

ANALYSIS OF GENDER EQUALITY AGAINST PER CAPITA INCOME ON SUMATRA ISLAND

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Abstract

This study analyzes the impact of gender equality on per capita income in the Sumatra region using a panel data approach with the Random Effects Model (REM) estimation method. The model yielded a coefficient of determination (R^2) of 0.73825. In the context of the Sustainable Development Goals (SDGs), gender equality is considered a key element in promoting inclusive and sustainable economic growth. This study utilizes panel data from 2018 to 2023, covering seven main indicators: the Human Development Index (HDI), the Gender Development Index (GDI), the Gender Inequality Index (GII), the ratio of average years of schooling between males and females (RLS), the ratio of the productive age population between males and females (RUP), the ratio of labor force participation rate between males and females (RTPAK), and women's representation in parliament (PP). The analysis results indicate that the Human Development Index and the ratio of average years of schooling between males and females have a positive and significant effect on per capita income in the Sumatra region.

Keywords: Gender Equality, Per Capita Income, Sumatra Island

INTRODUCTION

Per capita income is a commonly used economic indicator to describe the level of well-being of a population within a country or region. This indicator shows the average income received by each individual in a population over a given period. Per capita income reflects the end result of the dynamics of various economic, social, and development policy factors. One of the eight key goals in the Sustainable Development Goals (SDGs) system is justice and equality for women and men. These goals were agreed upon by all countries as part of the global commitment to sustainable development.

Gender refers to a social concept that describes the system of relationships and division of roles between men and women, which is no longer determined biologically, but rather shaped by social, cultural, political, and economic factors that develop within society. In the context of human development, gender equality between men and women, both in terms of opportunities and achievement, is a fundamental element (UNDP, 1995).

Worldwide, in 2023, Indonesia was ranked 87th and had a Global Gender Gap Index (GGGI) score of 0.697. The highest ranking was achieved by the Philippines with a score of 0.784, ranking 17th. Meanwhile, the lowest ranking was achieved by Malaysia with a score of 0.676, ranking 112th. (World Economic Forum)

The island of Sumatra is a region with diverse socio-economic characteristics, reflecting the broader situation in Indonesia. The island comprises several provinces with varying levels of development, access to education, labor force participation, and economic structures. This diversity allows for comparative analysis across regions within the island, providing a comprehensive picture of how variations in gender equality impact per capita income.

The 2018–2023 time period covers the pre-, post-, and post-COVID-19 pandemic phases, providing a unique context for examining the impact of the crisis on gender and income inequality. The pandemic has affected labor market structures, access to education, and women's domestic roles, allowing for a longitudinal analysis of how gender equality dynamics impact per capita income during periods of economic disruption and recovery.

Gary Becker (1964) in his human capital theory stated that improving human quality through education, training, and health will increase individual productivity, which will

impact per capita income. Investment in women's education and health strengthens human capital, which will increase per capita income.

The Brundtland Report (1987) and Amartya Sen's (1999) theory of sustainable development explain that economic development must be inclusive, equitable, and sustainable, taking into account social and environmental factors. Gender inequality hinders sustainable development because some populations (women) cannot contribute optimally to the economy. According to Nancy Folbre (1994) and Ester Boserup (1970), gender inequality in employment and wages can hinder economic growth because it potentially reduces the efficiency of labor allocation. Several real-world studies have shown that economies grow faster in regions with higher levels of gender equality than in regions with lower levels of gender equality.

In many developing countries, gender disparities remain evident in various sectors, such as access to education, labor force participation, wage disparities, and women's representation in the economic and political spheres. Female labor force participation remains relatively low, with only around 48% of women employed, compared to 75% of men in developing countries (World Bank, 2021).

Paul Romer's (1986) theory of endogenous economic growth states that factors that drive economic growth come from both within and outside the country. For example, foreign investment and capital accumulation are examples of external forces. Women's health and education can directly improve human capital, which in turn increases per capita income and labor output. If women have equal opportunities to attend school and find work, they can contribute more to the production of goods and services, thereby increasing per capita income.

