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The trade-off between Poverty and Environmental Degradation: Evidence from Indonesia

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Abstract. Poverty and environmental issues are correlated. Many reports suggest that poverty contributes to environmental degradation. Therefore, it is believed that the improvement of the quality of the environment must be started by alleviating poverty. The objectives of this study are to find the impact of poverty to environmental degradation and vice versa. This study uses data panel from 33 provinces in Indonesia from 2012 to 2017. Contrary to the belief, the result shows that the effort to reduce poverty resulting in environmental degradation. On the other way, one of the findings shows that the efforts to improve the quality of environment resulting in a high level of poverty. This implies that there is a consequence of reducing poverty, i.e. low quality of the environment. The trade-off occurs because when the government tries to reduce the poverty rate, then the quality of the environment also reduces. If the government wants to improve the quality of the environment, then the level of poverty will increase. This study suggests that the government must carefully conduct the poverty alleviation programs that create less harm to the environment and the government also needs to make regulations to protect the environment without harm the poor.

1. Introduction

It is undeniable that currently, global environmental problems are rising more severe than before [1]. Economic activities in developing countries have been increasing significantly, and these activities generate additional demand for energy and consumption, which causes environmental degradation [2]. Moreover, [1] suggests that in many cases, environmental degradation is driven by the need of countries to increase economic growth and development as well as their people seek to fulfil their basic human needs. However, there is a belief that environmental quality will improve at some point when countries continuously grow and reach some level of income per capita. This belief is based on the Environmental Kuznets Curve.

Environmental degradation is defined as high usage of rare nonrenewable resources and the activities that damage or destruct renewable resources [3]. There are many underlying causes of environmental degradation. One of them is weak. It is a consensus that poverty is closely linked with environmental quality [4] [5]. Usually, poor people have been blamed for environmental degradation, because they urgently need to meet their basic needs for surviving by cutting the forests, improper waste disposal into rivers that lead to the unhealthy living condition, for example, overexploitation of natural resources. This is known as the Poverty-Environment Hypothesis (PEH) [6]. A literature review by [4] found that there are three reasons behind this relationship, i.e.: (a) the poor people



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heavily rely on natural resources; (b) poor people only focus on current benefit rather than future development, and (c) poor people have limited accesses to resources.

Many international organizations' reports claim that poverty is the main reason of environmental degradation (for examples: the 1987 World Commission on Environment and Development's report: Our Common Future (also known as the Brundtland Report), 1992 World Development Report, and UNEP Global Environment Outlook (2000)). [7] estimates that 10 per cent of the world's population (about 736 million people) in 2015 lived on less than US\$1.90 a day, compared to 11 per cent in 2013 and almost 1 billion people are counted in extreme poverty compared to 1990. These enormous numbers of poor people are the biggest threat to the environment.

However, the conventional theory has been challenged, and there is still an ongoing debate about whether poverty really leads to environmental degradation. Some new evidence is against the conventional theory. [5] argues that there are other factors that involve in the relationship between poverty and environmental degradation and a simple conclusion about these multidimensional problems are often inaccurate and do not count into account other important factors that were contributing to environmental degradation. The three reasons behind the poverty led to environmental degradation hypothesis mentioned above have been challenged, and some evidence indicated that the reasons are doubted [4]. [10] concludes that environmental degradation is caused by (a) high consumption activities by non-low-income groups and (b) Governments' failures to conduct effective environmental policies.

On the other hand, others believe that environmental degradation also impacts poor people. [8] suggests that poor people get more suffering when environmental is degraded. As environmental disasters increase, the worst consequences are burdened by poor people [8] [9]. Some research demonstrated that environmental decline is highly associated with higher (for example [10] [11]). [9] informs that climate change will affect profoundly sick people due to significant impacts include water shortage, less agricultural productivity, flooding due to the rise of sea level, and more frequent rainfall. A study by [10] found little evidence of urban poverty contributes to environmental degradation but, in the opposite way, the study found that urban environmental degradation is the main reasons to higher urban poverty, while a study by [11] found clear evidence that environmental degradation contributes to higher poverty in Nigeria.

This paper contributes to the ongoing debate on the relationship between poverty and environmental degradation in the case of Indonesia, in two ways: (1) whether higher poverty leads to environmental degradation and (2) whether environmental degradation effects in making higher poverty. The paper is divided into four sections. Section 2 discusses the Environmental Kuznets Curve, the underlying theory to explain the relationship between income per capita and environmental degradation. Section 3 explains the research method and Section 4 discusses the results. The final section is the conclusion.

11 The Environmental Kuznets Curve

The environmental Kuznets Curve (EKC) is a curve that explains the inverted U-shaped relationship between some indicators of environmental degradation and income per capita, as seen in Figure 1. Based on the curve, in the beginning, stages, an increase of gross domestic product (GDP) per capita leads to environmental degradation. This area is called pre-industrial economies. In some level of higher income per capita, the trend will move to the opposite way. In this stage, higher income per capita level will improve the quality of the environment. This area is called the Post Industrial economy. At high levels of income per capita, enable society to afford environmentally friendly technology as well as pro-environmental regulations and policies [2].

