducted.

3.2 Hausman Test

This study employs the Hausman Test to determine whether FEM or REM models are superior. The following are the study's conclusions.

Table 5. Hausman Test Result

Chi Square	Prob. Chi Saquare
2.07	0.5588

Table 5. shows that the Hausman Test results have a Chi Square probability value of 0.5588 or greater than the critical value of 0.05. That is, the REM model is the best model in this study, therefore additional testing with the Lagrange-Multiplier is required (LM).

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3.3 Lagrange-Multiplier (LM) Test

The Lagrange Multiplier (LM) test is used to determine which model is better between CEM and REM. The Breusch-Pagan method is used in this test. The results of the tests are as follows.

Table 6. Lagrange-Multiplier (LM) Test Result

Chibar Square	Prob. Chibar Square
526.04	0.0000

Source: Processed Data Results (2021)

Table 6. shows that the results of the LM test using the Breusch-Pagan method have a Chibar Square Probability of 0.000, which is less than the critical value of 0.05. That is, the REM model is the best model in this study. According to Gujarati and Porter (2009), the REM model is an estimation model that uses the Generalized Least Squares (GLS) method and adheres to the classical assumptions.

3.3.1 Panel Static Regression Model Result

The best model, REM, is chosen as the estimation model for static panel regression. The model is utilized to test the three research hypotheses proposed. This hypothesis was partially tested by incorporating three independent which are; economic growth, industrial value added, and population, and one dependent variable, carbon dioxide emissions. If the probability level in the study is 0.01 (1 %) and 0.05 (5%), then the research hypothesis can be accepted. The following are the findings of this study's hypothesis testing.

Table 7. Results of Partial Hypothesis Testing (t-test)

Independent Variable	Expected Impact	Coef.	Prob.	Conclusion
Economic Growth	+	0.4784803	0.020	H_1 accepted
Industrial Value Added	+	-0.0602662	0.781	H_2 rejected
Population	+	0.2800263	0.031	H_3 accepted
Constant		-4.13702	0.033	
R^2				
Within	= 0.8167			
Between	= 0.9399			
Overall	= 0.9341			

Table 7. shows that the variable coefficient of economic growth is 0.4784803 with a probability level of 0.020 or less than 5%. This means that, with a confidence level of 5%, the economic growth variable can have a statistically significant positive effect on carbon dioxide emissions. These findings are consistent with the proposed hypothesis, so H1 is accepted. The industrial value-added variable coefficient has a probability level of 0.781 or greater than the critical value of 0.05. Based on these findings, we conclude that the industrial value-added variable has no statistically significant effect on carbon dioxide emissions. Because these findings contradict the

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proposed hypothesis, therefore, H2 is rejected. Meanwhile, the population variable's coefficient value is 0.2800263, with a probability level of 0.031 or less than the critical value of 0.05. With a confidence level of 5%, these findings indicate that the population variable has a statistically significant positive effect on carbon dioxide emissions. These findings support the proposed hypothesis, hence, H3 is accepted.

The overall R2 value for this study was 0.9341. That is, 93.41 percent of the variation in carbon dioxide emissions can be explained by the variables of economic growth, industrial value added, and population. While other variables not included in the test can explain the remaining 6.59 percent, the carbon dioxide emission variable. The following is a summary of the research hypothesis testing results.

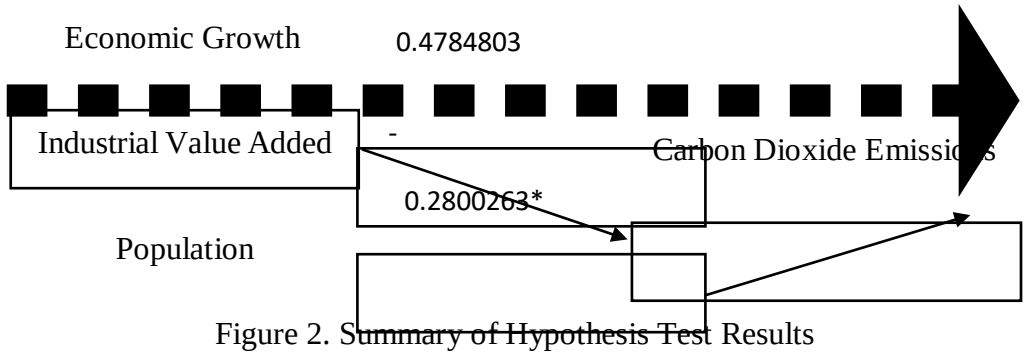

Figure 2. Summary of Hypothesis Test Results

Notes:

