INDEKS SUBJEK

A

Analisa kointegrasi 79, 86, 89, 90
Analisa korelasi 79, 80, 85, 89
Asuransi pertanian 45, 46, 47, 48, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61

E

Economic growth 27, 28, 29, 30, 31, 32, 33, 39, 40, 41

H

HDI (Human Development Index) 27, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42

I

Infrastructure 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 39, 40, 41, 42
Integrasi pasar modal 79, 80, 81, 82, 83, 90

J

Jaminan Kesehatan Semesta 63, 64, 67, 68, 69, 71, 75, 77

K

Kedaulatan pangan 1, 2, 3,4, 5, 9, 10, 11, 12, 14, 16, 27
Ketahanan pangan 1, 2, 3,4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 18, 20, 21, 22, 23

P

Politik fiskal 1, 2, 3, 7, 9, 16, 17, 19, 20, 21
Politik pangan 1, 2, 3, 4, 9, 10, 11
Poverty 27, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42

S

Swasembada pangan 1, 2, 3, 5, 6, 9, 10, 13, 14, 15, 16, 17, 18,19, 21, 22, 23, 24
Subsidi premi 45, 46, 47, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61

V

Visual inspection 79, 80, 83, 84, 86, 88, 90

THE ROLES OF BASIC INFRASTRUCTURE ON POVERTY ALLEVIATION IN INDONESIA

Peran Infrastruktur Dasar Terhadap Penurunan Kemiskinan Di Indonesia

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Abstrak

Pengaruh infrastruktur terhadap kemiskinan memang sudah banyak diteliti, namun penulusuran tentang alur transmisi pengaruh infrastruktur terhadap kemiskinan masih perlu ditelusuri dalam rangka penyusunan kebijakan yang lebih spesifik. Penelitian ini bertujuan untuk menelusuri peranan infrastruktur dasar dalam menanggulangi kemiskinan melalui hubungan antara panjang jalan, transmisi listrik, distribusi air bersih, jumlah fasilitas kesehatan, dan jumlah sekolah pada area tertentu terhadap tingkat kemiskinan di Indonesia. Penelitian ini menggunakan metode regresi sederhana, dengan data panel 26 provinsi pada tahun 2000-2008 di Indonesia. Hasil penelitian mengungkapkan bahwa panjang jalan, transmisi listrik, distribusi air bersih, jumlah fasilitas kesehatan, dan jumlah sekolah berdampak terhadap tingkat kemiskinan melalui pertumbuhan ekonomi dengan Indeks Pembangunan Manusia (IPM) sebagai proksinya, atau dengan kata lain hubungan antara penyediaan infrastruktur dan kemiskinan adalah hubungan yang tidak langsung. Oleh karena itu, jika pemerintah Indonesia serius dalam usaha untuk menurunkan kemiskinan, maka pemerintah Indonesia seharusnya memberikan perhatian yang lebih pada kebijakan yang memihak pada rakyat miskin dan menyediakan infrastruktur dasar bagi rakyat miskin, selain itu aksesibilitas terhadap infrastruktur dasar oleh rakyat miskin harus ditingkatkan meskipun efek yang ditimbulkan adalah tidak langsung.

Kata kunci: infrastruktur, IPM, kemiskinan, pertumbuhan ekonomi

Abstract

The effect of infrastructure on poverty has been studied many times by researchers, but investigation about the transmission channel of infrastructure's effect on poverty needed more investigation due to more specific policy compiling. The aim of this present study is to investigate the role of basic infrastructure to fight the poverty by depicting the relationship of lenght of road, electricity transmission, clean water distribution, number of health care center, and number of school in particular areas with the poverty rate in Indonesia. This present study uses simple regression method, using panel data from 26 province level for year 2000-2008 in Indonesia. The result of this study reveals that road, electricity transmission, number of health care center, and number of school have an impact on poverty rate through economic growth which is proxied by human development index (HDI), in the other words the relationship between infrastructure and poverty is indirect relationship. Thus, if the Indonesian government is serious about reducing poverty, then the policy should give more emphasis on the poor and provide them with those basic infrastructures; and also have to improve the accessibility of the infrastructures for the poor people although its effect is indirectly.

Keywords: infrastructure, HDI, poverty, economic growth

JEL Classification: H53, H54

I. INTRODUCTION

Indonesia once outperformed many of its peers in infrastructure provision, but since 1997-1998 crises, has lagged behind many other regions in terms of both public and private investment in infrastructure. Inadequate infrastructure, especially in Indonesia's outer islands, is widely recognized as a constraint on sustainable economic growth. The government has been forthright in acknowledging weaknesses in infrastructure and has taken major steps to make funding be increased, to improve regulatory quality and also to allow for greater private participation (OECD, 2010). As stated in OECD report, there is a difference in public infrastructure provisioning by Indonesia government among several main islands in Indonesia. For example, the road in Java and Bali Island has been more developed than the other islands.

The Indonesian government has a challenge to use the long-term policies on increasing the potential growth in order to equally achieve the level in living standards with other wealthier countries among the OECD area. The major factor that drives the growth in Indonesia is the input accumulation instead of higher productivity level. Before the crisis period, the Indonesian GDP growth trend was increased mostly by the labor and physical capital accumulation. Indonesia's amount of investment in infrastructure building accounted for around 10% of GDP in the 1970s and 1980s. By 2007 this ratio had fallen substantially, despite a strong recovery since 2000.

