

The Impact of Foreign Direct Investment to the Quality of the Environment in Indonesia

Hadi Sasana^{1*}, Rr. Retno Sugiharti² and Yuliani Setyaningsih³

¹ Faculty of Economics and Business, Diponegoro University, Semarang – Indonesia

² Faculty of Economics, Tidar University, Magelang - Indonesia

³ Faculty of Public Health, Diponegoro University, Semarang – Indonesia

Abstract. Foreign Direct Investment (FDI) is the main element of the industrial development and economic growth. FDI will bring spillover effect in the form of technology transfer, increased competitiveness and surely will open up employment. But the presence of FDI into the country is not necessarily without problems. In the massif, the presence of FDI will build new factories that will bring the potential negative environmental externalities. This research aims to analyze the impact of FDI on the quality environment represented by CO₂ emissions. In addition to the FDI also hosted other macroeconomic variables to see the impact on the environment in the aggregate economy. By using the time series regression analysis, the results show that the presence of the FDI has positive effects significantly to an increase in CO₂ emissions. While the other macroeconomic variable, namely, poverty and population growth has a negative effect against CO₂ emissions.

Keywords: CO₂ Emission; Foreign Direct Investment; Population; Poverty

1. Background

Economic activity has caused environmental damage in Indonesia and reaching conditions of concern. Some conditions are recorded, among others, the rate of deforestation reached 1.8 million hectares/year, from the year 2001 until 2017, Indonesia loses forest area of 24.4 Mha leaving only 68% of the forests of Indonesia in 2010, as well as 30% of the 2.5 million acres of corals in Indonesia suffered damage (GWF, 2016) [1]. Data on CO₂ emissions released by World Bank Report 2016 [2] showed a significant improvement from the year 1990 to 2015 (Figure 1).

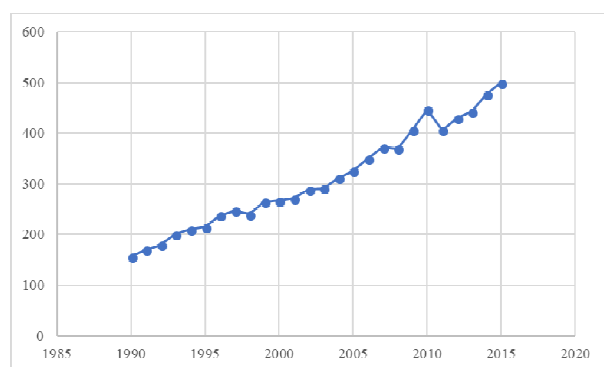


Fig 1 CO₂ Emission in Indonesia in 1990-2015 (Source: World Bank Report 2016, managed)

The level of CO₂ emissions increased from 157 metric tons in 1990 to become 500 metric tons in 2015.

The damage to the environment caused the decrease the environmental quality, increasing natural disaster events, threatening the sustainability of flora and fauna, increases the risk of disasters towards coastal areas, threatening the biodiversity of the sea, and sea fisheries production as well as lower increasing air pollution, water pollution, soil pollution, and pollution of the sea. The results of the study by Sasana and Ghazali (2017) [3] showed that the consumption of fossil energy and the increasing population has prompted increasing CO₂ emissions, and environmental quality is declining.

The donation is the largest environmental damage from human activities that don't care to improve the environment. The possibility cannot be denied that the more economic development activities leading to industrialization can enhance the welfare of society, but on the other hand has lowered the environmental quality. In 2017 no fewer than 30,000 industry thriving in Indonesia and will increase each year. The advent of the industrialization era that was marked with the establishment factories that produce a wide range of human needs have increased welfare, but on the other hand the level of environmental pollution is also growing. Study of the Sasana and Ghazali (2017) [3] in the country of the BRICS showed that industrialization of fossil energy by consuming coal in particular positive and significant effect against economic growth in BRICS countries. Instead of renewable energy consumption thus has negative influence towards economic growth in BRICS countries.

