The Influence of Infrastructure on Inequality of Income Distribution in Eastern Indonesia

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Abstract

This quantitative research was on income inequality and infrastructure in Eastern Indonesia. This study investigates the impact of road, electricity, water, telecommunication, housing, education, and health infrastructure on income inequality from 2012 to 2018. Using panel data from 16 Eastern Indonesia provinces with 96 observations, this study combines cross-sectional data from 16 Eastern Indonesia provinces and six years of time-series data (2012, 2013, 2014, 2015, 2017, 2018). The results from the Fixed Effect Model by Panel Data indicate that (1) Road, electricity, water, housing, education, and health infrastructure were not significantly correlated with income inequality, and (2) Telecommunication infrastructure harmed income inequality. The implication is that in achieving a more just income distribution, the government should reexamine the distribution of infrastructure projects, i.e., road, electricity, water, housing, education, and health, that are being built. This can be done by focusing the projects on less developed areas.

Keywords: Income Inequality; Infrastructure; Eastern Indonesia.

Abstrak

Penelitian ini merupakan penelitian kuantitatif dari ketimpangan distribusi pendapatan dan infrastruktur di Kawasan Timur Indonesia. Tujuan penelitian ini adalah untuk mengetahui pengaruh infrastruktur jalan raya, listrik, air, telekomunikasi, perumahan, pendidikan, dan kesehatan terhadap ketimpangan distribusi pendapatan. Penelitian ini menggunakan data dari 16 provinsi di Kawasan Timur Indonesia. Metode yang digunakan dalam penelitian ini adalah data panel dengan jumlah observasi sebanyak 96 observasi. Data yang digunakan adalah kombinasi antara data kerat lintang sejumlah 16 provinsi dan data garis waktu selama 6 tahun (2012, 2013, 2014, 2015, 2017, 2018). Hasil penelitian dan hasil analisis data dengan Model Efek Tetap pada Data Panel menunjukkan bahwa: (1) Jalan raya, listrik, air, perumahan, pendidikan, dan kesehatan tidak berpengaruh signifikan terhadap ketimpangan distribusi pendidikan, (2) Telekomunikasi berpengaruh negatif terhadap ketimpangan distribusi pendapatan. Implikasi dari kesimpulan di atas yaitu dalam upaya menurunkan ketimpangan distribusi pendapatan, pemerintah sebaiknya memperhatikan persebaran pembangunan infrastruktur jalan raya, listrik, air, perumahan, pendidikan, dan kesehatan yang dikerjakan.

Kata kunci: *Ketimpangan Distribusi Pendapatan; Infrastruktur; Kawasan Timur Indonesia.*

INTRODUCTION

Inequality in income distribution is the difference in the proportion of aggregate income received by low-income and high-income people (Drennan, 2015, p. 8). This means income inequality is the unequal economic distribution of people's income. Currently, the measure commonly used by economists to measure inequality in income distribution is the Gini coefficient.

In the period 2012 to 2018, the Gini coefficient for Eastern Indonesia had a stagnant trend. In 2018, the Gini coefficient was 0.384, down slightly from 2012, which was 0.41

The United Nations Development Program (UNDP; 2017) states that one of the main factors causing inequality is the unequal distribution of socio-economic and physical facilities, such as roads, electricity, schools, hospitals, etc., between rural and urban areas. , as well as between one region and another. So, to achieve equal distribution of socio-economic and physical facilities and reduce inequality, infrastructure development is needed.

Infrastructure development can be carried out in physical infrastructure and social infrastructure. According to the Organization for Economic Cooperation and Development (OECD; 2019), social infrastructure comprises education, health, child care, and all other services, such as parks and recreation centers. In comparison, physical infrastructure includes water, roads, telecommunications, electricity, and housing.

Road infrastructure uses the ratio of the length of national roads, provincial roads, and district/city roads. In 2012, every kilometer of highway served 239 residents. The figure increased to 240 in 2014. In 2018, each kilometer of highway served fewer people than the initial year of the period, namely 238.