Indonesia has some of the poorest infrastructure development indicators in Southeast Asia, and this infrastructure bottleneck is one of the main obstacles to investment, thus the poor infrastructure development will impede the economy's growth in a whole (OECD, 2008). As in OECD Economic Surveys in 2008, it published comparison of selected infrastructure indicators between Indonesia and the Southeast Asia regional countries. Alongside 1990, 2010, and 2004 selected infrastructure indicators of Indonesia was increase gradually, but its pace was still slower than other peer countries improvement in selected infrastructure provisioning. It can be seen on selected infrastructure indicators such as improved water source, electricity power consumption, fixed line and mobile subcribers, and internet users in OECD report.

Based on OECD report, the improved water source infrastructure indicator showed that Indonesia still left behind from other Southeast Asia countries on percentage of population with access to that infrastructure. Only 77% of indonesian people had access to improved water source, compare to 78,5% of population that accessed in other Southeast asia countries in 2004. In the same year, 2004, Indonesia's energy and transport infrastructure indicators, especially for electricity power consumption, was also far behind compare to other Southeast asia contries indicator. Only 478,2 kWh per capita was consumed by Indonesian, while other sountheast asia countries consumed 1.343,5 kWh per capita.

The fact that Indonesia infrastructure stock was less built up compare than its peer countries in Southeast Asia indicate that Indonesia economic growth in 2004 was lower than its peer countries within the same region at Southeast Asia. It means that the competitiveness and productivity of Indonesia also lagged behind its peer countries. While Aschauer (1989) stated that "core" infrastructure such as streets and highways, airports, electrical and gas facilities, mass transit, water systems and sewers were highly related to productivity. His study also suggested that public capital expenditures is important to improve the productivity though there is lag time for infrastructure to improve productivity due to infrastructure need some time for construction.

Fedderke and Bogetic (2009), in their study stated that in the development literature, there is important factor that affect the economic growth, which is infrastructure investment. The economic growth is influenced by the infrastructure investment directly through capital accumulation, for example an infrastructure investment on road provisioning will reduce cost of transportation. The

reducing of cost will create efficiency related to economic activities, and when economic activities are more efficient it will generate higher return for the parties involved in it. So, the result will be more growth for the economy as a whole.

For long time an appropriate infrastructure provisioning has been noted as an important factor for productivity and growth. Moreover, in recent years the role of infrastructure has been a prominent attention for the policy maker because of its importance related to economic growth. The amount of Infrastructure stocks and the quality of infrastructure has been recognized has a positive effect in the long-run for the economic growth and also has negative effect which is decreasing the income inequality (Calderon and Serven, 2004).

The fact that adequate infrastructure provisioning can boost the economic growth and at the same time can reduce income inequality is obvious as the importance of infrastructure service to poverty reduction.

Indonesia experienced high economic growth and a rapid reduction in poverty in the pre-Asian financial crisis period, but it is becoming lower economic growth and slower pace in poverty reduction after post-crisis period. Indonesia government tries several ways to cope with this problem. Many programs have been launched in order to gain back the achievement in economic growth and to reduce poverty.

Infrastructure is an important factor in economic development in addition to the factors of production to another, namely capital and labor. Indonesian government becomes lack of intention about providing infrastructure to support economic development after the 1998 financial crisis. The government's focus at that time was to stabilize exchange rates, the decline in inflation, prevent malicious capital flight, and combat foreign debt to swell. Therefore the infrastructure in Indonesia, particularly in eastern Indonesia became worse off. With poor infrastructure it will affect and hinder economic growth, investment climate, and poverty alleviation. However, Indonesian government recently began showing serious attention to the provision of infrastructure by building new infrastructure and improving the state of the existing infrastructure (Tambunan, 2006).

In sum, the provision of adequate infrastructure is essential to support economic growth in Indonesia. With good economic growth and sustainable development, the community will be better off, then it can be said that the government made a success achieving one of the development goals, namely reducing poverty in Indonesia.

The issue that will be investigating in this present study is important because the government needs to know if the government's spending on infrastructure provisioning programs can effectively reduce poverty in Indonesia.

The aim of this study is to investigate the role of basic infrastructure provisioning to fight poverty in Indonesia during 2000 until 2008 by depicting the relationship and link of physical infrastructure provisioning and poverty reduction. If a clear view about the relationship between infrastructure development and poverty reduction, and also through what channel infrastructure will reduce poverty, can be shown in this present study, then the government can decide and has more focus to develop on what kind of infrastructure provisioning that have more potential to alleviate poverty, so that government can use its budget more effectively to make the community more prosperous.