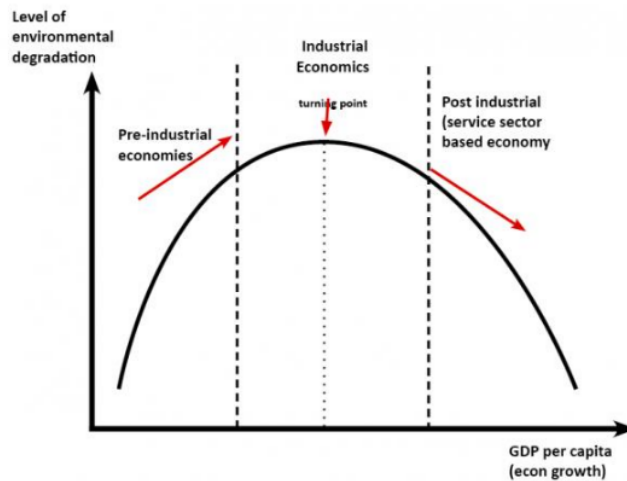


Figure 1. the Environmental Kuznets Curve
Source: [11]

There is a relationship between the EKC and poverty. The EKC postulates the environment will be damaged at the beginning of poverty alleviation efforts [6]. The decreasing number of poor people means that poor people have reached the minimum income, so they are no longer counted as poor people. It means that reducing poverty resulted in higher income per capita. Therefore, poverty alleviation is linked with higher income per capita and reducing the number of poor people has an impact on the level of environmental degradation as suggested by the Environmental Kuznets Curve.

3. Research methods

The data panel method is used in this study. Data panel is a method that combines time-series data and cross-section data due to the limited number of observations. The data were secondary data of 33 Provinces in Indonesia (excluding North Kalimantan Province) and were collected from Indonesia Central Statistics Agency and Ministry of Environment and Forestry Republic of Indonesia from 2012 to 2017.

This study constructs two empirical models to find out the relationship between poverty and environmental degradation in the case of Indonesia, in two ways: (1) the impact of poverty (POV) on environmental degradation (ENV) and (2) the impact of environmental degradation (ENV) on poverty POV. In this study, Poverty Rate is used as a proxy of poverty and Environment Quality Index is used as a proxy of environmental degradation. In addition, the models also include Average Years of Schooling (EDUC), Percentage of Household with Access to Improved Sanitation (SANI), and Percentage of Slum Household (SLUM) as independent variables. The empirical models are written as follows:

$$LOG(EQI)_{it} = \alpha_0 + \alpha_1 POV_{it} + \alpha_2 LOG(EDUC)_{it} + \alpha_3 SANI_{it} + \alpha_4 SLUM + e_{it} \quad (1)$$

and

$$POV_{it} = \beta_0 + \beta_1 LOG(EQI)_{it} + \beta_2 LOG(EDUC)_{it} + \beta_3 SANI_{it} + \beta_4 SLUM + \mu_{it} \quad (2)$$

In the above models, LOG indicates the natural logarithm, e and μ indicate the error terms, i represents the observations based on provinces and t is the time. Data panel methods consist of three models, i.e., Common Effect Model (CEM), Fixed Effect Model (REM) and Random Effect Model

(REM). The best model between CEM, FEM and REM is selected through three tests: Chow test, Lagrange Multiplier test and Hausman test. Figure 2 shows the tests for choosing the best model.

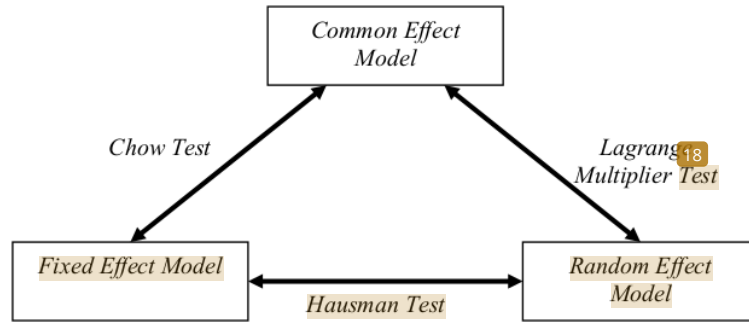


Figure 2. Three Tests for Selection of Best Model

4. Results and Discussion

As seen in table 1, the selection tests of the best model show that FEM is the best model for Model 1 (model with EQI as dependent variable). Chow test and Hausman Test support the hypothesis that the best model is FEM. Meanwhile, REM is the best model for Model 2 (model with POV as the dependent variable), as it is indicated by the Hausman Test.

