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STUDY OF INCOME INEQUALITY IN SUMATERA 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 with a panel data regression analysis tool with a fixed effect model approach. 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, then Infrastructure has a positive and significant effect on income inequality on the island of Sumatra

ARTICLE INFO

Keywords:

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

1.0 INTRODUCTION

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In developing countries, income inequality often occurs and is a classic problem in development design. Todaro (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 society, resulting in greater differences in income between groups in society. The island of Sumatra is located in the western part of Indonesia and attracts attention because of its interesting comparison of income inequality. Its interesting income inequality dynamics, which show a lower level of income inequality compared to Java, provide an interesting focus for further research.

$$GR = I = \sum_{i=1}^n f p_i * (F c_i + F c_{i-1})$$

Rapid economic growth should be followed by a decrease in unemployment rates and 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 that are the focus of growth in a region are expected to be able to have a positive impact on people's welfare, especially through the creation of new jobs that can reduce unemployment rates and equalize income. 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 that shows a positive relationship between economic growth and income inequality, there is more evidence that the main factor that determines income distribution is the structure of the economy and 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, which is a measure of income inequality, shows significant variation between provinces, with some provinces recording lower levels of inequality than others. For example, Aceh had the lowest Gini Ratio in 2022 (0,291), indicating a higher level of income distribution equality, while the Riau Islands had the highest Gini Ratio in the same year (0,341), indicating a higher level of inequality. Overall, most provinces in Sumatra Island experienced a decline in the Gini Ratio from year to year, indicating efforts to reduce income inequality, but there are several provinces whose Gini ratios are approaching moderate inequality. Many factors are suspected to be the cause, namely the quality of Human Resources, Open Unemployment Rate, Economic Growth Rate, Infrastructure and Information and Communication Technology in Sumatra Island. 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.

2.0 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 so that there is a striking difference in income in society.

The calculation of the Gini Coefficient was introduced by Corrado Gini in 1909 through his book entitled "Concentration and Dependency Ratios" (Riani, 2016). The Gini Index is the most commonly used measure to measure 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).

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Where:

GR = Gini Coefficient (Gini Ratio)

f_{p_i} = population frequency in the i -th expenditure class

F_{c_i} = cumulative frequency f of total expenditure in the i -th expenditure class

$F_{c_{i-1}}$ = 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) who said that there are health and education factors that can overcome the existing gap. By increasing the quality of human resources, it will increase the per capita income of the region, especially the lower or poor community groups and reduce the gap. Therefore, by improving the quality of the Human Development Index, it will increase the per capita income of the region 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 who is actively looking for 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. Where the higher the unemployment rate indicates that community welfare is still low, and the lower the unemployment rate indicates that community welfare is already high (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 results of the IMF study found a positive relationship between unemployment and inequality. Where 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

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The theory of economic growth is defined as an effort to increase production capacity to achieve additional output, which is measured using gross domestic product (GRDP) for the regional level. 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 that 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, 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 have an impact on 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 opening 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, on the other hand, ICT can exacerbate inequality if access to the technology is unequal.

3.0 METHODOLOGY

This study uses Quantitative Descriptive Research Method to describe the level of disparity and to determine the influence between the identified variables. The data used in this study is Income Inequality data is the Gini Ratio by Province and Region in Sumatra Island in 2013-2022. Human Development Index (HDI) data is (new method) the Human Development Index by Province in Sumatra Island in 2013-2022. Open Unemployment Rate (TPT) data is the Open Unemployment Rate by Province (Percent) in Sumatra Island in 2013-2022. Economic Growth Rate data will be operationalized as the Gross Regional Domestic Product (GRDP) growth rate by province (percent) at new prices (ADHK) in 2013-2022. Infrastructure data is the Length of Roads by Province and Level of Government Authority (km) in Sumatra Island with a period of 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 answering the first problem, descriptive research is used to describe phenomena related to the problem being studied. 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 (pooled data) or also called longitudinal data is a combination of cross-section data and time series data, so of course it will have more observations compared to cross-section data and time series data alone.