II. LITERATURE REVIEW

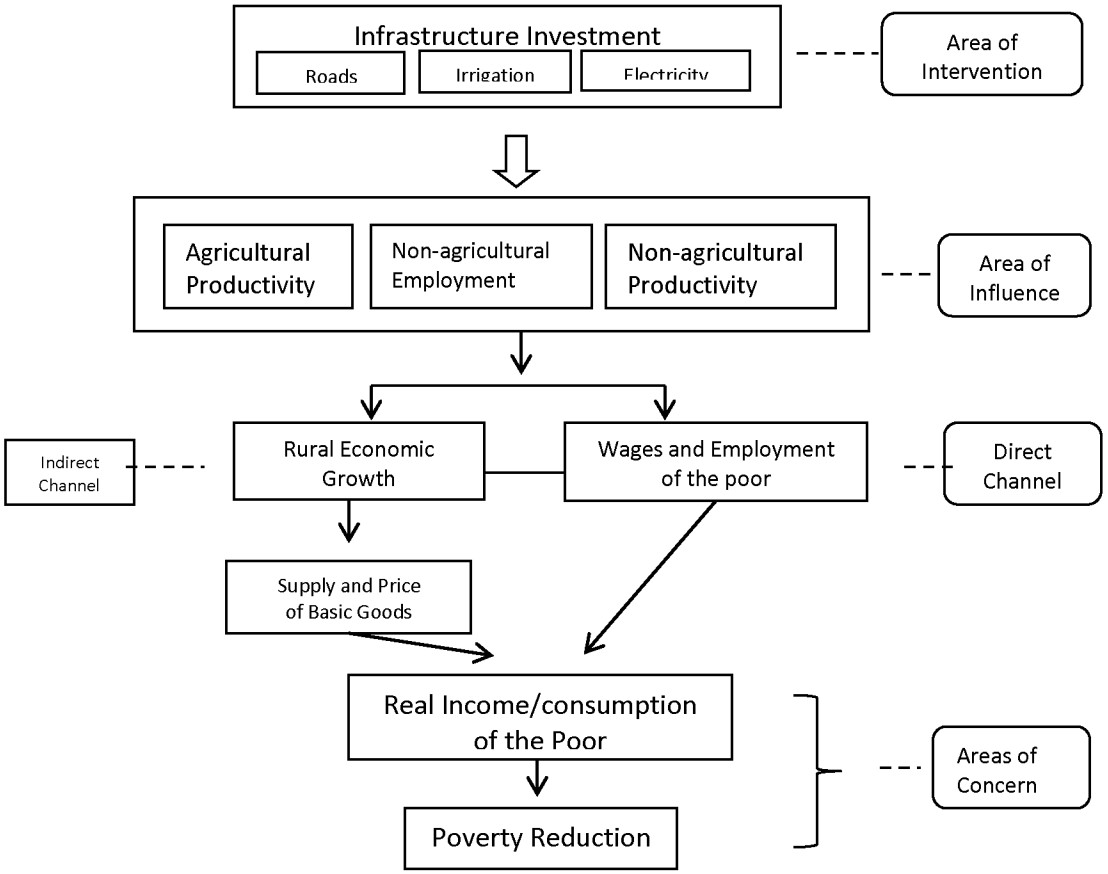
Many definitions were stated by previous researchers about infrastructure, Auschauer (1989); Hansen (1965), Biehl (1991), Gramlich (1994), and Jacobs et al. (1995) as in Torrisi (2009) tried to define infrastructure and studied its impact. The infrastructure definition in this study is following

Torrisi that distinguished infrastructure into economic and social infrastructure. Economic infrastructure is all infrastructures that directly support to productive activities, while social infrastructure is infrastructures that are used to increase the social comfort and to act on economic productivity.

Segun et al. (2008) studied the importance of rural infrastructure provisioning to agricultural productivity in Nigeria. They found that rural infrastructures are highly significant to the growth of agriculture sector. Adequate supply of infrastructure facilities will improve the level of farm output of farmers. Alongside with supply of infrastructure facilities, problem of accessing those are must be concerned too. Because when there is poor access to infrastructure facilities, it will lead to a low agriculture productivity on that particular area.

Myriad of researchers have been studied about infrastructure and its impact on economic growth and poverty. The relationship between infrastructure development and economic growth was studied by Sahoo et al. (2010), they stated that in developing countries infrastructure is prominent determinant of economic growth, both for economic and social infrastructure. But, Zhang and Fan (2004) stated that evidence from prior studies is not clear to justify the causalities between one that lead to other whether infrastructure lead economic growth or the way around.

Yoshino and Nakahigashi (2000), argued that infrastructure provisioning is one of the ways that possibly will reduce poverty. They found that infrastructures have various effects on the economy such as its affect the production activities and infrastructure education can increase economic growth. They argued using education improvement, infrastructure can be the way to fight poverty. But, Braithwaite et al. (2004) stated, generally the linkage between infrastructure and poverty reduction is indirect.



Source: Ali and Pernia

Figure 2.1. The links between infrastructure and poverty reduction.

The clearer view about relationship between infrastructure and poverty was depicted by Ali and Pernia (2003) in their study. According to them, an economic growth is needed to reduce poverty and it should be followed by good macroeconomic management in order to gain greater sustainable poverty reduction. Thus, government should invest on infrastructure and should be in line with poverty reduction programs to foster the economic growth. Based on Ali and Pernia (2003), the link between infrastructure investment and poverty reduction could be an indirect relationship as can be seen in Figure 2.1. Infrastructure investment will influence economic growth at first; then economic growth will affect real income or real consumption of the poor; and the final result is that real income or real consumption will reduce poverty.

III. RESEARCH METHOD

The hypothesis of this present study is that provisioning of infrastructures has a negative and direct relationship to poverty reduction. The role of physical infrastructure provisioning in Indonesia is to reduce poverty rate. Thus, the more infrastructures provided, the less people become poor. But, if the hypothesis cannot be proved, one should investigate the way physical infrastructure provisioning will reduce poverty, whether there is no relationship between infrastructure provisioning and poverty reduction or there is some way that infrastructure can reduce poverty, which is via intervening variables. The big picture of this puzzle should be depicted clearly.

The basic infrastructure that is investigated are particularly on the provisioning of economic and social infrastructure such as road, electricity, clean water, health care center, and school which is measure by their physical measurement been provisioned, such as the length of roads, the length of electricity transmission, and the total number of health care center and school. So that, this study will have more real measurement of infrastructure provisioning. The following model is used to investigate the effect of basic infrastructure provision in Indonesia to determine its role on the reduction of poverty incidence in Indonesia.

$$Flnpovrate_{i(t+1)} = \beta_1 lnroadcov_{it} + \beta_2 lnelectpop_{it} + \beta_3 lnwaterpop_{it} + \beta_4 lnhcenterpop_{it} + \beta_5 lnnschoolpop_{it} + \beta_6 hdi_{it} + \beta_7 lnpercapita_{it} + \beta_8 povrate_{it} \quad (1)$$

where:

