

## Infrastructural development and poverty reduction in Java, Indonesia 2002-2012

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### ABSTRACT

Research on the linkage between the infrastructural development and poverty reduction has not expanded as the studies on the impact of infrastructural development towards economic growth yet Indonesian government takes the infrastructural construction as one of main policies to eradicate poverty. Therefore, this paper attempts to examine whether the infrastructural development is an effective policy to reduce the poverty incidence in Java Island, Indonesia, the homes of the most number of poor people in within the nation compared to other major islands. Panel data regression was performed by using the macroeconomic data in Java Island from 2002-2012 to answer such question. The statistical results proves that household access to basic infrastructures more significantly contribute to poverty alleviation than the government expenditures for specific allocation that in some parts used for the enhancement of infrastructure. Surprisingly, the government expenditure for infrastructure increases the poverty prevalence within the island. The policy recommendation that can be proposed from this research is that the government should formulate more effective mechanism to make the government expenditure an effective tool to alleviate poverty and increase the percentage of budget sharing to sub-national level within the framework of fiscal decentralization.

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### 1. Introduction

Poverty alleviation has long been an important agenda to promote global sustainable development as evidenced by the fact that poverty eradication is the first goal and a major challenge in Sustainable Development Goals (SDGs) that have been stipulated by the United Nations, and agreed by 193 countries in the world. As argued and reported in the Sustainable Development Goals Report 2016, poverty is the most serious issue in sustainable development as the effects are multi-dimensional, such as the inadequacy in fulfilling some basic needs including education, health, access to basic infrastructures, unproductivity, less empowered society, and so on, and there are still approximately 836 million

people living in extreme poverty in today's world. (United Nations Development Program, 2016). In addition, poverty does not only cause some negative effects for those reclusive societies living with the poverty but also triggers negative phenomena for the global political economy. As stated by United Nations Development Program (2016), the fast-growing inequality causes a drawback to global economic growth, an obstacle to encouraging global social capital, a driving factor to political tensions as well as a possible cause of global conflicts and instability. Nevertheless, it is not an easy task to create a world without poverty as one of the objectives in SDGs because it needs comprehensive policies and the collaboration among all

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the stakeholders. In fact, Sachs (2008) mentioned that to tackle global poverty as this world's very great problem, what is required is the amalgamation of ethical commitments from all stakeholders as well as multi perspective solutions from different fields of science. In fact, tackling poverty issues in some countries with a high population and middle-income trap like Indonesia would need more serious endeavors. As the United Nation Development Program stated in one of its publications, countries with issues with high population and a low middle-income condition, such as: India, Indonesia, and Nigeria are the home of half of the world's poor people.

Considering multi-dimensional causes of poverty within the country including inadequate access to basic needs and infrastructures, unemployment problems, social exclusion, and so forth, the Indonesian government has perceived and applied several policies to reduce the occurrence of poverty. As mentioned by Sudarsana (2009), there are 4 (four) main policies implemented by the Indonesian government to combat the poverty, as follows:

1. The enhancement of access to education, health and basic infrastructure
2. Improvement of social protection
3. Solve issues of malnutrition and food security
4. Expansion of employment opportunity

Taking the list above into consideration, the improvement of infrastructure has been placed as a priority by the Indonesian government to overcome the poverty issues in Indonesia. Learning from the global experience, as studied by World Bank (2016), the enhancement of basic infrastructures contributes to the economic growth in developing countries by approximately 30 percent. In line with this finding, the United Nations Human Settlement Program (2011) uttered that a sufficient access to infrastructure does not only have a positive causation to the economic growth but also contributes to driving the poverty combat. Therefore, this study would examine the impact of infrastructural development to reduce the poverty in Java Island, Indonesia that has the most number of poor people compared to other major island in Indonesia. According to Asian Development Bank (2015), most of the poor people in Indonesia live in Java island by 16 million, compared to other major islands, for instance, Sumatera by 6,1 million, Kalimantan by 900,000, Sulawesi by 2 million and Papua island by 1,2 million.

