

Determinants of Green Gross Domestic Product (GDP) in ASEAN-5 Countries

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Abstract

The over-exploitation of natural resources to increase economic growth causes environmental degradation, and climate change has been a serious research issue. Gross Domestic Green Product (green GDP) is a proxy of Green economic growth. It is an indicator of sustainable economic development that considers aspects of environmental degradation. This study aims to determine the effect of carbon dioxide emissions, foreign direct investment, current account balance, and population on green GDP in five ASEAN countries: Indonesia, Malaysia, Thailand, the Philippines, and Myanmar. This study utilized panel data, a combination of time series and cross-section data. The selected model was the Fixed Effect Model (FEM). This study found that two independent variables: carbon dioxide emissions and the population had a significant positive effect on green GDP. Meanwhile, Foreign Direct Investment and current accounts do not significantly affect green GDP. Thus, the government as a regulator has a role in managing policies related to carbon emissions and population in supporting green economic growth.

Keywords: Green GDP, CO2, FDI, Population, Current Account

JEL classification: O44, P45, Q56,

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1. INTRODUCTION

Increasing economic growth is one indicator of the economic development progress. Many theories explain that higher economic growth will trigger income distribution through a trickle-down effect (Wu et al., 2021a). Income equality will be distributed automatically to the community through employment or other economic opportunities. Conventionally, economic growth is measured by GDP (Zhang et al., 2022a).

However, developments measured by high GDP cannot solve problems such as poverty,

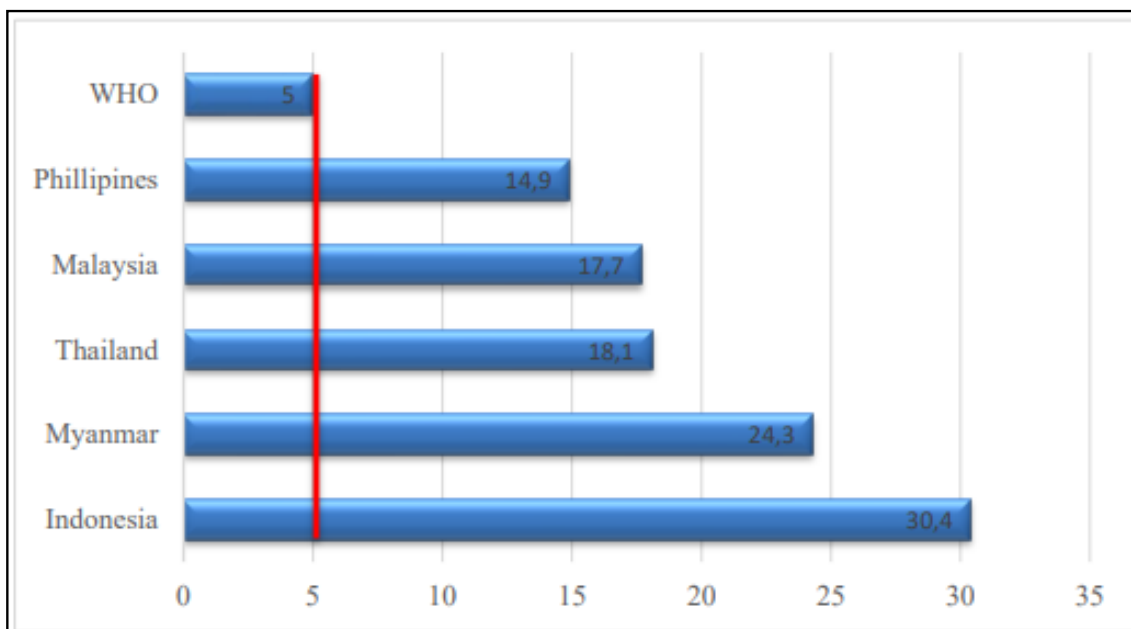
unemployment, income distribution, and environmental degradation (Hoff et al., 2021). Therefore, economic development is needed, which does not only focus on economic growth but also focuses on sustainable economic development. Sustainable development does not only focus on economic growth but also other aspects in the form of economic sustainability, social sustainability, and environmental sustainability (Zugravu-Soilita et al., 2021). Development indicators for a sustainable economy do not use GDP and GRDP, calculated based on the System of National Accounts

(SNA). The indicators are based on Green GDP or Green GRDP, calculated using an integrated concept between the environment and the economy (Listra & Prasetyia, 2020).

