The Impact of CO_2 Gas Emissions on Government Expenditure of Health Sector in Indonesia

Hadi Sasana[1,*], *Panji* Kusuma[2], *Yuliani* Setyaningsih[3]

[1] Department of Economic Development, Faculty of Economics and Business, Diponegoro University, Semarang - Indonesia
[2] Department of Economic Development, Faculty of Economics, Tidar University, Magelang – Indonesia
[3] Faculty of Public Health, Diponegoro University, Semarang – Indonesia

Abstract. Improving the degree of public health is increase government expenditure on the health sector. The study aims to analyse environmental degradation, demographic and economic factors on government expenditure in health. The analytical tools used in this study are multiple regression. The results showed that increased government spending on the health sector caused by demographic factors that are increasing the number of elderly people and environmental factors, namely CO_2 gas emissions.

Keywords: **Government Expenditure; CO_2 Emissions; GDP.**

1 Introduction

In building a country, it takes a strong economy to synthesize the entire activity. The development of the economic field to improve people's welfare should be followed by progress in the field of social and environmental quality. Indicators of social field advancement include education, health care, adequacy of housing needs, and CO2 emissions. Thus, the development of a country is not merely pursuing economic achievement (achieving a maximum level of income) but has undergone changes in the direction of environmental quality Development, as well as human resources. The lack of environmental quality due to the process of economic development will lower the degree of health and increase the development cost of health care.

There are several factors affecting government expenditure on the health sector. Dreger [1] tested the influence between per capita income, life expectancy, and infant mortality rate against the manufacturing of the health sector. It stated that government expenditure on the health sector not only influenced by public income. Another important factor is the development of the health world that seen from the life expectancy and the infant mortality rate. Another case with research conducted by Samadi [2] who tested the influence of per capita income, and the number of elderly people on government expenditure on the health sector, found that the per capita income is a variable Influence of government expenditure. They also found that in their research the influence of the number of elderly people on government spending is negative. According to them, this is due to the level of health in the country that belongs to the *Economic Cooperation Countries* (ECO) is very good that the inhabitants need much less health service than the country level is Low health. Another study conducted by Boachie [3] which tested the influence of per capita income, life expectancy, birthrate, inflation, and CO2 emissions against government expenditure on the healthcare sector concluded that revenues, numbers of expectations And birth rates are the most influential variables of government expenditure on the healthcare sector. While inflation and CO2 emissions effects are positive but insignificant.

CO2 emissions are carbon dioxide derived from the combustion of fossil fuels and factories produced during the process of fuel consumption of solids, liquids, liquefied gases, and combustion gases. CO2 gas emissions are very harmful to the human body. The higher the CO2 emissions effect on air quality is worse. Increasingly lack of air quality will greatly affect the condition of human health, which can lead to various diseases that will ultimately increase the demand for health care so that it will increase government expenditure in the healthcare sector. Environmental damage resulted in decreased health degrees and increased health costs. The research conducted by Abdullah [4] on the impact of environmental, economic and demographic factors on government spending on health sector in Malaysia shows the results where CO2, SO2, and NO2 gas emissions proved to be Have a significant influence on the government expenditure on the healthcare sector. The same results discovered by Khoshnevis [5] on their research on the influence of revenues, CO2, and PM10. In their research, they found the results that people's income and CO2 are the variables that most affect the Government's expenditure

* Corresponding author: hadisasana@live.undip.ac.id

on the health sector. Thus, increasing pollution has the potential to increase government expenditure on the health sector.

Improving the degree of public health has the potential to increase government expenditure on the health sector. The health budget setting requires an accurate estimate. Investigation of factors affecting the government expenditure of the health sector in Indonesia needs to be implemented. The study aims to test the impact of CO2 emissions, demographic factors, and economic factors on government expenditure in the health sector.

2 Literature Review

According to Wagner [6] in encouraging the development of government activities, the ratio of government spending to GDP is getting larger, based on observations in European countries, the US, and Japan. Wagner's law stated that when per capita income increases then the government's spending is also relatively rising.

The government spending on the health sector not only influenced by public income but also developments in the medical world seen from life expectancy figures and infant mortality rate [1]. Similarly, the research from Furuoka [7] is in 12 Asian countries. He found that the community's income variables and the number of elderly people were the most influential variables of government expenditure on the healthcare sector. Per capita income, the proportion of the elderly population, and transfer income were the most influential variables on the amount of government expenditure on the health sector [8].