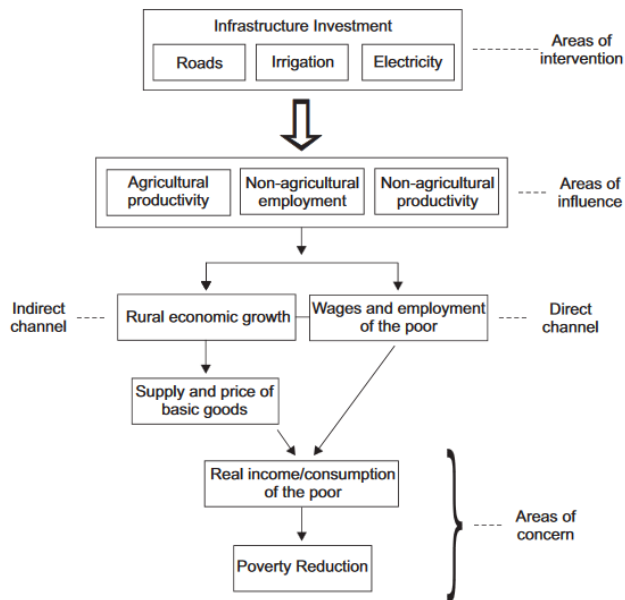
## 2. Theory

There are some misconceptions in the society regarding the definition of infrastructure as infrastructure is only correlated with the physical subject. Nonetheless, according to the UN Habitat (2011), infrastructure is divided into 2 (two) categories: hard infrastructure and soft infrastructure. Hard infrastructure is generally associated with physical infrastructure, and includes transportation facilities such as roads, ports, and railways; telecommunication facilities such as telephone and internet; energy sources such as electricity generation, gas and oil pipeline; and facilities for basic utilities such as: water supply, health facilities and education facilities. Quite its contrary, soft infrastructure refers to mechanisms that support the operation and development of the physical infrastructure, such as regulations, policies, and institutional frameworks. However, giving consideration to the availability of the data and the time constrained, this study only tries to cover the hard infrastructure. Meanwhile, Asian Development Bank (1999) stated that poverty is defined as a deprivation of basic opportunities and assets that every human has the right to possess to improve the quality of the standard of living. In more quantitative definition, extreme poverty refers to per capita consumption that is valued at less than \$2 per day (Asian Development Bank, 1999).

In addition, some theories have been developed to address the causation between the infrastructure development and poverty reduction. An instance of these theories is one that was developed by Straub & Terada-Hagiwara (2010) stating that the positive causation of infrastructure development for contributing to alleviating the poverty is derived from the fact that it contributes to provide both final consumption services to households and key intermediate consumption items for production. In line with this argument, Fay and Morison (2007) uttered that in developing countries, infrastructure can equally provide the final consumption for the household and the intermediate consumption by manufacturers. Among all infrastructures, water and electricity can be employed for the household consumption as well as for the companies' productivity.

This study uses the analytical framework developed by Pernia & Ali (2003) depicting that there is a correlation between infrastructure development and poverty reduction even though the causation is not direct. The analytical framework of Pernia and Ali (2003) is depicted in the figure 1:

Figure 1. Simple Analytical Framework Depicting the Links between Infrastructure and Poverty Reduction



There has been a considerable amount of study to find out the linkage between infrastructure development and poverty alleviation in both Indonesia and some countries in the world. Nevertheless, there are 2 (two) camps of findings showing the opposite results - one representing that there is a causation between the two variables (Baliasacan, 1999; Brenneman & Kerf, 2002; Calderon & Seven, 2004; Nanda, 2016), and the other one signifying no relation between infrastructure and poverty alleviation (Runsinarith, 2002; Lestari, 2008).

Brenneman and Kerf (2002) who conducted a literature study on the linkage of infrastructure and poverty found that infrastructure has an impact on the decline of poverty because infrastructure can contribute to the increased gross domestic product and productivity, all of which are driving factors to eradicate poverty. In addition, Brenneman and Kerf (2002) stated that adequate access to electricity could facilitate in the increasing productivity of the small medium enterprises that are usually possessed by the poor people and it consequently caused the enhancement in the income, employment and entrepreneurial opportunities. Even though Brenneman and Kerf (2002) found that there is a connection between most kinds of infrastructures towards the poverty reduction, they divulged that water and sanitation have empirically proven not to contribute to the poverty reduction according to some studies they used in their research.

