

Study of Income Inequality in Sumatra Island

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ABSTRACT

This study aims to analyze (1) the picture of income inequality, Human Resource Quality (HDI), Open Unemployment Rate, Economic Growth Rate, Infrastructure and Information and Communication Technology in Sumatra Island, (2) its effect on the quality of Human Resources, Open Unemployment Rate, Economic Growth Rate, Infrastructure and Information and Communication Technology on income inequality in Sumatra Island. The research method used is quantitative descriptive analysis, employing a panel data regression with a fixed-effects model. The results of the study show that provincial income inequality in Sumatra Island during the 2013-2022 period was low with a downward trend, the Human Development Index experienced a consistent increase, the Open Unemployment Rate showed a downward trend at the beginning of the period and increased during the COVID-19 pandemic in 2020, as well as the rate of economic growth, road length infrastructure continues to experience an increasing trend, Information and Communication Technology experienced an increasing trend. The influence of the Human Development Index and Information and Communication Technology on income inequality is negative and significant; the Open Unemployment Rate and Economic Growth have a positive but not significant effect, and then Infrastructure has a positive and significant effect on income inequality on the island of Sumatra.

Keywords: *Inequality, Economic Growth, Human Development Index, Open Unemployment Rate, Infrastructure, and Information and Communication Technology*

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1. INTRODUCTION

In developing countries, income inequality is common and a classic problem in development design. Todaro in (Anshari, Azhar, & Ariusni, 2018) said that income inequality is a disproportionate distribution of total national income among various households in a country. In other words, income inequality is the difference in the amount of income received by different groups in society, resulting in greater differences in income between groups. The island of Sumatra is located in the western part of Indonesia and attracts attention for its notable disparity in income inequality. Its income inequality dynamics, which show lower levels of inequality compared to Java, provide an interesting focus for further research.

Rapid economic growth should be followed by a decrease in unemployment rates and an equal distribution of welfare. According to Breunig and Majeed, as stated in (Maurilla, Suriani, & Nasir, 2022), highlighting that areas with high poverty rates tend to experience income inequality, which has a negative impact on economic growth. Therefore, the main sectors driving growth in a region are expected to have a positive impact on people's welfare, especially by creating new jobs that can reduce unemployment rates and equalize incomes. This is based on the trickle-down effect theory (trickle down impact - prosperity), which was first developed by Hirschman (1954). The trickle-down effect theory explains that the progress obtained by a group of people will automatically trickle down so that jobs and various economic opportunities are created, which in turn will foster various conditions for the creation of equal economic growth. Although there is empirical evidence of a positive relationship between economic growth and income inequality, more evidence suggests that the main factor determining income distribution is the structure of the economy, not the level or rate of economic growth (Restiatun, 2009).

The Development of Income Inequality by Province in Sumatra Island, namely the Gini Ratio by province and region in the Province of Sumatra Island from 2013 to 2022, shows a variety of patterns and trends in income inequality. The Gini Ratio, a measure of income inequality, shows significant variation across provinces, with some provinces recording lower inequality than others. For example, Aceh had the lowest Gini Ratio in 2022 (0,291), indicating greater income distribution equality, while the Riau Islands had the highest Gini Ratio in the same year (0,341), indicating greater inequality. Overall, most provinces on Sumatra Island experienced a decline in the Gini Ratio from year to year, indicating efforts to reduce income inequality, but several provinces' Gini ratios are approaching moderate inequality. Many factors are suspected to be the cause, namely the quality of Human Resources, the Open Unemployment Rate, the Economic Growth Rate and Infrastructure and Information and Communication Technology on the island of Sumatra. Second, to analyze the influence of Human Resource Quality, Open Unemployment Rate, Economic Growth Rate, Infrastructure and Information and Communication Technology on the level of income inequality on Sumatra Island.

2. LITERATURE REVIEW

2.1 Income Inequality

According to Gunnar Myrdal in his theory, economic development produces a causal process that makes the rich increasingly profitable and the people who are left behind increasingly hampered, so that the opposite impact tends to increase and the spread effect tends to increase and decrease, so that this trend further exacerbates international inequality and causes regional inequality between developing countries (Jhingan, 2016). According to Todaro (2003), income inequality is the difference in income generated by society, resulting in striking disparities in income.

The Gini Coefficient was introduced by Corrado Gini in 1909 in his book "Concentration and Dependency Ratios" (Riani, 2016). The Gini Index is the most commonly used measure of income or wealth inequality. It measures the extent of the distribution of income or wealth in a population. The Gini Index ranges between 0 and 1, where 0 indicates perfect distribution (everyone has the same income) and 1 indicates perfect inequality (one person has all the income). Subrata (2018).

