



Environmental Quality and Poverty in Indonesia

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Abstrak: *Poverty is both a cause and a victim of deteriorating environmental quality. The poor are regarded as very dependent on the environment and natural resources in sustaining their lives so that the environment and natural resources are exploited regardless of their sustainability. On the other hand, environmental degradation causes the poor to get out of poverty. This study aims to (1) analyze the effect of poverty on the environment, and (2) analyze the effect of environmental quality on poverty along with other supporting factors in Indonesia 2012-2014. The analytical method used is simultaneous equation with EC2SLS method. The results show that poverty can affect environmental degradation but not vice versa. Exogenous variables that significantly affect the quality of the environment are the growth of the number of poor, economic growth, population density, and literacy rate. Exogenous variables that have significant effect on poverty are economic growth, wage, population density, and literacy rate.*

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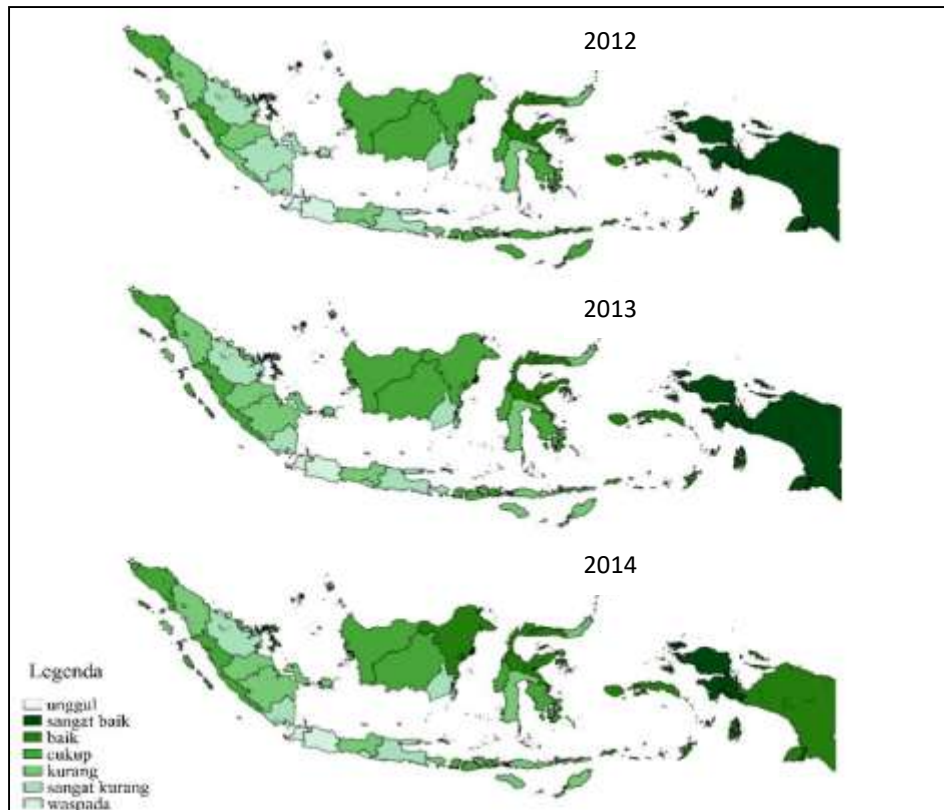
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INTRODUCTION

The successful development is not only determined by the conventional development that led high growth but also concerned a sustainable development that does not damage the social and environmental circumstances. Therefore, sustainable development is the key to resolve the problem because it has three main points which are environment, social, and economic (Thomas et al., 2001).

Indonesia's environmental quality has been rapid decline in last decade. According to Emerson et al. (2010) in Hill and Khan (2012), Indonesia's CO₂ emissions in 2005 of 2.1 gigatons are predicted to be 3.3 gigatons by 2030. Index of Environmental Quality Indonesia was rank 134 of 163 countries in the world and ranked 12th out of 13 countries in Southeast Asia at 2010. The cost to country due to declining environmental quality is estimated to be 0.9 percent of total Gross Domestic Product (Leitman et al., 2009 in Hal Hill and Khan, 2012).

The Environmental Quality Index (EQI) of Indonesia includes environmental quality index of air pollution, water, and forestry. EQI is already considering the balance indicator of green issues and brown issues (KLH, 2015). Based on Figure 1, EQI of Indonesia at 2012-2014 is quite alarming because it pertained "less" environmental quality that revolves around $58 \leq EQI < 66$. On the other side, Indonesia has differences EQI in 33 provinces. The western Indonesia has worse environmental quality than in eastern. Three provinces with the worst EQI are Jakarta, West Java, and Banten, all located in western Indonesia. The only "very good" environmental quality province is West Papua, which is located in eastern of Indonesia.