The electrical infrastructure uses the total electricity capacity produced by all power plants. In 2012, the electricity capacity produced was 18,737.46 MW. Electricity capacity consistently increased in 2014 and 2018 to 22,875.66 MW and 26,538.51 respectively.

Water infrastructure uses the volume of clean water distributed by clean water companies. In 2012, the volume of clean water distributed was 487,918 thousand cubic meters. The volume of clean water distributed increased in 2014 to 558,636 thousand cubic meters. At the end of the period, the volume of clean water distributed also increased to 705,638 thousand cubic meters.

Telecommunications infrastructure uses data on the percentage of households that have accessed the internet in the last three months. In 2012, the percentage who accessed it was 22.9%. The percentage increased in 2014 to 28% and increased sharply at the end of the period to 57%.

Housing infrastructure uses data on the percentage of houses with the largest non-ground floor. In 2012, the rate was at 92.8%. The percentage fell in 2014 to 92.1%. In 2018, the percentage increased again above the initial year of the period to 95.1%.

Educational infrastructure uses the indicator of the ratio of Senior High Schools (SMA) and Vocational High Schools per 10 thousand people aged 15-19 years. In 2012, there were 14.1 SMA/SMK for every 10 thousand residents. This number continued to increase in 2014 and 2018 to 14.7 and 16.2 schools, respectively.

Health infrastructure uses the ratio indicator of Community Health Centers (Puskesmas) availability for every 100 100,000 residents. In 2012, 8 Community Health Centers were serving 100 thousand residents. The number increased in 2014 to 8.3 and decreased in 2018 - although still higher than in the initial year of the period - to 8.1.

Several studies analyze the influence of infrastructure on income distribution inequality. UNDP (2017) states that one of the factors that drives inequality is the unequal distribution of socio-economic and

physical facilities. Apart from that, Maryati (2021) stated the importance of social facilities, in this case education, in increasing community prosperity and reducing inequality in income distribution. Research by Mendoza (2017), Danquah (2017), Hougbonon (2017), and Hooper (2018) confirms the UNDP statement. These studies both show that physical infrastructure (roads, electricity, telecommunications, and housing) can reduce inequality in income distribution. Suharno (2019), in his research, shows that high transportation and travel costs can reduce the community's tourism economy. In other research conducted by Keller (2010), Omar (2020), Dabla-Norris (2015), Wahyuni (2016), Coady (2017), Danquah (2017), and Padhan (2018), it was shown that education and health infrastructure reduces inequality income.

In theory, infrastructure is the primary facilitator of economic growth. Economic growth is a reflection of an increase in income. This means that two possibilities will happen. First, the increase in infrastructure provision is followed by an increase in low-income groups' income so that income distribution inequality will also decrease. However, if infrastructure provision only increases the high-income group, then inequality in income distribution will increase. BPS data shows that from 2012 to 2018, income distribution inequality in the Eastern Region of Indonesia experienced a stagnant trend, namely from 0.41 in 2012, decreasing slightly to 0.384. In fact, in the same period, the provision of several physical and social infrastructures has increased quite significantly. This fact is an interesting phenomenon that needs to be studied further; even though there has been a significant increase in infrastructure provision, inequality in income distribution follows a different pattern.

LITERATURE REVIEW

Omar (2020) researched the influence of physical infrastructure (roads, electricity, telecommunications) and social infrastructure (education and health) on inequality in income distribution. Using the *Principal Component method*, the results show that physical infrastructure positively influences inequality. Meanwhile, social infrastructure harms inequality in income distribution. This means that social infrastructure can reduce the level of income inequality.

Bajar and Rajeev (2015) examined the influence of road and electricity infrastructure on income distribution inequality. The panel data regression analysis used shows that road and electricity infrastructure have a positive influence on distribution inequality in low-income areas. In contrast, it has a negative influence in high-income areas.

Research conducted by Dabla-Norris (2015) analyzed the influence of education and health infrastructure on income distribution inequality. The analysis results using panel data show that the two variables have a negative effect or can reduce inequality in income distribution.

Coady and Dizioli (2017) researched the influence of educational infrastructure on income distribution inequality. The dynamic panel data analysis shows that educational infrastructure has an influence in reducing inequality in income distribution.

