Projected CO2 Emissions and Social Welfare in Indonesia

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Abstract

This study examines the causality between various environmental, social, and economic related variables such as CO2 emissions, consumption, investment, and poverty in Indonesia. This study uses vectors autoregressive to model causal relationships between variables in the analysis of 21 years of data from 2000 to 2020. This study relies on data provided by the World Bank. From the various variables we observed, we found that poverty, consumption, and investment are significantly related to CO2 emissions, meaning that in the current Indonesian economy, increased investment will cause the economy to spin faster, which is thought to also lead to consumption levels. increase. This is what causes the higher number of CO2 emissions in Indonesia, this happens because of the lack of anticipation and implementation of green policies in Indonesia.

Keyword : CO2 Emissions, Consumption, Investment, Poverty, Indonesia.
JEL : E21, E22, I30

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Background

The government, in the view of the public economy, has a function, namely as a function of allocation, distribution, and stabilization (Filippetti & Vezzani, 2022 ; Mukhlis, & Viphindrartin, 2021). From the distribution function itself, it has the task of distributing government revenues in order to improve the welfare of the community where one form of community welfare is through increasing social welfare, both by establishing and maintaining a green environment and alleviating poverty (Brown, Kontonikas, Montagnoli, Moro, & Onnis, 2021 ; Novianto & Prabowo, 2021).

Nowadays, environmental pollution is an important problem in the process of economic growth (Li, Dong, Taghizadeh-Hesary, & Wang, 2022 ; Sasongko, Harnani, & Bawono, 2022). Economic growth and accompanied by population growth have increased pollution and environmental degradation at the end of this decade. The deterioration of the environment is also starting to have a direct impact on the quality of human life or even a threat to human survival. In general, humans depend on the state of the surrounding environment, such as natural resources that can support daily life (Li, Song, Cai, Bian, & Mohammed, 2022 ; Harnani, Rusminingsih, & Damayanti, 2022). In Indonesia today, the condition of environmental damage is getting worse day by day (Ronaldo & Suryanto, 2022). Environmental damage can indirectly threaten human life and have a direct impact on life. The causes of environmental damage are categorized as the result of natural events and the consequences of human activities (Sulisnaningrum, 2022).

The majority of emerging nations are beginning to move away from economies that prioritize agriculture and toward those that do, with the obvious aim of raising GDP from the industrial sector to GDP per capita (Adha, Asyhadie, & Kusuma, 2020 ; Widarni & Drean, 2021). Due to the fact that practically all industrial industries in Indonesia create garbage and do not employ environmentally friendly technologies, the industrial sector is the greatest generator of trash

(Huang, 2022 ; Purwantini, 2017; Damayanti & Rusminingsih, 2021). Sulfur dioxide, carbon dioxide, methane, and nitrogen oxides, emitted into the air like most businesses like refineries, interact with water vapor to form clouds (Liu, Zhang, Adebayo, & Awosusi, 2022).

The utility of this energy as a resource produced by fossils will produce emissions. Among these pollutants. Since CO2 is thought to be the main source of greenhouse gases, its concentration in the atmosphere can last for a very long time (Khezri, Heshmati, & Khodaei, 2022; Puspaningtyas, 2021). Jeon (2022) states that income is an important determinant of CO2 emissions. For instance, according to the Environmental Kuznets Curve Hypothesis, a rise in wealth will initially lead to an increase in CO2 emissions (Le, 2022). Due to more energy-efficient manufacturing, the use of renewable energy, and the capacity of consumers to spend their income on less harmful goods beyond a certain turning point in income, emissions will decline. This is directly proportional to Jeon's opinion that as income increases, consumption will also increase, this happens in most people.

One of the causes of extreme environmental stresses is poverty. When the populace is still in poverty, it is difficult to prevent environmental deterioration and destruction (Liu, et al., 2022). The intensity of resource consumption is increasing as a result of the fact that it is the only location to rely on in difficult circumstances. Without economic growth that benefits the poor, there won't be a major decrease in the number of people living in poverty (Balasubramanian, Burchi, & Malerba, 2022; Rachman & Sok, 2022). If you want to address the issue of poverty instantly, you must stimulate economic growth (Kouadio & Gakpa, 2022; Feriyanto, El Aiyubbi, & Nurdany, 2020). This study examines the causality between various environmental, social, and economic related variables such as CO2 emissions, consumption, investment, and poverty in Indonesia.