Source: Ministry of Environment (KLH)

Figure 1 The Map of Environmental Quality Index of Indonesia at 2012-2014.

World Commission on Environment and Development (WECD, 1987) declare that poverty is the major cause and effect of environmental problem. The poor is considered highly depends on environment and natural resources in sustaining their life. As a result, the environment and natural resources are exploited without considering sustainability. On the other hand, poor environmental quality has made it difficult for the poor to break the cycle of poverty due to lack of access to clean water and adequate sanitation.. These situation affect the health and reduce opportunity for poor to earn income. Urban and rural poverty have different characteristics in relation to poor environmental quality. Rural poor depend directly to environment and natural resources in sustaining life. They often cause polluted water, indoor air pollution and exposure to toxic chemicals, and they are very vulnerable to environmental disasters such as flood, drought, and other conflicts related to environment. On the other hand, the urban poor make the poor environmental quality because they make a lot of slums in megacity (World Bank, 2002).

Poverty also suggested to be an effect of poor environmental quality. One of the major causes of poverty is the unsustainable development. Exploitation of natural resources without regard to the environment, directly or indirectly, can have a negative impact on the continuity of people income and people health conditions. This is what ultimately worsens the poverty incidence (Irawan, 2004).

The link between poverty and environment are classified into three sections: (1) environmental quality affects poverty, (2) poverty affects environmental quality,(3) and the environmental quality-poverty will have a simultaneous (two-way) relationship. The environmental quality affects poverty can be explained based on study by Pratama (2013) which conclude that there were a significant relationship between environmental degradation and poverty in Indonesia. Environmental factors that affect poverty are sanitation, solid fuel use, fires and settlements on slopes, sanitation and solid fuel use in Java, sanitation and settlements in sloping areas outside Java, sanitation, solid fuel use and settlements in sloping areas in rural and urban sanitation.

The study by Ghani et al.(2014) concluded that there are relationship between poverty, population growth, and agricultural sector simultaneously to environmental degradation. On the other hand, poverty can affects environmental quality according the study of Hardini (2011). The study also concluded the relationship with environmental degradation from the most powerful namely economic growth, population growth, and poverty. In addition, Dariah (2007) uses simultaneous analysis to analyze two-way relationship between the environmental quality and poverty. The results showed the simultaneous relationship between economic growth, poverty, income inequality, and environmental degradation. Environmental degradation affects decreasing economic growth and increasing poverty. Environmental degradation can also be caused by poverty, income inequality, population, and economic growth.

Two-way relationship between environmental degradation and poverty have also been studied by Hassan et al. (2015), and Gaeddert and Oerther (2015). Hassan et al. (2015) analyses the relationship between economic growth, income inequality, poverty, and environment degradation. The results of the study are classified in the short and long term. In the short run, the relationship among CO₂ emissions, economic growth and poverty are negative, while the relationship between CO₂ emissions and Gini Rasio is positive. In the long run, the relationship among CO₂ emissions, economic growth, and Gini Rasio become positive, while the relationship between CO₂ emissions and poverty is negative.

Gaeddert and Oerther (2015) combines several methods such as Structural Equation Modeling (SEM), Latent Factor Regression (LFR), and Canonical Correlation Analysis (CCorA) to investigate the relationship between poverty and environment. The study concluded that the link between poverty and environment consist of multidimensional aspects from social and health indicators. Some health indicators affecting the environment namely diarrhea, fever, cough while social indicators that affect poverty: education, gender of household head, age of household head, and age at first marriage.

The reciprocal relationship between poverty and environment is an interesting issue, for several reasons. First, the relationship is multidimensional. Second, the study of the relationship of the incidence of poverty with environmental conditions at the same time is still rarely done. Previous studies still use environmental quality indicators that do not have a direct impact on environmental quality, namely air emissions (CO₂ emissions). Third, the study of relationship between poverty and environmental quality can be used as the policy recommendation as a direction strategies to achieve the 1st and 8th target of *Sustainable Development Goals* (SDGs). The 1st SDG's target is "End poverty in all its forms everywhere" and the 8th SDG's target is "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". Therefore, this study aim to: (1) analyze two-way relationship between poverty and environmental quality and (2) analyze the determinants of povety and environmental quality in Indonesia period 2012-2014.

