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Income Inequality Complexity in Yogyakarta Province: Poverty-Growth-Inequality Triangle Nexus

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Abstract: Income inequality is an important indicator because it can hinder the economic development process. Yogyakarta Province was the region with the highest income inequality among 33 other provinces in Indonesia, with the Gini ratio at a moderate level. The government still had not succeeded yet to overcome income inequality as their Gini ratio is always above the national level and still at a moderate level for the 2010-2021 periods. Therefore, this study aims to analyze income inequality complexity in Yogyakarta Province using the Poverty-Growth-Inequality Triangle model approach. Panel data from five districts/cities in Yogyakarta Province were used from 2010 to 2021. For the quantitative study, a Simultaneous Equation Model analysis with three iterations of least squares is performed. The results showed that income disparity has no reciprocal link with economic growth but does have one with poverty; poverty then has a reciprocal relationship with economic growth, and education and the district minimum wage have a partially meaningful impact on income inequality. Therefore, local governments can formulate policies related to reducing income inequality through improvements in education and its inequality, equity in the district minimum wage, equity the economic growth, and efficiency in the use of fund allocation related to reducing income inequality.
Keywords: Income Inequality; Economic Growth; Poverty
JEL Classification: I31; O11; O15; O40

Introduction

Development economics has prioritized economic growth since the 1950s, placing inequality as a secondary priority. It is predicated on the idea that growing inequality in emerging nations was to be expected, essentially unavoidable, and not something to worry about as long as poverty was decreasing. According to another opinion, policies to reduce inequality often inhibit economic progress and efforts to eradicate poverty (Ravallion, 2014). Then, in the 2000s, a fresh issue called into doubt this long-standing pro-poor viewpoint. Equity was revealed to be a crucial tool for achieving other essential objectives, such as human development and poverty alleviation. The country's development will be viewed as being threatened by high inequality.

One of the Sustainable Development Goals (SDGs) agenda objectives is inequality. Unchecked income inequality can impede economic growth in a number of different routes (Wan et al. 2006). The rapid economic growth and reduction of poverty in China between 1980 and 2000 did not account for the existence of income inequality, which increased the likelihood of future poverty (Wan, 2008). Also, income inequality adversely affects the provision of public goods and services because elites are more powerful (Bourguignon & Dessus, 2009). Therefore, income inequality can affect both an economic and social perspective.

One of the measures used to describe inequality is the Gini ratio, which is calculated by the Central Bureau of Statistics. Figure 1 shows the Gini ratio and its progress for 2010-2021 in Indonesia and Yogyakarta Province. As illustrated in Figure 1, during the period 2010–2021, the movement of the income Gini ratio in Indonesia showed an improvement, from the Gini ratio with a moderate level (> 0.4) in the 2011-2013 period to a low level (< 0.4), which was 0.384 in 2021. However, several regions have a Gini ratio at a moderate level.

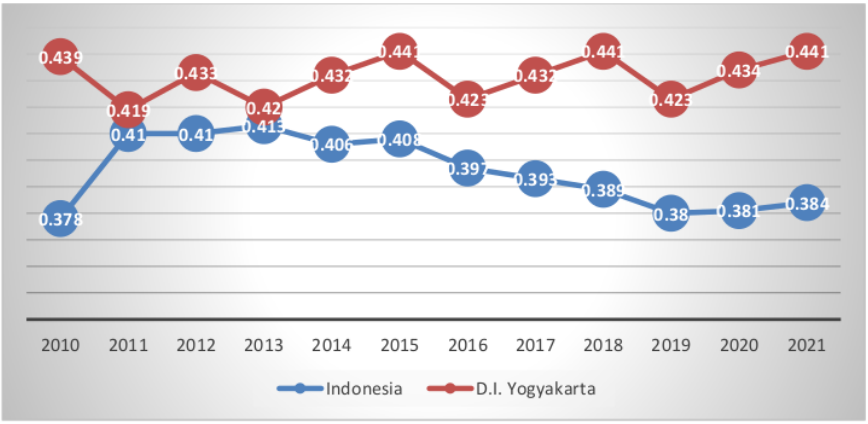

Figure 1. The Evolution of The Gini Ratio in Yogyakarta Province and Indonesia for the Period 2010-2021.