Mendoza (2017) examined the influence of electricity, water, and telecommunications infrastructure on income distribution inequality. The results of analysis using panel data analysis show that electricity infrastructure has a negative influence on inequality. Meanwhile, water and telecommunications infrastructure have a positive effect on inequality in income distribution.

Danquah (2017) analyzed the influence of road infrastructure, electricity, telecommunications, and education on

inequality in income distribution. The results show that physical infrastructure (roads, electricity, telecommunications) harms inequality. Meanwhile, educational infrastructure has not been proven to reduce inequality in income distribution.

Wicaksono (2017) researched the influence of educational infrastructure on income distribution inequality. The results of the *Shapley Value Decomposition Framework analysi*s show that inequality in educational infrastructure can increase inequality in income distribution.

Research conducted by Padhan (2018) analyzed the influence of physical infrastructure (roads, electricity, telecommunications) and social infrastructure (education and health) in India and China. Using *a Combined Cointegration analysis ARDL Bound Testing Approach to Cointegration,* the analysis results show that in India, physical infrastructure negatively influences income distribution inequality. Meanwhile, in China, the influence is positive. However, the difference in results in the two countries does not occur in social infrastructure because social infrastructure has an equal influence in reducing inequality in income distribution.

Hausa (2019) analyzed the influence of housing infrastructure on income distribution inequality. The results show that increasing people's access to housing infrastructure will lead to lower inequality in income distribution.

RESEARCH METHODS

This research uses a statistical method approach, namely a panel data regression model. The data used in this research is panel data from 16 provinces in Indonesia for 2012-2018. These data include one dependent variable and seven independent variables. These variables include:

1. Inequality of income distribution in 16 provinces of Eastern Indonesia from 2012 to 2018.
2. Infrastructure, consisting of roads, electricity, water, telecommunications, housing, education, and health infrastructure in 16 provinces of Eastern Indonesia for the 2012-2018 period.

The data used in this research is secondary data obtained from internet sources in the form of:

1. Ministry of Public Works, Public Housing, Statistical Information Book.
2. Central Statistics Agency (BPS) page.
3. Ministry of Education and Culture page.
4. Ministry of Health page.

Pooled Least Square (PLS) regression analysis tool to determine the magnitude of the influence of an independent variable on the dependent variable. This model uses a combination of time series and latitudinal data, usually called panel data.

The panel data regression model equation can be formulated in the model Y_{it}= α_{it}+β_1 X_{1it}+β_2 X_{2it}+β_3 X_{3it}+β_4 X_{4it}+β_5 X_{5it}+ $\beta_6 X_{6it}$ + $\beta_7 X_{7it}$ + μ_{it}, where *Y* is the income distribution inequality variable, and *X* is the seven infrastructure variables.

THEORETICAL FRAMEWORK

Income Distribution

Economic development is the main target of the majority of countries in the world. In traditional economics, a country's economic development indicator is an increase in national income. Income level is measured through Gross National Income (GNP), namely the population's total domestic and foreign output. When the increase in the national income level exceeds the population level, economic development occurs (Todaro, 2015). An increase in the level of national income is also known as economic growth.

The higher the level of economic growth, the greater the opening up of job opportunities and other economic opportunities. This mechanism is called the trickle-down effect. Trickle-down economics assumes that the main drivers of economic growth are investors, savers, and company

owners. Meanwhile, the general public is the group that receives "water drops." The three groups driving growth first gain profits through economic growth (Amadeo, 2018).

However, using economic growth as the only indicator of economic development has fundamental weaknesses. Economic growth only measures how much aggregate income the economy produces. Meanwhile, how aggregate income is distributed fairly in the population is still being determined. Therefore, high economic growth does not guarantee an increase in the income level of low-income groups (Fuente, 2016). This means that only three groups driving growth will enjoy an increase in the economic growth rate, while the general public, with its poverty, does not enjoy the trickle-down effect (Yoshida, 2014). Income distribution exists to answer how income is distributed in society.

