Involvement and Impact of Emissions Co^2 for The Sustainability of Green Economy in Indonesia: *Ardl* Approach

Yudhi Prasetiyo[1*], Sila Ninin Wisnantiasri[2], Yeni Widiastuti[3], Etik Ipda Riyani[4]

{yudhiprasetiyo@ecampus.ut.ac.id[1], sila.wisnantiasri@ecampus.ut.ac.id[2], yeni.widiastuti@ecampus.ut.ac.id[3]; etik.ipdariyani@ecampus.ut.ac.id[4]}

Department of Accountancy, Universitas Terbuka, Indonesia[1,2,3].

Abstract. Indonesia is considered one of the developing countries with the highest carbon emissions in Asia. However, the government has made efforts to reduce emissions and set low-carbon economy goals. This research aims to determine the factors that influence CO2 emissions and to find out how green economy financing and sustainable economic development function to measure carbon intensity. This research uses four indicators that influence carbon emissions (Co2), namely Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Gross National Expenditure (GNE), and population density. The analytical methods used are Autoregressive Distributed Lag *(ARDL)* Approach. The findings show that the DEN variable has a positive and significant influence on CO2 emissions in both the long and short term. The GDP variable shows a negative and significant effect on CO2 in the long term, but the FDI and GNE variables do not show a significant effect on CO2 emissions in the long term.

Keywords: Carbon Dioxide Emissions (Co2), GDP, GNE, FDI, DEN.

1. Introduction

Massive climate change has increased welfare risks in recent decades. Factors such as carbon dioxide emissions, natural damage and pollution have a significant influence on environmental damage [1]. According to the 2007 United Nations Framework Convention on Climate Change (UNFCCC), increased carbon dioxide (CO2) emissions are the main cause of climate change. Climate variability in 2007 consisted of natural variations that occurred over long periods of time as well as variations related to human activities and changes in the composition of the Earth's atmosphere. Ultimately, climate change, a consistent process, is responsible for global warming. Rising temperatures increase the likelihood of disaster [2]. Due to carbon emissions causing global warming and climate eclipse, there is growing concern about overcoming this crisis, especially in less developed countries. Because global warming is caused by significant human activities over the earth's surface, which causes more environmental damage [3], [4], [5]. Company activities are one of the causes of high carbon dioxide emissions. Optimizing

PSIC 2024, September 11-12, Lombok, Indonesia

DOI 10.4108/eai.11-9-2024.2354424

company value is the company's main goal, according to. The company's performance over several years reflects the company's value. Direct investment (FDI) and the economic conditions of the respective countries are the causes of carbon emissions in France, according to [6]. Along with increased investment and efforts to improve the country's economy, there has been sharp and subtle structural damage [7].

Green economy is an economic effort that aims to improve human welfare and justice in the long term during the production, distribution and consumption of goods and services. This can significantly reduce environmental and ecological damage [8]. According to the World Environment Program, a "green economy" means an economy that reduces carbon emissions through efficient and socially inclusive use of resources and encourages investment and innovation [9]. "The green economy offers the concept of a sustainable economic climate for the welfare of present and future generations of society [10]. According to the UN Environment Program, "green economy" means an economy that reduces carbon emissions, saves natural resources, is socially just, and does not relies on fossil fuels. UNEP divides the green economy into eleven parts: agriculture, buildings, cities, energy, fisheries, forestry, manufacturing, tourism, transport, waste, and water [11].

To achieve economic, sustainable and environmentally friendly development, each sector has an important role. In this case, the focus of the energy industry is to shift from fossil energy resources to renewable resources such as wind energy, solar energy and bioenergy. Indonesia is the country with the highest fuel energy consumption in Southeast Asia[12]. Increasing consumption of fossil energy can result in a decrease in energy reserves even though energy demand continues to increase. This situation has the potential to stop Indonesia's economic growth. Additionally, excessive use of fossil fuels leads to increased carbon dioxide (CO2) emissions, which contribute to greenhouse gas emissions and global warming, which has a detrimental impact on the environment [13]. Certain industries such as basic commodities and extractives continue to influence the country's economy, which has a negative impact on the environment. Government stimulus that can encourage a green economy has not been used properly. Policy options to encourage the preservation of the green economy include attracting environmentally friendly investment to Indonesia and ensuring that policies and regulations related to the green economy are consistent [14]. It is very important to move from conventional economic development models to green economic development models and green economic development approaches because of their negative effects on the environment both at the international and local levels [15]. According to research conducted by [16], Ghana's efforts to achieve green goals are threatened through the high costs of green technology, the increasing threat of climate change, and a lack of support for technology transfer and development. its economy. Policymakers must plan to address threats and weaknesses and exploit opportunities and strengths. Authorities must prioritize science and technology education to promote green economic growth.

