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The Role of Fiscal Policy and Monetary Policy in Environmental Degradation in Indonesia

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ABSTRACT

This study pores over the significance of Fiscal policy and monetary policy that's describe the effects on environmental issues. With the help of multiple linear regression, we found out the result that clearly explains the impact of fiscal and monetary policy on environmental issues like CO₂ emission. We have used three variables, i.e., GDP, exchange rate, and interest rate with CO₂ emission. For considering the possible finding on the impact of fiscal and monetary policy according to the pollution sources, we can also distinguish in between the consumptions and productions that are generated by CO₂ emissions. The emission of CO₂ and that is affected by an increase in the interest rate, and exchange rate and also GDP contributes the great role in affected the environmental issues. The results of ARDL bound testing further confirm a strong relationship between fiscal policy, monetary policy economic growth, and CO₂ emission in Indonesia. The long-run coefficient further confirms that fiscal and monetary policy is still in phase to enhance the environmental degradation in Indonesia. However, the government should pay extra attention to introduce some innovation in the domain of technology while formulating fiscal policies.

Keywords: Fiscal Policy, Monetary Policy, Environmental Degradation, Indonesia

JEL Classifications: O13, O44, Q5

1. INTRODUCTION

Environmental degradation and climate change in affecting countries all around the world, however, the intensity of its adverse effects vary in several regions based on their geographies. It is very common in the countries with island that are considered more prone to climactic fluctuation such as heavy rainfall that causes floods, such as Indonesia. In addition, due to the high population, the country faces greater consumption patterns to accommodate the demand of high populace. This excessive demand for goods and services is reflected in Indonesian industries that heavily rely on energy as the prime input. It is the main reason that Indonesia nowadays is the largest greenhouse gases emitters. The rising levels of energy consumption and carbon intensity is considered alarming for Indonesian Government that is motivated to accommodate according to increasing climate change.

Lately, it was noticed that the use of fossil fuel like oil and natural gas played a key role in air pollution and causes harm for human health and air pollution (Kristom, 2003). According to UN-Conference, the current environmental problem is pollution generated by man which damages greenhouse effect probably caused by greenhouse gases among which carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and chloro-fluoro-carbons are important. Another worst issue is an abatement of ozone layer 15-60 km above the Earth's surface, as well as depletion of the ozone layer, is more in the Antarctic region due to meteorological condition near the south pole (Buiter, 2013). The effect of this issue indirectly harmed by ultraviolet light, which damages plant and animal. Furthermore, another element which is playing its role in pollution is high concentration levels of SO₂, which causes respiratory diseases and increase corrosion of some material. SO₂ is largely emitted by manufacturing firms in addition to burning

of fossil fuels. So, following the extensive negative effects of harmful greenhouse gases, there is the need to make policies to control toxic emissions.

Moreover, the point of arguments which always affect the government policies in this domain is processing of financial and economic activities that are largely related to economic growth but significantly contributed to enhanced levels of greenhouse gases. If the controls measures were made to control the emission of CO₂, it will ultimately reduce other toxic gases such as SO₂, NOR, CO and particulate matter for which first and key policy is to reduce CO₂ emissions (Fankhauser, 2008). No doubt that if there is some adulteration in the use of fossil fuel will definitely affect calls for electricity and ultimately the economic activities. For any government, it is the major task to understand the connection between the economy and the direct and indirect effects of climate change.

It has been observed that demand for energy is increasing day by day in Indonesia. And if we relate it with the energy intensity of GDP, then it seems very low. Indonesia assimilates only about 0.3% of total energy (Hemming, 2015), however, there exist rising trend in country's energy need due to rapid population growth. To meet the growing need of energy, policy structures play significant role to comply with rising needs with the balance of maintaining sustainable environment. As climatic change and ozone damage have persisted heavy impact on government budgetary guidelines, the impact of policies in leading climate change is apparent. Usually, government bodies feel some problem and challenge in implementing control measures especially in manufacturing industries, forest damage, water impurification etc. In the greenhouse gases, carbon dioxide is regarded as the major threat of environmental sustainability (Giavazzi, 2002). This makes it prudent first to consider the problem of cunning and evaluation of policies directed against excessive carbon intensity and degrading environmental condition. Given the situation, the current study is focused to analyze the potential influence of monetary and fiscal policies on environmental condition of Indonesia. Although work is in progress by Indonesian's Government in the form of policy designing to fight declining ecological condition and controls over carbon intensity, the efficient implementation of fiscal and monetary policies is vital to ensure environmental sustainability.