Panel data regression is a method used in quantitative research to examine how factors change over time and how individuals relate to each other over time. This model allows for controlling for unobserved heterogeneity and analyzing the dynamics of change over time.

REVIEW OF LITERATURE

Amartya Sen, whose theory states that women play an equally important role as men in driving economic progress, argues that without women's active involvement in the economic sector, development will not be optimal. Women function not only in the domestic sphere as housewives but also have the capacity to take on public roles, including as breadwinners and economic actors in various sectors (Bag & Barman, 2022; Valencia, 2022).

One of the main characteristics of modern economic progress, according to Professor Kuznets' theory, is a significant increase in output per person (Mirza, 2012:13). Gross Regional Domestic Product (GRDP) per capita, in this case, is what is meant by "output per capita." When output per capita increases rapidly, people will change the way they consume things and their purchasing power will also increase. This increase in purchasing power has a direct impact on the Human Development Index (HDI), because purchasing power is an important part of calculating the HDI through income measurements.

H1. Human Development Index Increases Per Capita Income on the Island of Sumatra

Hidayah and Rahmawati (2020) revealed that the GDI impacts the size of GRDP. This finding is supported by a study by Sitorus (2016), which found that the GDI positively contributed to increasing GRDP per capita. This means that economic growth depends not only on improving the quality of men as economic actors but is also significantly influenced by the advancement of women's basic capabilities in various fields.

H2. The Gender Development Index increases per capita income on the island of Sumatra

According to Eitzen, there are two main factors behind the emergence of gender inequality. First, this inequality is seen as a result of how the positions of women and men are shaped and linked to the economic structure of society. Second, the separation between the domestic and public spheres also limits women's freedom of movement, where women's roles in reproduction and domestic work result in limited access to resources of high economic value.

H.3 Gender Inequality Index reduces per capita income on the island of Sumatra

Michael P. Todaro and Stephen C. Smith (2006) argue that education is a crucial component of economic growth. They emphasize that education is key to developing good human skills, which in turn directly impacts the growth process. People in poor countries

must be able to use modern technology, and education can help them do so. This is crucial for long-term growth and progress.

H.4 The ratio of the average length of schooling for boys and girls increases per capita income on the island of Sumatra.

Population growth, including growth in the working-age population, is often considered a factor supporting economic growth. This factor is highly dependent on the economic system's capacity to absorb and utilize additional labor productively, which is closely related to the level and type of capital accumulation and available managerial skills (Todaro, 2006). Population growth will result in increased consumption needs, necessitating increased incomes to meet these needs (Tambunan, 2003).

H.5 The ratio of productive age men and women increases per capita income on the island of Sumatra

Classical theory states that as the number of people employed increases, economic growth also increases. Inequality between men and women in the labor market can slow economic growth. According to Stephen Klasen (2009), inequality in employment impacts not only women but also men, children, and the economy as a whole.

H.6 The ratio of male and female labor force participation rates increases per capita income on the island of Sumatra.

Research by Sameul Fery reveals that women's political participation in West Nusa Tenggara can increase women's productivity, reduce gender discrimination, and positively impact family income. Increasing women's participation in parliament can result in more substantial political decisions and support policies that prioritize the interests of women and children (Supanji, 2021).

H.7 Women's involvement in parliament increases per capita income on the island of Sumatra

RESEARCH METHOD

This study uses annual data from each province from 2018 to 2023, using a panel data analysis approach. The data collected covers various social and economic indicators from all provinces on the island of Sumatra.

The research method used in this study is descriptive quantitative, meaning the researcher focuses on numbers to understand the social and economic events that occur. This method was chosen because it provides a clear and measurable picture of how various indicators of gender equality, such as the Human Development Index (HDI), Gender Development Index (IPG), Gender Empowerment Index (IDG), Gender Inequality Index (IKG), the ratio of the average years of schooling between men and women, the ratio of the Labor Force Participation Rate (TPAK), the ratio of productive age, and the number of women in parliament, affect the per capita income of a region. Python was used to examine the data. This program makes it easy to work with large amounts of data and view the results in various ways.