According to a comparison of 33 provinces, Yogyakarta Province had the highest Gini ratio in 2021. Yogyakarta Province's average Gini ratio between 2010 and 2021 was greater than 0.4 (moderate category), consistently exceeding the level of inequality in the country. The wealthiest 20% of the population spend the majority of money in Yogyakarta Province, accounting for 50% of all expenditures. The lowest 40% of the population, however, made up only 15% of the population overall. According to the world bank, moderate inequality exists when the percentage of the bottom 40% is between 12 and 17%. Hence, this expenditure distribution data also stated that there is a moderate level of income inequality in Yogyakarta Province.

Income disparity research is constantly expanding. Income inequality has been examined on how it interacts with macro indicators like economic growth and poverty since David Ricardo introduced the Political Economy Principle in 1817 (Ferreira, 2010). According to a study by Breunig and Majeed (2020), when a region has a high rate of poverty, income disparity has a negative effect on economic growth that gets worse. According to a different viewpoint, the rate of economic growth acceleration, the decline in inequality, and the eradication of poverty are all directly tied to the level of development being pursued by a nation (Todaro, 2012). To comprehend the development process in Asia, it is necessary to conduct a systematic, thorough, and cogent analysis of income inequality, economic growth, and poverty (Wan et al., 2020).

The Poverty-Growth-Inequality (PGI) triangle model is based on the relationship between income inequality, economic growth, and poverty. According to Bourguignon (2004), who used the PGI model, there is a mechanical relationship between income inequality, economic growth, and poverty. Changes in poverty are caused by changes in people's average income and educational inequality. Wan (2008) used the PGI model in his study in China from 1980 to 2000. Guiga and Rejeb (2012) explained the PGI triangle relationship in developing countries using the simultaneous equation model.

Poverty, economic growth, and inequality are macro targets in the development planning document (RPJMD) of Yogyakarta Province for the 2017-2022 period. At the end of the planning period in 2022, government targets are economic growth at 5.34%; the poverty rate at 7%; and income inequality with a Gini ratio of 0.3635.

The growth in Yogyakarta Province fluctuates with an average growth of around 5 % during the 2010-2021 period. The economic slowdown occurred in 2020, when economic growth was -2.68 %, due to the Covid-19 pandemic, but the economy bounced back in 2021 at 5.53 %. In 2021, the manufacturing sector was the largest contributor to the economy of Yogyakarta Province (12.36%), followed by the information and communication sector (10.72%), and the construction sector (10.14%). Meanwhile, based on expenditure, is dominated by household consumption (62.19%) and Gross Fixed Capital Formation (32.13%). When compared with the target in the development planning, economic growth has already reached the target.

Data for poverty shown in Figure 2, there is an improvement in poverty alleviation efforts by the government from a 15.63% poverty rate in 2010 to 12.8% in 2021 (Central Bureau of Statistics, 2022). However, the poverty rate in Yogyakarta Province is still above the national poverty level, Indonesia's poverty is 10.14% (2021). Furthermore, the poverty rate in Yogyakarta Province in March 2022 was 11, 34% is still far from the target at the end of the planning period on their development net planning document. Kulonprogo and Gunungkidul have the highest poverty rates, reaching more than 20 % during the 2010-2016 period.