As stated by [17]Wang et al., (2020),economic conditions and population have a positive impact on changes in the intensity of greenhouse gas emissions. Increasing population density will cause an increase in electrical energy consumption, which in turn causes an increase in the intensity of greenhouse gas emissions [18]. The population growth is not the only factor influencing environmental degradation. The population movement, which causes an increase in population in big cities, influences environmental degradation in Indonesia. This shows how important investment in human resources is to drive economic growth. Economic growth is

significantly influenced by investment in human capital in the same way as internet access and health. Based on the study above, the aim of this research was to view and analyze the factors that influence Co2 emissions in the implementation of sustainable development and a green economy in Indonesia.

2. Literature Review

Sustainable Theory

According to sustainability theory, social responses to environmental and cultural problems must be prioritized and integrated. Sustainability theory has become popular since 1987, when Brundtland stated that agencies and organizations should find ways to balance their current and future ecological responsibilities. Corporate sustainability (CS), the sustainability theory most commonly used by companies, emphasizes the importance of meeting stakeholder needs and maintaining a healthy environment. Companies anticipate reflections of ecological, economic, and social systems that will determine market conditions over a longer period of time than the data covered in company reports [19].

Green Economic

Most people consider a green economy, as an economic system that is environmentally friendly, ecological, and compatible with many social groups. Many green economy advocates believe that this crisis is a condition that must be applied to the economy. Economic greening is an alternative term to the conventional green economy concept [20]. Economic ecology is the basis of green economics, which discusses how humans are economically dependent on natural ecosystems due to climate change and the use of fossil fuels. This green economic model also contradicts the current economic model, known as the black economic model, which relies on fossil fuels [21].

Carbon Dioxide Emissions (CO2)

CO2 One type of greenhouse gas is carbon emissions. Greenhouse gases arise naturally or are caused by the activities of living things. This gas is located in the atmosphere and emits and absorbs infrared radiation from solar radiation. Heat containing infrared and trapped in GHGs increases the earth's temperature, which can cause global warming and climate change[22] .

Population Density

Population is one of the factors that increases CO2 emissions. According to Todaro (2006),explains that the increase in population compared to environmental degradation causes very severe environmental damage in various locations. This is caused by an increase in population compared to existing land, which results in a decrease in agricultural land productivity and a decrease in per capita food production [22].

Foregin Direct Invesment (FDI)

According to Article 1 paragraph (3) of Law Number 25 of 2007, foreign investment is the activity of investing capital to carry out business in the territory of the Republic of Indonesia carried out by foreign investors, either using foreign capital entirely or collaborating with investors. domestic. Foreign direct investment (FDI) does not just involve the transfer of ownership or funds; it also aims to obtain long-term management interests or control over a company in another country.

Gross Dosmestic Product
Gross domestic product is the value of final goods and services produced by an economy within a certain period of time based on market prices taking into account the economy's production factors. To increase its production possibilities, a country must use all its factors of production to produce goods and services, prepare some resources as capital, and increase and return goods and services.

Gross National Expenditure
GNE includes domestic investment, household consumption, and government expenditure as an indicator of a country's total expenditure. Increased energy consumption, especially from fossil energy sources such as coal, oil and natural gas, is often associated with increased economic activity, which is usually followed by increased energy consumption. These production and consumption processes result in significant carbon dioxide emissions, which contribute to climate change and air pollution. One example is the increase in private transportation costs and the manufacturing sector. As a result, although increasing GNE can represent economic progress, it also brings major challenges in efforts to reduce carbon emissions and achieve environmental sustainability. To overcome these negative consequences, a shift towards the use of renewable energy, the application of more efficient technology, and the implementation of policies that support sustainable development are needed.