METHOD

The study uses panel data in 33 provinces of Indonesia for period 2012-2014. All variables are obtained from Indonesian Central Bureau of Statistics (BPS) except Environmental Quality Index from Ministry of Environment and Forestry Indonesia (KLH). The method of this study uses Error Correction Two Stage Least Square (EC2SLS) to estimate the parameters in simultaneous panel data (Baltagi, 2005). The model equations are defined as:

Stuctural Equation I

$$\text{LnEQI}_{it} = \beta_0 + \beta_1 \text{LnGDP}_{it} + \beta_2 \text{POP}_{it} + \beta_3 \text{LnPOVERTY}_{it} + \beta_4 \text{GINI}_{it} + \beta_5 \text{LR}_{it} + u_{1it} \quad (1)$$

Stuctural Equation II

$$\begin{aligned} \text{LnPOVERTY}_{it} = & \beta_6 + \beta_7 \text{LnGDP}_{it} + \beta_8 \text{LnWAGE}_{it} + \beta_9 \text{UNEMPLOY}_{it} + \beta_{10} \text{POP}_{it} + \beta_{11} \text{LR}_{it} \\ & + \beta_{12} \text{LnEQI}_{it} + u_{2it} \end{aligned} \quad (2)$$

where LnEQI represents The Environmental Quality Index growth, LnGDP represents economic growth, POP represents population density in 1000 people/km², LnPOVERTY represents growth of poor people, GINI represents gini ratio, LR represents literacy rate, LnWAGE represents wage growth, UNEMPLOY represents percentage of unemployment rate, u_{1it} is error term in the first structural equation, dan u_{2it} is error term in second structural equation from i^{th} -province in t^{th} -period.

Poverty and EQI is chosen to be endogenous variabel based on a priori information, and Test of Endogeneity. According to Table 1, 95 percent of confident interval it can be concluded that EQI and poverty are endogenous variables.

Table 1 Test of Endogeneity.

Endogeneous Variables	Exogeneous Variables	Coefficient	p-value
Ln EQI	The Environment Quality Index		
	Intercept (*)	-35.5070	0.0000
	Ln Poverty	-0.000000336	0.9050
	Ln Poverty_cap (*)	3.3290	0.0000
	Unemployment (*)	-0.0821	0.0000
	Ln Wages (*)	2.8547	0.0000
	Literacy Rate (*)	0.0668	0.0000
	Gini Ratio (*)	0.0000	0.9680
	Population (*)	0.2761	0.0000
Ln POVERTY	Poor growth		
	Intercept (*)	-8635.7110	0.0000
	Ln EQI	0.0159	0.9700
	Ln EQI_cap (*)	1798.9420	0.0000
	Unemployment	-0.0002	0.9870
	Ln Wages	-0.0121	0.9560
	Literacy Rate (*)	-2.9015	0.0000
	Gini Ratio (*)	202.1941	0.0000
	Population (*)	52.3083	0.0000
	Economic Growth (*)	113.9278	0.0000

Note: *) significantly with $\alpha=5\%$

Both first and second structural equation are identified from order and rank condition as below:

1. Order Condition: the differences of predetermined variables between model and each equation should “more than” or “equal” with the amount of endogenous variables in model minus one. k represents predetermined variables in equation, K represents predetermined variables in model, and M represents endogenous variables in model.
2. Rank Condition: the rank of matrix should “more than” or “equal” with endogenous variables in model minus by one. Based on equation (1) and (2) before, the matrix is defined in Table 3.

Table 2 Order condition in each of structural equation.

Equations	K-k	Sign	m-1	Identification
(1)	(2)	(3)	(4)	(5)
EQI	6-4	>	2-1	Over identified
POVERTY	6-5	=	2-1	Just identified

Table 3 The matrix from equations.

Nu.	Coefficient								
	1	LnGDP	POP	LnPOV	GINI	LR	LnWAGE	UNEMP	LnEQI
(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(10)	(11)
I	$-\beta_0$	$-\beta_1$	$-\beta_2$	$-\beta_3$	$-\beta_4$	$-\beta_5$	0	0	0
II	$-\beta_6$	$-\beta_7$	$-\beta_{10}$	0	0	$-\beta_{11}$	$-\beta_8$	$-\beta_9$	$-\beta_{12}$

According Table 3 above, the rank condition identification can be presented by:

Table 4 Rank condition identification in each of structural equation.