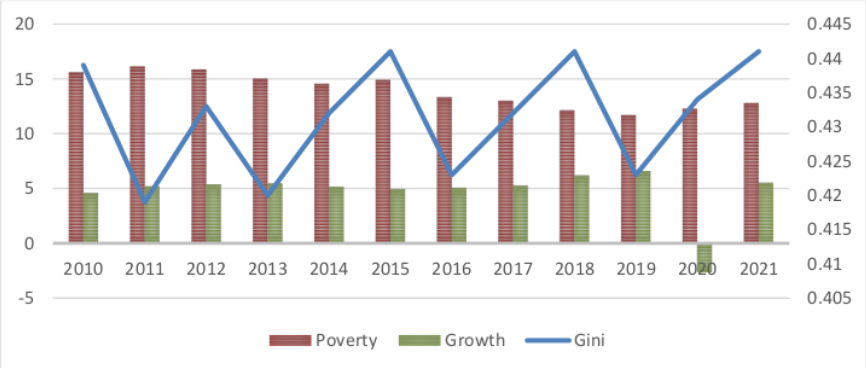

Figure 2. The Evolution of Poverty, Growth, Inequality in Yogyakarta Province Period 2010 – 2021

The Gini ratio in March 2022 reached 0.439, which is still at a moderate level. According to the type of region, the Gini ratio in urban areas was 0.446 while in rural areas it was

0.332. This difference shows that urban areas tend to be more unequal than rural areas. Urban areas tend to have more types of job fields with more varied levels of wages so that the incomes of the population are more diverse than those in rural areas. Kulonprogo and Gunungkidul have low-income inequality, while Bantul, Sleman, and Yogyakarta have moderate income inequality.

According to the data, it can conclude that the government has not succeeded in reducing income inequality from a moderate level to a low level. Various studies have been conducted regarding inequality in Yogyakarta Province. The study by Yuliani et al. (2021) on the determinant of income inequality in Yogyakarta Province used panel data for the period 2011-2017 with the variables Regional Gross Domestic Product (RGDP), human development index, and district minimum wage. Another study by Suryani & Woyanti (2021) on the effect of the Human Development Index (HDI), district minimum wages, economic growth, and unemployment on income inequality in Yogyakarta Province using panel data with the fixed effect model for the period 2010-2018. Dewi & Rachmawati (2020) also conducted a study on poverty and income inequality in Yogyakarta Province with the conclusion that HDI, RGDP, general allocation funds, and local original income affect the income inequality of the district in Yogyakarta Province. Figure 3 explained that a study using the PGI model (Nikoloski & Gveroski, 2017) approach has been carried out in Indonesia by Silva & Sumarto (2013) using regression-based decomposition analysis, but no one has conducted a study on income inequality through the PGI model in Yogyakarta Province. Referring to Bourguignon (2004), we assume that changes in income inequality are also caused by changes in economic growth and poverty so there is a complex relationship such as reciprocity between poverty, growth, and inequality in Yogyakarta Province.

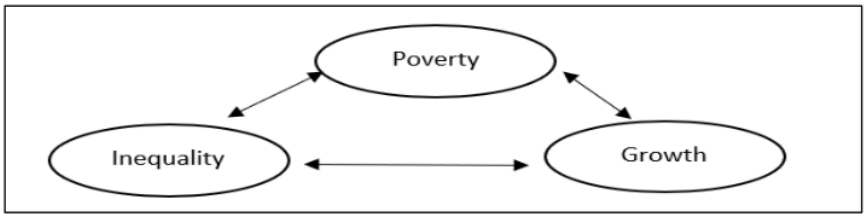

Figure 3. The Poverty, Growth, and Inequality (PGI Triangle).

The purpose of this paper is to examine the relationship between income inequality, economic growth and poverty in Yogyakarta Province using the PGI Triangle Model. This paper's writing is organized as follows. Section 2 discusses the research methodology, which is linked to the relevant analytical techniques and the model used. The empirical results of the chosen model will be presented in Section 3: Results and Discussion. Section 4 concludes with policy implications and recommendations for local governments.