Another study conducted by Lopreite [9] in Italy found that the government spending on the healthcare sector more respected by the number of elderly people compared to community revenues and life expectancy figures. Research from Barkat [10] found that in the short term, public income was very influential in government expenditure on the health sector. However, on the long runs not only income that significantly affects the issuance of the health sector. Other variables such as technological developments measured from the infant mortality rate and life expectancy also significantly affect the government expenditure of the healthcare sector.

Khan [11] in their research on factors affecting the government spending on the health sector in Malaysia found that the most result variables affecting government spending on the healthcare sector were GDP Percapita, the number of elderly people, and life expectancy. On OECD countries, Phi [12] found the result that there were three key variables affecting government spending on the health sector, namely the income of the population, the number of the elderly, and the life expectancy.

Another study conducted by Zhang [13] on the influence pollution on government expenditure in the health sector that three Chinese provinces found that air pollution has an impact on increasing government expenditure on the health sector. Similar research also conducted by [3] in Ghana. He found that the most influential variables on increasing government spending on the healthcare sector were public income, life expectancy, and rough birth rates. While inflation, urbanization, and CO2 gas emissions, levels do not significantly affect government agencies in the healthcare sector.

Along with the increasing demand for healthcare, governments need to increase their spending to adequate and fulfill the demands of healthcare, given that one of the factors affecting the high low degree of health is financing rates for the healthcare sector [14]. The amount of health expenditure has a positive relationship with the achievement of the degree of public health in a country. Therefore, the greater the health expenditure incurred by the Government, is the higher degree of public health.

The law No. 36/2009 on health mentions that a large central government health budget allocated at least 5% of the income budget and expenditure of the state outside of salary. The amount of provincial government health budget, Regency/City allocated at least 10% of the income budget and expenditure on the area outside the salary. This makes it very necessary for policymakers to identify the factors that are creating government expenditure on the health sector. According to Murthy [15], Government spending on the health sector was important because the government expenditure in this sector is one of the development strategies in a country. When the degree of health in a country is very good, it will have an impact on the overall economy with a growing form of productivity, more life expectancy, and the general level of well-being that will Increase.

3 Research Method

To investigate the increasing health expenditure in Indonesia, there are four free variables (CO_2 gas emissions, advanced population number, life expectancy, Percapita GDP) and one bound variable (government expenditure on the health sector) That will be used to estimate this research. The operational definitions of each variable are:

a. Government expenditure on the healthcare sector: all government-issued expenditures to finance government consumption, activities, and other expenditures in order to achieve health sector objectives in rupiah. Data sourced from the Ministry of Finance of Indonesia Republic.
b. The number of elderly people: a person who has reached the age of 65 years and above, in a unit of soul? Data sourced from World Bank.
c. Life expectancy: The average approximate number of years that are a person can reach since birth, in a unit of years. Data sourced from World Bank.
d. Per capita Gross Domestic Product: The result of GDP distribution with a population, the Percapita GDP reflects the average revenue of the population in a country in the rupiah unit. Data sourced from World Bank.

e. CO_2 gas emissions: carbon dioxide derived from the burning of fossil fuels and factories produced during the fuel consumption process of solid, liquid, liquefied gas, or combustion gases in a kilo ton. Data sourced from World Bank.

The object of this research is Indonesia. The data used is secondary data during the period of 1984-2017.

The analytical tools used in this study are double linear regression. Multiple linear regression models allow for the inclusion of more than one variable predictor. The classic assumption test includes normality test, autocorrelation test, heteroscedasticity test, and multicollinearity test. The Software analysis tool used is eviews 10 for Mac. Models of this research equation written as follows:

$$PHE = \alpha + \beta_1 POP65 + \beta_2 AHH + \beta_3 GDP + \beta_4 CO2 + \mu \quad ..(1)$$

where:

PHE	: Health sector government Expenditure (Rupiah)
CO_2	: CO_2 gas emissions (kilo-tonnes)
POP65	: Number of elderly people (residents)
AHH	: Life expectancy (years)
GDP	: GDP per capita (rupiah)
α	: Constant
β	: Regression coefficient
μ	: Error

4 Result and Discussion

The study investigated the government's expenditure on the health sector in Indonesia using secondary data during the period of 1984-2017. Based on the estimated results (table 1) The value of coefficient of determination (R^2) of 0.757036 implies that 75.70% of government expenditure variables in the health sector can be explained by the variables of the number of elderly populations, life expectancy, GDP Per capita, and CO_2 gas emissions and the remainder of 24.30% are described by other variables.