This study uses panel data from 10 provinces on the island of Sumatra for the period 2018-2023. The variables used in this study consist of independent and dependent variables. The data sources and variables used are as follows.

Table 1.
Variables and Data Sources

No	Name Variables	Type Variables	Definition	Unit	Source
1	Income per capita	Dependent	Gross Regional Domestic Product at constant prices divided by the population	Ratio	Central Statistics Agency Website
2	HDI	Independent	Indicators used to measure the achievement of human development based on quality of life components	Mark	Central Statistics Agency Website
3	IPG	Independent	Indicators used to measure the achievements of male and female gender development	Mark	Central Statistics Agency Website
4	IKG	Independent	Indicators used to measure gender inequality are measured from the aspects of Health, Empowerment, and access to the labor market.	Mark	Central Statistics Agency Website

5	Ratio of Male & Female in productive age	Independent	Proportion of men and women of productive age	Ratio	Central Statistics Agency Website
6	Ratio of male and female TPAK	Independent	Proportion of male and female workforce to male and female working age population	Ratio	Central Statistics Agency Website
7	RLS ratio of men to women	Independent	The average number of years spent by males and females aged 15 years and over on all types of education they have ever received	Ratio	Central Statistics Agency Website
8	Women in parliament	Independent	Women's involvement in women's seats	Percentage	Central Statistics Agency Website

In panel data analysis, various approaches or estimation techniques can be applied to build more accurate regression models. Each method has its own characteristics and advantages in handling combinations of data across time and between units. Selecting the right method is crucial because it will affect the validity of the estimation results and the model's ability to explain the relationships between variables in depth and comprehensively.

The Panel Data Model can be written as follows:

$$\text{Ln}(\text{GRDP})_{it} = \alpha + \beta_1 \text{IPM}_{it} + \beta_2 \text{IPG}_{it} + \beta_3 \text{IKG}_{it} + \beta_4 \text{RLS}_{it} + \beta_5 \text{RUP}_{it} + \beta_6 \text{RTPAK}_{it} + \beta_7 \text{PP}_{it} + \epsilon_{it}$$

Information:

- Ln(GRDP)_{it} : Natural logarithm of GRDP at constant prices
- IPM_{it} : the observation value of the kth predictor variable at the i-th observation location
- IPG_{it} : Gender Development Index
- IKG_{it} : Gender Inequality Index
- RLS_{it} : Ratio of length of schooling for boys and girls
- RUP_{it} : Productive Age Ratio of Men and Women
- RTPAK_{it} : Ratio of Male and Female Labor Force Participation Rates
- PP_{it} : Women's Participation in Parliament
- α : Intercept
- β : Regression Coefficient
- i : Individuals, covering 10 provinces on the island of Sumatra
- t : Period, 6 years 2018-2023

RESULTS AND DISCUSSION

From 2018 to 2023, the Riau Islands region consistently recorded a very high per capita income compared to other regions on Sumatra Island, ranging from Rp70,736,000.77 to Rp81,206,000.77. This region's economic superiority stems from its diverse and dynamic economic structure, encompassing the rapidly growing industrial, trade, fisheries, and tourism sectors.