** significant at α 0,01 one tailed test

* significant at α 0,05 one tailed test

——→ Hypothdesis is accepted

- - - - - - -→ Hypothesis is rejected

4. Discussion

4.1 Effect of Economic Growth on Carbon Dioxide Emissions

The results of the study demonstrate, with a level of confidence of 5%, the economic growth as measured by GDP has an effect on carbon dioxide emissions in five ASEAN countries: Vietnam, Indonesia, Malaysia, Brunei Darussalam, and the Philippines. Therefore, H1 is accepted. This study provides empirical evidence that for every 1 percent increase in economic growth in five ASEAN countries, carbon dioxide emissions increase by 0.478%. This includes household consumption expenditures, government consumption, investment, tax payments, and export-import trading activities conducted by several multinational corporations. To increase economic growth, the government focuses on implementing policies that improve the well-being of the people in each ASEAN country. To promote economic growth in each region, the government continues to encourage a variety of state-owned and private goods and service industries to increase company productivity through business development in new business lines or by increasing production capacity.

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Through the implementation of this policy, the government will be able to increase state revenue through taxes, and the community's welfare will be enhanced because unemployment, poverty, and economic growth will be promoted in every district, city, and even remote villages. On the other hand, the policy has a negative effect in that the company will exploit the policy by excessively exploring natural resources. These conditions can diminish environmental quality. For instance, the use of natural resources for the acquisition of raw materials, energy sources, and production sites results in the destruction of nature and the reduction of green land, which results in the emission of carbon dioxide. According to Shafik and Bandyopadhyay (1992), economic growth can lead to an increase in environmental pollution, inverting the U-shaped EKS curve. The combustion of fossil fuels leads to a rise in environmental pollution (Wen et al., 2021). Carbon dioxide emissions will result from the excessive combustion of fossil fuels, leading to global warming. Islam et al. (2017) found that ASEAN countries (Indonesia, Malaysia, and Thailand) between 1991 and 2010 provide evidence that economic growth and carbon dioxide emissions are positively correlated. In line, Wen et al. (2021) supported that economic expansion can lead to an increase in carbon dioxide emissions. While research conducted by Nie et al. (2019) in three regions of China, namely the eastern, central, and western regions, concluded that economic growth in these three regions could lead to an increase in carbon dioxide emissions, these regions are the eastern, central, and western regions.

4.2 Effect of Industrial Value Added on Carbon Dioxide Emissions

This research find that the added value of industry has a statistically negative but insignificant effect on the increase of carbon dioxide emissions in five ASEAN countries, thus H2 is rejected. This study present empirical evidence, although it is not statistically significant, that increasing industrial value added can reduce carbon dioxide emissions. Specifically, this study provides empirical evidence that a 1 percent increase in industrial value added can result in a

0.06 percent reduction in carbon dioxide emissions, although this effect is not statistically significant. The findings of this study support Nugraha and Osman's (2019) conclusion that industrial value added has no effect on the increase in carbon dioxide emissions in Indonesia from 1974 to 2014. Concurred with Ranelovi et al. (2019) that the added value of the industry has no effect on the increase of carbon dioxide emissions in Colombia, Indonesia, Vietnam, Egypt, Turkey, and African countries from 1989 to 2016 over the short term. This indicates that not all companies operating in the five ASEAN member states rely on carbon dioxide-emitting fossil fuels to increase their industrial value added.

This study provides evidence that businesses in five ASEAN countries are beginning to recognize the need to switch from carbon-emitting energy sources to those that are less harmful to the environment so as to prevent environmental degradation. Table 8. shows that since 2000, companies in Indonesia, the Philippines, Malaysia, and Vietnam have partially utilized renewable energy, followed in 2011 by Brunei Darussalam. Indonesian companies used the most renewable energy in 2015, at 36.88 percent of total final energy consumption, followed by Vietnam at 35.00 percent, the Philippines at 27.45 percent, Malaysia at 5.19 percent, and Brunei Darussalam at 0.01 percent, with an average of 20.91 percent.