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

To support industrialization in Indonesia, the Government has conducted numerous policy packages to attract investors infuse capital in Indonesia, during the Quarter IV in 2017, the realization of domestic Investment (PMDN) amount IDR 67.6 trillion (up to 16.4% from IDR 58.1 trillion in the same period in 2016). Foreign investment (PMA) amount IDR 112 trillion (up 10.6% from IDR 101.3 trillion in the same period in 2016) [4]. Based on the business sectors, the top five business sectors (PMDN & PMA) are: electricity, Gas and water (IDR 24.3 trillion, 13.6%); Transportation, warehousing and Telecommunications (IDR 22.6 trillion, 12.6%); Food industry (IDR 17.4 trillion, 9.7%); Mining (IDR 16.4 trillion, 9.1%); and food crops and Plantations (IDR 14.6 trillion, 8.1%) [5]. According to the fact that it can be inferred that the economy in Indonesia is more dominated by foreign capital. In addition, it also pointed out that foreign capital in Indonesia is used more for investments in the sectors with the risk of damage to the environment.

The development process of a country must pay attention to environmental elements. To examine the empirical data above, in these two-decade began popping up a research-study that tried to analyze the relationship and impact between the FDI with environmental degradation. This phenomenon occurs because in these two decades, increased Foreign Direct Investment and an increase in environmental damage increase simultaneously [6]. In addition to examine the impact of Foreign Direct Investment and economic growth to the environmental quality in Indonesia, the result of these study is expected to identify the factors that cause environmental damage. Later, it is hoped that it will be able to provide input to the government, especially regarding the policy of foreign capital entry into Indonesia so that economic activities remain based on the environment, especially CO₂ emissions.

2. Literature review

With economic-oriented pro capital (*capital oriented*), Indonesia successfully improve its economic *performance*. Not only a high economic growth and the ability to control inflation, Indonesia also increase income per capita of the population. Sources of financing of this development came from the FDI and PMDN. FDI is the current flow of capital stemming from abroad flowing into the private sector or country either through foreign direct investment (*Foreign Direct Investment*-FDI) as well as indirect investment portfolio-form. For the Government of Indonesia FDI as a source of foreign financing is considered relatively more stable and have a smaller risk than other types of investment, since FDI will precipitate in a long period and not vulnerable to turbulence Exchange rates [7]. But the expansion of foreign investment coming into Indonesia has two sides of the coin. The investment will always be followed by exploitation, exploitation and always close to the environmental damage, social conflict, and economic inequality. But on the other hand, FDI from technologically advanced countries can

bring new technologies and cleaner production methods that replace less efficient local company [8].

Environmental degradation occurring when this is explained by the Environmental Kuznets Curve (EKC) [9]. According to the Environmental Kuznets Curve (EKC) that at the beginning of development, environmental conditions will lead to environmental damage, but once a certain level of economic growth, the community began to improve its relationship with the environment, so the rate of environmental degradation is reduced. However, some of the results of the studies show there is no guarantee that economic growth will lead to a better environment. At the very least, this needs a policy and a strong stance to ensure that economic growth in accordance with the environment improves. Study of Sasana and Ghazali (2018) [10] found that fossil energy subsidies encourage an increase in CO₂ emissions and increasing social costs.

Some research which is analyzed the behavior of FDI with the environment expressed mixed results. Shahbaz et al study (2015) [11] found that the higher level of FDI, it will increase CO₂ emissions on the object of research of developing countries. FDI impact is sensitive to econometric specifications and a selection of countries and time periods in the sample. Conversely study conducted by Kim and Adilov (2012) [12] which analyze the impact of FDI against CO₂ emissions concluded that FDI in developing countries significantly reduce CO₂ emissions per capita, because the entire of FDI to developing countries will bring as well as advanced technology and more efficient so that production and waste management will be better. While studies conducted in France, Germany, Sweden, and United Kingdom by Zugravu-soilita (2017) [13] found that the impact of FDI on the environment depends on the environmental regulations that are set by the State, the difference in the level of domestic technology between domestic and foreign companies, and domestic labor productivity. The study also found the more stringent regulations of a country in terms of the environment then the lower levels of pollutants, another else otherwise. Government's role in controlling environmental damage was examined by Wang Chen (2014) [14] which found that FDI tends to raise CO₂ emissions, but this increase can be addressed by legal institutions and the environment. Further studies conducted by Lan et al (2012) [15] argued that the effect of FDI on the environment depends on the capabilities of the technology area. With proxy of human capital Lan et al. (2012) found that with the level of human capital is high then the influx of FDI will reduce pollution emissions, otherwise when human capital is low, then the presence of the FDI will increase pollution emissions.