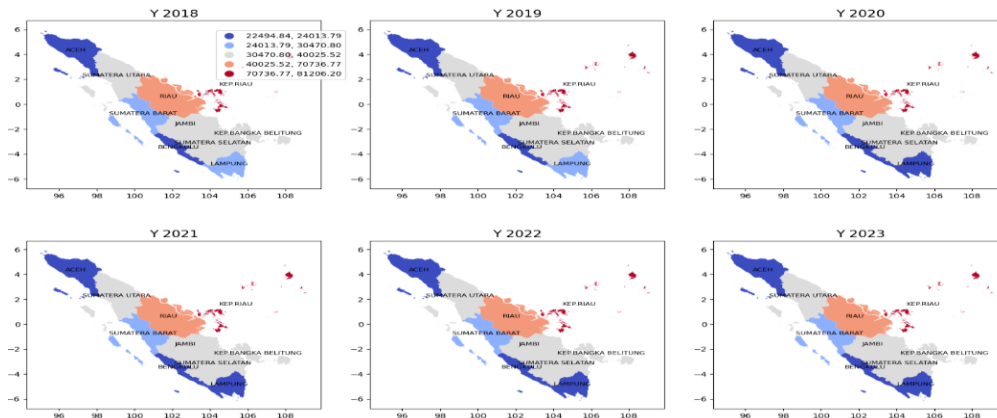


Figure 1
Per Capita Income in Sumatra Island 2018-2023

The Riau Islands Province is classified as having a very high Human Development Index (HDI), with a consistent value above 72.44 during the 2018–2023 period. This achievement is driven by a strong economic structure based on industry, trade, and plantations. The combination of these sectors significantly contributes to improving the quality of life for the community, providing access to education, and equitable healthcare services in urban and surrounding areas.

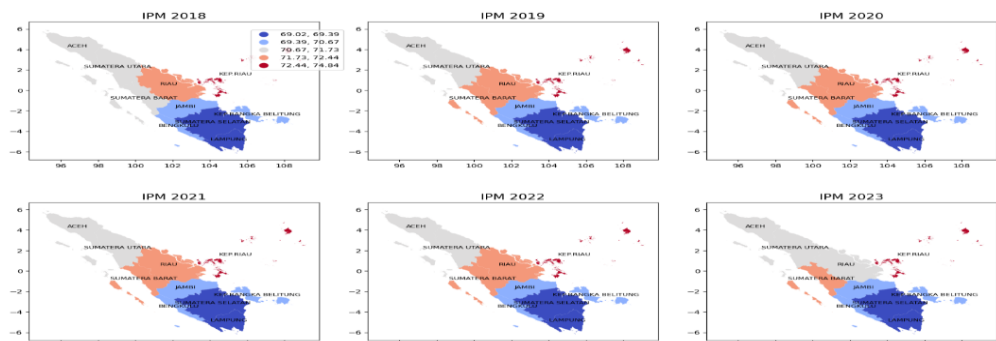


Figure 2
Human Development Index on Sumatra Island 2018-2023

West Sumatra Province was categorized as having a very high Gender Development Index on the island of Sumatra between 2018 and 2023, ranging from 92.62 to 94.70. West Sumatra has a Minangkabau culture that adheres to a matrilineal system, where descent is traced through the mother's side. This matrilineal culture contributes to high female participation in education and the economy, as well as policies that promote gender equality.

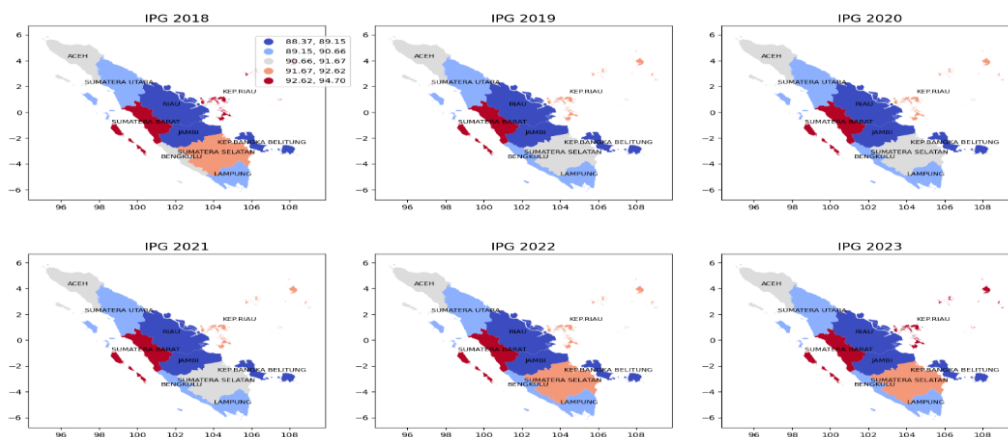


Figure 3
Gender Development Index on Sumatra Island 2018-2023

Jambi Province recorded a very high Gender Inequality Index (GII) on the island of Sumatra from 2018 to 2023, with values ranging from 0.56 to 0.59. This high gender inequality in the province is influenced by various structural and social factors. One of the main causes is the low level of women's participation in the economic sector, particularly in the more stable and secure formal sector. Furthermore, women's representation in politics and leadership positions at the local level remains very limited, reflecting their low involvement in strategic decision-making.