The concept of income in income distribution must be clarified if you want to analyze income for years (Campano & Salvatore, 2006). Campano and Salvatore (2006) differentiate the definition of income between developed and developing countries. In developed countries, income is defined as all income generated before it is taxed. Sources of income can be wages and salaries, interest, rent and royalties, compensation, aid funds, pension funds, etc. Meanwhile, calculating income becomes irrelevant in developing countries due to various limitations in presenting income data, similar to developed countries. The solution is to calculate household consumption levels. Calculating consumption levels is essential for measuring consumption distribution and income because every good consumed has a market value that can be added to household income (Campano & Salvatore, 2006).

Meanwhile, the Central Statistics Agency (BPS; 2019) defines household income as the income received by the household concerned, whether it comes from the income of the head of the household or the income of household members. Household income can come from remuneration for labor production factors (wages and salaries, profits, bonuses, etc.), capital remuneration (interest, profit sharing, etc.), and income from other parties' gifts. (transfer) (BPS, 2019).

The distribution of income depends on the ownership of production factors, be it land capital, including the value of the labor owned and the role of each factor in the production process. Ownership of land and capital is usually highly centralized, so anything that increases profits relative to these factors of production can create an unequal distribution of income. On the other hand, higher wages for production factors widely distributed in developing countries, namely informal workers, tend to make income distribution more equal (Perkins, 2013).

There are two types of income distribution measurements: personal income distribution and functional income distribution. Personal income distribution is the total income received by individuals or households, regardless of where the income comes from. Meanwhile, functional income distribution is the distribution of income towards production factors (labor, land, capital) without paying attention to the ownership of these production factors (Todaro, 2015).

Income inequality is the disproportionate distribution of total national income among households (Todaro, 2015). Income inequality relates to income distribution in terms of which groups receive the least or greatest income. Income inequality is an effort to compare income groups, namely high, middle, and low-income groups.

Infrastructure

Infrastructure is the basis of economic development. Infrastructure is the foundation on which production factors interact to produce output (Rouhani, 2016). Infrastructure is a cumulation of various economic components such as rules,

supplies, and measures that drive the economic potential of economic agents.

Infrastructure, often called *social overhead capital*, includes all services without which primary, secondary, and tertiary production activities cannot function. Services here are all public services, ranging from law and security through education and health to transportation, communications, electricity, and water, as well as agricultural capital such as irrigation and drainage systems.

Infrastructure has unique qualities that differentiate it from other economic sectors. These uniqueness include:

a. Public goods. Most physical infrastructure services have some element of public goods in them. These services are available to the public, and people may be charged additional fees to enjoy the services or not charged at all. Because it is a public good, infrastructure services must be used by people who choose not to pay any costs.
b. Externalities. The social benefits of infrastructure far exceed the costs of providing its services. As a result, pricing becomes difficult, making it difficult to determine prices for infrastructure services that can recover the costs of providing them.
c. Monopoly. It is challenging to eliminate monopolies and regulations in providing infrastructure. The inherent properties of the infrastructure prevent it from giving rise to more than one service provider.
d. Public sector dominance. The existence of externalities, especially in the field of social welfare, causes domination by the public sector in terms of production and supply of infrastructure services.
e. Full investment (*lumpy investment*). In general, infrastructure prospects require *a lump-sum* investment; spending on a part of the project can only be helpful after the entire part of the project has been completed and is ready to operate.
f. Indivisibilities. Round sum investments result from the indivisibility of infrastructure. The service provider cannot divide and re-divide the project into small parts for each to be operated.

Infrastructure is divided into two types, namely physical infrastructure and social infrastructure.

1. Physical infrastructure

   Physical infrastructure is closely related to the needs of the production sector, such as agriculture, industry, trade, etc. Physical infrastructure devices include roads, electricity, water, telecommunications, housing, etc.
2. Social Infrastructure

   Social infrastructure is closely related to devices that meet the basic needs of society, such as education and health.

   Education and health are the main goals of development. Education is essential to a comfortable and rewarding life. Education plays a vital role in developing countries' ability to absorb modern technology and develop the capacity for independent economic growth and development. Health is also essential for well-being. Good health can increase human productivity. Therefore, health is one of the main prerequisites for quality education (Todaro, 2015).