The following section throws light on the initiation and implementation of budgetary policies and its successful execution by Government bodies of Indonesia. The aim is to assess the presence of policies to curtail environment, however, it does not seek to calculate the effectiveness of these policies.

In 1978, President of Indonesia, choose Emil Salim as the first minister for environment and a fixed amount has been kept for generating guidelines and regulation. The first Law come to existence is the form of Law No. 4/1982. Later various amendments have been made with the time of governance and in 2010, the financing for environmental sustainability is increased to Rap. 416 billion. However, many believed that the monetary assistance from the government is not adequate to tackle environmental issues properly (Bowen, 2013). Here are a few

cases that have been refined by the Ministry of the Environment as a response towards changing climate.

Initially, in 1989 Ministry of Environment make Regulation No. 29/1986 and prepared a report on the situation of environment suggesting the impacts which were named as environmental impact assessment and later reviewed by an expert member of the government bodies to formulate policies accordingly.

In 1988, electricity generation was consumed by commercial energy, especially in eight developing countries i.e. Brazil, China, India, Indonesia, Malaysia, Pakistan, Philippines, and Thailand, while the consumption was mainly in industries. So, it was concluded that industries generate serious environmental problem as compare to energy use such as emissions of particulate matter (dust and smoke), Sulphur dioxide, nitrogen oxides, unburned hydrocarbons, carbon monoxide, the use of leaded fuels, and the sedentary air pollution (Sarantis, 2003). Indonesia then put effort on outgrowth and uses its petroleum resources for power generation to be mostly utilized in industries, however, maintaining the increasing daily demand for domestic uses (Newell, "Regulating stock externalities under uncertainty," 2014).

Later in 1989, Clean River Program also known as PROKASIH dealemerged as the report highlighting worsening quality of rivers in Jakarta. It deals with the control of the waste of water by industries. In this program, the quality of river and lakes, biochemical oxygen demand and total suspended solids is discussed strengthens environmental and institutional proficiency. In June 1990, a national environmental impact management agency was established to respond rising environmental issues and initiated several development programs.

Recently in 2014, Regulation No. 79, the potentials of green energy has been structured in Government in assessing National Energy Policy condition of Indonesia. The report suggested that the tendency of green energy in the country is 400 gigawatt (GW), however, its consumption is merely 8.8 GW that is only 2% of the total green energy potential (Jaelani et al., 2017). This has augmented the focus of policies towards enhancing green power plants and local and international business co-operation for the enhancements of green energy production and usage.

At present, Indonesia accounted 40% of total ASEAN power consumption. The country is considered as the highest power utilizer of the ASEAN region (ASEAN energy outlook, 2016). In similar context, the country is considered to put highest pressure on environmental condition. Given the adversity, Indonesian government projected to increase in green energy usage and production. In this regard, the energy policy targets have been generated. It followed that the green energy mix in total energy consumption of the country should be increased to 23% until 2025.

If an overview was taken, it going to notice that larges sources of energy are biomass and others were coal, oil, and gas. It's about 92% conservation of hydrocarbon of total energy consumption. Since 1978, Indonesia's shift its export to liquefied natural gas (LNG), but the problem is the limited account for about 8% of total

exports (Pollins, 2009). The use of fuels like firewood, charcoal, agricultural residues causes the emission of smoke and other pollutants like particulate matter, carbon dioxide, hydrocarbons, and nitrogen oxide. Nonetheless, the utmost impact of carbon emission is considered to disrupt environmental condition massively and therefore analyzed abundantly in the existing studies, such as, Alshehry and Belloumi (2015) in Saudi Arabia, Tang and Tan (2015) in Vietnam, Zhang and Da (2015) in China, Begum et al. (2015) in Malaysia and Dogan and Turkekul (2016) in United States.

