EFFECT OF ECONOMIC GROWTH, URBAN POPULATION, TRADE OPENNESS ON CARBON DIOXIDE EMISSIONS IN ASEAN-5

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ABSTRACT

This study aimed to influence economic growth, the urban population, and trade openness to carbon dioxide (CO_2) in ASEAN 5. This study panel data from the years 2010 to 2018. The unit of analysis is ASEAN countries: Indonesia, Malaysia, Philippines, Singapore, and Thailand. Panel data multiple linear regression method, with the help of Software Eviews 9. The results of the study show, t test, that the variable of economic growth has a positive and insignificant effect on carbon dioxide gas emissions in ASEAN 5. The urban population variable has a positive and significant effect on carbon dioxide gas emissions in ASEAN 5. The variable trade openness has a positive and insignificant effect on carbon dioxide gas emissions in ASEAN 5. The results of the F test, all independent variables of economic growth, urban population, and trade openness have a simultaneous and significantly to the dependent variable, namely carbon dioxide gas emissions in ASEAN 5.

Keywords: Emissions of Carbon Dioxide (CO_2); Economic Growth; Urban Population; Trade Openness; Panel Data.

INTRODUCTION

A serious environmental issue in the world is global warming. The impact of global warming is the shift of seasons and extreme weather in parts of the world. This is due to an increase in Greenhouse Gases (GHGs), including "carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and three categories of fluorine-containing gases (HFCs, PFCs and SFs_6). Of these six components, carbon dioxide gas contributes the highest 75% (Sukardi, 2012). (Karakaya and Ozcag, 2005) said that when the other gas components in GHG decreased, the emission of carbon dioxide gas increased. Source emissions of CO_2 are derived from human activities is 80%, the remaining 20% from deforestation and forest degradation (Sukardi, 2012).

ASEAN contributed to the growth of emissions of CO_2 n 2030 (OECD, 2011). Therefore, the active participation of ASEAN in reducing emissions of CO_2 is indispensable in order to control global warming is happening right now. The driving factors for emissions of Co2 (Dietz and Rosa, 1997) explains that anthropogenic factors, such as "(1) the population; (2) economic activity; (3) technological progress; (4) political and economic institutions; (5) attitudes and beliefs". Suparmoko (1997) states that the increasing number of people causes an increase in demand for goods and services. As a result, natural resources are running low and environmental pollution is increasing. This will cause the Greenhouse Gases (GHG) to be depleted. The second factor is economic activity as seen from economic growth. Economic growth measures the growth of a

country in producing goods and services. Other variables that affect emissions of CO $_2$ is the t*rade openness.*

Akram 2012), the research objective is to analyze the impact of climate change on economic growth in Asian countries, 1972 – 2009. The results of the study are that economic growth has a negative effect on carbon dioxide emissions; population growth and urbanization stimulate carbon dioxide emissions; and agriculture is the sector vulnerable to climate change, while the manufacturing sector is the sector least affected by climate growth.

Kasman (2015) investigates the causal relationship of energy consumption, economic growth, trade openness, and urbanization to carbon dioxide emissions in EU countries in 1992 – 2010. The results show that there is a short-term unidirectional panel causality that runs from energy consumption, international trade openness, urbanization to carbon dioxide emissions.

Sun (2019) investigates trade and carbon dioxide (CO2) emissions by integrating economic growth and energy use as the main potential determinants in 49 high-emissions countries in the Belt and Road Region from 1991 to 2014. The VECM results show a long-term causal effect between trade openness, economic growth, energy consumption on carbon dioxide (CO2) emissions in the Belt and Road in 1991 – 2014. The results of the Environmental Kuznet curve show an inverse U shape relationship between trade and carbon dioxide (CO2) emissions

Some results of these studies are the results of different studies, so the researchers examined the effect of economic growth objectives, the urban population (*urban population*), and openness of international trade (*trade openness*) to carbon dioxide (CO2) in ASEAN-5. The title of this research "The Influence of Economic Growth, City Population, and Openness of International Trade on Carbon Dioxide (CO2) Gas Emissions in ASEAN-5 Countries 2010 – 2018"