3. Methodology

A quantitative and descriptive approach was used in this research. The quantitative approach is based on adjusted calculations, so that solving problems that occur at the base of the test consists of numbers resulting from statistical calculations of the variables included in the model. We use secondary data from the World Bank and UNDP covering the years 1990–2022. The following variables will be analyzed using two different time series models. In this research, carbon dioxide (CO2) gas emissions are an independent variable with data obtained from UNDP. Then Population Density (DEN), Foreign Direct Investment (FDI), Gross Domestic Product (GDP) and Gross National Expenditure which are proxies for measuring economic growth are independent variables because they are indicators of how these variables relate to carbon dioxide (CO2) emissions, both in the long and short term. In this research, the data analysis method uses the Autoregressive Distributed Lag (*ARDL)* approach. According to Khan, et.al., (2020),when the independent variable experiences shocks, the ARDL model can be used to study, estimate and predict it. If there is a cointegration relationship between research variables, the ARDL simulation model can also be used as material for discussing the relationship between the variables studied.

The following is the operationalization and indicators of the variables used in this research

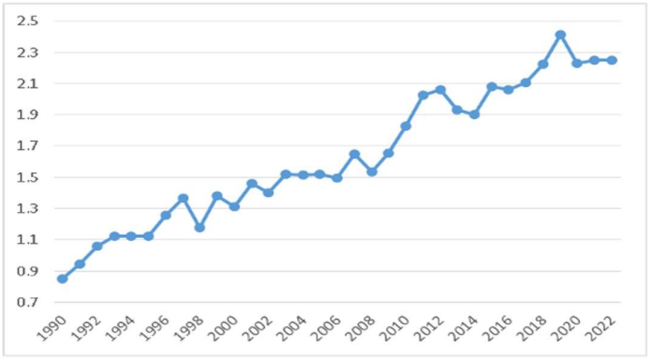
Table 1. Operationalization and indicators variables

Name	Explanation	Units	Source
CO2 (Y)	Carbon dioxide emissions per capita	Tons	UNDP
DEN (X1)	Population Density	Souls/km^2	World Bank
FDI (X2)	Foreign Direct Investment Inflows	Percent	World Bank
GDP (X3)	Economic Growth	Percent	World Bank
GNE (X4)	Gross National Expenditure (% GDP)	Percent	World Bank

Source: Author processed data, 2024

4. Results And Discussion

Development of Carbon Dioxide (Co2) Emissions



Picture 1. Graph of Development of CO2 Emissions Each Year

The graph of the development of CO2 gas emissions from 1990 to 2022 shows a consistent upward trend. During the 1990s and early 2000s, CO2 emissions increased gradually with a relatively steady and slow increase. However, starting around the 2000s, especially after 2010, the increase in CO2 emissions became more rapid and significant, characterized by a sharper graph slope. CO2 emissions peaked around 2018 with a value of just over 2.3, then decreased slightly and remained relatively stable until 2022. Despite annual fluctuations, the overall trend shows clear emissions growth. This graph indicates that despite efforts to reduce emissions, major challenges remain in containing the rate of increase in CO2 emissions.

Stationary Test Results

Table 2. Stationarity Testing

	Stationarity Testing (p-value)		
Variable	**Level I(0)**	**First Difference I(1)**	**Explanation**
CO2 (Y)	0,012	-	Stationary at I(0)
DEN (X1)	0,623	0,001	Stationary at I(1)
FDI (X2)	0,391	0,000	Stationary at I(1)
GDP (X3)	0,015	-	Stationary at I(0)
GNE (X4)	0,027	-	Stationary at I(0)

Source: Author processed data, 2024

Overall, from the results of this stationarity test it can be concluded that the CO2, GDP and GNE variables are stationary at Level (I (0)), while the DEN and FDI variables are stationary at First Difference (I(1)). These results indicate that these variables have different characteristics in terms of stationarity and require different treatment in further time series analysis.