Given the significance of carbon dioxide in enhancing environmental degradation, it is eminent to consider the government policies that can alter the levels of excessive carbon intensity and degrading environmental condition. As a solution, the adoption of green energy is considered relevant to decrease environmental pressures in the form of toxic emanations, along with fulfilling the energy need of industrial sector. However, given the limited adoption of green energy against its potential (Jaelani et al., 2017), there is a need of enhancing green energy emphasis on micro and macro business levels. This will require additional financing to initiate and install green projects that can be borrowed from banks or can be acquired from converting foreign money reserves. In addition, the adoption of eco-friendly business functions extensively relied on re-engineering, technological adoption to avail efficiencies and huge investments that largely depend on government's exchange rate and interest policies. In compliance, the current study is focused to analyze the potential influence of monetary and fiscal policies on environmental condition of Indonesia. Considering the eminent role of carbon emanation, the present study seeks to analyze the effect of exchange rate and interest rate policies on carbon intensity of the country.

The remaining of the study is followed by literature review which highlights the outcomes and research gap of from the previous study, methodology which explain the modelling framework of the current study, followed by data analysis which explain the effect of considered variables in the short and long run period, and finally conclusion and discussion section provide the valid policy formulation to the government.

2. LITERATURE REVIEW

Indonesia has grown up quickly over the past years that are 25 years, around about 7% per year. While however, the GDP is still slow relative to other variables. About 3% of the population of the world, Indonesia is the only have 0.3% form the overall total energy. According to the World Bank, Indonesia is about having 0.27 ton of oil equivalent as compared to other statistics, Indonesia is slowly and gradually increased. (Newell, "Regulating stock externalities under uncertainty," 2003).

According to Alper and Oguz (2016) industrialization is increasing day by day and many of the countries are facing the environmental problems that are in the relationship with the energy uses such as the emission of some of the matters like for example dust and smoke particles. Some of the other matter particles that make the environment polluted like these are Sulphur dioxide, unburned

hydrocarbons like some carbon mono oxides like some nitrogen oxides.

According to Azam et al. (2014) Indonesia is being leaned and heavily uses of their petroleum resources for the generation of power, and this is very important for the transportations, and it is a need of industrial sectors and as well as it's a major source of use in foreign exchange. According to Adebambo et al. (2014) the point of arguments which always affect the working in this domain is financial and economic situations which had a vast effect on its execution Local, regional and global air pollution problems are of course intimately connected. If the controls measures were made to control the emission of CO₂, which ultimately reduces SO₂, NOR, CO and particulate matter for which first and key policy is to reduce CO₂ emissions.

According to Abidin et al. (2015) the rapid extensions of demand of domestic its combines with the little stockpiles and it is now appearing on the like vise countries that will become the net haulers of oils as from the period of 2010 to 2012. The crude oil and reserves of gas are becoming their consummations per annual as per the annual percentages of reserves was 2.2%. Since 1978, Indonesia's shift its export to LNG, but the problem is the limited account for about 8% of total exports (Pollins, 2009). The use of fuels like firewood, charcoal, agricultural residues causes the emission of smoke and other pollutants like particulate matter, carbon dioxide, hydrocarbons, and nitrogen oxide. Another pollutant which is not more pronebuthasan effect on pollution is open cooking stoves, which cause chronic lung disease and acute respiratory disease (Roland-Holst, 2015).

Indonesia then put effort on outgrowth and uses its petroleum resources for power generation and for other means. While keeping in view the increasing daily demand for domestic uses. (Newell, 2014). Now, the country will become a net oil hauler. Oil and gas reserves are more plenteous for use. Reserves of oil and gas in 1950 stood at 30 billion toe (btoe) and in 1990, more than 250btoe while thetotal world consumption over the 40-year period was 100 btoe (Webster, 2009).