Runsinarith (2002) also found that telecommunication and irrigation do not significantly impact the poverty reduction by conducting an empirical study by using survey data from the National Institute of Statistics of 600 households in the border of Cambodia.

Similar with the findings in several countries in the world, the studies on the effect of infrastructure development and poverty reduction in Indonesia show two contrasting findings. Maqin (2011) who researched the effect of electricity supply towards poverty alleviation in 22 municipalities in West Java province, found that electricity has contributed to the poverty alleviation through economic growth with a significant impact. Interestingly, Lestari (2008), who utilized national level time series data from 1976-2008, found quite the opposite - that infrastructure expenditure does not have positive impacts on alleviating the poverty incidence in Indonesia.

This study tries to close the research gap that this study will combine the household access to basic infrastructure, the government expenditure on specific allocation, agricultural and non agricultural productivity as well as human capital to be linked with the poverty alleviation to provide more robust findings.

### 3. Research Method

#### 3.1. Data

The data used in this study is macroeconomic data to test the analytical framework developed by Pernia & Ali, which holds that there is a positive correlation between infrastructure and poverty reduction. Some empirical literatures have used different proxies to signify infrastructure. For instance, Calderon and Servén (2004), Maqin (2011) and Morimoto and Hope (2001) employed electricity supply (number of Mwh) as a proxy divulged the connection between electrical supply to poverty reduction. Furthermore, Schwart and Johnson (1992) used water supply (in cubic meter) to present the infrastructure development particularly related to the water supply. Nevertheless, the majority of these recent studies concentrates on the infrastructure related municipal level data; this study makes use of household level data to present more detailed depictions as the household is the lowest level in a community. This argumentation is supported by Straub (2008), who stated that household data concerning infrastructure would display more effective explanation of the connection between infrastructure and poverty reduction.

In addition, the selection of the government expenditure for specific purposes as the variables is under the consideration that public investment in infrastructure is vital for the social and economic development of a country, once it provides an attractive environment for private investments, thus making services cheaper and more competitive and therefore supporting all other economic activities (Hirschman, 1958). In addition, government expenditure for specific allocation variables have been used in a considerable

amount of studies to prove whether the government expenditure mechanism is effective to combat poverty (Asian Development Bank and the Resources Center for Economic Development, 1999; Rajkumar & Swaroop,

2008; Seetanah, *et al.*, 2009; Marinho, 2017). Table 1 describes the detailed data used in this study. All data retrieved from World Bank database 2016.

Table 1. Variables, definitions and sources

Variables	Definition
Poverty	The rate of poverty (in percentage)
Electricity	Household access to electricity (in percentage)
Sanitation	Household access to sanitation (in percentage)
Agricultural production	GDP in agriculture (in log)
Non-Agricultural production	GDP in transportation and telecommunication (in log)
Infrastructural expenditure	Government expenditure in infrastructure (in log)
Health expenditure	Government expenditure in health (in log)
Education expenditure	Government expenditure in education (in log)
Net enrollment in junior secondary education	The ratio of enrollment in junior secondary education (in percentage)
Net enrollment in senior secondary education	The ratio of enrollment in senior secondary education (in percentage)

### 3.2. Statistical analysis

This study performs statistical analysis by utilizing multiple data regression by employing basic infrastructures, such as: sanitation and electricity, government expenditure in infrastructure, health and education, agricultural and non-agricultural production as well as human capital measurement to be linked to the poverty reduction. By modifying the analytical framework by Penia and Ali, the empirical model utilized by this research is as follows:

$$\text{Poverty Rate} = \alpha + \beta_1 \text{electricity} + \beta_2 \text{sanitation} + \beta_3 \text{health expenditure} + \beta_4 \text{education expenditure} + \beta_5 \text{agricultural production} + \beta_6 \text{non agricultural production} + \beta_7 \text{net enrolment in junior secondary education} + \beta_8 \text{net enrolment in senior secondary education}$$

To provide more robust findings, we also provides the statistical descriptive analysis completed with some graphics drawn by we by using R software.

