The Impact of Health Spending on CO2 Emissions and Economic Growth in Indonesia: A VECM Analysis

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Abstract

The study's overarching objective is to examine the impact of healthcare expenditures on carbon emissions as a means of bolstering Indonesia's economy. The World Bank was consulted for its database covering the years 2000-2019 in Indonesia. Current health expenditure, carbon emissions, and gross domestic product are the variables that will be put through the VECM test. Previous Health spending was associated with lower levels of carbon emissions. The opposite is true for carbon emissions, which rise as GDP rises. The health budget in Indonesia is positively correlated with the country's GDP. Policymakers in Indonesia can have a favourable effect on the country's economic growth by prioritising the increased allocation of expenditure on quality health care. In addition, the correlation between current healthcare expenditures and CO2 emissions only goes in one direction. The reason for this is that although emissions have no influence on health care costs, the opposite is true.

Background

The term "health" refers to more than just the absence of disease or incapacity; it also encompasses emotional, mental, and spiritual prosperity. Some of the many factors that influence someone's health are their genes, their surroundings, their way of life, their level of education, and their access to medical treatment. The Declaration of Human Rights guarantees everyone the right to medical treatment. The complexity and variability of health are measured in a number of different ways (Widarni, Irawan, Harnani, Rusminingsih, & Alim, 2022; Prabowo, Sasongko, & Damayanti, 2022).

The World Health Organisation (WHO) defines health as more than only the absence of disease symptoms. Concerns that this is an idealistic and unrealistic concept have been raised by many who live with chronic illnesses or disabilities. Other, competing definitions of health have been put up as a result. These include good health, which emphasises a person's strengths rather than weaknesses, and salutogenesis, which places greater value on the process of creating health rather than its end result. There can be large gaps in national health budgets even amongst countries with comparable GDP. Spending in the health sector in low-income countries has to be increased because current levels are so far below what is required by society (Gövdeli, 2019).

The health of a population is dynamic, changing through time and between various regions and demographic subsets. New health issues may emerge or existing ones may change significantly depending on time period, region, government, and culture. Major health challenges faced by the global community in the twenty-first century include infectious diseases (such as COVID-19), non-communicable diseases (such as diabetes and cancer), environmental degradation (such as climate change and air pollution), and health inequities (such as access to health care

and social protection). In order to successfully face these difficulties, health systems must be strengthened and adapted to meet the ever-evolving demands of the persons they provide care for. The long-term correlation between health care costs and GDP growth is profoundly affected by inequalities in human capital. Health expenditures have a particularly unfavourable correlation with economic growth in times of inadequate human capital. Health expenditures stimulate economic expansion when human capital is average, but not by a significant margin. High levels of human capital multiply the economic advantages of health spending (Yang, 2020). Many human activities, such as the burning of fossil fuels for purposes including producing electricity, transportation, industry, and agriculture, contribute to the emission of greenhouse gases (GHGs) into the atmosphere. Global warming and climate change are detrimental to human health and wellbeing, and they are both worsened by human carbon emissions. In 2019, direct patient care accounted for only 24% of the NHS' overall carbon footprint in England, while the supply chain accounted for 62% (including emissions from imported items and services). Decarbonizing the health care industry entirely will need a global effort, as shown by this evidence (Tennison et al., 2021).

Population and GDP are very sensitive to shifts in CO2 emissions, and this is especially true of China and the United States. There is a strong correlation between GDP growth, HLE, and HLE, and sector CO2 emission for the vast majority of the countries examined. The prediction of sectors' CO2 emission for 2030 revealed a rise of CO2 for all the nations (Mohammed et al., 2019), hence a policy strategy to reduce CO2 emissions from countries is needed for a safer environment. Strong positive correlations exist between larger environmental degradation and decreased revenue and greater logistics requirements. More deforestation occurs because individuals in poorer countries are compelled to use ever-increasing amounts of forest products for their own survival and economic gain. However, these activities rely heavily on the use of fossil fuels, which can increase carbon, methane, and greenhouse gas emissions that can have serious consequences for the environment and contribute significantly to climate change. This is because ASEAN countries do not use enough fuel-efficient/green vehicles and environmentally friendly practises in their logistical operations. Therefore, reducing poverty and promoting renewable energy and environmentally friendly methods to logistics are both excellent strategies to lessen the impact that humans have on the planet (Khan, 2019). Long- and short-term positive correlations between migration and carbon emissions persist after adjusting for unobserved factors such as renewable energy utilisation and real GDP. Greenhouse gas emissions are negatively correlated with trade policy, notwithstanding its short-term significance. Short-term and long-term health effects of carbon emissions exposure have been little studied. Use of renewable energy and real GDP both have considerable effects on carbon emissions (Alola, 2019).

The reduction of carbon emissions may be sped up, for example, if more people were aware of the health benefits of engaging in regular physical activity. Decisions concerning infrastructure, housing, and job locations can positively affect health and the environment if they are supported by increased funding for public transit. Short, frequent motor excursions are increasingly being replaced by walking and cycling. Measuring the synergies between different residential models in terms of land use and renewable energy provides a methodology that can aid in learning from policy initiatives. This can pave the way for the speedier and more widespread implementation of policies, such as those that aim to slow the rate at which the planet's climate is changing (Howden-Chapman, Keall, Whitwell, & Chapman, 2020).