In comparison to olden days, it has been observing that demand for energy is increasing day by day in Indonesia. And if we relate it with the energy intensity of GDP, then it seems very low. Indonesia assimilates only about 0.3% of total energy (Hemming, 2015). In 1988, electricity generation was consumed by commercial energy, but in eight developing countries (Brazil, China, India, Indonesia, Malaysia, Pakistan, Philippines, and Thailand) consumption was mainly in industry. So it was concluded that industries generate serious environmental problem as compare to energy use such as emissions of particulate matter (dust and smoke), Sulphur dioxide, nitrogen oxides, unburned hydrocarbons, carbon monoxide, the use of leaded fuels, and the sedentary air pollution.

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1950 stood at 30 btoe and in 1990, more than 250btoe while the total world consumption over the 40-year period was 100 btoe (Pollins, 2008). If an overview was taken, it going to notice that larges sources of energy are biomass and others were coal, oil, and gas. It's about 92% conservation of hydrocarbon of total energy consumption (Henry, 2014).

Since 1978, Indonesia's shift its export to LNG, but the problem is the limited account for about 8% of total exports (Pollins, 2009). The use of fuels like firewood, charcoal, agricultural residues causes the emission of smoke and other pollutants like particulate matter, carbon dioxide, hydrocarbons, and nitrogen oxide. Another pollutant which is not more prone but hasan effect on pollution is open cooking stoves, which cause chronic lung disease and acute respiratory disease (Roland-Holst, 2015).

3. METHODOLOGY

Due to the speculative and existential background that indicate the factors and on the other hand, according to Fredrick and Lundstorm (2012), CO₂ explains that total carbon dioxide emission in a country, IR represents as interest rate, ER denotes exchange rate and measures and finally, GDP explains as total finish goods and services. The data is gathered by the World Development Indicator managed by the World Bank during the period from 1973 to 2018. All the variables are converted into natural logarithmic series (Martínez-Zarzoso, 2011).

Although it could be applauded on the focus of the founded literature that gives beneficial impacts on government expenditures. Nonetheless, it is possible that the structure of government coming and implemented the monetary policy that also has the earthshaking impact in the terminations of environmental policy. Further, these are the following variables through which we have conducted this research. From the 4 variables, we found out the impact of policies changes in CO₂ emissions like these variables is given below:

- Interest rate
- Exchange rate
- CO₂
- GDP.

Where, CO₂ explains that total carbon dioxide emission in a country, IR represents an interest rate, ER denotes exchange rate, and finally, GDP explains as total finish goods and services. The data is gathered by the World Development Indicator managed by the World Bank during the period from 1973 to 2018. All the variables are converted into natural logarithmic series (Jayanthakumaran, 2012).

4. DATA ANALYSIS AND INTERPRETATION

In this study, the identifications by Mountford and Uhlig (2002), the shock between the fiscal policy by using the sign restrictions when controlling the monetary cycle and business cycle shocks. This consumption was properly performed by using a Bayesian approach to describe the relationship b/w the multiple linear regression method, and this is one step ahead of the error of prediction and the structural shocks of macroeconomics, the sign identifies the procedure starting from multiple linear regression model method as:

$$CO_2 = \beta_0 + IR\beta_1 + ER\beta_2 + GDP\beta_3 + \mu$$

Where, CO₂ explains that total carbon dioxide emission in a country, IR represents an interest rate, ER denotes exchange rate and measures, and finally, GDP explains as total finish goods and services. The data is gathered by the World Development Indicator managed by the World Bank during the period from 1973 to 2018. All the variables are converted into natural logarithmic series.

Finally, we explainthrough the following table that presents the results of descriptive analysis. The results of descriptive statistics are reported in Table 1. This table is showing descriptive results. Mean, standard deviation and also showing the normality as Jarque-Bera is significant means data is not normal further it is also showing the correlation which is at least 89% and significant as well.