The utilization of green GDP will slow economic growth compared to brown GDP. Brown GDP is a term for conventional GDP which only focuses on economic sustainability but does not pay attention to environmental issues (Shirazi et al., 2020). This is because brown GDP does not include depletion factors and environmental damage. Thus, the value of natural resource loss and environmental damage cannot be identified (Suparmoko, 2020). Brown GDP only focuses on measuring economic value, while green GDP includes natural resource depletion and environmental degradation with the goal of sustainable development (Suryanto, 2009). Environmental degradation will decrease, and the recovery cost will be insignificant because it has been calculated as an annual cost of green GDP. Meanwhile, the brown GDP does allow for rapid economic growth because it does not consider the limits of environmental capabilities. After

all, there is a notion that high income can overcome environmental impacts. Exploiting natural resources causes depletion and severe environmental degradation. Thus, the recovery costs are more significant.

Air pollution is a form of environmental degradation caused by exploiting natural resources to achieve high economic growth. According to the United Nations Environment Program (UNEP), air pollution in ASEAN's five countries, Indonesia, Malaysia, Thailand, the Philippines, and Myanmar, will have air quality above the ideal standards of the World Health Organization (WHO) in 2022. According to WHO, the maximum limit value for air quality is five micrograms per cubic meter. In Indonesia, Myanmar, Thailand, Malaysia, and the Philippines, the air quality is 30.4, 24.3, 18.1, 17.7, and 14.9 micrograms per cubic meter, respectively, indicating that the air quality in the area is not good. Therefore, research on Green GDP, which covers environmental degradation variables, is important, especially in the five ASEAN countries with non-ideal air pollution values.



Grafik 1. Air Quality in Five ASEAN Countries

Some studies conducted in East and Southeast Asia revealed that increased per capita economic growth positively impacts pollution. Increasing per capita income will generate environmental pollution (Gunay et al., 2022). Perwithosuci et al. (2022) also found that carbon dioxide emissions and population density positively affected economic growth in five South Asian countries. Research discussing the factors affecting green growth in 123 developed and developing countries concludes that economic development and the utilization of renewable energy positively influence green growth. At the same time, trade openness can harm green growth (Lin & Zhou 2022). Nevertheless, each country requires a different strategy for achieving sustainable development goals. Vieira & MacDonald (2020) found that the current account balance can explain 12% of variations in economic growth by performing a simple linear regression.

Meanwhile, research conducted in ASEAN countries using panel data linear regression found that economic growth has a negative effect on carbon dioxide emissions. Meanwhile, population and economic growth have a positive but insignificant relationship (Hananya & Handoyo, 2021). This study's results differ from research conducted in the Tebo district in 2016-2020, which concluded that population size partially and significantly affects economic growth (Darma, 2021). Other studies which employed Ordinary Least Squares (OLS) and Engle-Granger Error Correction Model (EG-ECM) found that Foreign Direct Investment has a positive and significant effect on economic growth in the short term (Lin & Zhou, 2022b). A study by Muvawala et al. (2021) regarding the relationship between economic growth, population, and carbon dioxide, revealed that population and economic growth have the opposite effect on carbon dioxide emissions in Uganda by using Autoregressive Distributed Lag (ARDL). The population significantly affects economic growth, while statistically, economic growth is not significant but has a positive effect in the long term (Çetin et al. 2023).

Thus, many previous studies have discussed economic growth. However, not many studies have discussed green growth in ASEAN countries. This study examines the effect of carbon dioxide emissions, foreign direct investment, the current account balance, and total population on green economic growth in ASEAN countries: Indonesia, Malaysia, Thailand, the Philippines, and Myanmar.

2. LITERATURE REVIEW

2.1 Green Growth and Green PDB

Green growth is a concept derived from factors to maintain good environmental quality. This idea appears because conventional economic growth, often called brown economic growth, has so far been unable to solve the problem of climate change, ecological damage, and environmental degradation caused by exploiting natural resources to produce high economic growth. Green growth theory emphasizes the importance of expanding sustainable economic development according to natural resource conditions (Belmonte-Ureña et al., 2021; Gunay et al., 2022b). Green growth can encourage economic growth and development while ensuring the availability of natural resource assets and environmental services, which are the primary basis of life. Thus, economic development is expected to be sustainable without avoiding environmental damage (De Pascale et al., 2020). Studied on green growth found that economic development and renewable energy consumption affect green growth positively, while trade openness and fossil energy consumption negatively affect green growth (Tawiah et al., 2021).