Costs for medical care and carbon dioxide emissions go up as the economies of China and Brazil grow. Increases in pollution have the same effect on health budgets in both countries. Environmental deterioration is harmful to people's health. Better health and a higher standard

of living for their citizens can be achieved if the G7 countries adopt stronger measures to reduce CO2 emissions and slow down climate change. Countries should also increase spending on infrastructure and healthcare, especially for vulnerable people that are exposed to environmental dangers (Dritsaki & Dritsaki, 2023) due to their precarious living conditions. More than 260 million people call Indonesia home, and the country's natural and cultural landscapes are as varied as its people. However, the effects of climate change on human health and well-being present significant difficulties for Indonesia as well. Efendi, Indartono, and Sukidjo (2019) found that improving health and education at the same time significantly reduced poverty in Indonesia. In this piece, we'll look at how healthcare spending in Indonesia affects the country's overall carbon footprint.

Research Method

This paper a test is conducted which aims to see the effect of health spending on carbon emissions in the economy in Indonesia. Data sources were obtained from the World Bank with a range of 2000-2019 for Indonesia. The variables used are Current Health Expenditure, CO2 Emissions, and GDP which will be tested through the Vector Error Correction Model (VECM). Model equation as follows:

$$CHEt = \beta 0 + \beta 1COEt1 + \beta 2GDPt2 + et$$
$$COEt = \beta 0 + \beta 1CHEt1 + \beta 2GDPt2 + et$$
$$GDPt = \beta 0 + \beta 1CHEt1 + \beta 2COEt2 + et$$

Information:
CHE   = Current Health Expenditure
COE   = CO2 Emissions
GDP   = Economic Growth (in percent)
β = Konstanta
e   = Error term
t   = Time Period

Result and Discussion

Table 1. Stationery Test CHE, COE, and GDP Result

Variable	Level		First Difference	
	Prob.	**Description**	**Prob.**	**Description**
CHE	0.0574	Not Fulfil	0.0132	Fulfil
COE	0.7461	Not Fulfil	0.0091	Fulfil
GDP	0.1464	Not Fulfil	0.0001	Fulfil

Table 1 above uses the unit root test to check for data stationarity. As a result, issues with data stationarity have been eliminated. At the initial level of differentiation, no changes were seen in any of the research variables. The optimal lag test is performed once the unit root test has been completed to establish the lag that will be utilised throughout the research. The optimum lag test will then be explained in table 2 below.

Table 2. Lag Optimum Test Result

Lag	LogL.	LR	FPE	AIC	SC	HQ
0	14.94659	NA	5.71e-05	-1.257535	-1.108414	-1.232298
1	49.67461	54.83373*	3.88e-06*	-3.965749*	-3.369261*	-3.864799*

Based on table 2's findings, the optimal latency is 1, so that's what we'll do. After establishing if the VECM is enough, we will conduct a cointegration test. Test can be carried out which will be explained in table 3.

Table 3. Cointegration Test

Hypothesized	Eigenvalue	Trace Statistic	0,05 Critical Value	Probability
None *	0.712909	34.93360	29.79707	0.0117
At most 1	0.371180	12.47040	15.49471	0.1357
At most 2 *	0.204583	4.120002	3.841466	0.0424

The cointegration test has been carried out in table 3 with the result that there are 2 cointegration, so the analysis is carried out with the VECM test which will be explained in table 4.

Table 4. VECM Test Result

	D(CHE)	D(COE)	D(GDP)
D(CHE(-1))	-0.290188	0.119435	0.771929
	(0.33824)	(0.03720)	(1.26341)
	[-0.85794]	[3.21083]	[0.61099]
D(COE(-1))	-0.301608	0.442145	5.941856
	(1.66586)	(0.18320)	(6.22245)
	[-0.18105]	[2.41342]	[0.95491]
D(GDP(-1))	0.026314	-0.003724	-0.302813
	(0.06472)	(0.00712)	(0.24176)
	[0.40656]	[-0.52319]	[-1.25253]
C	0.057297	-0.012134	0.084066
	(0.04564)	(0.00502)	(0.17050)
	[1.25528]	[-2.41728]	[0.49307]

Table 4 displays the results of the VECM study. D(CHE(-1)) and D(COE) have a t-statistic of [3.21083], indicating that previous health expenditures will have a substantial positive impact on carbon emissions. There is a positive correlation between GDP and health care spending, as measured by D(GDP(-1)) and D(CHE), which has a t-statistic of [0.40656]. The t-statistic for the correlation between D(GDP(-1)) and D(COE) is [-0.52319], suggesting that GDP has a negative effect on CO2 emissions. Greenhouse gas emissions decreased in correlation with previous healthcare spending. However, carbon emissions tend to increase along with GDP growth. Indonesia's health spending increases alongside the country's GDP.

Table 5. Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
COE does not Granger Cause CHE	19	1.90432	0.1866
CHE does not Granger Cause COE		2.25939	0.0113
GDP does not Granger Cause CHE	19	0.42371	0.5243
CHE does not Granger Cause GDP		1.15762	0.2979
GDP does not Granger Cause COE	19	0.46998	0.5028
COE does not Granger Cause GDP		0.13401	0.7191

The findings of a Granger causality test, which examines the potential for causation between two independent variables, are presented in Table 6. Only one path of causality can be demonstrated between CHE and COE, with a probability of 0.0113. The discrepancy between healthcare costs and carbon output explains this pattern.

Conclusion
Investment in healthcare in the past has been linked to lower emissions of greenhouse gases. Emissions of carbon dioxide, on the other hand, increase in tandem with GDP growth. The GDP in Indonesia is positively connected with health spending. By focusing the increasing allocation of expenditure on excellent health care, policymakers in Indonesia can have a positive impact on economic growth. In addition, there is only a positive association between current healthcare costs and CO2 emissions. The converse is true, however, despite the fact that emissions have no effect on health care expenses.

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