In the further step, we applied two novel unit root test in order to confirm the stationary properties of the variables. The results of the ADF and PP unit root test are reported in Table 2. The results

Table 1: Results of descriptive statistics

Variables	Mean	Minimum	Maximum	Std. dev.	Jarque-Bera	Correlation
ER	12453.061	10596.34	14350.44	107.052	24.346***	0.894***
IR	8.439	5.547	9.436	3.436	58.345***	0.901***
GDP	285.348	174.348	394.396	30.282	25.915***	0.942***
CO ₂	391.385	204.482	484.436	29.439	19.549***	-

***represents the values are significant at 1%, Source: Authors estimation

Table 2: Results of unit root test

Variables	ADF unit root test				PP unit root test			
	I (0)		I (1)		I (0)		I (1)	
	C	C&T	C	C&T	C	C&T	C	C&T
ER	0.376	0.339	-5.328	-5.211	0.473	0.446	-5.264	-5.327
IR	0.324	0.361	-4.484	-4.118	0.332	0.385	-4.222	-4.395
GDP	-0.274	-0.245	-5.994	-6.011	-0.195	-0.245	-6.204	-6.117
CO ₂	-0.449	-0.415	-5.684	-5.248	-0.649	-0.594	-5.372	-5.219

Source: Authors estimation

suggested that all the variables are showing non-stationarity features at level series. However, the outcomes indicate that all the variables are showing stationarity properties at the first differential series. After confirming the stationary property, we analyze the long-term cointegration by using ARDL bound testing cointegration test.

The results of ARDL bound testing cointegration is reported in Table 3. The F-test values are 44.322 and significant which confirm the rejection of null hypothesis and the acceptance of alternative hypothesis which means that there is a strong long-run relationship between fiscal policy, monetary policy, economic growth and environmental degradation in Indonesia.

Lag length means to see the impact of previous years on the dependent variable we take lags. and how long previous year should be taken we decide through this given table, and it is showing the previous 1 year should be selected. The results of lag length are shown in Table 4.

The results of lag length confirm that all variables are suitable using 1 lag length; therefore, the coefficient of long and sort run estimation is performed using the same lag as mentioned above. In the next step, the results of the long-run coefficient of ARDL is reported in Table 5.

Table 3: Results of bound testing for cointegration

Lags order	AIC	HQ	SBC	F-test statistics
0	-3.584	-3.984	-3.889	44.322*
1	-5.175*	-5.843*	-5.885*	
2	-4.856	-4.908	-4.929	
3	-4.472	-3.998	-3.894	

* 1% level of significant, Source: Authors' estimation

Table 4: Results of lag length selection

Lag	0	1	2	Nominated lags
	SBC	SBC	SBC	
ER	-2.058	-2.968*	-2.173	1
IR	-1.994	-2.684*	-2.018	1
GDP	-1.385	-2.374*	-2.110	1
CO ₂	-1.585	-2.194*	-1.985	1

*indicate minimum SBC values, Source: Authors' estimation

Table 5: Results using ARDL approach (Long run)

Variables	Coeff.	t-stats.	Prob.
C	-0.147	-4.284	0.000
CO ₂ (-1)	0.089	3.485	0.000
ER	0.274	5.348	0.000
ER (-1)	0.002	0.879	0.391
IR	0.211	5.662	0.000
IR (-1)	0.004	0.936	0.350
GDP	0.485	4.483	0.000
GDP (-1)	0.194	6.493	0.000
Adj. R ²		0.937	
D.W stats.		2.083	
F-stats. (Prob.)		4984.732 (0.000)	

Source: Authors' estimation

The results of the long-run coefficient of ARDL confirm that all variables have a positive and significant impact on carbon dioxide emission in Indonesia. The results confirm that an increase in 1 unit in the exchange rate will increase 0.274 unit of carbon dioxide emission in Indonesia. On the other hand, the outcome further suggested that an increase in 1 unit in interest rate will increase 0.211 unit of carbon dioxide emission. Finally, the results of the ARDL long-run coefficient confirm that economic growth also has a positive and significant impact on carbon emission in Indonesia. The results confirm that an increase in 1 unit in economic growth will increase 0.485 units of carbon dioxide emission.