Research Method

This study relies on secondary data from the Central Bureau of Statistics. Panel data were used in 5 districts/cities of Yogyakarta Province from 2010 to 2021. The data collected include the Regional Gross Domestic Product (RGDP), the number of poor people (Pov),

the Gini ratio (Gini), the open unemployment rate (Un), gross fixed capital (Inv), the average length of schooling (Edu), and district minimum wage (Wage).

The quantitative analysis is used in the form of simultaneously the interdependence between poverty, growth, and inequality using a system of simultaneous equations model. This model is used because it allows for a reciprocal relationship between variables (Guiga & Rejeb, 2012). The estimation in the simultaneous equations is done by considering the information in other equations, so the relationship becomes very complex. In addition, this model can also be used to analyze the two-way relationship between the variable (Suriani & Chenny, 2022). The estimation method in this study is three-stage-least-square (3SLS). 3SLS is used because it is asymptotically more normal and consistent under certain conditions, as well as asymptotically more efficient than single equation estimates (Zellner & Theil, 1962). 3SLS is also more efficient than 2SLS because it allows for the correlation of unobserved disturbances across multiple equations (Bakhsh et al., 2017). The model is based on Guiga and Rejeb's (2012) model, with modifications. In this study, the simultaneous equations model's system is as follows:

$$\mathrm{LnRGDP_{it}} = \propto_1 + \beta_{11}\mathrm{LnPov}_{\mathrm{it}} + \beta_{12}\mathrm{LnGini_{it}} + \beta_{13}\mathrm{Inv_{it}} + \varepsilon_{1\mathrm{it}} \quad (1)$$

$$\mathrm{LnPov_{it}} = \propto_2 + \beta_{21}\mathrm{LnGini_{it}} + \beta_{22}\mathrm{LnRGDP_{it}} + \beta_{23}\mathrm{LnEdu_{it}} + \beta_{24}\mathrm{Un_{it}} + \varepsilon_{2\mathrm{it}} \quad (2)$$

$$\mathrm{LnGini_{it}} = \propto_3 + \beta_{31}\mathrm{LnPov_{it}} + \beta_{32}\mathrm{LnRGDP_{it}} + \beta_{33}\mathrm{LnWage}_{\mathrm{it}} + \beta_{34}\mathrm{Edu}_{\mathrm{it}} + \varepsilon_{3\mathrm{it}} \quad (3)$$

This system of equations includes three structural models. The first model expresses the economic growth equation. The second model represents the poverty equation and the third model is the income inequality equation. The endogenous variables on the system equation are RGDP, poverty (Pov), and income inequality (Gini) in terms of the natural logarithm (Ln) as their growth rate. The predetermined variables are investment (Inv), unemployment (Un), education (Edu), and district minimum wage (Wage).

The steps for this research method are as follows. First, we will test the simultaneity problem or endogeneity of the variables LNRGDP, LnPov, and LnGini using the Hausman Simultaneity Test (Gujarati, 2009). Second, we identify the structural equation to ensure the 3SLS estimation method can be used. 'K' is the sum of predetermined variables in the system and k is the sum of predetermined variables in each structural equation. 'm' is the sum of endogenous variables in each structural equation. The structural equation is Over-identified if K-k > m-1, Exactly-identified if K-k = m-1, and Under-identified K-k < m-1 (Gujarati, 2009). For estimation to be carried out, the equation identification results must be exactly identified or overidentified (K-k > m-1).

Third, we estimate the system equation model using STATA using the 3SLS approach. Fourth, the estimation of the model must typically be checked for the classical assumptions using the normality test, heteroscedasticity test, multicollinearity test, and autocorrelation test (Karina et al., 2021). The purpose of these assumptions is to guarantee that the estimators are the Best Linear Unbiased Estimators (BLUE). The assumption of autocorrelation is unnecessary because we are using panel data. The F-test and t-test are employed to examine the impact of the independent variable on the dependent variable.