Research Method

Autoregressive vectors were used in this study's 21-year data analysis from 2000 to 2020 to represent the causal link between variables. This study relies on data provided by the World Bank. Our study examines the poverty, consumption, investment, and CO2 emissions of Indonesia. The causal relationship between CO2 emissions, consumption, investment, and poverty in Indonesia was examined using the following model:

$$CE_t = \beta_0 + \beta_1 P_t + \beta_2 CO_t + \beta_3 I_t + e_t \quad \text{eql 1}$$

$$P_t = \beta_0 + \beta_1 CE_t + \beta_2 CO_t + \beta_3 I_t + e_t \quad \text{eql 2}$$

$$CO_t = \beta_0 + \beta_1 CE_t + \beta_2 P_t + \beta_3 I_t + e_t \quad \text{eql 3}$$

$$I_t = \beta_0 + \beta_1 CE_t + \beta_2 P_t + \beta_3 CO_t + e_t \quad \text{eql 4}$$

Description :

CE : CO2 emissions

P : Poverty

CO : Consumption

I : Investment

β : the magnitude of the effect of causality

t : time series

eql: equation

E : error term

Result and Discussion

Table 1. Unit Root Test

Variable	Unit Root	ADF test	Value	Description
CO2 Emission (CE)	Level	0.271574	0.9699	
	First Diff	-3.091622	0.0454	Stationer
Poverty (P)	Level	-0.927165	0.7564	
	First Diff	-4.053986	0.0067	Stationer
Consumption (CO)	Level	-1.838596	0.3523	
	First Diff	-1.811369	0.3640	
	Second Diff	-3.197277	0.0371	Stationer
Investment (I)	Level	-2.619887	0.1056	
	First Diff	-6.547377	0.0000	Stationer

The CE, P, and I data are stationary at the 1 DF, the CO data are stationary at the 2 DF. Because all the data has been stationary, then the next test can be done. Both the VAR test and the causation test demand sufficient lag length sensitivity. Prior to doing the next test, it is crucial to choose the time lag that is most appropriate for the circumstance.

Table 2. Optimum lag test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-135.7092	NA	64.85733	15.52324	15.72110	15.55052
1	-92.91114	61.81936*	3.504792	12.54568	13.53498	12.68209
2	-78.96730	13.94384	6.153893	12.77414	14.55489	13.01968
3	-44.04538	19.40106	2.317805*	10.67171*	13.24389*	11.02638*

Table 2 shows the results of the Optimum Lag test. The FPE, AIC, SC, and HQ at Lag 3 are the most appropriate lengths of Lag variables, according to the AIC value at Lag 0 to 3. The third lag will be selected since the results of the four criteria are identical.

Table 3. Cointegration Test

H	Eigenvalue	Trace Stat.	0.05 value	Prob.**
None	0.612747	43.19330	47.85613	0.1279
At most 1	0.493802	25.16846	29.79707	0.1555
At most 2	0.388386	12.23275	15.49471	0.1461
At most 3	0.141163	2.891337	3.841466	0.0891

The results of the cointegration test show that there is no evidence of cointegration because the probability is higher than the threshold of 5% significance. From here the researcher will continue with the estimation of the auto regressive vector