The results of the ARDL short-run coefficient is reported in Table 6. The results confirm that the same results are found in the short run time period as well. Also, the value of the error correction term is -0.205, indicating the speed of adjustment, which is 20.5%. Moreover, the sign of the coefficient is the same as the long-run coefficient, while the magnitude is varied.

In the final step, we applied the Granger causality analysis, and the results are reported in Table 7. The results of Granger causality a bidirectional causal relationship between interest rate and carbon dioxide emission. Moreover, the results further confirm a bidirectional causal relationship between exchange rate and carbon emission in Indonesia. Finally, the outcomes of Table 7 recommend a bidirectional causal connection between economic growth and carbon emanation. In general, the results suggested a bidirectional causal relationship between interest rate, exchange rate, economic growth, and carbon dioxide emission in Indonesia.

Table 6: Results using ARDL Approach (Short run)

Variables	Coeff.	t-stats.	Prob.
C	-0.246	-3.039	0.005
Δ CO ₂ (-1)	0.263	2.486	0.022
ΔER	0.358	5.375	0.000
ΔER (-1)	0.204	3.795	0.000
ΔIR	0.038	-0.811	0.426
ΔIR (-1)	0.018	1.535	0.119
ΔGDP	0.402	4.598	0.000
ΔGDP (-1)	0.194	2.890	0.000
ECM (1)	-0.205	-5.385	0.000
Adj. R ²		0.932	
D.W stats.		2.094	
F-stats. (Prob.)		1285.435 (0.000)	

Source: Authors' estimation

Table 7: Results of granger-causality test

Null hypothesis	F-statistic	Prob.
ER does not granger cause CO ₂	9.439	0.000
CO ₂ does not granger cause ER	14.326	0.000
IR does not granger cause CO ₂	10.361	0.000
CO ₂ does not granger cause IR	8.437	0.000
GDP does not granger cause CO ₂	19.235	0.000
CO ₂ does not granger cause GDP	14.467	0.000

Source: Author's estimation

5. CONCLUSIONS AND POLICY IMPLICATIONS

In this study from the linear multiple regression model that is deployed on this model, we applied the method that is multiple linear regression method, and by the sign restrictions approach, we applied the novel identification approach. The CO₂ emission is used as the environmental variable that was taken from the model availability from statistics. As it is the only defilement for which we have quarterly data available for a huge time period. To examine the Fiscal policy disturbance.

Here, we only rely on the information given from the macroeconomic side time series of vector autoregression method with the minimum of pre supposed views. Particularly, we have no restrictions on the key variable of interest rates, likewise GDP, exchange rate and CO₂ emission. The investigation gives the results between the relationship of CO₂ emission and fiscal policy by verifying some of various fiscal policies scenario, as deficit financial tax cutting and deficit financial spending policies. The results show that there is a positive and significant impact of govt expenditure on both areas, that is consumption and production generated areas of CO₂ emissions, as per the recent studies.

On the other side, there is a positive support to the hypothesis, whereas the results give a positive impact between the policy with an increase in some amount of CO₂ emission. In addition, a suggestion is made that the govt expenditure should be enhanced by focusing on the specific division where the spending should be made. Further, we analyze that the spending on public goods can lead to the most remarkable reduction of CO₂ emission than spending on aggregate, for both sides, that is consumption and production generated emissions.

Despite this consideration, it has to be mentioned that there are some of the factors that have to be taken into consideration on the developing of fiscal policies, likewise the effect of conglomerate each policy on the real economy and on the abilities of debt of the government. In this study, there is a huge depth of theoretical models that gives the impacts of the liaison b/w fiscal policy, environmental, and output quality. However, there is a huge era for the enhancement for the publication of such a model for which the results can be taken from this study as an applicative baseline.

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