## 4. Results and Discussion

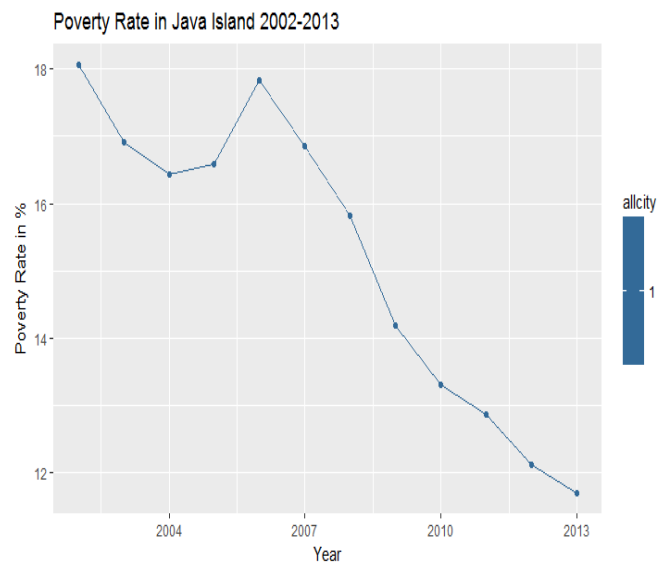
### 4.1. Results

#### 4.1.1. Descriptive statistics and regression results

The municipal governments in Java island have achieved greatly in an endeavor to alleviate the poverty. Nonetheless, the challenges faced by the the governments remain formidable. The pace of poverty reduction in Java island is slowing. In addition, the disparity of the number of people living in poverty across the country's regions as well as across the city-

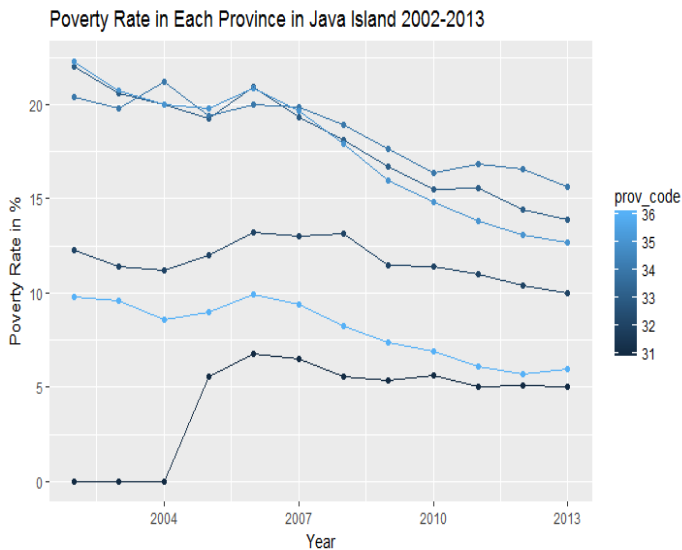
regency areas remains wide. The pace of poverty decline in Java Island can be seen in the figure 2.