ARDL Model Estimation Results

Table 3. ARDL Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CO2(-1)	0.6384	0.1585	4.0278	0.0014***
CO2(-2)	-0.6196	0.1541	-4.0214	0.0015***
DEN	0.0290	0.0059	4.8965	0.0003***
FDI	0.0614	0.0184	3.3421	0.0053***
FDI(-1)	-0.0245	0.0151	-1.6287	0.1273
FDI(-2)	0.0186	0.0148	1.2552	0.2315
FDI(-3)	-0.0896	0.0168	-5.3452	0.0001***
FDI(-4)	0.0687	0.0142	4.8412	0.0003***
GDP	0.0039	0.0041	0.9456	0.3616
GDP(-1)	-0.0194	0.0050	-3.8648	0.0020***
GNE	0.0031	0.0048	0.6466	0.5292
GNE(-1)	-0.0061	0.0061	-0.9941	0.3383
GNE(-2)	0.0179	0.0055	3.2744	0.0060***
GNE(-3)	-0.0130	0.0052	-2.5147	0.0259**
GNE(-4)	0.0060	0.0044	1.3744	0.1926
C	-2.7820	1.2566	-2.2139	0.0453**
R-Square		0.9911	F-Statistic	97.5719
Adjusted R-Square		0.9810	Prob(F-Statistic)	0.0000

Source: Author processed data, 2024
*Description: ***, **,* significant at 1%, 5%, 10%*

Table 3 displays the estimation results from the ARDL model which is used to analyze the relationship between the independent variables (CO2, DEN, FDI, GDP, and GNE) and the dependent variable. Overall, this model has an R-Square of 0.9911, indicating that the independent variables explain approximately 99.11% of the variation in the dependent variable. A high F-Statistic (97.5719) with a very low p-value (0.0000) indicates that the overall model is statistically significant. Adjusted R-Square of 0.9810 adjusts the R-Square for the number of variables and observations in the model, confirming good model fit

Bound Test Results

Table 4. Bound Testing

Test Statistic	Value	Sig.	I(0)	I(1)
F-statistic	9.265478	10%	2.2	3.09
k	4	5%	2.56	3.49
		1%	3.29	4.37

Source: Author processed data, 2024

Based on the table above, the F-statistic value (9.265478) is greater than the upper limit (I (1)) at all levels of significance (10%, 5% and 1%), we can conclude that there is a cointegration relationship between the variables tested. This means that there is a significant long-term relationship between the independent variables (DEN, FDI, GDP, GNE) and the dependent

variable (CO2) in the model.

Long Term Model Estimation Results

Table 5. Long Term Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEN	0.0295	0.0012	23.7341	0.0000***
FDI	0.0351	0.0228	1.5404	0.1474
GDP	-0.0158	0.0067	-2.3678	0.0341**
GNE	0.0081	0.0103	0.7854	0.4463
C	-2.8353	1.0439	-2.7161	0.0176**

Source: Author processed data, 2024
*Description: ***, **,* significant at 1%, 5%, 10%*

Based on the results of the long-term model estimation, it can be concluded that the DEN variable has a positive and significant influence on CO2 emissions. The DEN coefficient is 0.0295 with a t-statistic value of 23.7341 and a p-value of 0.0000, indicating that every 1 unit increase in DEN will increase CO2 by 0.0295 units, with this effect being very significant at the 95% confidence level. On the other hand, the GDP variable shows a negative and significant influence on CO2. The GDP coefficient is -0.0158 with a t-statistic value of -2.3678 and a p-value of 0.0341 indicating that every 1 unit increase in GDP will reduce CO2 by 0.0158 units, significant at the 95% confidence level. However, the FDI and GNE variables do not show a significant effect on CO2, with p-values of 0.1474 and 0.4463 respectively, which are greater than 0.05. This indicates that foreign direct investment (FDI) and government expenditure (GNE) do not significantly influence CO2 emissions in this model. In addition, the model intercept of -2.8353 is significant at the 95% confidence level, indicating that there are other factors outside the analyzed variables that also influence CO2 emissions.