Where:

GR = Gini Coefficient (Gini Ratio)

fp_i = population frequency in the i -th expenditure class

Fc_i = cumulative frequency f of total expenditure in the i -th expenditure class

Fc_{i-1} = cumulative frequency of total expenditure in the $(i-1)$ th expenditure class

The basic idea of calculating the Gini coefficient actually comes from the effort to measure the area of a curve that describes the distribution of income for all income groups. The criteria for income inequality based on the Gini Coefficient (Laksani C.S, 2010) are as follows:

- Less than 0, 4: low level of inequality
- Between 0,4-0,5: moderate level of inequality
- Higher than 0,5: high level of inequality

Todaro in (Riani, 2016) explains that the use of the Gini Coefficient as an aggregate measure for the level of equality actually meets four highly sought-after criteria, namely (1) the principle of anonymity where the measure of inequality does not depend on what has become a belief; (2) the principle of scale independence where the measure of inequality does not depend on the unit of measurement used; (3) the principle of population independence where the measure of inequality should not be based on the number of residents and; (4) the principle of transfer which allows for a more even distribution of new income.

2.2 The Relationship between Income Inequality and the Variables that Influence It

1. The Relationship between Human Resource Quality and Income Inequality

Todaro (2004) argued that health and education factors can help overcome the existing gap. Improving the quality of human resources will increase the region's per capita income, especially among lower-income or poor community groups, and reduce the gap. Therefore, improving the quality of the Human Development Index will increase the region's per capita income and reduce the gap (Subrata, 2018).

2. Relationship between Open Unemployment Rate and Income Inequality

Unemployment is a person who is included in the workforce, is actively seeking work at a certain wage level, but cannot get the job he wants (Aulya, 2016). While the open unemployment rate is the number of unemployed as a percentage of the workforce. The unemployment rate is used as one of the indicators in measuring community welfare. The higher the unemployment rate, the lower the community welfare; the lower the unemployment rate, the higher the community welfare (Zusanti, Sasana, & Rusmijati, 2020). The open unemployment rate is strongly correlated with income inequality because high unemployment reduces income for many people, widening the gap between those who work and those who do not. The IMF study found a positive relationship between unemployment and inequality. In the group of low-income countries and developing countries, emphasizing the importance of the quality of job creation and a policy to support employment can reduce inequality and encourage more inclusive growth (Khoirudin & Musta'in, 2020)

3. The Relationship between Economic Growth and Income Inequality

The theory of economic growth is the study of efforts to increase production capacity to achieve additional output, measured at the regional level by gross domestic product (GDP). Economic growth in the context of the region includes various aspects, including sectoral aspects, spatial location, natural resources, exports, income distribution, growth inequality and disparities between regions (Rahardjo, 2013). Economic growth can increase overall income, but the benefits are not always evenly distributed, so it often increases income inequality in the early stages of economic development, in accordance with the Kuznets Curve hypothesis.

4. The Relationship between Infrastructure and Income Inequality

The availability of infrastructure is very important in development because it will create strong connectivity between regions, reduce logistics costs, reduce disparities, improve people's quality of life, and eliminate economic disparities between regions, which will ultimately have an impact on increasing competitiveness and stimulus for economic growth, and a more equitable distribution of income so that infrastructure variables become important indicators in reducing disparities between regions. This is indicated by the significant influence of the three infrastructure variables used (Widodo, Ariani, & Supriadi, 2023).

5. The Relationship between Technology, Information and Communication and Income Inequality

In general, the development of information and communication technology has brought significant changes to the structure of the economy and society, which can ultimately affect income inequality. The Information and Communication Technology Development Index is a combined index that is a benchmark that can be used to monitor and compare the development of Information and Communication Technology between regions and over time (Central Bureau of Statistics, 2023). ICT can reduce inequality by expanding access to information, education, and new economic opportunities, especially for those in remote or less-developed areas. ICT also enables small businesses and individuals to participate in the digital economy, increasing financial and economic inclusion. However, ICT can exacerbate inequality if access to technology is unequal.

3. METHODOLOGY

This study uses the Quantitative Descriptive Research Method to describe the level of disparity and to determine the influence of the identified variables. The data used in this study is Income Inequality data, specifically the Gini Ratio by Province and Region on the Island of Sumatra, from 2013 to 2022. Human Development Index (HDI) data are the HDI by Province in Sumatra Island from 2013 to 2022. Open Unemployment Rate (TPT) data is the Open Unemployment Rate by Province (Percent) on the island of Sumatra from 2013 to 2022. Economic Growth Rate data will be operationalized as the Gross Regional Domestic Product (GRDP) growth rate (percent) at new prices (ADHK) by province for 2013-2022. Infrastructure data is the Length of Roads by Province and Level of Government Authority (km) on the island of Sumatra, for the period 2013-2022. And the Information and Communication Technology data is the Information and Communication Technology Development Index (IP-ICT) between Provinces on the Island of Sumatra for the period 2013-2022.