Flnpovrate	*: Logarithm natural of next year percentage of people below poverty line using logit form (%)*
lnroadcov	*: Logarithm natural of length of national, provincial, and municipal roads per province square area (km/km^2)*
lnelectpop	*: Logarithm natural of length of electricity transmission per population (km/1 million person)*
lnwaterpop	*: Logarithm natural of total water production capacity per population (m^3/1 million person)*
lnhcenterpop	*: Logarithm natural of total number of healthcare center and hospital per population (unit/1 million person)*
lnnschoolpop	*: Logarithm natural of total number of school from elementary until senior high school per population (unit/1 million person)*
hdi	*: Human development index (index between 0 and 1)*
lnpercapita	*: Logarithm natural of GRDP(Gross Regional Domestic Product) in rupiah per capita (Rp/1 million person)*
povrate	*: Current year percentage of people below poverty line using logit form (%)*
i	*: Province*
t	*: Year*

This study uses the above econometric model following Haughton and Khandker (2009), and Huang et al. (2007). Following them, but because of limitation of data, this study modifies the model, so that, it end up with the above econometric model. The difference of this present study's model with the previous study's model is that this present study's model is simpler and directly measures the basic infrastructure using physical measurement.

This study decides to use fixed effect with robust standard error adjustment to regress the model after conducting the Hausmann test. In order to investigate the relationship, to prove the link, and to see more clear through what channel the physical infrastructure provisioning will impact the poverty rate, furthermore, this study will use model 1 but it will be modified by changing the dependent and independent variables that is used in each regression model. First, model 1 will be changed to model 2.

Model 2 will only use all infrastructure variable as independent variable and poverty rate for the dependent. It is to investigate if there is true negative and significant impact of provisioning physical infrastructure to poverty rate. Here, this study put out HDI and GRDP per capita from the regression, to solely prove the impact of infrastructure to poverty. After that, model 1 will be modified to model 3 and 4.

In model 3, HDI is used as the dependent variable, while in model 4 GRDP per capita is used as the dependent variable. These are to investigate the relathionship of all infrastructure variables with HDI and GRDP per capita. One should investigate whether physical infrastructure will impact the HDI and GRDP per capita to make sure the channel of physical infrastructure way to fight poverty.

The big picture of the way of infrastructure to reduce poverty will more complete when one can prove the way HDI and GRDP per capita will effect poverty rate. So, in model 5 this study used hdi as independent variable and regressed it with Flnpovrate, while in model 6, this study used GRDP per capita as the independent variable.

To finish the puzzle, model 7 is used. In this model the relationship of HDI and GRDP per capita as the intervening variables of infrastructure and poverty rate is investigated. The way infrastructure to make GRDP better off, will it impact HDI or not? can be proved by regress model 7. Thus, all model basically use the same variables as model 1, but each relathionship investigated by regressing each model that had been modified by changing its dependent or its independent variable.

In the above model this present study uses ($t+1$) for the poverty rate variable as independent variabel and for all dependent variables using data from the t periode of time. The ($t+1$) is the lead variable of poverty rate one year ahead, which is the lag time, is used to capture the effect of change in the independent variables in t year or current year as an input of the next year poverty rate . The reason to use lead time is because the provisioning of infrastructure needs some time to create an effect to the economy. The logic is when there is infrastructure provisioning, for example roads, to build it will definitely takes time to be provided may be by one year. Then, after that people will start using the existing road to do their economic activities in that year. Due to that, the effect of infrastructure provisioning to the economic growth needs some time to occur and the effect on the poverty reduction will take some time as well.

This present study uses logarithm natural of percentage of people below poverty line as dependent variable, which is obtained and based on Statistics Indonesia data released, but in this study it was transformed into logit form first before making it into logarithm natural. The transformation of dependen variable into logit form is following Simatupang and Dermoredjo (2003). The reason to use logit form as dependent variable is that by using logit form the parameter

of poverty rate will be limited between 0 to 100 percent. So that, the the predicted dependent variable will not have value that is below 0 and upper than 100.

HDI, GRDP per capita, and the initial poverty rate at current year (t), is used as the controlling variable. The use of these controling variables is to measure the other factors that determine the poverty reduction despite the provisioning of infrastructure itself. Especially for initial poverty variable, it is important to be analized when one want to investigate more clear picture about the relationship of initial poverty and economic growth.

HDI is a composite index consists of life expectancy at birth, adult literacy, and real gross national income per capita that is used to assess government achievement on development of a country. HDI proposed annually in Human Deevelopment Reports by United Nations Development Programme (UNDP). Using hdi and lnpercapita variable despite of using lnnschoolpop as independent variables in the model, looks like will lead the model with multicollinearity problem. Since this study uses physical measurement of number of school to measure the impact of infrastructure provisioning, so it will not have linear relationship with the adult literacy as one index in HDI. When this study conducted test for checking the multicollinearty problem in the model using VIF test, the result showed that for all variables there are no VIF values which greater than 10.

Previous study that explained about the effect of initial poverty conducted by by Lopez and Serven (2009). They said that poverty may deter economic growth and can create poverty traps in countries with higher initial poverty would grow less rapidly, in terms of its economic growth, than comparable countries with lower initial poverty. Ravallion (2009), also found that in countries with higher poverty rate, the poverty impact of economic growth is smaller, due to its higher initial poverty. But, in Indonesia case, it was reversed. Study by Sumarto et al. (2014), said that regions with higher levels of poverty will experience larger decrease in poverty rate related to the level of education, existence of conflict, and degree of urbanization.

This present study uses secondary data. The infrastructure data such as length of road was collected from Ministry of Public Works, while from Statistics Indonesia (BPS) several data was collected such as the poverty rate, length of electricity transmission, production of clean water, number of health care centers, number of schools, human development index (HDI), and gross domestic regional product (GRDP) per capita.