Method

This study uses panel data from 2010 – 2018. The unit of analysis is ASEAN countries: Indonesia, Malaysia, Philippines, Singapore, and Thailand. The data used is secondary data from the *World Development Indicators of the* World Bank. The operational definitions of variables are described in table1:

Table 1. Operational Definition

Variable	Explanation	Reason	Hypothesis	Unit
Carbon Dioxide (C02) Emissions	Emissions from the burning of fossil fuels and the manufacture of cement resulting from the consumption of solid, liquid, and gaseous fuels and the combustion of gases	Carbon dioxide emissions can be affected by economic growth, urban population, and international trade openness	The higher the emission of carbon dioxide (C02), the higher the economic growth, the urban population, and the openness of international trade	Metric Tons per Cap
Economic growth	Economic growth is seen from the growth of Gross Domestic Product (real GDP)	A good economic condition of a country can be seen from high economic growth	The higher the economic growth, the higher the emission of carbon dioxide (C02).	Percent
Urban Population	People living in urban areas	The urban population plays an important role in carbon dioxide (C02) emissions	The higher the urban population, the higher the emission of carbon dioxide (C02).	Person
Trade Openness	The ratio of total exports plus the total imports of goods and services to Gross Domestic Product (real GDP)	International trade openness plays an important role in contributing to carbon dioxide (CO2) emissions	The higher openness of international trade, the higher the amount of carbon dioxide (CO2)	Percent

Source: Authors (2021)

This research model is modified from Akram's (2012) research, so the equations of this research are:

$$CO_{2t} = \alpha_1 + \beta_1 PE_{tj} + \beta_2 PPK_{tj} + \beta_3 KPI_{tj} + \varepsilon_t \quad \text{...} \quad (Eq\ 1)$$

Keterangan:

CO_2 = Carbon Dioxide Emissions; PE = Economic Growth; PPK = Urban Population; KPI = Trade Openness; α = Constant; t = Time; j = Country; β = Variable Coefficient; and ε = *Error term.*

Results And Discussion

Panel data models are: Pooled Least Square, Fixed Effect Model, Random Effect Model (Gujarati, 2009).

Table 2. Chow test

Results	Criteria	Selected Result Description
0.0000	Prob 0.0000 < = 0.05	The selected model is the *Fixed Effect Model*

Source: Data processed by the author (2021)

Table 2, the probability of the chow test is 0.0000, the probability result is less than α = 0.05. So, it can be concluded that Ho is rejected and Ha is accepted. The selected model is the *Fixed Effect Model.*

Table 3. Hausman test

Results	Criteria	Selected Result Description
0.4830	Prob 0.0000 > = 0.05	The selected model is the *Random Effect Model*

Source: Data processed by the author (2021)

Table 3, the probability of the Hausman test is 0.4830, the probability result is greater than α = 0.05. So, it can be concluded that Ho is accepted and Ha is rejected. The selected model is the *Random Effect Model.*

Table 4. Lagrange Multiplier Test

Results	Criteria	Selected Result Description
0.0000	Prob 0.0000 < = 0.05	The selected model is the *Random Effect Model*

Source: Data processed by the author (2021)

Table 4, the probability of the lagrange multiplier test is 0.0000, where the probability result is less than α = 0.05. So, it can be concluded that Ho is rejected and Ha is accepted. The selected model is the *Random Effect Model.*

Table 5. Multiple Linear Regression Results (Random Effect Model)

Variable	Coefficient	t-Statistic	Probability	$\square$	Results
PE	0.008515	0.598976	0.5525	0.05	Not significant
PPK	0.077744	4.580400	0.0000	0.05	Significant
KPI	0.000743	0.372989	0.7111	0.05	Not significant

Source: Data processed by the author (2021)

So, after being processed using eviews 9, equation 2 is obtained as a whole, namely:

$$Yi = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + e_{it} \dots\dots\dots\dots\dots\dots\dots\text{(Eq 2)}$$
$$= -0.639929 + 0.008515 + 0.0777444 + 0.000743 + e_{it}$$