In addressing the first problem, descriptive research is used to describe phenomena related to the problem under study. And in answering the second problem is quantitative research using panel data regression.

3.1 Panel Data Regression

This Panel Data Regression Analysis is used to answer the second problem formula. According to Gujarati (2005), panel data (also called longitudinal data) is a combination of cross-sectional data and time series data, so, of course, it will have more observations than cross-sectional data or time series data alone.

The following is the general equation for panel data regression:

$$GR_{it} = \beta_0 + \beta_1 HDI_{it} + \beta_2 TPT_{it} + \beta_3 LPE_{it} + \beta_4 IF_{it} + \beta_5 ICT_{it} + e_{it}$$

Where:

GR_{it} = Gini Ratio (GR)

β_0 = Intercept or constant
 i = Provinces in Sumatra Island
 β_1 HDI_{it} = Human Development Index
 β_2 TPT_{it} = Open Unemployment Rate
 β_3 LPE_{it} = Economic Growth Rate
 β_4 IF_{it} = Infrastructure
 β_5 ICT_{it} = Information Communication Technology
 t = Year
 e = error term

4. FINDINGS AND DISCUSSION

4.1 Description of Research Variables

The description of income inequality, quality of human resources, Open Unemployment rate, Economic Growth Rate, Infrastructure and Information and Communication Technology on the island of Sumatra can be seen in Table 1. In general, all provinces on the island of Sumatra had income inequality levels classified as low to moderate during the period 2013-2022. No province has a Gini Ratio exceeding 0,5, indicating a high level of inequality. The province with the lowest level of inequality on Sumatra Island during this period is the Bangka Belitung Islands, with a Gini Ratio ranging from 0,269 to 0,311, or below 0,4. Meanwhile, Riau and the Riau Islands are the two provinces with the highest levels of income inequality in their regions, although they are still in the moderate category. Overall, income inequality on the island of Sumatra decreased from 2013 to 2022. However, there are still disparities in inequality between provinces that require further equalization, especially in Riau and the Riau Islands, which have moderate levels of inequality.

Table 1 :Average level of income inequality, description of human resource quality, Open Unemployment Rate, Economic Growth Rate, Infrastructure and Information and Communication in Sumatra Island 2013-2022 (Percent)

Province	Incom e Inequ ality	Human Develop ment Index	Open Unemploy ment Rate	Econom ic Growth	Length of the Road	Informatio n and Communic ation Technology Level
Aceh	0,325	70,72	7,48	2,63	23,66	3,65
Sumatera Utara	0,319	70,67	6,12	4,34	40,765	4,17
Sumatera Barat	0,313	71,26	6,18	4,43	20,999	4,66
Riau	0,346	71,87	6,04	2,23	24,206	5,04
Jambi	0,332	70,15	4,47	4,48	13,202	4,78
Sumatera Selatan	0,351	68,80	4,85	4,55	19,587	4,65
Bengkulu	0,344	70,05	3,80	4,45	9,228	4,85
Lampung	0,333	68,36	4,65	4,22	20,765	4,35
Kep. Bangka Belitung	0,286	70,22	4,37	3,75	5,891	4,78

Kep. Riau	0,359	74,68	7,74	4,10	5,688	6,17
Average (Sumatra)	0,331	70,68	5,57	3,92	183,991	4,71
Average (Indonesia)	0,394	70,82	5,94	4,34	546,725	4,85

Source: Central Bureau of Statistics of Indonesia, 2024

The average Human Development Index (HDI) in this region increased from 67,68 in 2012 to 72,66 in 2022, indicating progress in human development on the island of Sumatra. However, there is a significant disparity in the Human Development Index across provinces. The Riau Islands have the highest Human Development Index, with an average of 74,47, while Lampung Province has the lowest, at 68,05. Other provinces with a Human Development Index above the island of Sumatra's average are Riau, West Sumatra, and Aceh. Overall, efforts to increase access to education and health services, and to increase community income, are very important for raising the Human Development Index across the island of Sumatra more evenly. This can address existing gaps and ensure more inclusive human development between provinces on the island of Sumatra.