Table 4. VAR result

	CE	P	CO	I
CE(-1)	0.653899	0.029122	0.187964	0.033255
	(0.98460)	(0.09765)	(0.31527)	(0.03509)
	[0.66413]	[0.29822]	[0.59620]	[0.94773]
P(-1)	0.753822	0.482615	0.463459	-0.227597
	(4.76979)	(0.47306)	(1.52729)	(0.16998)
	[0.15804]	[1.02019]	[0.30345]	[-1.33893]
CO(-1)	2.760018	-0.012176	0.530427	-0.229552
	(4.32906)	(0.42935)	(1.38617)	(0.15428)
	[0.63756]	[-0.02836]	[0.38266]	[-1.48791]
I(-1)	-0.780531	-0.038816	-1.098700	-0.096938
	(4.41580)	(0.43795)	(1.41394)	(0.15737)
	[-0.17676]	[-0.08863]	[-0.77705]	[-0.61599]
C	-49.88121	-3.565261	-5.123762	-1.158492
	(63.2005)	(6.26814)	(20.2368)	(2.25232)
	[-0.78925]	[-0.56879]	[-0.25319]	[-0.51435]

The t-statistic of 0.66413 and the coefficient of 0.653899 indicate a significantly positive connection between CE(-1) and CE. With a coeff of 0.029122 and a t-stat of 0.29822, the association between CE and P is statistically positive, indicating that the greater the CE, the higher the P. With a coeff of 0.187964 and a t-stat of 0.59620, the link between CE and CO is also statistically positive, demonstrating that the relationship is inversely correlated with CE. The t-statistic was 0.94773 and the coefficient was 0.033255, indicating that the association between CE and I was substantially positive. This shows that the higher the level of co2 emissions will increase the percentage of poverty in the population, and the higher consumption is also allegedly causing the high rate of increase in co2 emissions. This is related to the positive correlation between investment and consumption, which has a unidirectional relationship. This is also evidenced by the relationship between investment and co2 emissions which is also significantly related.

Table 5. Granger Causality

H0	Obs	F-Stat.	Prob.
CE Granger does not cause P	18	1.64590	0.2355
P Granger does not cause CE		0.37796	0.7708
CO Granger does not cause P	18	0.68616	0.5790
P Granger does not cause CO		0.77478	0.5320
I Granger does not cause P	18	4.71029	0.0238

P Granger does not cause I		0.12281	0.9447
I Granger does not cause CO	18	0.09939	0.9587
CO Granger does not cause I		1.72631	0.2192

The Granger causality analysis findings using the CE, P, CO, and I variables show that variable I and variable P are causally related. Furthermore, there is no causal connection between the other factors. The variation of the shock's change from each variable to other variables in the model is divided using a process known as variance decomposition. It is anticipated that no variable change in the model will be correlated. Variance decomposition explains the extent of the impact of a change in one variable on other variables in the model. According to the analysis's findings, the variance decomposition of the national income variable explains why it is completely impacted by the variable in the first period.

Table 6. Variance decomposition

Period	S.E.	CE	P	CO	I
1	6.948575	100.0000	0.000000	0.000000	0.000000
2	12.45355	97.08968	0.339244	2.558739	0.012334
3	22.74407	95.04516	2.164249	2.434622	0.355970
4	39.74123	91.51988	5.114742	2.678856	0.686519
5	70.45427	90.63203	5.169628	3.635323	0.563021
6	127.0139	90.49909	5.045465	3.943357	0.512086
7	226.6068	90.28452	5.371711	3.844731	0.499037
8	397.5370	90.12594	5.564229	3.799210	0.510616
9	700.9514	90.16196	5.541280	3.788285	0.508473
10	1238.924	90.23985	5.463178	3.798020	0.498956

The results of the analysis state that the variance decomposition of the CO2 emission variable explains that in the first period it is influenced by the variable itself, which is 100 percent. However, in the second period, the value continued to decrease to 97.08 percent and then decreased again until the 10th period. The contribution of the shock variable poverty to co2 emissions was initially 0.0000 percent, but in the second period and so on it increased until the fifth period, but then fluctuated until the 10th period to 5.46 percent.

Conclusion

From the various variables that we observed, we found that poverty, consumption, and investment are significantly related to co2 emissions, meaning that in the current Indonesian economy, increasing investment will cause the wheels of economic turnover to accelerate, which is allegedly also causing the consumption rate to increase. This is what causes the higher number of CO2 emissions in Indonesia, this happens because of the lack of anticipation and implementation of green policies in Indonesia.

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