Therefore, in addition to FDI, other factors thought to affect the environment are economic growth, growth, and poverty of human population. Population growth effect significantly to CO₂ emissions expressed by Shi (2001) [16], that the higher growth rate of the population of the higher economic activity, surely it

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

needs for energy and other resources is increased and the impact on the environment is evident both in the developed countries or the developing countries.

3. Research Methods

This study uses quantitative data collected from the Central Bureau of statistics and the Ministry of the environment and the World Bank with the object of research in Indonesia. Data analysis is using multiple linear regressions with the method of Ordinary Least Square (OLS). The research was conducted during the period of 1990 – 2015.

The variable that is used in this study is the dependent variable i.e. environmental quality as measured from the level of CO₂ emissions, calculated from metric tons of Carbon Dioxide per capita. For the independent variables that are used include:

(1) Economic growth, as measured by the GDP value growth of the formula calculation: $R(t-1, t) = (PDBt - PDBt-1)/PDBt-1 \times 100\%$. Where R = the rate of economic growth in percentage (%). PDBt: gross domestic product (real national income) in year t

PDBt-1: gross domestic product (real national income) in the previous year,

(2) Population growth, which is calculated by the formula:

$P_{(t-1, t)} = (Pop_t - Pop_{t-1})/Pop_{t-1} \times 100\%$. Where P: population growth rate in percentage (%). Pop_t: Indonesia population in year t, Pop_{t-1}: the population of Indonesia in the previous year (t-1)

(3) Poverty, as measured from the number of poor population (BPS) poor population in units of millions of people

(4) Foreign Investment (FDI) is net inflows (new investment inflows minus dis-investment) in the reporting economy from foreign investors, and divided by GDP, this variable unit is percent.

Based on theory and previous research, then the research model that is used in this study are:

$$CO2_t = f(FDI_t, GRDPG_t, Pov_t, POPGR_t) \quad (1)$$

$$CO2_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 GRDPG_t + \alpha_3 POV_t + \alpha_4 POPGR_t + \varepsilon_t \quad (2)$$

Note:

CO₂ : Total carbon dioxide emission (CO₂)

FDI : Foreign Direct Investment

GRDPG : Economy Growth

POV : Poverty

POPGR : Population Growth

α_0 : intercept

α : Variables Coefficient

t : 1,2,3, ... data time series dari 1990 – 2015

ε_0 : Error term

4. Result and Discussion

Empirical research on data description on Table 1 indicates that the average value of FDI was

1,134. Economic growth on average, amounted to 3.44, average population growth of 1.43, and poverty has an average of 33.40. The mean values of the magnitudes of each independent variable indicate the magnitude of the influence of FDI and macro variables that occur in Indonesia. The value of carbon dioxide emissions (CO₂) indicates the level of pollution in Indonesia than in 1990-2015, with an average of 310,808.

Table 1 CO₂ Emission Value, Economy Growth, Population Growth and Poverty

Criterion	CO ₂	FDI	GDPGR	POPGR	POV
Mean	310.80	1.134	3.438	1.425	33.396
Median	290.00	1.285	4.243	1.388	33.255
Max	500.00	2.820	6.565	1.781	49.500
Min	157.00	-2.590	-14.347	1.181	22.500
Std. Dev.	100.70	1.407	3.889	0.154	6.939
Skewness	0.27	-1.077	-3.883	0.855	0.565
Kurtosis	1.92	3.521	18.290	3.011	2.763
Obs	26	26	26	26	26

Source: data managed

From a descriptive analysis in table 1 above, it can be seen that the value of the standard deviation is large enough. This becomes problematic to continue on further analysis. Therefore before stepping on the estimation of regression, advance conducted testing assumptions. Test results from the heteroskedasticity stated that the regression model violates the assumption heteroskedasticity, so do not meet the assumptions of BLUE (Best Linear Unbiased Estimator). Heteroskedasticity test result is displayed as follows:

Table 2 Heteroskedasticity Test

Heteroskedasticity Test: ARCH			
F-statistic	1.597	Prob. F(2,21)	0.2261
Obs*R-squared	3.169	Prob. Chi-Square(2)	0.2051