Figure 2 Poverty Rate in Java Island 2002-2013



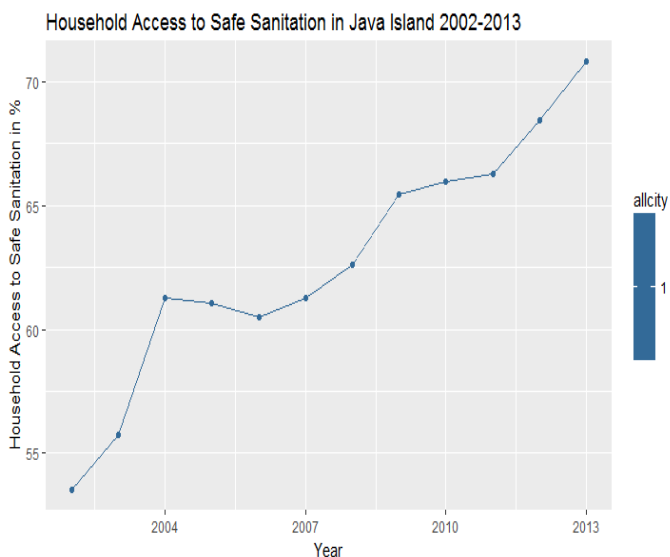
As depicted clearly in the above figure, the pace of poverty decline in Java Island is slowing down from 2006 to 2008 that shows a sharp decline yet from 2008 to 2013 the line depicts more moderate decline. If we take closer to every province in Java island, every provincial government has successfully reduced the poverty prevalence in each respective region. The trend of decline in poverty rate in each province in Java island can be seen in the figure 3.

Figure 3 Poverty Rate in Each Province in Java Island 2002-2013



The above figure shows that even though every province can reduce the poverty incidence but there is a sharp unequal welfare across provinces and some of the provinces reduce the poverty prevalence more slowly than any other province. The unequal distribution of poverty rate in each municipality can be seen in figure 6. Java Island also successfully developed the infrastructure that can be seen in figure 4 yet there is still gap of infrastructural access than is depicted in figure 5.

Figure 4 Household Access to Safe Sanitation in Java Island 2002-2013.



If there is an inequality in both poverty distribution and infrastructural access, the question that may appear is that whether the unequal access of infrastructure causes the unequal poverty prevalence in Java Island. Therefore, this study attempts to find the statistical

answer of the question by utilizing the regression test that can be seen in table 2.

Figure 5 Unequal Access of Safe Sanitation in Java Island 2002-2013

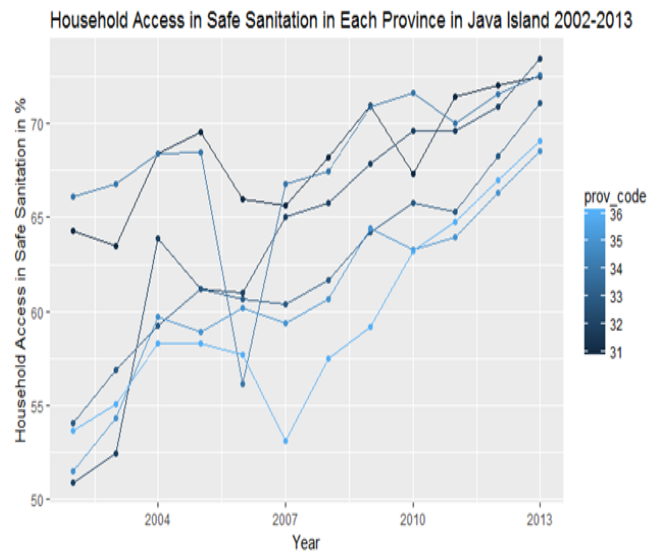


Table 3 presents the results of fixed effect and random effect regression and according to the Hausman test, fixed effect is more appropriate to this model. The result of the regression depicts that all infrastructures such as electricity, water, sanitation, government expenditure on health and education as well as net school enrolment on junior secondary and senior secondary education have a positive contribution to reducing the poverty rate and this is statistically proven significant. However, in contrast with the findings from the previous research conducted by Nanda (2016) in all municipalities in Indonesia, the infrastructure expenditure increases the poverty rate in Java island. Considering the fact that most of the infrastructure expenditure in Java is used for increasing the road and transportation (Suleman & Iqbal, 2013), the findings shows that road and transportation system in Java still benefits rich people more than poor people.

It is supported by the argumentation of Cook, *et al.* (2005) that the transportation system in some areas in developing countries does not take adequate concerns to the poor people. Much of the transportation system is not appropriate for poor people to mobilize as they need a cheap mode of transportation and it hampers the poor people to travel long distance. Therefore, the increasing number of roads most benefit the rich people. For instance, in the case of Java Island, due to higher access of the road, businessmen can build some shops in rural areas, for instance: *Indomaret* and *Alfamart*. These make the poor people lose their income and increase the poverty rate. In addition, as per the opinion of Cook (1983), less than a half of all travel in rural areas is



conducted for working. Most of the traveling is aimed to seek education or health. That is another reason why the

increase of the road do not contribute to reducing the poverty incidence in Indonesia.