Short Term Model Estimation Results

Table 6. Short Term Model Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CO2(-1))	0.6196	0.0981	6.3161	0.0000***
D(FDI)	0.0614	0.0104	5.9296	0.0000***
D(FDI(-1))	0.0024	0.0090	0.2666	0.7940
D(FDI(-2))	0.0210	0.0093	2.2634	0.0414**
D(FDI(-3))	-0.0687	0.0094	-7.3196	0.0000***
D(GDP)	0.0039	0.0028	1.3794	0.1911
D(GNE)	0.0031	0.0036	0.8498	0.4108
D(GNE(-1))	-0.0109	0.0033	-3.3322	0.0054***
D(GNE(-2))	0.0070	0.0033	2.1319	0.0527*
D(GNE(-3))	-0.0060	0.0031	-1.9822	0.0690*
CointEq(-1)	-0.9812	0.1118	-8.7735	0.0000***
R-Square		0.8983		
Adjusted R-Square		0.8419		

Source: Author processed data, 2024
*Description: ***, **,* significant at 1%, 5%, 10%*

The short-term model estimation results show that there are several variables that have a significant influence on changes in CO2 emissions. The coefficient of change in CO2 at lag 1 (D (CO2 (-1))) is 0.6196 with a t-statistic value of 6.3161 and a p-value of 0.0000 indicating a very significant positive effect at the 95% confidence level. This indicates that changes in CO2 emissions in the previous period have a significant effect on changes in current CO2 emissions.

The FDI change variable (D(FDI)) has a coefficient of 0.0614 with a t-statistic value of 5.9296 and a p-value of 0.0000, indicating a very significant positive influence. Meanwhile, the change in FDI at lag 2 (D (FDI (-2))) has a coefficient of 0.0210 with a t-statistic value of 2.2634 and a p-value of 0.0414, indicating a significant positive influence at the 95% confidence level. However, the change in FDI at lag 3 (D (FDI (-3))) shows a significant negative effect with a coefficient of -0.0687, a t-statistic value of -7.3196, and a p-value of 0.0000. This indicates that increasing FDI in the previous three periods tends to reduce current CO2 emissions significantly. This is in line with the statement in the Winda & Falianty (2023), study which states halo pollution, which means that investment from companies in developed countries contributes to reducing emissions in the host country. This is due to the application of green technology in the new development structure carried out by the company.

The variables change in GDP (D(GDP)) and changes in GNE (D(GNE)) do not show a significant influence on changes in current CO2 emissions, with p-values of 0.1911 and 0.4108 respectively. However, the change in GNE at lag 1 (D (GNE (-1))) shows a significant negative effect with a coefficient of -0.0109, a t-statistic value of -3.3322, and a p-value of 0.0054. In addition, changes in GNE at lag 2 (D (GNE (-2))) and lag 3 (D (GNE (-3))) show an almost significant effect with p-values of 0.0527 and 0.0690 respectively.

The error correction term coefficient (CointEq (-1)) is -0.9812 with a t-statistic value of -8.7735 and a p-value of 0.0000, indicating that there is a very significant adjustment mechanism in the short term to return to long-term balance. The R-Square value of 0.8983 and Adjusted R-Square of 0.8419 indicates that this model can explain approximately 89.83% and 84.19% of the variation in changes in CO2 emissions, which indicates that the model has a good fit.

Classic Assumption Test Results

Table 7. Classic Assumption Test

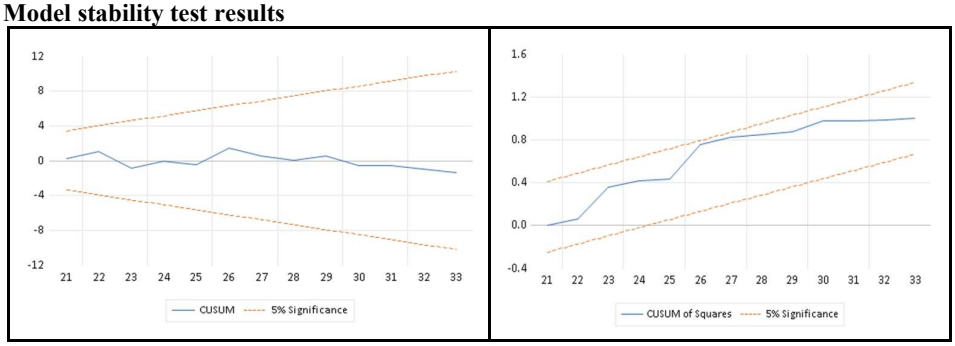
Assumption	Test	Stat Test	P-value
Normality	Jarque Bera	4.318	0,115
Homoscedasticity	Breusch Pagan	9.987	0,820
Non-Autokorelation	Brush Godfrey	3.068	0,079