Result and Discussion

Before estimating the model, we performed the Hausman Simultaneity Test. The null hypothesis indicates that an Ordinary Least Square (OLS) estimator will be consistent and a rejection of the null hypothesis indicates that OLS will be not consistent so instrumental variable techniques are required such as the simultan equation model (Omri, 2013). Table 1 provides information about the Hausman Simultaneity Test in the system equations. Res_1 significant at 5 % shows that there is a simultaneity problem between LnRGDP and LnPov. Res_2 is also significant at 5 % showing that there is a simultaneity problem between LnRGDP and LnGini. Res_3 significant at 10 % shows that there is a simultaneity problem between LnPov and LnGini. These results support that a simultan equation model is more appropriate to use.

Table 1. Result of Hausman Simultaneity Test

Variables	Residual	Statistics	Probability
LnRGDP-LnPov	Res_1	2.94	0.005
LnRGDP-LnGini	Res_2	-2.12	0.039
LnPov-LnGini	Res_3	-1.93	0.059

The simultaneous model in this study has three structural equations with three endogenous variables (m=3) and four predetermined variables (K=4) in the system equation. The findings of the identification models are reported in Table 2. For the LnRGDP model, since K-k > m-1, the equation is overidentified. For the LnPov model and LnGini, since in their K-k = m-1, each equation is exactly identified. These identification results show that the 3SLS estimation method can be carried out.

Table 2. Results of Structural Model Identification

Structural Equation	K	k	m	K-k	m-1	Identification
LnRGDP	4	1	3	4-1 =3	3-1 =2	Overidentified
LnPov	4	2	3	4-2 = 2	3-1 =2	Exactly identified
LnGini	4	2	3	4-2 = 2	3-1 =2	Exactly identified

The estimation result can be shown in Table 3. To ensure the estimation result is BLUE, it is necessary to do some classical assumption tests (normality, heteroscedasticity, and multicollinearity). For normality assumption, on overall system normality test using the Anderson-Darling Z test shows that the statistic value is 0.0092 with the probability is 0.9885. It can conclude that the overall system fulfils the normality assumption as its p-value is not significant at level 5%. For the heteroscedasticity assumption, on overall system heteroscedasticity test using the Breusch-Pagan LM test shows that the statistic value is 5.4425 with the probability being 0.1421. It can conclude that there is no heteroscedasticity problem as its p-value is not significant at level 5 %. For multicollinearity based on the cross-correlation among variables shows that the majority correlation value is low, except for the correlation between the LnRGDP and Inv variables, which is fairly high (0.8690). However, this study uses simultaneous equation models, which be used to develop accurate final multiple regression models when collinearities among explanatory variables are thought to be present, then this is not a problem (Graham, 2003).

Based on the F- test, each equation, LnRGDP, LnPov, and LnGini is significant as its p-value is lower than 0.05 (significant at alpha 5%). The growth of poverty and income inequality, and investment togetherly have significant effects on economic growth. Meanwhile, economic growth, the growth of income inequality and education, and unemployment togetherly have effects on poverty growth. Moreover, the economic growth, the growth of poverty, education, and district minimum wage togetherly have significant effects on income inequality growth.

On the economic growth (LnRGDP) model, poverty has a negative effect on economic growth. It means that an increase in poverty growth by 1 % will reduce the economic growth by 0.268 %. This result is in line with the study by Perry et al. (2006), poor regions are unable to contribute to national growth. Poverty has a negative impact on economic growth caused by limited access to credit and financial funding, and health problems that can interfere with productivity and low levels of education so their human capital stock is also of low quality.