Since this present study only focuses on Indonesia, it uses Indonesia provincial level data for the analysis purpose. Firstly, Indonesia has had 27 provinces since 1976. However, in 1999 one of Indonesia province, Timor Timur (East Timor) was separated from Indonesia with referendum under the United Nation. Thus, after that Indonesia only have 26 provinces. After 1998, some province in Indonesia had been expanded as the mandate of decentralization law. Beginning in 1999 until 2012 some provinces in Indonesia have been expanded from 26 to 34 provinces, so there are some new provinces that have no available administrative data recording yet or the data are still in agregate for the period of this study.

As several provinces just recently established, then the data for those provinces, which are newly established, may not be sufficiently obtained which is very important in this study. So that, this present study covers for only 26 provinces in Indonesia and panel data, which consists of 26 provinces from year 2000 until 2008 in provincial level, was conducted. One year lead for the dependent variable is used in this present study, but due to the availability of the dataset collection, it only ranges from 2001 to 2008. The sample observation in this dataset is 208.

IV. EMPIRICAL RESULT

The purpose of this present study is to investigate the relationship between poverty rate reduction and basic infrastructure provisioning and also to depict link . This present study expects the result in line with the hypotheses which is there is direct and negative relationship between basic infrastructure and poverty rate. For those reason, the sign of the interest variables named: lnroadcov, lnelectpop, lnwaterpop, lnhcenterpop, and lnnschoolpop, are expected to be negative and statistically significant. Estimation result for model 1 can be seen in Table 4.1.

In Table 4.1. the sign of each infrastructure variable is different from the expected sign, according to the theory, except for road infrastructure variable.

The infrastructure variable such as electricity, clean water, health care center, and school are have unexpected sign, but the controlling variable such as hdi, grdp percapita, and initial poverty have the expected sign.

Table 4.1. Estimation result for model 1

Variable	Fixed effect with robust standard errors
Road	-0.0136615
	(0.680)
Electricity	0.0981621
	(0.053)
Clean water	0.0352683
	(0.099)
Health care center	0.0065691
	(0.842)
School	0.0669869
	(0.745)
Human development index	-0.0212207
	(0.000)
GRDP per capita	
	-0.1178506
	(0.048)
Initial povrate	
	1.200627
	(0.000)
_cons	
	1.174008
	(0.196)
R-square overall	0.7613
Number of cross section	26
Number of observation	208
Prob > F	0.0000

dependent variable: **Flnpovrate**

number in ( ) is P>|t| value

The result showed that only electricity and clean water infrastructure variable that seem statistically significant at 10% level of significance, and for all controlling variables it is found to be statistically significant at 5% level of significance.

This finding are interesting, because from this perspective the provisioning of electricity and clean water infrastructures looks like that it will severe the poverty more if one provide those to the society.

As been explained in methodology, to investigate more and also to get the true impact of infrastructure variables to poverty rate, this study modified model 1 into model 2 by changing the independent variables and regressed again the independent variable with all infrastructure variable and only one controlling variable which is initial poverty. The result can be seen in Table 4.2.

$$Flnpovrate_{i(t+1)} = \beta_1 lnroadcov_{it} + \beta_2 lnelectpop_{it} + \beta_3 lnwaterpop_{it} + \beta_4 lnhcenterpop_{it} + \beta_5 lnnschoolpop_{it} + \beta_6 povrate_{it} \quad \text{.....(2)}$$

Table 4.2. Estimation result for model 2

Variable	Fixed effect with robust standard errors
Road	-0.0772876
	(0.125)
Electricity	0.0574679
	(0.273)
Clean water	0.0069286
	(0.803)
Health care center	-0.0623353
	(0.270)
School	0.2227267
	(0.249)
Initial povrate	1.590628
	(0.000)
_cons	-2.366174
	(0.000)
R-square overall	0.7332
Number of cross section	26
Number of observation	208
Prob > F	0.0000

dependent variable: **Flnpovrate**
number in ( ) is P>|t| value

The result from the revised model showed that all infrastructure variable is statistically insignificant. This result seems ascertain that provisioning of infrastructure have no impact to poverty reduction in Indonesia or in the other word, there is look like no direct impact of infrastructure to poverty reduction.

As Ali and Pernia stated, there is possibility that infrastructure provisioning have indirect impact to poverty reduction. To confirm Ali and Pernia, this present study tries to depict the relationship between infrastucture, hdi and grdp, and poverty as framework link which can be seen in Figure 4.1.

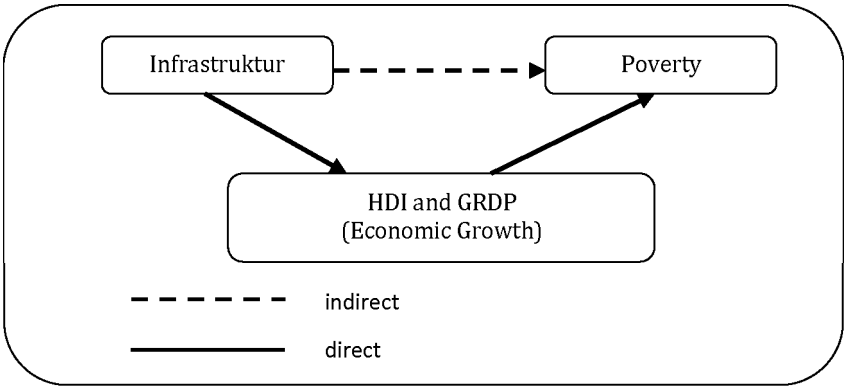


Figure 4.1. Relationship between variables.