Figure 5 Unequal distribution of poverty rate in Java Island



Table 2. The regression result of the impact of infrastructure on the poverty reduction in Java Island

Variables	Fixed Effect	Random Effect
Electricity	-0.109** (0.034)	-0.136*** (0.036)
Sanitation	-0.098*** (0.014)	-0.124*** (0.0134)
Government Expenditure in Infrastructure	0.658** (0.254)	0.571* (0.267)
Government Expenditure in Health	-0.350 (0.569)	-1.398** (0.534)
Government Expenditure in Education	-1.171** (0.438)	-1.082* (0.457)
Agricultural production	-14.468*** (1.419)	-0.626 (0.671)
Non-agricultural production	-5.973*** (1.405)	-7.677* (0.954)
Net enrolment in Junior Secondary Education	-0.019 (0.010)	-0.015 (0.011)
Net Enrolment in Senior Secondary Education	-0.039*** (0.011)	-0.054*** (0.011)
Constant	147.115***	130.695***
Observations	1154	1154
R-Square	0.562	0.507

Note: \* $p < 10\%$ , \*\* $p < 5\%$ , \*\*\* $p < 1\%$

Overall, all the variables reduce the poverty prevalence in Indonesia. The most significant effects have been shown by electricity, sanitation, as well as agricultural and non-agricultural production. The regression result shows that if the household access to electricity increases by 1%, the poverty rate will decrease by 10.96 %, and if the household access to sanitation increases by 1%, the poverty rate will decline by 9.84%. These findings support the previous findings divulging that there is a correlation between infrastructure development and poverty alleviation (Brenneman & Kerf, 2002; Nanda, 2016)

As per the statistical findings that have been elaborated in the previous sections, we will discuss each variable in the following sections:

#### 1. Electricity

The statistics result show that 1% increase in household access to electricity reduces the poverty incidence in Java Island by 10.96%. Therefore, the government should improve the household access to electricity. To achieve this objective, the Indonesian government can stimulate the electrical investment in the regions that are deprived of the adequate access to electricity by both public and private investment. According to Suleman & Iqbal (2013), several things hamper the electrical investment in Indonesia, such as electricity tariffs, land acquisition, policy and regulatory conditions, supply constraints, and low load factors. By minimizing these hampering factors, it is expected that the Indonesian government can improve the household access to electricity in Indonesia.

#### 2. Sanitation

The statistics result show that 1% increase in household access to electricity reduces the poverty incidence in Java Island by 9.84%. Based on the data from the BPS, a municipality that has a low level of sanitation is prone to have high level of diarrhea and consequently reduce increase the cost for health and contribute to increase to the poverty. (Niimi and Chatani, 2013).

#### 3. Road and transportation

It has been discussed in the previous section that the increasing access to roads increases the poverty rate. It is caused by the fact that the rich people than the poor people utilize the transportation system more effectively. Therefore, the researcher's policy recommendation is that the Indonesian government needs to create mechanisms to make a transportation

system that could also be used effectively by the poor people, for instance by the following mechanisms:

- a. The establishment of agro industrial enterprises along the corridor of the rural roads.
- b. Establishment of cheap modes of transportation.
- c. Enhancement of the quantity of the small medium enterprises by using the mode of transportation, for instance, at present, Indonesia has 'gojek' that is the online transportation system that recruits poor people to drivers.