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Table 8. Renewable Energy Consumption (% of Total Final Energy Consumption) in Five Countries in ASEAN Region 2000 – 2015

Year	Indonesia	Philippines	Malaysia	Brunei Darussalam	Vietnam	Average
2000	45.58	34.85	6.74	0.00	57.96	29.03
2001	44.31	33.53	6.48	0.00	56.36	28.14
2002	44.64	32.83	5.72	0.00	52.41	27.12
2003	42.98	32.05	5.41	0.00	51.02	26.29
2004	41.42	31.31	5.17	0.00	45.99	24.78
2005	41.45	31.43	4.92	0.00	44.36	24.43
2006	39.94	32.60	4.99	0.00	44.46	24.40
2007	39.97	31.20	4.56	0.00	42.10	23.57
2008	40.16	31.73	4.73	0.00	39.46	23.21
2009	38.97	31.22	4.23	0.00	37.17	22.32
2010	37.75	28.81	3.82	0.00	34.80	21.04
2011	38.23	29.40	4.11	0.02	36.53	21.65
2012	38.23	30.22	4.41	0.01	38.11	22.20
2013	38.11	29.31	4.49	0.01	37.39	21.86
2014	37.45	28.58	4.77	0.01	37.04	21.57
2015	36.88	27.45	5.19	0.01	35.00	20.91

With the evolution of increasingly sophisticated technology. The government continues to encourage companies that utilize renewable energy to increase their industrial value added. This method is implemented as evidence of the success of a program for sustainable economic development. Ullah and Nefo (2021) argue that the emergence of carbon energy is an opportunity for every nation to streamline national energy resources through the incorporation of fossil energy and renewable energy in the near future in order to completely switch to renewable energy. The application of renewable energy is highly dependent on the use of poly generator systems in micro power plants, which can reduce environmental pollution, in both commercial and public sectors (Mohsin et al. 2021). Additionally, the use of such energy can boost economic growth and decrease carbon dioxide emissions (Ullah & Nefo. 2021).

4.1 Effect of Population on Carbon Dioxide Emissions

The results of the study provide empirical evidence that the population has a statistically positive effect on increasing carbon dioxide emissions so that H3 can be accepted. It means that an increase in the population of the five ASEAN countries can result in a rise in carbon dioxide emissions. Population growth can lead to an increase in carbon dioxide emissions, as demonstrated by Zhang and Tan's (2016) research. The increase in population is a result of the annual increase in population. This population increase has the potential to increase community activities. in both rural and urban regions. Table 9. shows that the majority of the average population in five ASEAN countries from 2000 to 2001 resides in rural areas, as shown in Table

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8. The urban population began to increase and shift between 2002 and 2018. It implies that in urban areas, community activities are increasing.

Table 9. Distribution of Population Areas in Five Countries in the ASEAN Region 2000 – 2018

Year	Indonesia		Philippines		Malaysia		Brunei Darussalam		Vietnam		Average	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rura	Urban	Rural
2000	42.00	58.00	46.14	53.87	61.98	38.02	71.16	28.84	24.37	75.63	49.13	50.87
2001	42.78	57.22	46.05	53.95	62.92	37.08	71.65	28.35	24.94	75.06	49.67	50.33
2002	43.57	56.43	45.97	54.04	63.86	36.14	72.05	27.95	25.51	74.49	50.19	49.81
2003	44.36	55.64	45.88	54.12	64.78	35.22	72.42	27.58	26.09	73.91	50.71	49.29
2004	45.15	54.85	45.80	54.21	65.69	34.31	72.79	27.21	26.68	73.32	51.22	48.78
2005	45.94	54.06	45.71	54.29	66.59	33.41	73.16	26.84	27.28	72.72	51.74	48.26
2006	46.74	53.26	45.63	54.38	67.48	32.52	73.53	26.47	27.89	72.11	52.25	47.75
2007	47.54	52.47	45.54	54.46	68.36	31.64	73.89	26.11	28.50	71.50	52.77	47.23
2008	48.34	51.67	45.46	54.55	69.23	30.78	74.25	25.75	29.13	70.87	53.28	46.72
2009	49.13	50.87	45.37	54.63	70.08	29.93	74.61	25.39	29.76	70.24	53.79	46.21
2010	49.91	50.09	45.33	54.67	70.91	29.09	74.96	25.04	30.42	69.58	54.31	45.69
2011	50.60	49.41	45.52	54.48	71.61	28.39	75.31	24.69	31.08	68.92	54.82	45.18
2012	51.28	48.72	45.71	54.29	72.28	27.73	75.66	24.34	31.75	68.25	55.33	44.67
2013	51.96	48.05	45.90	54.10	72.93	27.07	76.00	24.00	32.43	67.57	55.84	44.16
2014	52.64	47.37	46.09	53.91	73.58	26.42	76.33	23.67	33.12	66.89	56.35	43.65
2015	53.31	46.69	46.28	53.72	74.21	25.79	76.66	23.34	33.81	66.19	56.86	43.14
2016	53.99	46.01	46.48	53.53	74.84	25.16	76.99	23.01	34.51	65.49	57.36	42.64
2017	54.66	45.34	46.68	53.32	75.45	24.55	77.31	22.69	35.21	64.79	57.86	42.14
2018	55.33	44.68	46.91	53.09	76.04	23.96	77.63	22.37	35.92	64.08	58.36	41.64