In order to be more comprehend about the relationship between variables as in Figure 4.1, this study tries to find more evidence about the indirect relationship of infrastructure and poverty reduction by forming another models and regress it partially, so that the link between each variable can be explained more clearly.

This study form model 3 and 4 to see the the relationship between infrastructure and hdi; and between infrastructure and grdp percapita, because there is presumption that poverty reduction will be impacted by infrastructure provisioning through intervening variable first such as hdi and grdp percapita. The new modified models then:

$$hdi_{it} = \beta_1 lnroadcov_{it} + \beta_2 lnelectpop_{it} + \beta_3 lnwaterpop_{it} + \beta_4 lnhcenterpop_{it} + \beta_5 lnnschoolpop2_{it} + \beta_6 povrate_{it} \ldots\ldots\ldots\ldots\ldots (3)$$

and,

$$grdp\ percapita_{it} = \beta_1 lnroadcov_{it} + \beta_2 lnelectpop_{it} + \beta_3 lnwaterpop_{it} + \beta_4 lnhcenterpop_{it} + \beta_5 lnnschoolpop_{it} + \beta_6 povrate_{it} \ldots\ldots\ldots\ldots\ldots (4)$$

Model 3 uses school variable square which is parabolic, because when a linear infrastructure school variable is used in the model, there is negative relationship between school variable and dependent variable which is hdi. Using parabolic function, school variable can explain that for long run provisioning of school will have positive correlation to hdi, because its density will tend to increase hdi, and this is more logic.

Table 4.3. and Table 4.4. will show the results of estimation using model 3 and model 4 respectively.

From Table 4.3., it can be found that most of the infrastructure variables are stastistically significant and have the expected sign. But, there is only one out of five infrastructure variable which is clean water that is statistically insignificant. From this result, the relationship between infrastructure and hdi can be found and it is more real than the relationship between infrastructure and poverty as previous result had been found. In sum, there is four infrastructure variables that have direct relationship with hdi.

Table 4.3. Estimation result for model 3

Variable	Fixed effect with robust standard errors
Road	3.600375 (0.010)
Electricity	2.795893 (0.038)

Clean water	0.4958287 (0.279)
Health care center	2.793149 (0.053)
School	15.43489 (0.008)
Initial povrate	-19.46699 (0.002)
_cons	80.26185 (0.000)
R-square overall	0.4148
Number of cross section	26
Number of observation	234
Prob > F	0.0000

dependent variable: **hdi**
number in ( ) is P>|t| value

Table 4.4. Estimation result for model 4

Variable	Fixed effect with robust standard errors
Road	-0.0180622 (0.811)
Electricity	0.0752352 (0.329)
Clean water	0.1057094 (0.015)
Health care center	0.1138479 (0.069)
School	0.2167086 (0.440)
Initial povrate	-0.4823793 (0.310)
_cons	15.60903 (0.000)
R-square overall	0.2089
Number of cross section	26
Number of observation	234
Prob > F	0.0000

dependent variable: **grdp per capita**
number in ( ) is P>|t| value

From Table 4.4., it can be found that only two out of five infrastructure variables that have positive relationship and statistically significant to GRDP per capita, which are clean water and health care center variables. Based on model 4, the relationship between infrastructure and grdp per capita is direct relationship with two positive and statistically significant infrastructure variables.

To investigate the relationship between hdi and grdp per capita as a proxi of economic development, and its impact on poverty reduction, this study form another model which is model 5 and 6.

$Flnpovrate_{i(t+1)} = \beta_1 hdi_{it} + \beta_2 povrate_{it}$ ..... *(5)*

and:

$Flnpovrate_{i(t+1)} = \beta_1 grdp\ percapita_{it} + \beta_2 povrate_{it}$ ..... *(6)*

The result of estimation using model 5 can be seen in Table 4.5. In Table 4.5., hdi has the expected sign which is negative and statistically significant as an explanatory variable to poverty rate.

The Based on this result, hdi has negative and direct relationship with poverty. So, the better hdi will impact to lower poverty rate.

Table 4.5. Estimation result for model 5

Variable	Fixed effect with robust standard errors
Human development index	-0.0229052 (0.000)
Initial povrate	1.21241 (0.000)
_cons	-0.3688431 (0.119)
R-square overall	0.7415
Number of cross section	26
Number of observation	208
Prob > F	0.0000

dependent variable: **Flnpovrate**

number in ( ) is P>|t| value

The next relationship being investigated is the relationship between grdp per capita and poverty by regress it using model 6. The estimation result as in Table 4.6.

Table 4.6. Estimation result for model 6

Variable	Fixed effect with robust standard errors
GRDP per capita	-0.190407 (0.049)
Initial povrate	1.539118 (0.000)
_cons	0.9414613 (0.512)
R-square overall	0.8041
Number of cross section	26
Number of observation	208
Prob > F	0.0000

dependent variable: **Flnpovrate**

number in ( ) is P>|t| value

It can be found on estimation result of model 6, grdp percapita has the expected sign and statistically significant to poverty rate. It mean that the relationship between grdp percapita and

poverty is direct and negative relationship, so, when grdp percapita is better, then it will reduce poverty rate.

To complete the understanding about the relationship of each variable to depict the best framework link between infrastructure provisioning and poverty reduction in Indonesia, this study also investigate the relationship between hdi and grdp percapita. To do that, this study uses model 7 as follows.

