The development of infrastructure and the level of poverty in the eastern part of Indonesia

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Abstract. This research aimed to figure out the infrastructure effect on the poverty level in the Eastern Part of Indonesia. The developed research model applies an econometric approach i.e. simultaneous equation model using data panel of 16 provinces. The variables of the energy, housing, transportation, clean water, education, health, and telecommunication were used to measure the effects of the infrastructure whereas the growth and income inequality were used as the intervening variables. The result indicates that housing, clean water, and telecommunication have a negative and significant effect, while energy has a positive and significant effect on the poverty level. Indirectly, housing, clean water, education, and telecommunication variables have a negative and significant effect on the poverty level. In addition, energy and transportation have positive and significant effects on the poverty level. Another finding is improving economic growth in the Eastern Part of Indonesia causing more equal income distribution. However, it is not accompanied by poverty reduction.

1. Introduction
Prosperity is an issue that continues to be discussed with poverty as a key issue that is not resolved in recent decades. This research creates a model to discover facts and empirical evidence of the linkages between economic development and welfare with infrastructure and poverty as an indicator. Why Infrastructure matters? and how infrastructure is able to reduce poverty?. Keynes began to demonstrate the indirect relationship between infrastructure and poverty in an economic depression and market failure. High public expenditure is required to adjust the economy back to full employment. This means that high public investments in infrastructure will increase national income, employment opportunities and welfare. Conceptually, infrastructure investments are essential to achieving economic development as well as improving and providing services or access for the poor to take advantage of the economic opportunity to get out of poverty and contribute to growth. Bourguignon (2008), Growth–Poverty–Inequality Triangle that poverty can be reduced through growth and/or increasing revenue distribution but growth can lead to decreased or increased inequality. Meanwhile, poverty and growth depend on the current level and the dynamics of inequality [1,2].
Lelethu K, Okem, and Andrew Emmanuel (2016) the implementation of infrastructure projects is required in order to enhance the infrastructure benefits for the poor further. The provision of infrastructure does not by itself reduce poverty if it is not accessible to the poor because of several factors such as costs, location and regulation/system of governance. Poverty reduction through infrastructure development must be associated with income and job creation and must include variables that can measure how infrastructure can increase the social and natural capital available to Poor [3,4]. Given the fundamental role that infrastructure plays in mediating community welfare, it is undeniable that the provision, management, and maintenance of social facilities contribute to the welfare of the public in general and the poor and vulnerable in particular. In Indonesia, there are differences in the poverty characteristics between absolute and relative poverty value to geographical location. In the absolute sense, more than half the total number of Indonesians living in the poor are in Java island, while in the relative sense, provinces in eastern Indonesia show higher poverty. During this time the planning was undertaken by Bappenas (Indonesian Ministry of National Development Planning) in infrastructure development only uses a demographic approach that focuses infrastructure development on a population-dense area that is assessed to produce economic activity. This is different from Eastern Indonesia's region, which is demographic but has large potential. Thus, there are different views on infrastructure development planning patterns that use a demographic approach with a potential approach.

The activity of the leading sector that does not require much infrastructure is causing the percentage of infrastructure development in eastern Indonesia is lower than the western region of Indonesia. So, the investment gaps in service provision and infrastructure quality with gaps widen over time. Overall, infrastructure constraints will reduce competitiveness and become barriers to economic development and major constraints in reducing poverty. The infrastructure of transportation, energy, communication, clean water, housing, education, and health is inadequate to strengthen economic growth and reduction of poverty in the eastern region of Indonesia.

This research makes the parameter model see the causality between the provision of infrastructure importance of transportation, energy, drinking water, sanitation and irrigation, housing, education and health through economic growth and income inequality Poverty to achieve prosperity in the eastern region of Indonesia.
2. Methods

This research was conducted in the eastern region of Indonesia. The type of research used is quantitative research using an econometric approach in the form of a simultaneous equation model system using the 16 provincial data panel. Data collection is conducted by researchers using secondary data obtained from BPS (Statistics Indonesia) as well as the publication of data issued by the ministry regarding the data required in this study.