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Population growth in urban areas can lead to a regional economic expansion. This economic expansion was brought on by a rise in demand for both goods and services. According to Cui et al. (2019), population growth in urban areas can stimulate infrastructure development in residential areas, which has a long-term impact on the emergence of economies of scale, particularly in the early stages of urbanization. The development of infrastructure is used to fulfill the needs and provide access to facilities that can facilitate community activities. According to Hashmi and Alam (2019), population and prosperity are two important factors that have a significant impact on the amount of carbon dioxide emissions. The rise in population has prompted a number of businesses to provide not only infrastructure, but also food, drink, clothing, electronics, housing, and other auxiliary equipment. This condition is extremely advantageous for the government because it has the potential to stimulate economic growth in the region. On the other hand, this condition can worsen the quality of the surrounding environment by increasing waste production and carbon dioxide emissions. Empirically. This study provides evidence that population growth in five ASEAN countries, which are Indonesia, Philippines, Malaysia, Brunei Darussalam, and Vietnam, can increase carbon dioxide emissions by 0.280 percent for every 1 percent increase in population.

5. Conclusion

This study examines the impact of economic growth, industrial value added, and population on carbon dioxide emissions in five ASEAN countries consist of: Indonesia, Philippines, Malaysia, Brunei Darussalam, and Vietnam from 2000 to 2018. On the basis of the preceding discussion, it can be concluded that economic growth has a positive effect on carbon emissions in five ASEAN countries (Indonesia, Philippines, Malaysia, Brunei Darussalam, and Vietnam) over the period 2000 to 2018 with a level of confidence of 5%; therefore, H1 is accepted. This means that a 1 percent increase in economic growth can result in a 0.478% increase in carbon dioxide emissions. Statistically, industrial added value has no effect on carbon emissions in five ASEAN countries from 2000 to 2018: Indonesia, the Philippines, Malaysia, Brunei Darussalam, and Vietnam; thus, H2 is rejected. Every 1 percent increase in industrial value added can reduce carbon dioxide emissions by 0.060%, which is insignificant. H3 is accepted because population has a positive effect on carbon emissions in five ASEAN countries (Indonesia, Philippines, Malaysia, Brunei Darussalam, and Vietnam) over the period 2000 to 2018 with a confidence level of 5%. This means that for every 1 percent increase in population, carbon dioxide emissions can increase by 0.280 percent.

References

Abdullah, L. (2015). Linear Relationship between CO2 Emissions and Economic Variables: Evidence from a Developed Country and a Developing Country. Journal of Sustainable Development, 8(2): 66-72.

Alam, M. A., Murad, M. W., Noma, A. H. M., & Oztruck, I. (2016). Relationships among carbon emissions, economic growth, energy consumption and population growth: Testing Environmental Kuznets Curve hypothesis for Brazil, China, India and Indonesia. Ecological Indicators, 70, 466-479.

Vol. 6, No.08; 2022

ISSN: 2456-7760

Begum, R. A., Sohag, K., Abdullah, S. M. S., & Jaafar, M. (2015). CO2 emissions, energy consumption, economic and population growth in Malaysia. Renewable and Sustainable Energy Reviews, 41, 594-601.

Boopen, S., & S. Vinesh. (2011). On the Relationship between CO2 Emissions and Economic Growth: The Mauritian Experience. In University of Mauritius, Mauritius Environment Outlook Report.

Cui, P., Xia, S., & Lisha, H. (2019). Do different sizes of urban population matter differently to CO2 emission in different regions? Evidence from electricity consumption behavior of urban residents in China. Journal of Cleaner Production, 240, 1-12.