The following is the general equation for panel data regression:

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

Where:

- GR_{it} = Gini Ratio (GR)
 β_0 = Intercept or constant
 i = Provinces in Sumatra Island
 $\beta_1 HDI_{it}$ = Human Development Index
 $\beta_2 TPT_{it}$ = Open Unemployment Rate
 $\beta_3 LPE_{it}$ = Economic Growth Rate
 $\beta_4 IF_{it}$ = Infrastructure
 $\beta_5 ICT_{it}$ = Information Communication Technology
 t = Year
 e = error term

4.0 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 in Sumatra Island can be seen in table 1. In general, all provinces in Sumatra Island have income inequality levels that are 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 in Sumatra Island during this period is the Bangka Belitung Islands, with a Gini Ratio ranging from 0,269 – 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, the trend of Income Inequality in Sumatra Island has decreased in the period 2013-2022. 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)

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Province	Income Inequality	Human Development Index	Open Unemployment Rate	Economic Growth	Length of the Road	Information and Communication 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 achievement of the Human Development Index between provinces. The Riau Islands have the highest Human Development Index with an average of 74,47, while Lampung Province is the province with the lowest Human Development Index with an average of 68,05. Other provinces that have a Human Development Index above the average for the island of Sumatra are Riau, West Sumatra, and Aceh. Overall, efforts to increase access to education, health services, and increase community income are very important to increase 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 in Sumatra Island shows a trend that tends to fluctuate 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 impact of the COVID-19 pandemic. In 2022, the Open Unemployment Rate in Sumatra Island 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 of 7,50%, while Bengkulu has the lowest average Open Unemployment Rate of 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 in Sumatra Island still needs attention, especially for provinces with high Open Unemployment Rates such as the Riau Islands and Aceh. Efforts to create jobs, improve the quality of the workforce, and equalize economic development are very important to reduce the Open Unemployment Rate throughout Sumatra Island more effectively.

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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 where Sumatra Island experienced economic growth below the national average, such as in 2019 and 2020. Jambi Province recorded the highest economic growth with an average of 5,02% during that period, followed by Bengkulu with an average increase of 4,66%. Meanwhile, the Riau Islands recorded the lowest economic growth with an average of 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 tends 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 to improve connectivity and support economic growth in the regions. However, after that it decreased until 2022 to 183,991 km. This decrease was most likely caused by the reallocation of the road construction budget to other sectors or technical constraints in the implementation of road projects.

The development of the Information and Communication Technology Development Index (IP-ICT) between provinces on the island of Sumatra for the period 2013-2022 shows various dynamics that reflect the level of adoption and development of technology in each province. Overall, the average Information and Communication Technology Development Index on the island of Sumatra continues to increase 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 and consistent increases, while other provinces experienced fluctuations and slower increases. This reflects differences in infrastructure development policies, investment, and information and communication technology in each province.

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 in Sumatra Island, it is necessary to carry out steps to determine which approach is best 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 Square common effect and the Fixed Effect Model.

Table 2 Chow test to choose between Partial Least Square and Fixed Effect Model models
Redundant Fixed Effects Tests
Pool: Untitled

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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, show strong significance (with a p-value of 0,0000), which indicates the 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.
Cross-section random	11.766531	5	0.0381

Source: Processed Data, Eviews 12 (2024)

From the calculation results that have been done, the probability value in the cross section random effect test shows a figure of 0,0381. This figure indicates that there is significance at the 95% confidence level, which is assumed with a significance level of $\alpha = 5\%$, 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 that there is a significant difference between the fixed effect and random effect models. As a result, the most appropriate estimation model to use in this study is the fixed effect 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

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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 regression analysis using EViews 12 software with a significance level of $\alpha = 0,05$, it can be concluded that there are certain factors that have a significant influence on the inequality of income distribution on the island of Sumatra. Constants have a positive and significant influence on the inequality of income distribution, while the human development index has a significant negative influence. In addition, unemployment has a positive but insignificant influence on the inequality of income distribution. 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 the inequality of income distribution. Meanwhile, information and communication technology also has a significant positive influence on the inequality of income distribution on the island of Sumatra.