With the value of the Prob. greater than the significance level, then shows the violation of heteroskedasticity on the model regression. To resolve it, extensive robust is standard error. Robust standard error is a technique to obtain unbiased standard errors of the OLS coefficients under heteroscedasticity. By using Robust standard errors of the regression estimates is persistent to classical assumption problems [17]. Furthermore, the results of the estimation variable independent of the dependent variable i.e. CO₂ emissions obtained the following results:

Table 3 The Estimation Result of Regression by Dependent Variable Emission CO₂

Variables	Coeff	Robust Std. Error	t-Stat	Prob.
FDI	8.823	4.525	1.950	0.065***
GDPGR	-0.163	1.314	-0.120	0.902
POPGR	-627.660	45.343	-13.840	0.000*

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

POV	-3.735	1.538	-2.430	0.024**
C	1320.519	97.738	12.926	0.000*
R-squared	0.921			
F-statistic	85.380			
Prob(F-statistic)	0.000			

*significance on level 1%
 ** significance on level 5%
 *** significance on level 10%

From the results of the regression, the value of R-squared of 0.921, indicating that 92.1% of the independent variable effect on CO₂ emissions amounted to 7.9%, while CO₂ emissions are affected by other variables outside of the model. At the level of significance of 1%, the goodness of fit test is indicated by a value of the F-statistic shows the value of 85.380 significant at level 1%. This value indicates that the model has been specified correctly. The regression equation is formed from the estimation results are as follows:

$$CO_2t = 1320.519 + 8.823 FDI_t - 3.735 POV_t - 627.660 POPGR_t + \varepsilon_t(3)$$

The estimation results on each independent variable, the first is a positive relationship of FDI shows significantly to CO₂ emissions with a value of the t-statistic 1,950 significantly on the level of 10%. A variable elasticity of FDI suggests that the 1 percent rise in FDI will increase CO₂ emissions of 8,823 percent, this is consistent with research from Zakarya, et al (2015) [18] that examined the relationship of FDI with CO₂ emissions on the BRICS country.

Then the variable economic growth (GDPGR) surprisingly has no effect significantly to CO₂ emissions. These results were found by jga Ahmed and Qazi (2014) [19] who did the study in Mongolia. Population growth variable (POPGR) has a negative significant effect to the CO₂ emissions with a value of the t-statistic of 13,840 significant at a level of 10%. 1 percent rise in population growth will lower CO₂ emissions amounted to 627%. One of the variables examined by Omri et al (2014) is urbanization, which is calculated from the urban population as a share of the total population, the results show a negative value variables urbanization significantly to CO₂ emissions [20], this certainly bring a view contradictory to that

- 1 GFW, "Indonesia Global Forest Watch Report," 2016. [Online]. Available: www.globalforestwatch.org.
- 2 World Bank, "Word Development Report - Pembangunan dan Perubahan Iklim," 2017.
- 3 Sasana H. and Ghazali I., "The Impact of Fossil and Renewable Energy Consumption on the Economic Growth in Brazil , Russia , India , China and South Africa," *Int. J. Energy Econ. Policy*, vol. 7, no. 3, pp. 194–200, 2017.
- 4 BKPM, "Badan Koordinasi Penanaman Modal," 2018.

development of urbanization leads to degraded environmental quality.

The poverty variables (POV) have a negative effect significant to the CO₂ emissions with a value of the t-statistic of 2,430 significant at 5% level. 1 percent rise in Poverty would decrease CO₂ emissions of 3,735 percent. Poverty linked to per capita income, with significant negative results then the higher per-capita income a person then the lower of CO₂ emissions that is released, it indicates the existence of the Environment Kuznet Curve (EKC) [9]. The reading of elasticity may not be applied directly, but this result is interesting because when observed this behavior follows the pattern of the Environment Kuznet Curve (EKC) where there are indications of changes in the pattern of community life that is increasingly aware of the environment.