Source: Author processed data, 2024

Based on Table 7, the results of classical assumption testing show that the model used meets all the basic assumptions in regression. The normality test using Jarque-Bera produces a test statistic of 4,318 with a p-value of 0.115. Since the p-value is greater than the 0.05 significance level, there is not enough evidence to reject the null hypothesis that the residuals from the model follow a normal distribution. The homoscedasticity test using Breusch-Pagan produces a test statistic of 9.987 with a p-value of 0.820, indicating that the variance of the residuals is constant, fulfilling the assumption of homoscedasticity. Apart from that, the non-autocorrelation test

using Breusch-Godfrey produced a test statistic of 3.068 with a p-value of 0.079. Since the p-value is greater than the 0.05 significance level, there is not enough evidence to reject the null hypothesis that there is no autocorrelation in the residuals. Thus, all classic assumptions in regression, namely residual normality, homoscedasticity and non-autocorrelation, have been fulfilled, indicating that the model used is valid and the coefficient estimation results can be interpreted well.

Model stability test results



Picture 2. Cusum and Cusum-SQ graphs

The results of the model stability test using the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUM of Squares) methods show that the model used is stable. In the CUSUM test, the graph shows that the CUSUM line shown by the blue line remains within the 5% significance boundaries shown by the orange dotted line throughout the tested period. This indicates that there were no significant structural changes in the model during this period. Similarly, in the CUSUM of Squares test, the CUSUM of Squares line shown by the blue line also remains within the 5% significance boundaries throughout the tested period. This indicates that the model is also stable in terms of residual variability. Thus, it can be concluded that the model used has good stability and does not show any significant structural changes, either in the regression residual values or in residual variability during the period tested.

5. Conclusion

From the results of this research, it can be concluded that carbon dioxide emissions (CO2), economic growth (GDP), and gross national expenditure (GNE) are stable at the basic level, while population density (DEN) and foreign direct investment (FDI) are stable after experiencing changes First. The ARDL model shows that the DEN variable has a positive and significant influence on CO2 emissions in both the long and short term, with a coefficient of 0.0295 in the long term and a consistent coefficient in the short term. On the other hand, the GDP variable shows a negative and significant influence on CO2 in the long term, but the FDI and GNE variables do not show a significant influence on CO2 emissions in the long term. The Bound Test confirms the existence of a significant cointegration relationship between the variables tested, indicating that there is a strong long-term relationship between the independent variable and the dependent variable. In the short term, changes in previous CO2 emissions and changes in foreign direct investment in several periods show a significant influence. This research model meets all classical assumptions and shows stability, so that the estimation results can be interpreted well and are reliable.

To reduce CO2 emissions, it is recommended to control population density in certain areas, considering the significant influence of population density on CO2 emissions. Sustainable and environmentally friendly economic growth strategies need to be pursued, considering the negative influence of economic growth on CO2 emissions. In addition, policies that encourage foreign investment with a focus on environmentally friendly technologies can be an effective solution. Considering that government spending does not show a significant influence on CO2 emissions, it is necessary to consider fiscal policies that are more oriented towards reducing emissions. Further monitoring and additional research is also needed to understand other factors that influence CO2 emissions. Flexible and adaptive policies are needed to overcome short-term fluctuations and maintain long-term balance.

Acknowledgements
The author would like to thank the parties who have helped the author in completing this article, especially the entire team who have worked hard to complete this article. The author also conveys to the economics and business lecturers at the open university who have provided full material and non-material support to be able to provide a good opportunity for the author to communicate this at international conferences. Hopefully this article can provide benefits to many parties, and the author also apologizes to all parties if this article is still far from perfect and needs improvement if necessary.