The equation shows that β_0 or C or the coefficient affects the emission of carbon dioxide (CO_2) by 2,185. The result of $\beta_1 X_{1it}$ or the variable of economic growth will affect carbon dioxide emissions by 0.008515. The result of $\beta_2 X_{2it}$ or the urban population variable will affect the carbon dioxide emission gas by 0.0777444. At $\beta_3 X_{3it}$ or the variable of international trade openness will affect carbon dioxide gas emissions by 0.000743.
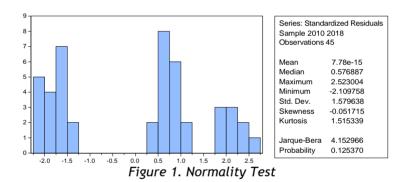
Classic Assumption Test
Autocorrelation Test

Table 6. Autocorrelation of Cochrance-Orcutt Method

D count	DW	Du	dL	4-Du	4-dL
Score	1.816	1.6662	1.3832	4- 1.6662 = 2.3338	4- 1.3832 = 2.6168

Source: Data processed by the author (2021)

The image above shows that DW 1.816, dl 1.3832, du 1.662. So, 4-dl = 2.6168 and 4-du = 2.338. This DW value is in an area where there is no autocorrelation.

Normality test

Series: Standardized Residuals
Sample 2010 2018
Observations 45

Mean	7.78e-15
Median	0.576887
Maximum	2.523004
Minimum	-2.109758
Std. Dev.	1.579638
Skewness	-0.051715
Kurtosis	1.515339
Jarque-Bera	4.152966
Probability	0.125370

Figure 1. Normality Test

Source: Data processed by the author (2021)

Figure 1, the normality test, Jarque-Bera of 4.152966 with a probability value of 0.125370 > α 0.05 (greater than 0.05) concluded that the normality test using Jarque Berra data is normally distributed.

Heteroscedasticity Test

Table 7. Heteroscedasticity Test

Variable	Coefficient	t-Statistic	Prob.
C	1.616843	2.622787	0.0122
PE	0.002189	0.158733	0.8747
KDP	0.002862	0.287622	0.7751
KPI	-0.002636	-1.682191	0.1001

Source: Data processed by the author (2021)

Table 7, the probability PE variable is $0.8747 > \alpha = 0.05$. The population variable of the population of the city has a probability of $0.7751 > \alpha = 0.05$. The variable of international trade openness has a probability of $0.1001 > \alpha = 0.05$. The probability value is more than $= 0.05$, then there is no heteroscedasticity.

Hypothesis Test f and t

F Test

Table 8. F Test

F- Statistics	Prob. (F-Statistics)	Results
14,40129	0.000000	Significant

Source: Data processed by the author (2021)

Table 8, F-Statistic of 14.40129 with a probability value of 0.000000 (less than 0.05). In conclusion, the independent variables of economic growth, urban population, and international trade openness have a simultaneous and significant effect on the dependent variable, namely carbon dioxide gas emissions.

T test

Table 9. T Test

Variable	Coefficient	t-Statistic	Probability	🔲	Results
PE	0.008515	0.598976	0.5525	0.05	Not significant
PPK	0.077744	4.580400	0.0000	0.05	Significant
KPI	0.000743	0.372989	0.7111	0.05	Not significant

Source: Data processed by the author (2021)

1. Variable economic growth

   The probability is 0.5525, meaning that it is greater than the significance level of α 5% (0.05). So, Ho is accepted and Ha is rejected, meaning that the independent variable of economic growth has no significant effect on the dependent variable of carbon dioxide gas emissions (C02). The coefficient of economic growth is 0.008515, meaning that if there is an increase in the value of the X variable (economic growth) by 1 percent, it will result in an increase in the value of the Y variable (carbon dioxide gas emissions) of 0.008515. Thus, economic growth has a positive and insignificant effect on carbon dioxide emissions.

2. Urban Population

   The probability is 0.0000, meaning that it is smaller than the significance level of α 5% (0.05). So, Ho is rejected and Ha is accepted, meaning that the independent variable of urban population has a significant effect on the dependent variable of carbon dioxide gas emissions (C02). The coefficient on the population of the city population is 0.077744, meaning that if there is an increase in the value of the X variable (city population) by 1 person, it will result in an increase in the value of the Y variable (carbon dioxide gas emissions) of 0.077744. So, the urban population has a positive and significant effect on carbon dioxide emissions.