5. Conclusion

The conclusions that can be drawn from this study are as follows:

1. Increase in the flow of FDI has positive impact to increase of CO₂ emisison and rather significantly in observations of 1990-2015
2. The increase in economic growth will lower CO₂ emissions but not significant effect
3. Population growth and significant negative effect against CO₂ emissions
4. Poverty and influential negative and significantly to CO₂ emissions

The flow of FDI effect positive significantly to CO₂ emissions, this indicates that production activities undertaken by multinational companies have an impact on environmental degradation. The relationship of negative economic growth is good (though not significantly) with CO₂ emissions, population growth and poverty, indicating that the public is increasingly aware of the environment so that economic activity not positively impact on CO₂ emissions. Therefore, need to look for factors affecting on environmental degradation, use the proxy in addition to CO₂ emissions and using the study panel may become alternative development research this further.

Reference

- 5 Kementerian Lingkungan Hidup dan Kehutanan (KLHK), "Indeks Kualitas Lingkungan Hidup Indonesia 2016," p. 173, 2017.
- 6 H. Gholipour Fereidouni, "Foreign Direct Investments in Real Estate Sector and CO₂ Emission," *Manag. Environ. Qual. An Int. J.*, vol. 24, no. 4, pp. 463–476, 2013.
- 7 C. S. F. Ho and H. M. R. Ahmad, "Macroeconomic and Country Specific Determinants of FDI," *Bus. Rev.*, vol. 18, no. 1, pp. 219–227, 2011.
- 8 M. A. Cole, R. J. R. Elliott, and L. Zhang, "Foreign Direct Investment and the Environment," *Annu. Rev.*

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

- Environ. Resour.*, vol. 42, no. 1, pp. 465–487, 2017.
- 9 D. I. Stern, “The Rise and Fall of the Environmental Kuznets Curve,” *World Dev.*, vol. 32, no. 8, pp. 1419–1439, 2004.
 - 10 H. Sasana and A. E. Putri, “The Increase of Energy Consumption and Carbon Dioxide (CO₂) Emission in Indonesia,” in *E3S Web of Conferences*, 2018, vol. 01008, p. 5.
 - 11 M. Shahbaz, S. Nasreen, F. Abbas, and O. Anis, “Does Foreign Direct Investment Impede Environmental Quality in High, Middle, and Low-income Countries?,” *Energy Econ.*, vol. 51, pp. 275–287, 2015.
 - 12 M. H. Kim and N. Adilov, “The lesser of two evils: An empirical investigation of foreign direct investment-pollution tradeoff,” *Appl. Econ.*, vol. 44, no. 20, pp. 2597–2606, 2012.
 - 13 N. Zugravu-Soilita, *How does Foreign Direct Investment Affect Pollution? Toward a Better Understanding of the Direct and Conditional Effects*, vol. 66, no. 2. Springer Netherlands, 2017.
 - 14 D. T. Wang and W. Y. Chen, “Foreign direct investment, institutional development, and environmental externalities: Evidence from China,” *J. Environ. Manage.*, vol. 135, pp. 81–90, 2014.
 - 15 J. Lan, M. Kakinaka, and X. Huang, “Foreign Direct Investment, Human Capital and Environmental Pollution in China,” *Environ. Resour. Econ.*, vol. 51, no. 2, pp. 255–275, 2012.
 - 16 A. Shi, “Population Growth and Global Carbon Dioxide Emissions,” *Int. Union Sci. Study*, vol. 47, no. June, pp. 1–207, 2001.
 - 17 J. C. Escanciano, “A simple and robust estimator for linear regression models with strictly exogenous instruments,” *Econom. J.*, vol. 21, no. 1, pp. 36–54, 2018.
 - 18 G. Y. Zakarya, B. Mostefa, S. M. Abbes, and G. M. Seghir, “Factors Affecting CO₂ Emissions in the BRICS Countries: A Panel Data Analysis,” *Procedia Econ. Finanec.*, vol. 26, no. May, pp. 114–125, 2015.
 - 19 K. Ahmed, “Environmental Kuznets curve for CO₂ emission in Mongolia: an empirical analysis,” *Manag. Environ. Qual. An Int. J.*, vol. 25, no. 4, pp. 505–516, 2014.
 - 20 A. Omri, D. K. Nguyen, and C. Rault, “Causal Interactions Between CO₂ Emissions, FDI, and Economic Growth: Evidence from Dynamic Simultaneous-equation Models,” *Econ. Model.*, vol. 42, pp. 382–389, 2014.

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