The Open Unemployment Rate on the island of Sumatra shows a fluctuating trend during the 2013-2022 period, with an average of 5,54%. There was a decrease in the Open Unemployment Rate from 2013 to 2019, but it increased again in 2020 due to the COVID-19 pandemic. In 2022, the Open Unemployment Rate on the island of Sumatra fell again to 5,33%. However, there is a significant disparity in the Open Unemployment Rate between provinces in this region. The Riau Islands have the highest average Open Unemployment Rate at 7,50%, while Bengkulu has the lowest at 3,78%. Other provinces that have Open Unemployment Rates above the average for Sumatra Island are Aceh, Riau, and North Sumatra. Overall, the condition of the Open Unemployment Rate on Sumatra Island still requires attention, especially in provinces with high Open Unemployment Rates, such as the Riau Islands and Aceh. Efforts to create jobs, improve workforce quality and equalize economic development are very important for reducing the Open Unemployment Rate across Sumatra Island more effectively.

For several years, the economic growth of Sumatra Island as a whole has been quite stable, but fluctuating. The average economic growth of Sumatra Island during that period was 4,29%, slightly below the national average of 4,77%. However, there were several years when Sumatra Island experienced economic growth below the national average, including 2019 and 2020. Jambi Province recorded the highest economic growth, with an average of 5,02% during that period, followed by Bengkulu at 4,66%. Meanwhile, the Riau Islands recorded the lowest economic growth, averaging only 3,94% during the same period. Therefore, there needs to be a policy that focuses on strengthening economic growth in underdeveloped provinces to reduce income inequality on Sumatra Island as a whole.

Length of Roads by Province and Level of Government Authority (km) in Sumatra Island for the period 2013-2022. It can be seen that in 2012, the total length of roads in Sumatra Island reached 169,789 km. The province with the longest road length is North Sumatra at 36,049 km, followed by Riau at 23,714 km, and Aceh at 22,457 km. Meanwhile, the province with the shortest road length is Riau Islands at 4,514 km. In the period 2013-2022, the length of roads in Sumatra Island tended to increase every year. The peak occurred in 2017 with a total distance of 187,993 km. This increase was driven by government policies to build and repair road infrastructure, improving connectivity and supporting economic growth across regions. However, after that, it decreased to 183,991 km by 2022. This decrease was most likely due to the reallocation of the road construction budget to other sectors or to technical constraints in implementing road projects.

The development of the Information and Communication Technology Development Index (IP-ICT) across provinces on the island of Sumatra for the period 2013-2022 shows various dynamics that reflect the level of technology adoption and development in each province. Overall, the average Information and Communication Technology Development Index on the island of Sumatra has increased from 4,32 in 2013 to 5,42 in 2022. However, this value is still below the national average in Indonesia, which increased from 4,50 in 2013 to 5,78 in 2022. Although all provinces on the island of Sumatra experienced an increase in the Information and Communication Technology Development Index, the rate and magnitude of the increase varied greatly. Several provinces showed significant, consistent increases, while others experienced fluctuations and slower growth. This reflects differences in infrastructure development policies, investment, and information and communication technology across provinces.

4.2 Panel Data Model

Before analysing the influence of Human Resource Quality, Open Unemployment Rate, Economic Growth, Infrastructure and Information and Communication Technology on Income Inequality on the Island of Sumatra, it is necessary to determine the best approach to use. These steps are:

4.3 Test Chow

The Chow Test is conducted to compare/select which model is best between the Partial Least Squares common effect and the Fixed Effect Model.

Table 2

Chow test to choose between the Partial Least Squares and the Fixed Effect Model models

Redundant Fixed Effects Tests Pool: Untitled Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	34.079694	(9,85)	0.0000
Cross-section Chi-square	152.788901	9	0.0000

Source: Processed Data, Eviews 12 (2024)

The test results using EViews 12 show that the second test, both F and chi-square, is highly significant (p-value = 0,0000), indicating rejection of the null hypothesis (H0). This leads to the conclusion that the Fixed Effect model is more suitable than the Common Effect model.

4.4 Hausman test

The Hausman Test is carried out to compare/choose which model is the best between the Fixed Effect Model and the Random Effect Model.

Table 3 :Hausman test to choose between the Fixed Effect Model and the Random Effect Model

Correlated Random Effects - Hausman Test

Pool: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
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Cross-section random	11.766531	5	0.0381
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Source: Processed Data, Eviews 12 (2024)

From the calculation results that have been done, the probability value in the cross-sectional random effect test shows a figure of 0,0381. This figure indicates significance at the 95% confidence level ($\alpha = 5\%$) and uses a chi-square distribution. In the context of the Hausman test, the decision taken is to reject the null hypothesis ($p\text{-value} < 0,05$). Rejection of this null hypothesis indicates a significant difference between the fixed-effect and random-effect models. As a result, the most appropriate estimation model for this study is the fixed-effects model.