RESULT AND DISCUSSION

The Influence of Infrastructure on Inequality of Income Distribution

Based on the results of the panel data regression test for the 2012-2018 period, it can be seen that the model has an *adjusted value* R^2 amounting to 0.713740. These results show that the independent variables can explain the dependent variable by 71%. Other variables outside the model explain the remaining 29%.

The influence of infrastructure on income distribution inequality in the Eastern Region of Indonesia is analyzed using panel data regression analysis in the 2012-2018 period. The results of the analysis are presented in table 1 below.

Table 1. Panel Data Regression Test Results

Variable	**Coefficient**	***P - Value***
C	0.250207	0.0901
Highway	0.000159	0.2580
Electricity	1.75E-06	0.7071
Water	-1.82E-07	0.4642
Telecommunication	- 0.000884	0.0018
Housing area	0.000813	0.4380
Education	0.005066	0.1037
Health	-0.003671	0.7215
$AdjustedR^2$	0.719860	

Source: Secondary data, processed (2021)

The significant variable is telecommunications infrastructure, with *a p-value* below alpha of 5%. Meanwhile, road infrastructure, electricity, water, housing, education, and health variables do not significantly influence income distribution inequality.

The results of the panel data regression t-test (Table 1) show that telecommunications infrastructure negatively and significantly influences income distribution inequality. The coefficient for the telecommunications infrastructure variable is – 0.000884 with a p-value of 0.0018, indicating that a decrease will follow a 1% increase in educational infrastructure in income distribution inequality of 0.0009%.

The estimation results show that inequality of opportunity is more significant for men and the elderly than for women and young people and is more significant in Togo urban areas. In addition, state variables such as 'residence' and 'region' are vital in explaining opportunity gaps in access and use of telecommunications services (Wonyra, 2021). Telecommunications infrastructure has a significant role in encouraging economic activity, especially in the 21st century. Telecommunications enables the exchange of information between economic actors to work together to increase the scale of their respective businesses. This will decrease the unemployment rate due to the increasing need for business actors to accommodate the increasing scale of business. Apart from that, telecommunications also allow the public to have smooth access to information. In the short term, telecommunications allows people to search for the information they need to earn more significant income. The choice of opportunities for better jobs becomes more varied. Meanwhile, in the medium and long term, telecommunications can be a means for people to gain knowledge and hone their skills. The internet in the 21st century has become an online library where all sources of knowledge and expertise are widely available.

The influence of telecommunications infrastructure, both on large-scale economic actors and on individual scales, is essential in efforts to increase aggregate income. The labor absorption reflects that more people have income and contribute to aggregate income on an individual scale. Individuals with access to information about the world of work or knowledge and skills online have a more significant opportunity for a greater income. Thus, its contribution to aggregate income is more significant. If these two contributions are contributed by lower economic groups, then inequality in income distribution can be reduced. This research proves this mechanism.

The increase in telecommunications infrastructure, which is reflected in the percentage of households accessing the internet in the last three months from 2012-2018, has resulted in a decline in income distribution. The increasing number of

households accessing the internet means more individuals are accessing the information and knowledge they need to work. This will encourage a collective change in individual status from not working to working or working with a low income to a higher income. As a result, the contribution of low-income groups to aggregate income is getting higher. Inequality in income distribution can also be reduced.

CONCLUSION

Based on the results of the analysis of the influence of road, electricity, water, telecommunications, housing, education, and health infrastructure on income distribution inequality in the Eastern Region of Indonesia in 2012-2018, several conclusions were obtained:

1. Road, electricity, water, housing, education, and health infrastructure do not have a significant influence on income distribution inequality.
2. Telecommunications infrastructure, as indicated by the percentage of households that have accessed the internet in the last three months, negatively and significantly influences income distribution inequality. The influence of telecommunications infrastructure on income distribution inequality is 0.000884. These results show that the availability of good telecommunications infrastructure can increase citizens' income. Access to telecommunications infrastructure encourages citizens to have good information and knowledge. Good information can open up people's opportunities for available jobs, preventing them from being without income for a long time. Meanwhile, good knowledge can improve residents' skills, so opportunities for jobs with higher incomes are wider open.