3. Trade openness

   The probability is 0.7111, meaning that it is greater than the significance level of α 5% (0.05). So, Ho is accepted and Ha is rejected, meaning that the independent variable of international trade openness has no significant effect on the dependent variable of carbon dioxide gas emissions (C02). The coefficient of the international trade openness variable is 0.000743, meaning that if there is an increase in the value of the X variable (international trade

openness) by 1 percent, it will result in an increase in the value of the Y variable (carbon dioxide gas emissions) of 0.000743. Thus, international trade openness has a positive and insignificant effect on carbon dioxide emissions.

Coefficient of Determination (R^2)

Table 10. Coefficient of Determination (R^2)

R-Squared	Adjusted R-Square
0.343540	0.295507

Source: Data processed by the author (2021)

Table 10, R-Squared of 0.343540 and Adjusted R-Squared of 0.295507, it is concluded that the relationship between the variables of economic growth, urban population, and international trade openness to carbon dioxide emissions in 2010-2018 is only 22.8% with the remaining 100 % – 34.3% = 65.70% will be explained by variables that are not in this study.

Effect of economic growth on carbon dioxide emissions

Economic growth has a positive and insignificant effect on carbon dioxide emissions. This result is not in accordance with Akram (2012), which states that economic growth has a negative and significant effect on carbon dioxide emissions. However, the results of this study are in accordance with the findings of Shahbaz et al. (2013) which states that economic growth has a positive effect on carbon dioxide gas emissions. The higher the economic growth of a country, the more carbon dioxide gas emissions. This happens because a country that has high economic growth usually carries out economic activities or activities of a high country. The high economic activity causes the country's carbon dioxide emissions to be high.

Effect of urban population on carbon dioxide emissions

The urban population has a positive and significant effect on carbon dioxide emissions. The results of the study are in accordance with Grunewald and Zarzoso (2009); Rahmansyah (2012); Jugurnath and Emrith (2016) stated that urban population has a positive influence on carbondioxide emissions. However, this study is not in accordance with the research results of Rahman et al (2020). The results of the study the more or higher the population of a country's urban population,the higher the carbon dioxide emissions. This is in accordance with the theory, because the increasingnumber of city residents makes their daily activities usually use energy so that it will contribute to high or quite a lot of carbon dioxide emissions (Widyawati, 2021).

Activities that contribute to higher carbon dioxide emissions, for example, are the use of infrastructure, use of transportation, energy, and the transition of activities from agriculture to industry. These various activities cause the use of fossil fuels to increase which in turn will lead to an increase in environmental pollution or carbon dioxide emissions. This is also influenced by the quantity of the population of the city's population which causes more and more carbon dioxide emissions in a country. The level of education and awareness of city dwellers in behaving in daily activities will affect their environment.

Effect of international trade openness on carbon dioxide emissions

The openness of international trade has a positive and insignificant effect on carbon dioxide emissions. The results of the study are not in accordance with Kasman (2015) and (Halicioglu, 2009),

international trade openness has a negative effect on carbon dioxide emissions. This means that the higher the international trade openness of a country, the lower its carbon dioxide emissions. This can happen because the country specializes in trade or industry which has a comparative advantage. Countries that have a comparative advantage can allocate resources more efficiently so as to improve the welfare of its population. If the welfare of the population is good, the government will tighten regulations on the environment. This will encourage innovation from the government and citizens to reduce carbon dioxide emissions. However, the results of this study are in accordance with Sun et al (2019) which states that international trade openness in long-term equilibrium relationships and causality relationships has a significant effect on carbon dioxide gas emissions. This is because countries that have high international trade openness will usually produce high levels of goods and services.

CONCLUSION

The conclusions from the results of the research above are: Economic growth has a positive and insignificant effect on carbon dioxide gas emissions in ASEAN-5 countries in 2010 – 2018. The urban population has a positive and significant effect on carbon dioxide emissions in ASEAN-5 countries in 2010 – 2018; and international trade openness have a positive and significant impact on the carbon dioxide emissions of ASEAN-5 countries in 2010 – 2018.

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