4.5 Estimation of Fixed-Effect Model Variable Coefficients

The following are the results of the Fixed Effect model analysis to determine the impact of various variables, including Human Resource Quality, Open Unemployment Rate, Economic Growth Rate, Infrastructure, and Information and Communication. Technology, the level of income inequality in Sumatra Island is as follows:

Table 4

Fixed Effects Model (FEM) Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.808273	0.085674	9.434325	0.0000
HDI?	-0.007401	0.001390	-5.325551	0.0000
TPT?	0.000865	0.001560	0.554294	0.5808
LPE?	0.000568	0.000677	0.838179	0.4043
IF?	3.80E-06	1.80E-06	2.106873	0.0381
ICT?	-0.006483	0.003028	-2.141093	0.0351
Fixed Effects (Cross)				
_P1--C	-0.032956			
_P2--C	-0.096340			
_P3--C	-0.031109			
_P4--C	0.001213			
_P5--C	0.017080			
_P6--C	0.004023			
_P7--C	0.046703			
_P8--C	-0.024270			
_P9--C	0.002264			
_P10--C	0.113393			
Effects Specification				
Cross-section fixed (dummy variables)				
Root MSE	0.011892	R-squared	0.805985	
Mean dependent var	0.330800	Adjusted R-squared	0.774029	
S.D. dependent var	0.027135	S.E. of regression	0.012899	
Akaike info criterion	-5.725889	Sum squared resid	0.014142	

Schwarz criterion	-5.335113	Log likelihood	301.2944
Hannan-Quinn criter.	-5.567735	F-statistic	25.22216
Durbin-Watson stat	1.847697	Prob(F-statistic)	0.000000

Source: Processed Data, Eviews 12 (2024)

From the results of panel data regression with a fixed effects model, the following regression equation is obtained:

$$GR_{it} = 0,808273 - 0,007401HDI_{it} + 0,000865TPT_{it} + 0,000568LPE_{it} + 3,80E-06IF_{it} - 0,006483ICT_{it} + e_{it}$$

t-count (-5,325551) (0,554294) (0,838179) (2,106873) (-2,141093)

Based on the results of a regression analysis using EViews 12 software at a significance level of $\alpha = 0,05$, it can be concluded that certain factors have a significant influence on the inequality of income distribution on the island of Sumatra. Constants have a positive and significant influence on income inequality, while the human development index has a significant negative influence. In addition, unemployment has a positive but insignificant effect on income inequality. Then, economic growth has a positive influence on the inequality of income distribution, but is not statistically significant. On the other hand, infrastructure has a positive and significant influence on income inequality. Meanwhile, information and communication technology also has a significant positive influence on income distribution inequality on the island of Sumatra.

4.6 Statistical F Test

From the analysis results, it was revealed that the Prob (F-statistic) value was 0,000000, which was lower than the significance level of 0,05. This comparison shows that the Prob(F-statistic) is much smaller than the set significance level. This finding provides an understanding that together, independent variables such as HR quality, Open Unemployment Rate, Economic Growth Rate, Infrastructure, and Information and Communication Technology, simultaneously play a role in influencing the level of income inequality on the island of Sumatra.

4.7 Statistical t-test

In the T-test, the human development index variable has a significant effect on income inequality because the p-value is $0,0000 < 0,05$. The open unemployment rate variable has no significant effect on income inequality because the prob value is $0,5808 > 0,05$. The economic growth rate variable has no significant effect on income inequality because the prob value is $0,4043 > 0,05$. The infrastructure variable has a significant effect on income inequality because the prob value is $0,0381 < 0,05$. And the information and communication technology variable has a significant effect on income inequality because the p-value is 0.0351.

4.8 Test Adjusted R2

The value of the determination coefficient (Adjusted R2) or goodness of fit is 0,774029. This shows that the independent variables in the study explain the dependent variable by 77,4%. The remaining 22,6% is explained by other variables outside the model.

4.9 The Influence of the Human Development Index on Income Distribution Inequality on Sumatra Island

Based on the results of the regression analysis, the regression coefficient for the HDI variable is -0,007401, with a probability of $0,0000 < 0,05$, which is smaller than the previously set significance level of 0,05. This shows that HDI has a negative relationship to income inequality on the island of Sumatra. When HDI increases by 1 point, it is estimated to reduce income inequality on the island of Sumatra by 0,007401 points, assuming other variables remain constant. The effect of HDI on income inequality in Sumatra is negative and significant.