Earth System Research Laboratory. (2015). The NOAA Annual Greenhouse Gas Index (AGGI). Web: http://www.esrl.noaa.gov/gmd/aggi/aggi.html. Accessed on August 14, 2021.

Grossman, G., & Krueger, A. (1995). Economic growth and environment. Quarterly Journal Economics. 110, 353–377.

Gujarati, D. N., & Porter, D. C. (2009). Basic Econometric. 5th Edition. New York: McGraw–Hill.

Hashmi, R., & Alam, K. (2019). Dynamic relationship among environmental regulation, innovation, CO2 emissions, population, and economic growth in OECD countries: A panel investigation. Journal of Cleaner Production, 231, 1100-1109.

Hundie, S. K. (2018). Modelling Energy Consumption, Carbon Dioxide Emissions and Economic Growth Nexus in Ethiopia: Evidence from Cointegration and Causality Analysis. Turkish Journal of Agriculture - Food Science and Technology. 6(6), 699-709.

Islam, R., Ghani, A. B. A., dan Mahyudin, E. (2017). Carbon Dioxide Emission, Energy Consumption, Economic Growth, Population, Poverty and Forest Area: Evidence from Panel Data Analysis. International Journal of Energy Economics and Policy, 7(4), 99-106.

Khan, M. K., and Khan, M. I., dan Rehan, M., (2020). The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. Financial Innovation, 6(1), 1-13.

Mohsin, M., Kamran, H. W., Nawaz, M. A., Hussain, M. S., & Dahri, A. S. (2021). Assessing the impact of transition from nonrenewable to renewable energy consumption on economic growth-environmental nexus from developing Asian economies. Journal of Environmental Management, 284, 1-8.

Nie, Y., Wang, E., & Zhang, T. (2019). Study of the nonlinear relations between economic growth and carbon dioxide emissions in the Eastern, Central and Western regions of China. Journal of Cleaner Production, 219, 713-722.

Nugraha, A. T., & Osman, N. H. (2019). CO2 Emissions, Economic Growth, Energy Consumption, and Household Expenditure for Indonesia: Evidence from Cointegration and Vector Error Correction Model. International Journal of Energy Economics and Policy, 9(1), 291-298.

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ISSN: 2456-7760

Poku, F. A. (2016). Carbon Dioxide Emissions, Urbanization and Population: Empirical Evidence In Sub Saharan Africa. Energy Economics Letters, 3(1), 1-16.

Ranđelović, M. P., Mitić, P., Zdravković, A., Cvetanović, D., & Cvetanović, S. (2020). Economic growth and carbon emissions: evidence from CIVETS countries. Applied Economics, 52(6), 1806-1815.

Sarkodie, S. A., & Uwusu, P. A., (2016). Carbon dioxide emissions, GDP, energy use, and population growth: a multivariate and causality analysis for Ghana, 1971–2013. Environmental Science and Pollution Research, 23, 13508 –13520.

Shafik, N., & Bandyopadhyay, S. (1992). Economic Growth and Environmental Quality: Time-Series and Cross-Country Evidence. World Bank Publications, 904, 1-50.

Stern, D. I., Common, M. S., & Barbier, E. B. (1996). Economic Growth and Environmental Degradation: the Environmental Kuznets Curve and Sustainable Development. World Development, 24(7), 1151–1160.

Solomon, S., Plattner, G.-K., Knutti, R., & Friedlingstein, P. (2009). Irreversible climate change due to carbon dioxide emissions. Proceedings of the National Academy of Sciences. 106 (06), 1704-1709.

Ullah, H. Q., & Nevo, C. M. (2021). The impact of renewable energy consumption and environmental sustainability on economic growth in Africa. Energy Reports. 7, 3877-3886.

Wen, J., Mughal, N., Zhao, J., Shabbir, M. S., Niedbaa, G., Jain, V., & Anwar, A. (2021). Does globalization matter for environmental degradation? Nexus among energy consumption, economic growth, and carbon dioxide emission. Energy Policy. 153, 1-8.

World Bank. (2021). Indicator. Web: https://data.worldbank.org/indicator. Accessed on August 11, 2021.

World Resource Institute. (2021). The History of Carbon Dioxide Emissions. Web: https://www.wri.org/insights/history-carbon-dioxide-emissions. Accessed on August 10, 2021.

Zhang, C., & Tan, Z. (2016). The relationships between population factors and China's carbon emissions: Does population aging matter?. Renewable and Sustainable Energy Reviews. 65, 1018-1025.