According to Mohsin et al. (2022), green economic growth is environmentally friendly and low in carbon dioxide (CO₂) economic growth. CO₂ is one of the greenhouse gases which causes global warming by raising the earth's temperature. Green growth is sustainable economic growth. As sustainable economic growth, green economic growth can be used as an appropriate development performance

measurement tool. Thus, the economic growth indicators still using Conventional or Brown GDP and GRDP can switch to Green GDP and GRDP as mandated by Law Number 32 of 2009 concerning Protection and Environmental Management. The law states that each government, whether the Regional Government or the Central Government, must develop green GDP or GRDP, which has considered environmental dimensions in the form of natural resource depletion and environmental degradation. Thus, Green GDP can be calculated by subtracting Conventional GDP from environmental pollution cost and resource depletion cost (Wang et al., 2020; Sidjabat & Apsari, 2020).

2.2 Carbon Dioxide Emission (CO₂)

Carbon dioxide (CO₂) emissions are generated 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. CO₂ emissions are one of the factors that can generate global warming, which can cause climate change, which is a strategic issue at this time. According to Zhang et al. (2022b), economic growth, urban population, and international trade openness can affect carbon dioxide emissions. Conventionally, higher carbon dioxide (CO₂) emissions increase economic growth. This is because conventional economic growth does not pay attention to environmental elements.

2.3 Foreign Direct Investment

According to Investment Law No. 25 of 2007, foreign investment is an investment activity to run a business in the Republic of Indonesia territory, which is conducted by foreign investors either using entirely foreign capital or joint ventures with domestic investors.

Foreign investment plays a vital role in the economic growth of developing countries. It influences employment scenarios, production, prices, income, imports, exports, the general welfare of recipient countries, and the balance of

payments. It is an essential source of economic growth (Cieřlik & Ghodsi, 2021; Setyadharna & Fadhilah, 2021).

2.4 Current Account Balance

The current account balance is one of the structures in the balance of payments. Theoretically, the current account balance consists of goods, services, and unilateral transfers. A positive value in the current account indicates an increase in the current account, which means there is a current account surplus. Conversely, if the value is negative, there is a decrease in the current account, which is called a current account deficit (Beirne et al., 2021).

2.5 Population

A population is the number of people living in a specific geographic area for six months or more. In classic economic growth indicators, the economic growth rate can be linked to population growth because the population will ultimately enjoy the resulting economic growth rate. Thus, the population needs to be considered not only as a subject but also as an object of development. Changes in the population aspect will affect the development process and the goals (Wahyuningrum & Aisyah, 2023).

3. RESEARCH METHOD

3.1 Data

This study utilizes secondary data covering five ASEAN countries: Indonesia, Malaysia, Thailand, Philippines, and Myanmar annually from 1996-2020. There is a dependent variable and four independent variables. The variable definitions are shown in Table 1.

This current study employs the panel regression method. There are three-panel models of the regression method consisting of Common-Effect, Fixed-Effect, and Random Effects. Generally, some studies have to choose between Fixed-Effect and Random-Effect models due to the limitations of the Common-Effect model.

Table 1. Variabel Specification

No	Variable	Unit	Source
1.	Green GDP	US\$	Green GDP = GDP Riil - Total natural Resources rents - energy depletion (calculated by authors)
2.	Carbon dioxide emission	Metric Per Capita	World Bank
3.	Foreign Direct Investment	US\$	World Bank
4.	Current Account Balance	US\$	World Bank
5.	Population	People	World Bank

Source: World Bank

Data Analysis Model

This study employs panel data regression. Following the research objectives and theory development, the econometric model in this study is as follows:

$$GreenGDP_{it} = \beta_0 + \beta_1 CO2_{it} + \beta_2 FDI_{it} + \beta_3 CA_{it} + \beta_4 POP_{it} + \varepsilon_{it}$$

Based on the formula above, Green GDP is the dependent variable obtained by subtracting real GDP from the total natural resources rents and energy depletion calculated by the author. β_0 is constant, CO2, FDI, CA, and POP are independent variables representing carbon dioxide emissions, foreign direct investment, current account balance, and population, respectively. ε_{it} is the error term, and the term (it) subscript indicates panel data: i for countries and t for the period.