Table 1. Results of the Dependent Variables of the Health Sector Government Expenditure

Variables	Coefficients	Std. Error	t-Statistic	Prob.
CO_2	10929945	6252189	1.748179	0.0914**
POP65	2109533	500633.1	4.213730	0.0002*
AHH	-9.88E+11	3.25E+11	-3.041994	0.0052*
GDP	-169050.9	171161.6	-0.987668	0.3318
C	4.94E+13	1.67E+13	2.964285	0.0061
R-squared	0.757036			
Adjusted R-squared	0.722327			
S.E. of regression	3.65E+11			
Sum squared resid	3.73E+24			
F-statistic	21.81087			
Prob(F-statistic)	0.000000			

Significance 5%*; significance 10%**

The test result F from Table 1, indicating the value of F count 21.81087 with a significance rate smaller than 0.05. This indicates that the variable is independent (CO_2 gas emission variables. The number of elderly residents, life expectancy figures, per capita GDP) in models jointly affects the dependent variable (government expenditure of health sector).

The T-Statistic test from Table 1 shows how much influence individual variables individually or partially in describing the dependent variables. Based on the results of the estimate the equation of study results regression is as follows:

$$PHE = 4.94E+13 + 10929945\ CO2 + 2109533POP65 - 9.88E+11AHH - 169050.9GDP \quad (2)$$

Based on the estimated results of the CO2 gas emission variables have a coefficient value of 10929945 with a significance of 0.0914 which is smaller than 0.10. This means that CO2 gas emissions have a positive and significant influence over the government expenditure variables in the health sector partially. Increased CO2 emissions will increase the burden of the health budget. These results were in accordance with the research conducted by [4, 5] in which both studies tested the influence of revenues and CO2 on government spending on health sectors. In both studies, it found the result that CO2 gas emissions strongly affect government expenditure on the healthcare sector. Thus, increasing pollution has the potential to increase government expenditure on the health sector.

Further findings stated that the variable number of the elderly population (POP65) has a coefficient of 2109533 with a significance of 0.0002 which is smaller than 0.10. This means that the number of elderly people has a positive and significant influence on the variables of government expenditure on the health sector partially. The results of this study are in line with the research conducted by [7, 9]. Which in both studies stated that the rising of the elderly population would cause increased health demand where often the elderly are likely to have a less than optimal health condition that will require much health care? In addition, often the elderly have insufficient financial circumstances that this increased demand for healthcare services will be a burden on the government and will greatly affect government expenditure on the health sector.

The life expectancy (AHH) variable has a coefficient of 9.88 E + 11 with the significance of 0.0052 which is smaller than 0.10. This means that the life expectancy rate has a negative and significant influence on the government spending variables in the health sector partially. This thought to happen because people have more knowledge of the importance of maintaining health. So that people will pay more attention to the pattern of their life that makes the term of their life become longer and healthier so as not to charge the country. The government spending on the health sector would increase when life expectancy also increases [2]. However, this expenditure will begin to decline after the life expectancy figure reaches its peak. He also stated in his research that in countries with a high level of health, the life expectancy of the elderly will increase and the elderly tend to be healthier so as not to burden the government for health care their old day.

The final findings suggest that the variable GDP per capita (GDP) has a coefficient of-169050.9 with a

significance of 0.3318 which is greater than 0.10. This means that the GDP Percapita has a negative but insignificant influence on the government expenditure variables in the health sector partially. The negative influence gained from this estimate is not in accordance with the expectations of the researcher where the per capita GDP expected to positively influence. In accordance with the research conducted by [8] where the per capita income had a significant influence on the government expenditure on the health sector positively. However, in the study conducted by [16] in the country incorporated in MENA. The results found that GDP Percapita was negatively affecting government spending on healthcare in the country of Qatar, the United Arab Emirates, and Kuwait. This indicates that health services are *inferior goods* in line with the increase in GDP Percapita, government expenditure of the health sector is decreasing.