The results of this study are in accordance with the theory or expectations of all of us who want an increase in the HDI to reduce Income Inequality. This phenomenon can be explained using the human capital theory proposed by Gary Becker. According to this theory, investment in human resources, such as education and health, can increase labor productivity and encourage sustainable economic growth. Thus, an increase in the HDI, which reflects higher-quality human resources, can help reduce income inequality.

It can be seen that there are several reasons that can explain why increasing the Human Development Index (HDI) can reduce income inequality on the island of Sumatra, including improving the quality of human resources that encourage productivity and more equitable economic growth, increasing access to education that enables social mobility, improving public health that supports economic participation, increasing living standards through higher per capita income, and implementing appropriate policies to reduce economic inequality.

This is consistent with research by Mustika, Nurjanah and W.B. (2023), which shows that on the island of Sumatra, the Human Development Index has a significant negative effect on poverty and inequality. This is also in line with research by Miranti, Syahputra and Maipita (2021) in the Indonesian Journal of Economics and Development, which found a significant negative relationship between the Human Development Index (HDI) and income inequality on the island of Sumatra. , The results of the panel data regression analysis show that a 1 percent increase in the Human Development Index will reduce the Gini ratio (income inequality) by 0.12 percent in Sumatra Island. This confirms the significant negative effect of the Human Development Index on income inequality in the region.

4.10 The Influence of Open Unemployment Rate on Income Distribution Inequality on Sumatra Island

Based on the results of the regression analysis, the regression coefficient for the TPT variable was 0,000865, with a probability of $0,5808 > 0,05$, greater than the previously determined significance level of 0,05. This shows that TPT has a positive relationship with income inequality on the island of Sumatra, but the effect is not significant. When TPT decreases by 1 percent, it is estimated to reduce income inequality on the island of Sumatra by 0,000865 points, assuming other variables remain constant. The effect of TPT on income inequality in Sumatra is positive but not significant.

The results of this study are consistent with the theory and expectations of all of us who want a decrease in TPT to reduce Income Inequality. According to the neoclassical theory of economic growth proposed by Robert Solow (1956), in the long run, the unemployment rate will return to its natural rate and will not have a permanent effect on income distribution.

It can be seen that there are several reasons that can explain why the increase in the Open Unemployment Rate (TPT) can increase income inequality on the island of Sumatra, such as the loss of sources of income for those who lose their jobs, pressure on wages that has a greater impact on low-skilled workers, limited access to job opportunities especially for those from lower socio-economic backgrounds, reduced purchasing power that can slow economic growth, and increased dependence on the informal sector which is often characterized by low wages and poor working conditions. The results of this study are consistent with research by Maulidina and Setiawati (2022), titled "The Influence of Economic Growth, Unemployment, and the Human Development Index on Income Inequality in Indonesia," which uses panel data from 33 Indonesian provinces for 2016-2020. The results of the study show that the unemployment variable does not have a significant effect on income inequality in Indonesia.

4.11 The Impact of Economic Growth on Income Distribution Inequality in Sumatra Island

Based on the results of the regression analysis, the regression coefficient for the LPE variable was 0,000568, with a probability of $0,4043 > 0,05$, which is smaller than the previously set significance level of 0,05. This shows that LPE has a positive relationship with income inequality on the island of Sumatra, but the effect is not significant. When LPE increases by 1 percent, it is estimated to increase income inequality on the island of Sumatra by 0,000568 points, assuming other variables remain constant. The effect of LPE is positive and not significant on income inequality on the island of Sumatra.

The results of this study do not match the theory or expectations of all of us who want an increase in economic growth to reduce Income Inequality. This phenomenon can be explained using the inverted U-curve theory proposed by Simon

Kuznets. According to this theory, in the early stages of economic development, income inequality tends to increase because economic growth is only enjoyed by a handful of groups in society. However, once a certain point is reached, sustainable economic growth will be followed by a gradual decrease in income inequality.

It can be seen that there are several reasons that can explain why the increase in the Economic Growth Rate can increase income inequality in Sumatra Island, such as uneven economic growth between sectors and regions, where capital-intensive sectors and more developed regions tend to grow faster, concentration of wealth in certain groups who have greater access to resources and economic opportunities, and structural shifts in the economy that benefit workers with high skills and better education, while workers with low skills may be left behind, thus widening the income gap.

In line with the research conducted by Febrianto (2017) in East Java Province, with a research period of 2011-2015. The results of the study indicate that increases in economic activity and regional spending have a positive and significant effect on income inequality, while the Human Development Index (HDI) has a negative and significant effect on income inequality between regions in East Java Province.