Table 3. Result of Estimation of Simultaneous Equation

Three-Stage-Least-Square			
Equation	**Observation**	**'R-Sq'**	**Probability**
LnRGDP	60	0.738	0.000*
LnPov	60	0.487	0.000*
LnGini	60	0.481	0.000*
LnRGDP	**Coefficient**	**t-student**	**Probability**
Cons	17.105	34.80	0.000*
LnPov	-0.268	-2.78	0.005*
LnGini	0.120	0.31	0.757
Inv	1.62e-7	9.79	0.000*
LnPov	**Coefficient**	**t-student**	**Probability**
Cons	-3.431	-1.01	0.310
LnGini	-1.424	-2.03	0.042**
LnRGDP	0.603	3.36	0.001**
LnEdu	-1.269	-2.24	0.025**
Un	-0.175	-3.57	0.000*
LnGini	**Coefficient**	**t-student**	**Probability**
Cons	-6.872	-6.78	0.000*
LnPov	0.105	1.12	0.263
LnRGDP	-0.027	-0.39	0.694
LnWage	0.341	5.44	0.000*
LnEdu	0.475	1.72	0.086***
Endogenous variables: LnRGDP, LNPov, LnGini			
Exogenous variables: Inv LnEdu Un LnWage			

Note: Indicates significance: *at the 1% level, ** at the 5% level, *** indicates at 10% level.

On the other hand, in the poverty (LnPov) model, economic growth has a significant positive effect on poverty. An increase in economic growth by 1 % will increase poverty growth by 0.603 %. The possibility of a positive association between economic growth on poverty cannot be ruled out (Gupta & Mitra, 2004). This positive result can happen because

income inequality in the region is still high. As the results of a study by Wan (2008), rapid economic growth in China without considering income inequality can trigger new poverty.

According to the economic growth model, income inequality has little effect on economic growth. This is consistent with the findings of Bennos and Karragianis (2018), who discovered that changes in income inequality have no effect on economic growth. Similarly, in the income inequality model, economic growth has no effect on income inequality. This finding is consistent with the findings of Niyimbanira (2017), who discovered that economic growth reduced poverty but had no effect on income inequality in the province of South Africa. These results could be happened due to the inequality in economic growth among the districts/city in Yogyakarta Province. For example, in 2018-2019, the construction of the Yogyakarta International Airport (YIA) in Kulonprogo drove economic growth to reach more than 10 %. Kulonprogo's (2019) economic growth reached its peak on 2019, which was about 13.49 %, while other regions only reached an economic growth of around 5-6 %. According to the Gini ratio, Kulonprogo has a low-income inequality during the 2010-2021 period (< 0.4) with values that tend to be consistent.

As illustrated in Table 3, On the poverty model, income inequality significantly affects poverty, an increase of 1 % in the growth of the Gini ratio will reduce poverty growth by 1.423 %. On the other side, poverty does not significantly affect income inequality. This is in line with a study by Suriani, et al. (2020) found that there is a one-way causal relationship between income inequality and poverty, in which income inequality has a significant effect on poverty in the long run. There is an odd phenomenon of income inequality and poverty in Yogyakarta Province. Kulonprogo and Gunungkidul are regions with lower income inequality but higher poverty rate compared to other regions. In addition, based on the Poverty Severity Index (P2), which shows the disparity in spending between the poor, both districts have a higher P2 index value than other regions. When overall the income Gini ratio in Kulonprogo and Gunungkidul has a low value, however, inequality among the poor is even higher than in other districts. This causes poverty to not affect income inequality because the poverty level in some areas of Yogyakarta Province is still relatively high and there is still a disparity in spending among the poor themselves. On the poverty model, unemployment has a significant effect on poverty. This is in line with the study by Wintara et al. (2021) found that the unskilled workers in Aceh cause a person's opportunity to become a manual worker to be greater so that they will earn relatively small incomes and the opportunity to be poor is greater even though they are already working.