#### 4. The government budget for education

According to Chatani (2013), low level of education can hamper the poverty alleviation through some phases. First, people with a low level of education tend to work in the agricultural sector in Indonesia that tends to have less salary than those working in industrial sectors. Second, people with a lesser level of education work in the informal sectors rather than in the formal sectors. People working in the informal sector do not receive non-wage benefits, such as medical care, and other social security arrangements. In addition, according to Chatani (2013), building schools in rural areas can benefit the poor people to reduce poverty in the long run. According to the findings, education expenditure reduces the poverty prevalence significantly in Indonesia. Nonetheless, in some parts of Indonesia, adequate access to education is not available. Therefore, the Indonesian government can allocate the addition amount of budget in the educational sector and implement strict supervision and monitoring, as there are several cases of corruption in the educational budget.

#### 5. The government budget for health

Investment in infrastructure in the health sector can reduce the poverty incidence because the people that have any disease can hamper its productivity and consequently, reduce their incomes (Marinho, *et al.*, 2017). The policy recommendation for health expenditure is to improve the health expenditure in rural areas since poor people tend to be more vulnerable to the decline of welfare when they have some health problems. According to Niimi and Chatani (2013), the health services in Indonesia do not support for the poor people. Furthermore, along with the ongoing endeavors to increase the government expenditure in the health sector, the efficiency and effectiveness of the use of budget need to be enhanced. In addition, according to the World Bank (2008), the government expenditure in health is still vertically unbalanced in Indonesia. Stated

in another way, the percentage of the share of the budget for sub-national health level is still low.

#### 6. Inequality issues in Java Island

Java island still faces some problems in inequality in both welfare and infrastructure distribution. In an endeavor to overcome these inequality issues, the Indonesian government has implemented some policies, such as: the big-bang decentralization that has been applied for nearly 2 (two) decades, equal welfare distribution, market driven policy to facilitate the equal spread of basic infrastructures, and some more efforts. Nonetheless, these policies have not yet positively influenced in reducing the inequality issue in Java Island. What we can infer from this situation is that those policies to overcome inequality failed to achieve equitable growth within the regions and among city and regency areas. Furthermore, undergoing continual inequity for decades have made this country not to have sufficient means of decision and information mechanisms to distribute equal resources and infrastructures to specific target locations or societies. Stated in another way, it is very crucial to learn these mechanisms to facilitate a more equal resource distribution on some issues such as limited budget, inadequate human resources and geographical detachment among islands.

The government budget on health and education also significantly contribute to the poverty alleviation. The government budget on health and education is a part of the Indonesian government's endeavors to reduce the inequality across the rural and urban areas and across the regions in Java Island. These government budgets are included in the special allocation budget and the amount of these budgets increase from year to year. Nonetheless, the sharing of budget to sub-national level in Indonesia is still low. According to Lewis (2002), the sharing of the government budget to provincial and municipal government is still less than 6 percent. There are 11 (eleven) allocations for these special budgets, such as education, health, road, irrigation, water and environmental treatment, maritime and fisheries, agricultural infrastructures, government infrastructures, environment, citizenship, and forestry. These findings support the previous research conducted by Marinho (2017) that the government expenditure on specific allocation has contributed to reduce the poverty rate.

This study has a number of limitations that should be addressed in future research. First, this study do not take into account about the endogeneity. It is true, for some parts, that the panel data methodology helps dilute endogeneity across the different cross-sections, which provides some treatment for it, but it is recommended that further study provide some tests for endogeneity by

using instrumental variables and/or difference in difference. Second, this study modifies the international development theory proposed by Pernia and Ali (2003) that infrastructural development contribute to poverty alleviation. However, according to the theory, the linkage is indirect or pass several intermediate measures. This study on the other hand uses the direct effect by using the regression model. Therefore, in order to develop models that are close to the theory, further studies need to develop mimic model and / or structural equation model.

#### 5. Conclusion

This research concludes that basic infrastructure contributes to the poverty alleviation. Nonetheless, government expenditures on specific allocations, such as infrastructure, education and health are still not effective to reduce the poverty prevalence. Therefore, the government needs to formulate more effective mechanism to make the budget able to effectively address the poverty issues, for instance by enhancing transparency and accountability. The government also needs to improve the sharing of sub-national budget within the framework of fiscal decentralization to stimulate the development in poor regions in Indonesia to reduce the inequality in not only infrastructural access but also overall economic condition.

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