4.12 The Influence of Infrastructure on Income Distribution Inequality on Sumatra Island

Based on the results of the regression analysis, the regression coefficient for the Infrastructure variable was $3,80E-06$, with a probability of $0,0381 < 0,05$, which is smaller than the previously determined significance level of $0,05$. This shows that Infrastructure has a positive relationship with income inequality on the island of Sumatra. When the road length infrastructure increases by 1 kilometer, it is estimated that it can increase income inequality in Sumatra Island by $3.80E-06$ points, assuming other variables remain constant. The influence of Infrastructure is positive and significant on income inequality on the island of Sumatra.

The results of this study do not match the theory or expectations of all of us who want infrastructure improvements to reduce Income Inequality. This phenomenon can be explained using the core-periphery theory proposed by John Friedmann. According to this theory, economic development tends to be centered in certain areas (centers) that have comparative advantages, such as adequate infrastructure, while other areas (peripheries) are left behind.

It can be seen that there are several reasons that can explain why infrastructure development can increase income inequality on the island of Sumatra, such as infrastructure development that is more focused on developed areas, thus accelerating economic growth in these areas compared to less developed areas, increasing land and property values around infrastructure projects that can benefit capital owners and harm low-income communities, and the possibility of a shift in labor from the traditional sector to the modern sector related to infrastructure development, where workers with appropriate skills can earn higher incomes, while those with less skills may be marginalized economically.

It can be seen that there are several reasons that can explain why increasing IP-ICT can reduce income inequality on the island of Sumatra, including increasing access to information and knowledge for people in various regions, so that it can improve the quality of human resources more evenly, the emergence of new digital-based economic opportunities that can be accessed by more people without being too constrained by geographic location, increasing efficiency and productivity in various economic sectors that can encourage more inclusive growth, and the development of digital-based public services that can reach people in remote areas, thereby reducing the gap in access to basic services such as education and health.

The results of this study are consistent with research by Sari and Ananda (2019), which shows that infrastructure development, especially road infrastructure, has a positive and significant effect on income inequality in North Sumatra Province. This is due to the concentration of infrastructure development in certain areas, thereby widening the gap with other areas that receive less attention.

4.13 The Influence of Information and Communication Technology on Income Distribution Inequality on the Island of Sumatra

Based on the results of the regression analysis, the regression coefficient for the IP-ICT variable was $-0,006483$, with a probability of $0,0351 < 0,05$, which is smaller than the previously determined significance level of $0,05$. This shows that IP-ICT has a negative relationship with income inequality on the island of Sumatra. When IP-ICT increases by 1

point, it is estimated that it can reduce income inequality in Sumatra Island by 0,006483 points, assuming other variables remain constant. The influence of infrastructure is positive and significant on income inequality on the island of Sumatra.

Empirical studies conducted on the island of Sumatra show that the development of information technology and the results of this study are in accordance with the theory or expectations of all of us who want an increase in IP-ICT to reduce Income Inequality. This phenomenon can be explained using the diffusion of innovation theory proposed by Everett M. Rogers. According to this theory, the spread and adoption of an innovation, such as information and communication technology, occurs gradually and unevenly across all levels of society. Some groups adopt the innovation more quickly, such as those with higher incomes or living in urban areas. Meanwhile, groups with low incomes or living in rural areas tend to adopt the innovation more slowly.

This is in line with research conducted by Nugroho and Kusuma (2021). The results of the study showed that increasing ICT infrastructure, such as internet connectivity and mobile phone availability, had a significant negative effect on income inequality across regions in East Java. This is due to the still-low access to and utilization of ICT in rural or underdeveloped areas.

4.14 Estimation of Fixed Effects Coefficients of Province Models in Sumatra Island

Table 5 : Fixed Effects Estimation Model

Province	Fixed Effect
Aceh	-0,032956
Sumatera Utara	-0,096340
Sumatera Barat	-0,031109
Riau	0,001213
Jambi	0,017080
Sumatera Selatan	0,004023
Bengkulu	0,046703
Lampung	-0,024270
Kep. Bangka Belitung	0,002264
Kep. Riau	0,113393

Source: Processed Data, Eviews 12 (2024)

Estimation of Fixed Effect Model Coefficients for the Model of Provinces in Sumatra Island. From the estimation results using the Fixed Effect Model, it can be explained that each province in Sumatra Island has a different intercept value. Individual Fixed Effects can be seen in the following table:

With the equation for each province as follows:

Aceh Province

$$GR_{p1} = 0,775317 - 0,007401HDI_{p1} + 0,000865TPT_{p1} + 0,000568LPE_{p1} + 3,80E-06IF_{p1} - 0,006483ICT_{p1}$$

North Sumatra Province

$$GR_{p2} = 0,711933 - 0,007401HDI_{p2} + 0,000865TPT_{p2} + 0,000568LPE_{p2} + 3,80E-06IF_{p2} - 0,006483ICT_{p2}$$