$hdi_{it} = \beta_1 grdp\ percapita_{it} + \beta_2 povrate_{it}$ ..... *(7)*

Table 4.7. Estimation result for model 7

Variable	Fixed effect with robust standard errors
GRDP per capita	6.172123
	(0.075)
Initial povrate	-19.25145
	(0.002)
_cons	-22.72974
	(0.665)
R-square overall	0.3347
Number of cross section	26
Number of observation	234
Prob > F	0.0003

dependent variable: **hdi**

number in ( ) is P>|t| value

The result estimation of model 7 is that there is direct relationship between grdp percapita and hdi. From the model, grdp percapita has positive sign and statistically significant at 10% level of significance to hdi. Based on the the result findings from model 5 and model 6, it seems that hdi and grdp percapita are found to be true as an intervening variable between interesting variable and poverty variable.

Recall the result in Table 4.3., there are four out of five infrastructure variables that can explain hdi, so, it can be said that there is direct relationship between infrastructure and hdi. When infrastructure variables are used to explain grdp percapita, there is two out of five infrastucture variables that have positive sign and statistically significant as results in Table 4.4.

Since the result in Table 4.2. showed that there is none of the infrastructure variables is statictically significant to explain poverty rate, but results in table 4.3. and table 4.4. showed that infrastructures variables affect the hdi and grdp per capita variable, while from table 4.5. and table 4.6. concluded that hdi and grdp per capita significantly affect poverty rate. Based on the findings previously explained, there is indirect relationship between infrastructure and poverty rate.

The infrastructure provisioning will affect poverty reduction indirectly via hdi and grdp percapita, which are the proxy of economic growth, but with different infrastructure drivers. Figure 4.2. shows more clearly about the relationship between infrastructures, economic growth, and poverty based on findings in this study. It also depict which infrastructures are the driver and through which channels are infrastructures will affect the poverty in Indonesia.

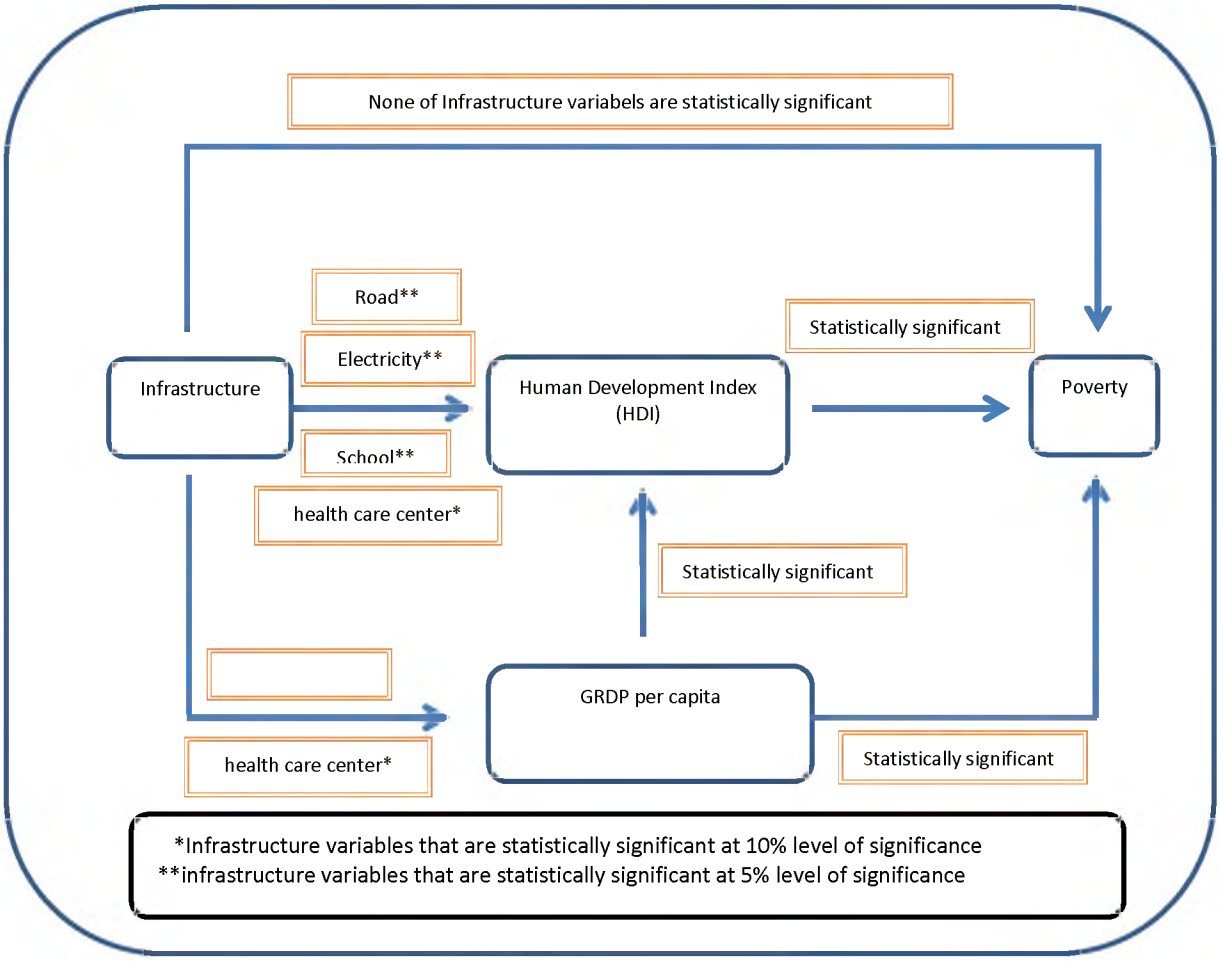


Figure 4.2. Flow chart of the infrastructure impacts on poverty.

Hdi and grdp per capita had showed its importance of alleviating poverty rates in Indonesia. Based on Figure 4.2., to fight poverty one could provide basic infrastructures such as road, electricity, school, health care center, and clean water system to the community.