Equations	R(A)	The sign of rank condition	M-1	The sign of order condition	Identification
(1)	(2)	(3)	(4)	(5)	(6)
EQI	1	=	1	>	Over identified
POVERTY	1	=	1	=	Just identified

Based on the order and rank condition above, the first structural equation is over identified so it can be estimated with Two Stage Least Square (2SLS) method. The second structural equation is just identified so it can be estimated by Indirect Least Square or Two Stage Least Square (2SLS). Estimation method of the study uses 2SLS because just identified in the first equation identification has the same estimation using 2SLS (Gujarati, 2003). This study uses error correction to apply 2SLS estimation because the observations are panel data, or it can be called by EC2SLS (Baltagi, 2005).

RESULT AND DISCUSSION

The estimation method used for both equations using EC2SLS. The first step to apply EC2SLS is using Ordinary Least Square (OLS) to estimate reduced form. The OLS estimation is defined below:

Structural Equation I

$$\widehat{LnEQI}_{it} = 4.5231^{**} - 0.0652^{**} LnGDP_{it} - 0.0284^{**} POP_{it} - 0.1192 GINI_{it} + 0.0015 LR_{it} + 0.0232 LnWAGES_{it} - 0.0040^{**} UNEMPLOYMENT_{it}$$

Structural Equation II

$$LnPOVERTY_{it} = 12.0740^{**} + 0.6871^{**} LnGDP_{it} - 0.0950^{**} POP_{it} + 1.0157 GINI_{it} - 0.0195 LR_{it} - 0.8790 LnWAGES_{it} + 0.0250^{**} UNEMPLOYMENT_{it}$$

EC2SLS can be used after OLS estimation and it is defined below:

Table 5 The estimation result of structural equation I.

Endogeneous Variables	Exogeneous Variables	Coefficient	p-value	R-squared
Ln EQI	The Environment Quality Index			R-squared 0.61250
	Intercept (**)	5.54730	0.0000	
	Ln Poverty (*)	-0.03885	0.0620	
	Economic Growth (**)	-0.04177	0.0220	
	Population (*)	-0.03081	0.0000	
	Gini Ratio	-0.09549	0.7760	
	Literacy Rate (**)	-0.00658	0.0000	

Note: *) significantly with $\alpha=10\%$

***) significantly with $\alpha=5\%$

Based on Table 5, R-squared from the first structural equation is 0.6125. It means the proportion of EQI variation can be explained by economic growth, population density, the poor growth, income inequality, and the literacy rate of 61.25 percent while the rest is explained by other variables outside model.

The estimation result of first structural equation shows that poverty has a negative influence on EQI. The theory of common property resource explains that the poor have a high dependence on natural resources for survival and led to worsening environmental quality because environmental management was not paying attention to sustainability (Hufschmidt, et al., 1983). According Jodha (1998) at World Bank Institute (2000), there are three assumptions why poor population can lead to environmental degradation, those are:

1. The natural resources exploitation of natural resources and environment are the only income source that the poor know.
2. Poor people do not know the limitations and consequences in exploiting natural resources and environment.
3. The poor have little stake in maintaining the natural resources and environment used.

That's what causes poverty negatively affects the EQI.

The relationship between economic growth and environmental quality is negative. According Environment Kuznets Curve (EKC) hypothesis, there is negative impact of economic growth on environmental quality, especially in developing countries. In developing countries, economic growth mostly is driven by industrialization process. The industrialization process produces residual released into environment, causing environmental degradation (Thomas et al., 2001). Based on World Bank classification in Thomas et al. (2001), Indonesia include into group of countries which have relatively fast economic growth but little concern for environmental quality.

The population density is the main cause of the environmental quality deterioration (Ismawan, 1999). High population density will lead to disasters starvation, exhaustion of natural resources, environmental damage may not be restored, and ecological destruction (Ehrlich, 1968 in Thomas et al., 2001). In addition, according to Arifin (2002) population will drive increased demand for agricultural land, which gradually will be more productive. The result is the land intensification in marginal areas without paying attention to the environmental conservation aspects. Therefore, the relationship between population density on the quality of the environment is negative.