West Sumatra Province

$$GR_{p3} = 0,777164 - 0,007401HDI_{p3} + 0,000865TPT_{p3} + 0,000568LPE_{p3} + 3,80E-06IF_{p3} - 0,006483ICT_{p3}$$

Riau Province

$$GR_{p4} = 0,809486 - 0,007401HDI_{p4} + 0,000865TPT_{p4} + 0,000568LPE_{p4} + 3,80E-06IF_{p4} - 0,006483ICT_{p4}$$

Jambi Province

$$GR_{p5} = 0,825353 - 0,007401HDI_{p5} + 0,000865TPT_{p5} + 0,000568LPE_{p5} + 3,80E-06IF_{p5} - 0,006483ICT_{p5}$$

South Sumatra Province

$$GR_{p6} = 0,812296 - 0,007401HDI_{p6} + 0,000865TPT_{p6} + 0,000568LPE_{p6} + 3,80E-06IF_{p6} - 0,006483ICT_{p6}$$

Bengkulu Province

$$GR_{p7} = 0,854976 - 0,007401HDI_{p7} + 0,000865TPT_{p7} + 0,000568LPE_{p7} + 3,80E-06IF_{p7} - 0,006483ICT_{p7}$$

Lampung Province

$$GR_{p8} = 0,784003 - 0,007401HDI_{p8} + 0,000865TPT_{p8} + 0,000568LPE_{p8} + 3,80E-06IF_{p8} - 0,006483ICT_{p8}$$

Bangka Belitung Islands Province

$$GR_{p9} = 0,810537 - 0,007401HDI_{p9} + 0,000865TPT_{p9} + 0,000568LPE_{p9} + 3,80E-06IF_{p9} - 0,006483ICT_{p9}$$

Riau Islands Province

$$GR_{p10} = 0,921666 - 0,007401HDI_{p10} + 0,000865TPT_{p10} + 0,000568LPE_{p10} + 3,80E-06IF_{p10} - 0,006483ICT_{p10}$$

5. CONCLUSION

Conditions on the island of Sumatra during the 2013-2022 period show income inequality classified as low (<0.4) to moderate ($0.4-0.5$), with a downward trend, although Riau and the Riau Islands have the highest inequality. Meanwhile, the Human Development Index (HDI) has consistently increased, with the Riau Islands at the highest level and Lampung at the lowest. The open unemployment rate (TPT) fluctuates, showing a downward trend at the beginning of the period and an increase due to COVID-19 in 2020, with the Riau Islands having the highest and Bengkulu the lowest. Economic growth also fluctuated, declining in 2020 due to the pandemic, with Jambi recording the highest increase and the Riau Islands the lowest. Road infrastructure continues to show an upward trend across all provinces, though growth varies. Meanwhile, Information and Communication Technology is experiencing an upward trend, with the Riau Islands showing the highest growth, while other provinces show mixed developments.

Simultaneously, the Human Development Index, Open Unemployment Rate, Economic Growth Rate, Infrastructure, and Information and Communication Technology affect income distribution inequality on the island of Sumatra. Partially, the Human Development Index has a negative and significant effect, meaning that improving the quality of human resources through education, health, and a decent standard of living can significantly reduce income inequality. The Open Unemployment Rate has a positive but insignificant effect, where increasing unemployment tends to increase income inequality. The Economic Growth Rate has a positive but insignificant effect, indicating that high economic growth does not necessarily reduce inequality if it is not accompanied by equality. Infrastructure has a positive and significant effect, indicating that uneven infrastructure development can significantly increase inequality. Meanwhile, Information and Communication Technology has a negative but insignificant effect, where increasing access to and utilization of Information and Communication Technology tends to reduce income inequality.

6. SUGGESTIONS

Based on the previous conclusions, the following are recommended:

1. Improving the quality of human resources through the expansion of education and health, improving education and health infrastructure in the regions.
2. Creating jobs and improving the quality of the workforce with the Pre-Employment Card Program, training collaboration between local governments, industry, and training institutions, and incentives for investors who open up employment opportunities.
3. Encouraging the growth of an inclusive economy by prioritizing labor-intensive sectors, increasing access to capital and opportunities for MSMEs, strengthening workers' social security, and providing market access through digital platforms.
4. Equal and sustainable infrastructure development, including the development of E-Commerce Distribution Hubs, prioritizing infrastructure in disadvantaged areas, equal budget allocation, involving local communities, and incentives for investors in rural/outlying areas.

5. Increasing access to Information and Communication Technology (ICT) through the expansion of internet networks, digital literacy programs, and the development of digital applications for community productivity.

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