Furthermore, on the income inequality model, the district minimum wage has a significant effect (alpha 5%) and education growth also has a significant effect (alpha 10%) on income inequality. An increase in district minimum wage growth by 1 % will increase Gini ratio growth by 0.341 %. An increase in education growth by 1 % will increase Gini ratio growth by 0.475 %. This is in line with research by Sungkar et al. (2015), Hidayat et al. (2020), and Suryani & Woyanti (2021), the increase in the district minimum wage shows that the price of labour is getting more expensive so it can cause a decrease in demand for labour. The decline in the demand for labour will cause unemployment to increase and more people without an income so income inequality is higher. As the neoclassical theory stated that an increase in the minimum wage of workers will increase income inequality because a non-market will be instrumental in setting the minimum threshold in the labour market so the demand for labour will be decreasing (Yuliani et al., 2021).

The education variable has a significant positive effect on income inequality. This is in line with the research findings of Battiston et al. (2014) in Latin American countries that an increase in the education sector increases inequality due to the convexity of returns to education on the labour market. However, investments in education are still needed because of the many positive implications for economic growth, poverty alleviation, inequality of opportunity, and others. The result of the study by Suriani, et al. (2021) found that distribution in education, such as from zakat, is beneficial in achieving sustainable development goals.

Table 4 illustrated the effort of the local government of Yogyakarta Province to overcome income inequality. In the last five years, from 2017 to 2021, the government of Yogyakarta Province has established programs and activities designed by the Regional Development Planning Agency of Yogyakarta Province to overcome income inequality. The budget for reducing income inequality continues to increase from 58,40 billion rupiahs in 2017 to 324,82 billion rupiahs in 2021. This budget should be a potential for the government to overcome inequality. The conventional neoclassical model stated that an increase in government expenditure on the productive side will reduce income inequality in the long run (Turnovsky & Erauskin, 2022).

Table 4. The Government Budget of Yogyakarta Province Related to Reducing Income Disparity from 2017 to 2021

No	Year	Programs	Activities	Budget (Billion Rupiah)	Gini Ratio
1	2017	5	7	58,40	0.432
2	2018	5	17	163.00	0.441
3	2019	5	17	163.00	0.423
4	2020	5	17	163.00	0.434
5	2021	13	17	324.82	0.441

In 2022, they focus on equitable development such as increasing access to health services, education, and infrastructure that all people can feel. These policies are expected to increase HDI, as a result of a study by Suryani & Woyanti (2021) stated that increasing HDI will reduce income inequality. Labour productivity will rise when the quality of HDI is getting better. The income received by the workers is even more and community welfare is more evenly distributed (Fadliansah, et al., 2021). Policies that include education as one of the main focuses are appropriate to the results of this study.

Based on the results imply that economic growth and poverty are not effective in reducing income inequality. Policies to reduce income inequality should not be focused on improving the social outcome. It should consider sustaining long-term growth (Cingano, 2014). Taxes and transfers as redistribution policies are a tool to ensure the distribution of economic growth. Besides that, it is important to promote equality of opportunity through accessibility and quality of education. This is also appropriate with the main focus of government, equitable development.

The development process is inseparable from income inequality, particularly in the early stage of development. However, increasing income inequality must be controlled because it will bring out various dissatisfactions and leads to various horizontal conflict in society (Suparmono & Partina, 2021).

Conclusion

Based on the discussion of results, it can be concluded that in Yogyakarta Province during 2010-2021, income inequality has no reciprocal relationship to economic growth and poverty. Meanwhile, economic growth and poverty have a reciprocal relationship. Economic growth and poverty do not significantly affect income inequality, so reducing inequality through economic growth and poverty alleviation is not effective. Income inequality is affected by the growth of district minimum wage and the growth of education. Based on that, to overcome this income inequality, the recommendations to local government are: 1) ensure the equal distribution of economic growth in all districts/cities in Yogyakarta Province and all economic sectors; 2) ensure the equal distribution of education and its quality; 3) tax policy and its proper use; 4) reducing inequality in minimum wage among the districts/cities; 5) utilize the potential of the budget to determine strategic targets to reduce income inequality.

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