5 Conclusion

Based on the results of the regression that has conducted, there are positive and significant links between the number of the elderly population and CO2 gas emissions against government expenditure on the healthcare sector. This means that any increase in the number of elderly people and CO2 gas emissions will increase the government's expenditure on the health sector. These results are in accordance with previous studies considering the health conditions of the elderly tend to be not optimal and worsening, so that it will require health care and will increase government expenditure. Similarly, CO2 gas emissions. If the emission levels of the CO2 gas in the air are increasing, then the available air quality will be decreasing. Low air quality often results in a variety of diseases, especially respiratory diseases that are very harmful to one's health. The more often a person exposed to poor air quality, the more likely it is to fall ill to become larger. Therefore, it will increase the demand for health care and ultimately will increase government expenditure on the health sector.

The results of the regression have also shown a significant and negative relationship between life expectancy rates with government expenditure on the health sector. Economic factors that have been proxy variable GDP Percapita showed negative influence but this influence is not significant.

References

1. C. Dreger, H.E. Reimers, *Health care expenditures in OECD countries: A panel unit root and cointegration analysis*, International Journal of Applied Econometrics and Quantitative Studies **2**(2), 5–20 (2005)
2. A. Samadi, E.H. Rad, *Determinants of Healthcare Expenditure in Economic Cooperation Organization (ECO) Countries: Evidence from Panel Cointegration Test*, International Journal of Health Policy and Management **1**(1), 63-68 (2013)
3. M.K. Boachie, I.O. Mensah, P. Sobiesuo, M. Immurana, A.A. Iddrisu, *Determinants of Public Health Expenditure in Ghana: A Cointegration Analysis*, Journal of Behavioural Economics, Finance, Entrepreneurship, Accounting, and Transport **2**(2), 35-40 (2014)
4. H. Abdullah, M. Azam, S.K. Zakariya, *The Impact Of Environmental Quality on Public Health Expenditure in Malaysia,* Second Asia Pacific Conference on Advance Research (APCAR*),* Melbourne (2016)
5. S. Khoshnevis, B. Hanalizadeh, *Air Pollution, Economic Growth, and Healthcare Expenditure*, Economic Research **30**(1), 1181-1190 (2017)
6. A. Wagner, *Finanzwissenschaft*, Leipzig: C.F. Winter (1890)
7. F. Furuoka, B. Yee, E. Kok, M.Z. Hoque, Q. Munir, *What are the Determinants of Health care Expenditure? Empirical Results from Asian Countries*, Sunway Academic Journal **8**, 12-25 (2011)
8. L.D. Matteo, R.D. Matteo, *Evidence on the Determinants of Canadian Provincial Governmtn Health Expenditures: 1965-1991*, Journal of Health Economics **17**, 211-228 (1997)
9. M. Lopreite, M. Mauro, *The effects of population ageing on health care expenditure: A Bayesian VAR Analysis Using Data from Italy*, Health Policy **121**(6), 663-674 (2017)
10. K. Barkat, R. Sbia, Y. Maouchi, *Empirival Evidence On The Long And Short Run Determinants Of Health Expenditure In The Arab World*, Journal Of Economic Literature **7**(1), 1-10 (2018)
11. H.N. Khan, R.B. Razali, A.B. Shafie, *Modeling Determinants of Health Expenditures in Malaysia: Evidence from Time Series Analysis*, Front Pharmacol **7**(69), 7 (2016)
12. G. Phi, *Determinants of Health Expenditures in OECD Countries*, Honors Projects in Economics, Paper 26 (2017)
13. X. Zheng, Y. Yu, L. Zhang, Y. Zhang, *Does pollution drive up public health expenditure? A Panel Unit Root and Cointegration Analysis*, Journal of Economics Literature (2010)
14. A. Sujudi, *Investasi Kesehatan untuk Pembangunan Ekonomi*, Jakarta: Departemen Kesehatan Republik Indonesia (2003)
15. V.N.R. Murthy, A.A. Okunade, *The core determinants of health expenditure in the African context: Some econometric evidence for policy*, Health Policy **91**(1), 57–62 (2009)
16. O. Yorulmaz, *Can Healthcare Ever Be Less Than A Necessity In MENA Countries? A Semiparametric Estimation Of The Relationship Between Healthcare Expenditure And GDP*, Quality & Quantity **50**(3), 1233-1244 (2015)