4.6 Statistical F Test

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From the analysis results, it was revealed that the Prob (F-statistic) value was 0,000000, which turned out to be 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

T-test, the human development index variable has a significant effect on income inequality because the prob 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 prob 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 are able to 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, it was obtained that the regression coefficient of the HDI variable is $-0,007401$, with a probability of $0,0000 > 0,05$ 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 that it can reduce income inequality on the island of Sumatra by 0,007401 points assuming other variables remain constant. The effect of HDI is negative and significant on income inequality on the island of Sumatra.

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 better quality human resources, can contribute to reducing 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 in accordance with research conducted by (Mustika, Nurjanah, & W.B, 2023) showing that in Sumatra Island, the Human Development Index variable has a significant negative effect on poverty and inequality. This is also in line with research conducted by (Miranti, Syahputra, & Maipita, 2021) in the Indonesian Journal of Economics and Development, there is a significant negative relationship between the Human Development Index (HDI) and income inequality in Sumatra Island. , 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.

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

Based on the results of the regression analysis, it was obtained that the regression coefficient of 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 to income inequality on the island of Sumatra but is not significant. When TPT decreases by 1 percent, it is estimated that it can reduce income inequality on the island of Sumatra by 0,000865 points assuming other variables remain constant. The effect of TPT is positive and not significant to income inequality on the island of Sumatra.

The results of this study are in accordance with the theory or expectations of all of us who want a decrease in TPT to reduce Income Inequality. According to the theory of neoclassical economic growth proposed by Robert Solow (1956), in the long term, 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 in line with research conducted by (Maulidina & Setiawati, 2022) entitled "The Influence of Economic Growth, Unemployment, and the Human Development Index on Income Inequality in Indonesia" using panel data from 33 provinces in Indonesia in 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, it was obtained that the regression coefficient of the LPE variable was 0,000568, with a probability of 0,4043 > 0,05 smaller than the previously set significance level of 0,05. This shows that LPE has a positive relationship to income inequality on the island of Sumatra but is not significant. When LPE increases by 1 percent, it is estimated that it can 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 to 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, after reaching a certain point, 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 (Febrianto, 2017) in East Java Province with a research period of 2011-2015. The results of the study indicate that the increase in the economy and regional spending has a positive and significant effect on income inequality, while the Human Development Index (HDI) has a negative and significant effect on the level of 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, it was obtained that the regression coefficient of the Infrastructure variable was $3,80E-06$, with a probability of $0,0381 < 0,05$ smaller than the previously determined significance level of $0,05$. This shows that Infrastructure has a positive relationship to income inequality in Sumatra Island. 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 in Sumatra Island.

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 in line with research conducted by (Sari & Ananda, 2019) which shows that infrastructure development, especially road infrastructure, has a positive and significant effect on increasing income inequality in North Sumatra Province. This is due to the concentration of infrastructure development in certain areas only, thus widening the gap with other areas that receive less infrastructure 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, it was obtained that the regression coefficient of the IP-ICT variable was $-0,006483$, with a probability of $0,0351 < 0,05$ smaller than the previously determined significance level of $0,05$. This shows that IP-ICT has a negative relationship to income inequality in Sumatra Island. 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 in Sumatra Island.

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 the 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. There are groups of people who adopt the innovation more quickly, such as groups of people with higher incomes or living in urban areas. Meanwhile, groups of people with low incomes or living in rural areas tend to be slower to adopt the innovation.

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This is in line with research conducted by (Nugroho & Kusuma, 2021). The results of the study showed that increasing ICT infrastructure such as the availability of internet networks and mobile phones had a negative and significant effect on income inequality between regions in East Java. This is due to the still low access 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

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

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

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

5.0 CONCLUSION

Conditions on the island of Sumatra during the 2013-2022 period show income inequality that is 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 the highest and Lampung 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 open unemployment rate and Bengkulu the lowest. Economic growth also fluctuates, with a decline in 2020 due to the pandemic, with Jambi recording the highest increase, while the Riau Islands recorded the lowest. Road infrastructure continues to experience an upward trend in all provinces although there are differences in growth. Meanwhile, Information and Communication Technology is experiencing an upward trend, with the Riau Islands the highest and other provinces showing mixed developments.

Simultaneously, the Human Development Index, Open Unemployment Rate, Economic Growth Rate, Infrastructure, and Information and Communication Technology have an effect on the inequality of income distribution in Sumatra Island. 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.

6.0 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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