Table 1. The best model based on chow test, Lagrange multiplier test and Hausman test

Tests	Dependent Variables		Results
	LOG (EQI) (Model 1)	POV (Model 2)	
Chow Test	4.38***	4.43**	H ₀ is rejected for both models. It means FEM is better than CEM
LM Test	43.62***	1.60**	H ₀ is rejected for both models. It means REM is better than CEM
Hausman Test	26.64***	7.30	H ₀ is rejected for the first model. It means FEM is better than REM. H ₀ is accepted for the second model. It means REM is better than FEM.
Conclusion	FEM is the best model	REM is the best model	

Note: *** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$

The results of the fixed effect model 1 output indicate that POV and SANI have positive and statistically significant effects on EQI with $\alpha = 1\%$, while SLUM has a negative and statistically significant effect on EQI with $\alpha = 1\%$. This result shows that if the poverty level decreases by 1%, the environmental quality index also decreases by 0.008%, *ceteris paribus*. This study also indicates that if the Percentage of Household with Access to Improved Sanitation increases by 1%, the environmental quality index decreases by 0.002%, *ceteris paribus*. In addition, this study shows that if the Percentage of Slum Household increases by 1%, the environmental quality index decreases by 0.004%, *ceteris paribus*. This study cannot find enough evidence that EDUC has a significant effect on EQI.

Table 2. Results of the data panel

Dependent Variable: Log of Environment Quality Index (EQI)		Dependent Variable: Poverty Rate (POV)	
POV	0.008639 (3.706135)***	LOG (EQI)	7.442234 (3.828278)***
LOG (EDUC)	-0.104957 (-1.025595)	LOG (EDUC)	-12.87576 (-4.322518)***
SANI	-0.002803 (-2.776361)***	SANI	0.016676 (0.565413)
SLUM	-0.004629 (-3.655516)***	SLUM	0.256924 (7.951279)***
Constant	4.524005 (21.72481)***	Constant	2.117257 (0.193894)
Adjusted R ²	0.493831	Adjusted R ²	0.532622

Note: *** significant at $p \leq 0.01$. t-statistics are reported in parentheses.

The positive relationship between the poverty rate and environmental quality index shows that efforts to reduce poverty lead to environmental degradation. This result is contrary to the Poverty-Environment Hypothesis (PEH). Furthermore, this result can be explained by the environmental Kuznets curve. The Environmental Kuznets Curve explains that initially, the efforts to increase income per capita will cause environmental degradation until income per capita reaches a certain point, then the opposite occurs. Reducing poverty is related to increasing income per capita of the poor. In other words, by reducing poverty, the income of poor people will increase, environmental damage will occur at the early stage as postulated in the hypothesis in the Kuznets Environmental Curve. This result shows that Indonesia is still in the pre-industrial economies category, as shown in Figure 1. It can be concluded that currently, Indonesia has not reached the point of per capita income that is able to reduce environmental damage. The result also indicates that it is due to limited government funds that cannot jointly reduce poverty and at the same time, improve the quality of the environment.

The results of the random effect model 2 output show that EQI and JM have a positive and statistically significant impact on POV with $\alpha = 1\%$, while EDUC has a negative and statistically significant impact on POV with $\alpha = 1\%$. This result suggests that if the environmental quality index increases by 1%, the poverty level also increases by 7.44%, *ceteris paribus*. This study also indicates that if the Percentage of Slum Household increases by 1%, the poverty level increases by 0.25%, *ceteris paribus*. In addition, this study shows that if include Average Years of Schooling increases by 1%, the poverty rate decreased by 12.87%, *ceteris paribus*. This study cannot find enough evidence that SANI has a significant effect on POV.

The positive connection between the environmental quality index and poverty rate shows that efforts to improve environmental quality create "bad" impacts on poverty. This result does not support previous studies. The result indicates that by improving the quality of the environment, for example, by putting more strict regulations related to environmental protection, some people who previously have access to natural resources, now they have only limited access. Alternatively, in the worst case, they do not have access to natural resources at all. Some people rely on the natural resources for their survival and livelihoods, and since the access to natural resources is forbidden, they do not have income and may become weak.

5. Conclusion

Based on the findings from model 1 and model 2, this study finds a unique relationship between poverty and environmental degradation. It is concluded that there is a trade-off between efforts to reduce poverty and efforts to improve environmental quality. It may relate to the limited government

funds that cannot jointly reduce poverty and at the same time, improve the quality of the environment. Strict regulations to protect the environment may also harm people because they are only having limited access to natural resources and in the end, increases poor people. That is, if the government wants to reduce poverty, the consequence is that good environmental quality cannot be realized. On the other way, if the government wants to improve the quality of the environment, it is difficult to get a low poverty rate. It is vital for the government to undertake individual efforts to reduce poverty but in the same time create less harm to the environment and the government also needs to make regulations to protect the environment without harm the poor.

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