4. RESULT AND DISCUSSION

The fixed-Effect model is performed to estimate the data. The result showed that FDI and the current account balance negatively affect the Green Gross Domestic Product. Meanwhile, population and carbon dioxide emissions positively affect the Green Gross Domestic Product at the level of α 1% in the model. Table 2 provides the panel data estimation results.

Table 2. Estimation Result

Variable	PLS		FEM		REM	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
CO2	4.E+10	0.000	7.E+10	0.000	4.E+10	0.000
FDI	-17.824	0.000	-1.427	0.534	-17.824	0.000
CA	1.763	0.236	-0.724	0.361	1.763	0.019
POP	2036.052	0.000	12063.280	0.000	2036.052	0.000
C	-1.E+11	0.000	-1.E+12	0.000	-1.E+11	0.000
R ²	0.694		0.926		0.694	
Adj R ²	0.684		0.921		0.684	
F-stat	65.269		174.580		65.269	
Prob(F-stat)	0.000		0.000		0.000	

* = significance at $\alpha = 0,01$; ** = significance at $\alpha = 0,05$; *** = significance at $\alpha = 0,10$. The number in brackets is the empirical probability (p-value) of the t-statistic.

Table 3. Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	87.5048	-4,111	0.000

Table 4. Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	350.0192	4	0.000

The Chow test determines the best model between the Fixed Effects Model and the Common Effects Model (Pooled Least Squares). If the results accept the null hypothesis, the fixed effect model best fits the test, continuing with Hausman Test (Wu et al., 2021). The results of the Chow test are shown in Table 3 with a p-value or F probability of $0.000 < 0.05$. Thus, the Fixed Effects Model (FEM) is utilized.

The Chow test result showed that the null hypothesis was accepted. Then, the Hausman test is performed to select the model. The p-value of the Chi-Square or Random Cross Section showed $0.000 < 0.05$. Thus, the fixed effect model is the chosen model.

The increasing economic growth of the ASEAN 5 countries (Indonesia, Malaysia, Thailand, the Philippines, and Myanmar) is followed by higher emission growth. Carbon emissions significantly affect the green economy (Perwithosuci et al. 2022). This follows the phenomenon in Indonesia, where Indonesia is implementing a carbon tax for users of fossil fuels such as transportation, gas, and so on (Sikder et al., 2022). The legal basis for implementing a carbon tax is Presidential Regulation 98 of 2021 concerning carbon taxes and Law Number 7 of 2021 concerning harmonizing tax regulations.

The significant foreign direct investment in ASEAN-5 countries decreases the Green GDP. In supporting the green economy, the ASEAN-5 countries should construct policies to develop the economy and protect the environment simultaneously. Currently, preferring the quality of synergistic foreign investment has encouraged sustainable development in reducing the number of pollutants and emissions (Rofiuddin et al., 2019). Furthermore, it is necessary to encourage foreign investment and establish sustainable businesses to achieve inclusive green economic growth in ASEAN-5 countries to support green economies (Li & Ramanathan, 2020).

The current account balance shows transactions of goods, services, and transfers in a country. The current account balance can be either a surplus or a deficit. This study's results are in line with (Çetin et al. 2023). The study found that the current account balance variable does not significantly affect economic growth. Furthermore, green GDP and the current account do not significantly affect green GDP.

The population has a positive and significant effect on Green GDP. The result contrasts Sidjabat and Apsari (2020), which stated that a large population causes greater exploitation of natural resources and the environment. People intend to exploit an environment to fulfill their needs when it still exists harmoniously. They exploit natural wealth without considering the ecological balance (Sidjabat & Apsari, 2020).

5. CONCLUSION

This study aims to determine the effect of carbon dioxide emissions, foreign direct investment, current account balance, and population on green GDP in five ASEAN countries. The findings show that carbon dioxide emissions and population positively and significantly affect green GDP. The two variables, foreign direct investment and population, have no significant effect on green GDP. Thus, as a regulator, the government has a role in managing policies related to carbon emissions and population in support of green economic growth. The government does not only focus on economic activities but also pays attention to environmental aspects and people's welfare. Green GDP is at least a medium for reducing pressure on the environment. Some limitations of this study are the limited number of regressors to determine the effect of green GDP. Furthermore, the current study only covers five ASEAN countries, future studies can explore a wider scope of regions or increase the number of observed countries.

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