References

[1] J. Lan, S. U. Khan, M. Sadiq, F. Chien, and Z. A. Baloch, "Evaluating energy poverty and its effects using multi-dimensional based DEA-like mathematical composite indicator approach: Findings from Asia," *Energy Policy*, vol. 165, p. 112933, Jun. 2022, doi: 10.1016/j.enpol.2022.112933.

[2] H. Cahyo, S. D. Purnomo, S. K. Octisari, M. Surveyandini, S. Sundari, and E. K. Purwendah, "Environment, Population, and Economy on CO2 Emission in Indonesia," *International Journal of Energy Economics and Policy*, vol. 13, no. 6, pp. 295–303, Nov. 2023, doi: 10.32479/ijeep.14938.

[3] T. S. Adebayo and A. O. Acheampong, "Modelling the globalization-CO2 emission nexus in Australia: evidence from quantile-on-quantile approach," *Environmental Science and Pollution Research*, vol. 29, no. 7, pp. 9867–9882, Feb. 2022, doi: 10.1007/s11356-021-16368-y.

[4] A. O. Acheampong and E. B. Boateng, "Modelling carbon emission intensity: Application of artificial neural network," *J Clean Prod*, vol. 225, pp. 833–856, Jul. 2019, doi: 10.1016/j.jclepro.2019.03.352.

[5] M. Sadiq, T. Q. Ngo, A. A. Pantamee, K. Khudoykulov, T. Thi Ngan, and L. P. Tan, "The role of environmental social and governance in achieving sustainable development goals: evidence from ASEAN countries," *Economic Research-Ekonomska Istraživanja*, vol. 36, no. 1, pp. 170–190, Jan. 2023, doi: 10.1080/1331677X.2022.2072357.

[6] M. Mert and A. E. Caglar, "Testing pollution haven and pollution halo hypotheses for Turkey: a new perspective," *Environmental Science and Pollution Research*, vol. 27, no. 26, pp. 32933–32943, Sep. 2020, doi: 10.1007/s11356-020-09469-7.

[7] D. A. Hasni and Z. Azhar, "Pengaruh Investasi, Kepadatan Penduduk, dan Jumlah Transportasi Terhadap Degradasi Lingkungan di Indonesia," *Jurnal Kajian Ekonomi dan Pembangunan*, vol. 3, no. 2, p. 25, Jun. 2021, doi: 10.24036/jkep.v3i2.13600.

[8] A. Ferdiansyah, R. Andriansyah, A. Maretasari, and Yuliwindiarti, “Penerapan Green Economy: Seberapa Hijau Ekonomi Indonesia Ditinjau Dari Pertumbuhan Ekonomi, Populasi, Dan Energi Terbarukan Tahun 1990-2020,” *Jurnal Ilmiah Penalaran dan Penelitian Mahasiswa*, vol. 7, no. 7, pp. 135–158, 2023.

[9] A. Kasztelan, “Green Growth, Green Economy and Sustainable Development: Terminological and Relational Discourse,” *Prague Economic Papers*, vol. 26, no. 4, pp. 487–499, Aug. 2017, doi: 10.18267/j.pep.626.

[10] M. Anwar, “Green Economy Sebagai Strategi Dalam Menangani Masalah Ekonomi Dan Multilateral,” *Jurnal Pajak dan Keuangan Negara (PKN)*, vol. 4, no. 1S, pp. 343–356, Dec. 2022, doi: 10.31092/jpkn.v4i1S.1905.

[11] T. Maidasari, L. Y. Prakoso, and S. Murtiana, “Renewable Energy As A Green Economy Stimulus In Indonesia,” *Jurnal Energi Baru dan Terbarukan*, vol. 4, no. 3, pp. 183–191, Dec. 2023, doi: 10.14710/jebt.2023.18496.

[12] Y. Afriyanti, H. Sasana, and G. Jalunggono, “DINAMIC: Directory Journal of Economic Volume 2 Nomor 3 Analisis Faktor-Faktor Yang Mempengaruhi Konsumsi Energi Terbarukan Di Indonesia Analysis Of Influencing Factors Renewable Energy Consumption In Indonesia 1)”.