Another study in line with this recent study is Suliswanto (2010) that studied the effect of Gross Regional Domestic Product (GRDP) and Human Development Index (HDI) to poverty in Indonesia. His study conducted using panel data from 2006-2008 and Random Effect Model (REM) method, found that both GRDP and HDI had significant negative influence on poverty, whereas HDI had more effect on poverty reduction than GRDP. This condition is conformity with World Bank's study, since there is large inequality on Indonesia's economic development; the economic growth is not significantly able to reduce poverty yet in Indonesia case. Thus, this study is in line with prior study which is based on Figure 4.2., hdi that is supported by more infrastructure impact than infrastructure impact that supports grdp per capita to reduce poverty.

Schools as basic infrastructures are known as the driver for improvement on human capital. Providing school to the community will potentially increase school attendance for schooling age children and this will make people more formally educated, so that they will be more creative and productive. This opportunity of being more educated, will open better chance for people to get better job or occupancy in their future, hoping with that opportunity people will step up to higher welfare life. As Ozturk (2001) stated in his study that education is a foundation of economic development and social well being. It will help to improve the poor from poverty by increasing the value and efficiency of labor, which is educated people, thus education is the main factor for economic efficiency and social consistency raising.

In addition, Sitepu et al. (2009) using CGE model argued that government's investment on human resource through education will directly increase productivity of workers, lead to real GRDP rise that can be shown from increase on stock, increase on trade, and increase on household consumption. Then, income distribution equality increase when there is investment on human capital and it tend to alleviate poverty, especially for farmer household in rural area. Education been said could decrease poverty incidence, poverty depth, and poverty severity.

As Sitepu et al. did so, Rahman et al. (2013) also pointed out that human capital development is needed to alleviate poverty and education has an impact on quality of life. Poor people tend to have lower levels of education, work in low paid job, and have low income as they are lack of skills. Based on them, poverty to level of education and skill are negatively correlated, when the outcomes of education, such as wages and job opportunity are related to poverty.

Providing of adequate basic infrastructure such as road is also a driver to increase poor people's income which will make poor people wealthier, so that they will have opportunity to come out from poverty. According to Gachassin et al. (2010), many literatures stated that roads can impact poverty via three channels: the human capital, the market access, and the labor activities. The human capital is impacted as road facilitates poor to access public health and education facilities. The second channel is impacted due to lower transport costs by road provisioning, while the last channel is impacted by road through creating an employment and new job opportunities. By improving road access automatically leads to poverty reduction. Study by Gachassin et al. in Cameroon found interesting finding which is contrary againts the previous studies, that is road access has indirect impact to poverty. This is because based on their study not just the road per se which reduce poverty, but the road that can open the opportunities to poor people to come out from the isolated area to the outside world.

Hettige (2006), argued that improved rural roads create better access to rural people so that they can save time and resources to achieve particular area outside their village. Rural roads become an important enabling condition for livelihood development. Hettige said that better rural roads are a necessary but not sufficient condition to reduce poverty, eventhough, poor people are beneficial from the indirect impacts of roads as it increase the opportunity of wage worker in the rural areas. Thus, Gachassin's and Hettige's study reinforce this study that infrastructure provisioning reduces poverty on indirect way.

In sum, based on the regression results in this study, the hypothesis that provisioning of infrastructures has a negative and direct relationship to poverty reduction is rejected. From the findings, it showed that the role of infrastructure to poverty reduction in Indonesia by first it will affect to people's welfare by increasing grdp per capita and hdi. Once hdi increased, it will affect poverty by reducing poverty rate. Thus, it can be said that infrastructure provisioning affect the poverty reduction indirectly through economic growth, which is in this study, measured by HDI and GRDP per capita.

V. CONCLUSION AND RECOMMENDATION

This study shows that basic infrastructure is indeed affect poverty incidence but indirectly through human development index (HDI). Basic infrastructure increases HDI which then reduces poverty incidence. HDI is a composite index of health quality (life expectancy), level of education (years of schooling) and standard of living (income per capita), and is generally accepted as a proxy for human capability. It can be said that best strategy for poverty alleviation is to improve human capability, includes through basic infrastructure development.

From a policy perspective, these results suggest that Indonesian government should pay greater attention to the provisioning of basic infrastructure such as road, electricity, clean water, health care center, and school in order to fight the poverty, although each of infrastructure variables work from different channel. Road, electricity, health care center and school affect poverty reduction through HDI, and clean water and health care center affect poverty reduction through grdp percapita in this present study case.

The basic infrastructure mostly needed in rural areas where most of Indonesian poor people are living. Moreover, it is not only the amount of basic infrastructures to be adequate provisioned, but the more important is the accessibility to the existing infrastructure is needed to improve for the poor people. Because once the infrastructure service can be accessed by the poor people, it can boost the economic activities and improve the poor's living standard. When there is improvement of the living standard of the poor people, the eventually can move away from poverty. Thus, the main goal of the provisioning of infrastructure can be achieved that is to reduce poverty.

In this study basic infrastructure role to alleviate poverty by improving human capital development in Indonesia are proven, as many prior studies also suggested. But, infrastructure povisioning is not the panacea for the government to tackle down poverty problem. This phenomena not only applied in Indonesia, but to every policy makers face when they manage to alleviate poverty. That is the reason why policy maker should also consider a comprehensif policy and fully supported programme to help poor people come out from poverty condition. Policy maker could lauch self empowering programme to poor people, financial assistance programme for rural community, and government investment that focus on poverty mitigation and equal income distribution in the particular areas where mostly poor people settled down. Thus, the poverty alleviation policies and programmes that in line with the provisioning of adequade infrastructure, if it can be done consistently will be one of the way on fighting the poverty and to level up people prosperity.

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