Income inequality causes the access to utilize natural resources and the environment has focused on wealthy residents. Wealthy residents who have high incomes have a high standard of living as well to meet all their needs. High living standards is demonstrated by the substantial level of consumption to luxury goods such as cars, motorcycles, and other woes that eventually adds environment quality (World Bank Institute, 2000). On the other hand, the rich have a great power of venture capital that can be used for economic activity. The economic activity have big impact to declining environment quality. Therefore, income inequality has a negative correlation to the environment quality (Andrich et al., 2010). The cause of income inequality on model does not significantly affect the quality of the environment because Indonesia gini ratio years 2012-2014 has not changed much.

Environmental education is inclusive, which means accessible to all people, all levels and in all channels of teaching and learning, both formal and non-formal. Environmental education by the government is disseminated through socialization, mass media, and written policies. However, the estimation results of the study had a different relationship with the direction of the study hypothesis. The difference was due to direction of relationship with environmental education is not considered to be successful if the lack of public awareness and concern the environment (Inoguchi et al., 2003). Although the literacy rates is increasing (it means better education), not necessarily able to improve the environment quality.

Table 6 The estimation result of structural equation II.

Endogeneous Variables	Exogeneous Variables	Coefficient	p-value	R-squared
Ln Poverty	The growth of poor people			R-squared 0.60180
	Intercept	13.02432	0.1040	
	Ln EQI	-0.85171	0.6100	
	Ln GDP (**)	0.64409	0.0000	
	Ln Wages (**)	-0.62681	0.0160	
	Unemployment	0.01279	0.7430	
	Population (*)	-0.12061	0.0880	
	Literacy Rate (*)	-0.02030	0.0710	

Note: *) significantly with $\alpha=10\%$

**) significantly with $\alpha=5\%$

R-square from the second structural equation estimation is 0.60180. That is, the proportion of poverty growth variation can be explained by economic growth, wage growth, the unemployment rate, population density, literacy rates, and Environment Quality Index growth by 60.18 percent while the rest is explained by other variables outside the model.

Poor environmental quality may affect poverty by influencing population health condition, thereby reducing their chances of obtaining revenue. Poor environmental quality is reflected in poor access to proper sanitation, poor access to clean water and poor environmental conditions (WECD, 1987). Thus, the environmental quality can not directly affect poverty. As a result, EQI does not significant effect on poverty. In addition, the estimation results explain that poverty affects the environment quality but neither does EQI. Thus, the relationship of environmental quality and poverty in Indonesia in 2012-2014 is not simultaneous (two way).

Economic growth will reduce poverty assuming trickle-down effect occurs. Assumptions trickle-down effect is explained that high economic growth is expected to generate a multiplier effect on the economic sectors upstream and downstream, causing an increase in employment and labor. Beside that, Tambunan (2013) also shows that higher wage, the poverty rate began to decline. Increasing labor wages the level of welfare is also higher so that poverty can be decreased.

The unemployment rate indicates loss of opportunity for someone to gain income to make ends meet. So the higher unemployment, the increasing levels of poverty. According to Tambunan (2013), one of causes of unemployment is the lack of jobs that absorb a lot of labor. According to Tambunan (2001), one reason the unemployment rate did not affect poverty that households do not face liquidity constraints or the current consumption is not affected by the current income so that unemployment will affect poverty in the long term.

Based on Indonesian Central Bureau of Statistics (BPS, 2015), Indonesia population density have increased every year followed by the increasing of Human Development Index (HDI). The increase in HDI shows that the condition of Indonesian human resources are improved. That's what causes the population density does not fit the theory as a positive influence on growth in poverty. According World Bank (2002), the poor hard to get out of the poverty cycle because it has a low level of education. Low educational level of the poor led to low productivity as well. As a result, output and income is also low, causing poverty.

CONCLUSION

All the exogenous variables, namely the poverty growth, economic growth, population density, and literacy rate has a negative influence on the environmental quality. The variables positive effect on poverty is economic growth, while the negative effect on poverty are growth of wage, population density, and the literacy rate. On the other hand, the environmental quality and the unemployment rate did not had significant effect on

poverty. Thus, the relationship between the environmental quality and poverty did not happen two ways because the environmental quality doesn't effect on poverty.

Based on the study results, the appropriate policies to improve the quality of the environment due to poverty have a significant effect on the environment, among others: (1) Increase the number of affordable housing units as cheap flats especially in urban areas; (2) Intensified activities of non-governmental organizations related to environment, especially to disseminate environmental education, for example socialization/education awareness of protecting the environment; (3) Applying Happy City program (improving the system of public space in synergy with environment); (4) Feature ads or improve socialization government about caring for the environment to make it more attractive; (5) Procurement event overall environmental care and are conducted regularly.

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