2.1. Data analysis

The research design used in this thesis is a time series with pooled data of 16 provinces in eastern Indonesia during 2010-2015. Infrastructure variables consist of energy, housing, transportation, clean water, education, healthcare, and telecommunications as an exogenous variable, poverty-level variables as endogenous variables using growth and inequality as a control variable. Andren, (2007), Method of estimation using method two-stage least square model Simultaneous Equation Model [5]. Data were then processed with the help of SPSS 23 software and Amos 21.

Poverty modelling:

\[ Y_2 = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7, Y_{11}, Y_{12}) \]  \hspace{1cm} (1)

Economic growth and distribution of income as explanatory variables in the model of simultaneous equations can be endogenous variables so that in the model to explain poverty gained also models the equation as follows:

Economic growth model:

\[ Y_{11} = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7) \]  \hspace{1cm} (2)

Income distribution Modelling:

\[ Y_{12} = f (Y_{11}) \]  \hspace{1cm} (3)

Based on the functional relationship above it is described in some sub-structure equations as follows:

Equation of poverty model sub-structure:

\[ e^{Y_2} = \alpha_0 X_1^{\alpha_1} X_2^{\alpha_2} \]
\[ \epsilon \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 Y_{11} + \alpha_9 Y_{12} \]
\[ Y_2 = ln(\alpha_0 + \alpha_1 lnX_1 + \alpha_2 lnX_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 Y_{11} + \alpha_9 Y_{12} + \mu_1) \]  \hspace{1cm} (4)

Equation of the sub-structure of the economic growth model:

\[ e^{Y_{11}} = \beta_0 X_1^{\beta_1} X_2^{\beta_2} e^{\beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \epsilon} \]
\[ Y_{11} = ln(\beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \epsilon) \]  \hspace{1cm} (5)

Equation of income distribution model substructure:

\[ e^{Y_{12}} = \lambda_0 \lambda_1 Y_{11} + \epsilon \]
Of the three equations above, the specified explanatory variables along with the dependent variable are usually correlated with a term error thereby causing the bias and inconsistency of the equation so as to eliminate exponential then logarithmic (LN) on the X1 and X2 variables as well as the Y (1) variable, and. As previously described above, that in the simultaneous equation model, the variable dependent can be variable explanatory in the next equation. Thus, using the reduced form equation in the simultaneous equation model, equation 5 and Equation 6 is a substitution to equation 4:

\[ Y_{12} = \ln \lambda_0 + \ln \lambda_1 Y_{11} + \varepsilon \]

The following new poverty equation is achieved:

\[ Y_2 = \ln a_0 + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 (\ln b_0 \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon) + \alpha_9 (\ln \lambda_0 + \ln \lambda_1 Y_{11} + \varepsilon) + \mu_1 \]

The following new poverty equation is achieved:

\[ Y_2 = \ln a_0 + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 (\ln b_0 \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 \varepsilon + \alpha_9 (\ln \lambda_1 Y_{11} + \alpha_9 \varepsilon + \mu_1) \]

So, the equation of estimation for the poverty model is:

\[ Y_2 = \delta_0 + \delta_1 X_1 + \delta_2 X_2 + \delta_3 X_3 + \delta_4 X_4 + \delta_5 X_5 + \delta_6 X_6 + \delta_7 X_7 + \delta_8 Y_{11} + \varepsilon \]

Where: X1 is an electrical capacity installed; X2 is a housing; X3 is the ratio of vehicle-road; X4 is a household of clean water access; X5 is the ratio of the number of students with teachers from elementary to senior high school (SD-SLTA); X6 is the ratio of healthcare staff to the population per province per 100,000 population; X7 is a household internet access; Y1.1 is the pace of the business field PDRB; Y1.2 is Gini ratio and Y2 is the level of poverty.