REFERENCES

Amadeo, K. (2021, March 29). *Why Trickle-Down Economics Works in Theory But Not in Fact*. Retrieved March 30, 2021, from The Balance - Make Money Personal: https://www.thebalance.com/trickle-down-economics-theory-effect-does-it-work-3305572

Bajar, F., & Rajeev, M. (2015). "The Impact of Infrastructure Provisioning On Inequality: Evidence From India". *Global Labour University working paper No. 35*.

Campano, F., & Salvatore, D. (2006). *Income Distribution.* New York: Oxford University Press.

Coady, D., & Dizioli, A. (2017). "Income Inequality and Education Revisited : Persistence, Endogeneity, and Heterogeneity". *IMF Working Papers No. 17/126*, 1-22.

Dabla-Norris, E., Kochnar, K., Suphaphiphat, N., Ricka, F., & Tsounta, E. (2015). "Causes and Consequences of Income Inequality: A Global Perspective". *International Monetary Fund SDN/15/13*, 1-39.

Danquah, M., & Ohemeng, W. (2017). "Unmasking the Factors behind Income Inequalities in Ghana". *International Journal of Social Economics, Vol. 44 No. 7*, 884-899.

Drennan, M. P. (2015). *Income Inequality: Why It Matters and Why Most Economists Didn't Notice.* New Haven: Yale University Press.

Fuente, B. P. (2016). "Economic Growth and Poverty Reduction in a Rapidly Changing World". *European Economy Economic Briefs Issue 19*, 1-24.

H., P., Rahman, M., & Haouas, I. (2018). Income Inequality in India and China: The Role of Infrastructure Development, Human Capital Formation and Remittance Inflows. *USQ Publication*.

Maryati, A., Gunawan, D. S., & Suharno, S. (2021). "Inequality Between the Region in the Province of Central Java 2012–2016". *ICORE*, *5*(1).

Mendoza, O. M. (2017). "Infrastructure Development, Income Inequality and Urban Sustainibility in the People's Republic of China". *ADBI Working Paper 713*, 1-27.

Omar, M.A. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal of Economic Structures*, *9*(1), ISSN 2193-2409, https://doi.org/10.1186/s40008-020-00214-4

Organization for Economic Cooperation and Development. (2019, March 7). *Gender Equality and Sustainable Infrastructure.* Retrieved March 30, 2021, from OECD.org - OECD: http://www.oecd.org/gov/gender-mainstreaming/gender-equality-and-sustainable-infrastructure-7-march-2019.pdf

Perkins, D. H., Radelet, S., Lindauer, D. L., & Block, S. A. (2013). *Economics of Development, Seventh Edition.* New York: W. W. Norton & Company.

Rouhani, O.M. (2016). Social welfare analysis of investment public-private partnership approaches for transportation projects. *Transportation Research Part A: Policy and Practice*, *88*, 86-103, ISSN 0965-8564, https://doi.org/10.1016/j.tra.2015.11.003

Suharno, & Sudjarwanto (2019). "The Travel Cost Approach for the Demand Natural Tourism Object of Cipendok Waterfall". *IOP Conf. Ser.: Earth Environ. Sci.* **250** 012047. https://doi.org/10.1088/1755-1315%2F250%2F1%2F012047

Todaro, M. P., & Smith, S. C. (2015). *Economic Development, 12th Edition.* Boston: Pearson Addison Wesley.

United Nations Development Programme. (2017). *Income Inequality Trends in sub-Saharan Africa.* New York: UNDP Regional Bureau for Africa.

Wicaksono, E., Amir, H., & Nugroho, A. (2017). "The Sources of Income Inequality in Indonesia: A Regression-Based Inequality Decomposition". *ADBI Working Paper Series Paper 667*, 1-12.

Wonyra, K.O. (2021). Inequalities of opportunity in the access and use of telecommunication services in Togo. *Telecommunications Policy*, *45*(5), ISSN 0308-5961, https://doi.org/10.1016/j.telpol.2021.102123