[13] W. A. Prastyabudi and Isa Hafidz, “Energy Consumption Data Analysis: Indonesia Perspective,” *Journal of Computer, Electronic, and Telecommunication*, vol. 1, no. 1, Jul. 2020, doi: 10.52435/complete.v1i1.47.

[14] B. Martawardaya, A. Rakatama, D. Y. Junifta, and D. A. Maharani, “Green economy post COVID-19: insights from Indonesia,” *Dev Pract*, vol. 32, no. 1, pp. 98–106, Jan. 2022, doi: 10.1080/09614524.2021.2002817.

[15] E. S. Tasri and S. Karimi, “Green Economy As An Environment-Based Framework For Indonesia’s Economic Reposition Structure,” *Economic Journal of Emerging Markets*, vol. 6, no. 1, pp. 13–22, Apr. 2014, doi: 10.20885/ejem.vol6.iss1.art2.

[16] E. B. Ali, V. P. Anufriev, and B. Amfo, “Green economy implementation in Ghana as a road map for a sustainable development drive: A review,” *Sci Afr*, vol. 12, p. e00756, Jul. 2021, doi: 10.1016/j.sciaf.2021.e00756.

[17] C. Wang, Y. Zhao, Y. Wang, J. Wood, C. Y. Kim, and Y. Li, “Transportation CO2 emission decoupling: An assessment of the Eurasian logistics corridor,” *Transp Res D Transp Environ*, vol. 86, p. 102486, Sep. 2020, doi: 10.1016/j.trd.2020.102486.

[18] A. Ozturen and H. Ozgit, “Conclusion: transitioning from unsustainable to sustainable solutions,” *Worldwide Hospitality and Tourism Themes*, vol. 14, no. 4, pp. 403–408, Jul. 2022, doi: 10.1108/WHATT-03-2022-0040.

[19] R.-D. Chang, J. Zuo, Z.-Y. Zhao, G. Zillante, X.-L. Gan, and V. Soebarto, “Evolving theories of sustainability and firms: History, future directions and implications for renewable energy research,” *Renewable and Sustainable Energy Reviews*, vol. 72, pp. 48–56, May 2017, doi: 10.1016/j.rser.2017.01.029.

[20] S. Fulai *et al.*, “‘Is the concept of a green economy a useful way of framing policy discussions and policymaking to promote sustainable development?,’” *Nat Resour Forum*, vol. 35, no. 1, pp. 63–72, Feb. 2011, doi: 10.1111/j.1477-8947.2011.01347.x.

[21] T. E. Anden, “Penerapan Konsep Green Economy : Dalam Pengembangan Pendidikan, Pariwisata Dan Rekreasi Sebagai Upaya Mewujudkan Pembangunan Berwawasan Lingkungan (Studi Pada Kota Palangka Raya),” *Prosiding Seminar Nasional Universitas Pgri Palangka Raya*, vol. 1, pp. 121–137, Sep. 2022, doi: 10.54683/puppr.v1i0.17.

[22] Yusril Izha Mahendra, Marselina, Heru Wahyudi, and Ukhti Ciptawati, “Pengaruh

Populasi Penduduk, FDI dan Control of Corruption terhadap Emisi CO2 di 9 Negara ASEAN," *Jurnal Multidisiplin Madani*, vol. 2, no. 10, pp. 3741–3753, Oct. 2022, doi: 10.55927/mudima.v2i10.1462.

[23] M. Todaro, *Pengembangan Ekonomi Dunia Ketiga Ketig*. 2006. doi: 10.21776/jdess.

[24] A. Khan, Y. Chenggang, J. Hussain, S. Bano, and Aa. Nawaz, "Natural resources, tourism development, and energy-growth-CO2 emission nexus: A simultaneity modeling analysis of BRI countries," *Resources Policy*, vol. 68, p. 101751, Oct. 2020, doi: 10.1016/j.resourpol.2020.101751.

[25] B. S. Winda and T. A. Falianty, "Pengaruh Foreign Direct Investment Terhadap Emisi Gas CO2 di Negara G20," *Al Qalam: Jurnal Ilmiah Keagamaan dan Kemasyarakatan*, vol. 17, no. 3, p. 1989, May 2023, doi: 10.35931/aq.v17i3.2163.