3. Result

3.1. The direct effect of infrastructure on growth and poverty

The results of the analysis showed that energy variables significant (0.000) negative (-0.161) on growth; and housing variables were significant (0.038) positive (0.31), clean water significant (0.010), positive (0.014); education significant (0.000) positive (0.067); and telecommunications significant (0.000) positive (0.039) against growth. While the relationship and education, variables have no effect on the growth of the effects of the infrastructure in the eastern part of Indonesia. The effect of infrastructure on the level of poverty is found: energy variables significant (0.000) positive (2.496); housing significant (0.000) negative (-1.169); clean water significant (0.001) negative (-0.203); and telecommunications significant (0.000) negatively (-0.404) against the level of poverty. Conversely, the variables of relationships, education, and health have no effect on the level of poverty.

3.2. The indirect effect of infrastructure against the level of poverty

The results of the analysis showed that energy significant (0.000) and positive (0.023); and transportation significant (0.000) positive (0.000) on poverty levels through economic growth and inequality. While the housing significant (0.000) negative (-0.044); clean water has a significant (0.000) negative (-0.002), education significant (0.000) negative (-9.743); health significant (0.000)
negative (-0.000) and telecommunications significant (0.000) negative (-0.005) against the level of poverty through growth and inequality of income.

4. Discussion
Infrastructure investments are essential to achieving economic development and improving and providing services or access for communities to take advantage of economic opportunities and contribute to growth. In addition, the trickle-down effect on economic development and redistribution to poor people also provides opportunities for the poor to get out of poverty. Statistical analysis shows that not all infrastructure in KTI is able to increase growth and reduce poverty and there are some infrastructures that are able to reduce poverty directly and there is also an indirect effect.

Srinivasu (2013)[6] and Gopalakrishna & Leelavathi (2011)[7] suggest that the infrastructure affects growth through increased productivity and efficiency. Infrastructure development will increase profits due to reduced production costs and increased market expansion. With the expansion of production, it has an impact on growth. Residential variables, clean water, healthcare, and telecommunications are the infrastructure that supports growth in KTI. Decent housing, clean water and access to health are able to provide the poor to survive the sick, improve the employment and in the end increase the income of poor people while access to Telecommunication makes it easier for people to obtain information that supports all their activities. On one side of education does not increase growth due to lack of educators and other school facilities so that the low number of school participation. The means of Nexus also very minimal with the low ratio of vehicles to the length of the road causes transport access is obstructed and leads to high costs as a growth barrier. On the other hand, electric energy has a negative influence on growth because the ratio of electrification in KTI is still low that is seen from low access to electricity because of the capacity of power plants lacking in Fulfill electricity demand.

Poverty reduction policies should focus on: social structures, such as health, nutrition, education, water, and sanitation systems; Agricultural production, including improving technology, rural infrastructures (such as roads, irrigation, and storage of facilities); Infrastructure, such as roads, ports, energy, and communications; Policy of Government industry that promotes economic activity. Statistical analysis found that significant positive-impact energy variables, in other words, the increase in energy infrastructure would increase poverty, these findings differed from the findings of Balisacan-Pernia (2002) [8] and Deininger-Okidi and Pueyo et al (2013) [9]. That renewable power generation capacity can lower poverty and improve prosperity through indirect effects of electricity availability in the production process.

Tunstall, et al (2013) stated that findings housing significant negative influential the relationship between poverty and housing due to high housing costs [10]. Desmond (2015) reaffirms that housing costs tend to increase while the poor income is stagnant and declining, other than that most poor families use more than half their income for the cost Housing [11]. While telecommunications significantly negative influence on poverty. The presence of telecommunication technology through Internet access makes communication more efficient in almost all cities/districts in KTI. The use of information and communication technology (ICT) is ensured to suppress high-cost economy, increase the absorption of labor and economic revenues, improve the welfare of the community, including the eradication of poverty, and increase the competitiveness of regional.

The results of the analysis showed that energy and relationship variables have a significant positive influence on poverty levels through growth and inequality, meaning that energy infrastructure and transportation are not able to make growth into inclusive/pro-poor growth, in other words, the relationship between the provision of energy infrastructure and the level of poverty is a direct relationship. While the variables of residential infrastructure, transportation, clean water, education, health, and telecommunications have a significant negative effect on poverty levels through growth and income inequality, in other words, variables This infrastructure makes inclusive/pro-poor growth.

Simulated results of economic growth determinants show that there is only increased economic growth and is accompanied by an increase in revenue but the growth is not followed by poverty
alleviation. This condition is in line with the concept of immiserizing growth, which is a poor growth by Bhagwati (1958)[12]. The findings show that to reduce the poverty rate in the eastern region of Indonesia is not enough simply to redistribute a more equitable income but must be ensured that the infrastructure project can be precisely targeted, namely Provide benefits to all walks of life in this context in accordance with the concept of Growth–Poverty–Inequality Triangle by Bourguignon (2008) [1] and McKay, Andy and Andy Sumner (2008) [13].

5. Conclusion
The direct influence of infrastructure on the level of poverty is significant positive energy infrastructure, while residential infrastructure, clean water, and telecommunications have significant negative influences. Statistical analysis results also found the direct influence of infrastructure on economic growth, which is a significant negative energy infrastructure, while residential infrastructure, clean water, education, and telecommunications are influential Significant positive. The indirect influence of infrastructure to the level of poverty is, energy infrastructure and relationships influence significant positive, while residential infrastructure, clean water, education, health, and telecommunications negatively affect Significant. Infrastructure development in eastern Indonesia will be more useful in alleviating poverty when development priorities in the provision of residential infrastructure, access to clean water, and quality of the telecommunication network. If the government wants to reduce poverty accompanied by increasing economic growth, the government should also prioritize education infrastructure through increased school participation rates. If the government wants to make infrastructure development in eastern Indonesia to increase growth, reduce revenue inequality with the final target of poverty reduction then infrastructure development priorities should be Focused on residential infrastructure, clean water, education, healthcare, and telecommunications.

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Appendixes

Appendix 1. The Direct Effect of Infrastructure on Growth and Poverty

| Variable   | Estimate | S.E. | C.R. | P     | Explanation |
|------------|----------|------|------|-------|-------------|
| Growth     | Energy   | -.161| .040 | -4.055*** | Significant |
| Growth     | Housing  | .031 | .015 | 2.071 .038 | Significant |
| Growth     | Transportation | .000 | .000 | -.016 .987 |
| Growth     | Clean Water | .014 | .005 | 2.577 .100 | Significant |
| Growth     | Education | .067 | .017 | 4.034 *** | Significant |
| Growth     | Health   | .004 | .005 | .845 .398 |
| Growth     | Telecommunication | .039 | .005 | 7.900 *** | Significant |
| Inequality | Growth   | -.002| .005 | -.278 .781 |
| Poverty    | Inequality | 72.712| 16.895 | 4.304 *** | Significant |
| Poverty    | Growth   | 3.886| 1.255 | 3.098 .002 | Significant |
| Poverty    | Energy   | 2.496| .486 | 5.130 *** | Significant |
| Poverty    | Housing  | -1.169| .170 | -6.878 *** | Significant |
| Poverty    | Transportation | -.004| .004 | -.976 .329 |
| Poverty    | Clean Water | -.203| .062 | -3.272 .001 | Significant |
| Poverty    | Education | .365 | .202 | 1.804 .071 |
| Poverty    | Health   | -.116| .060 | -1.948 .051 |
| Poverty    | Telecommunication | -.404| .073 | -5.539 *** | Significant |

Appendix 2. Indirect Effect of Infrastructure Against The Level of Poverty

| Indirect Effect | Estimate | P     | Explanation |
|-----------------|----------|-------|-------------|
| Energy          | 0.023    | 0.000 | Positive Significant |
| Housing         | -0.004   | 0.000 | Negative Significant |
| Transportation  | 0.000    | 0.000 | Positive Significant |
| Clean Water     | -0.002   | 0.000 | Negative Significant |
| Education       | -9.743   | 0.000 | Negative Significant |
| Health          | -0.000   | 0.000 | Negative Significant |
| Telecommunication | -0.005 | 0.000 | Negative Significant |