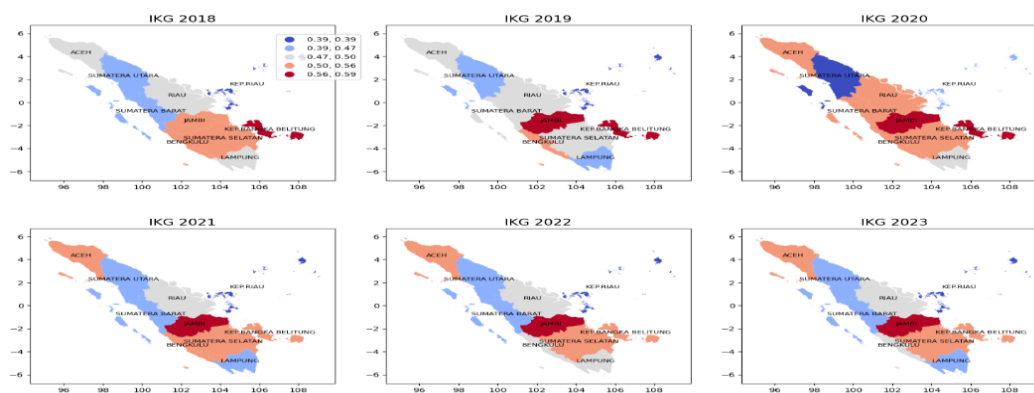


Figure 4
Gender Inequality Index on Sumatra Island 2018-2023

From 2018 to 2023, West Sumatra Province ranked first in terms of the average ratio of years of schooling between males and females on the island of Sumatra, which is categorized as very high. This achievement is due to various interrelated supporting factors. One of the main causes is the high participation of women in formal education, particularly at the tertiary level, which has brought the average years of schooling for women close to or even equal that of men.

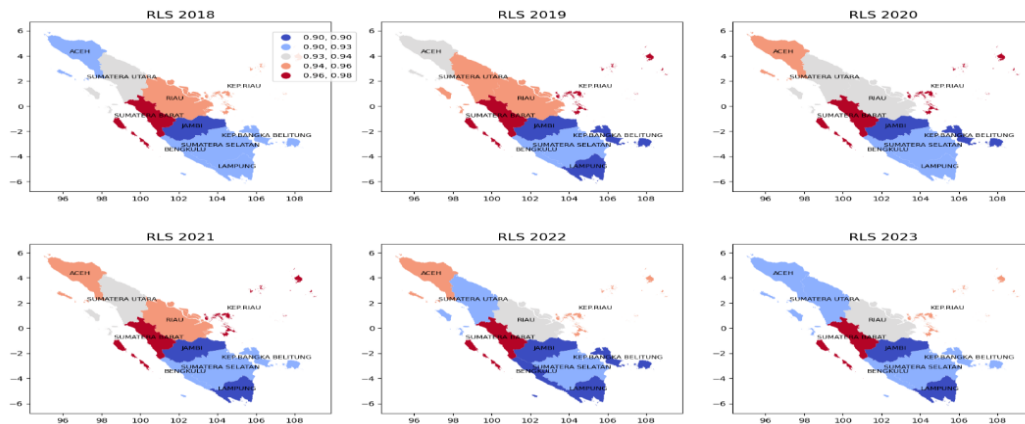


Figure 5
Average ratio of length of schooling for boys and girls on the island of Sumatra

North Sumatra Province has a ratio of productive age of men and women on the island of Sumatra in the very high category in the period 2018-2023. The fertility rate (birth) in North Sumatra is quite stable so that the number of women in productive age remains high, the increase in women's involvement in the informal and formal sectors makes the ratio of women's productive age close to or even exceeds that of men, Men of productive age from North Sumatra tend to migrate to other areas, such as Jakarta, Batam, or abroad to look for jobs with higher incomes, and the increase in women's education levels encourages more women to work which increases the ratio of women's productive age.

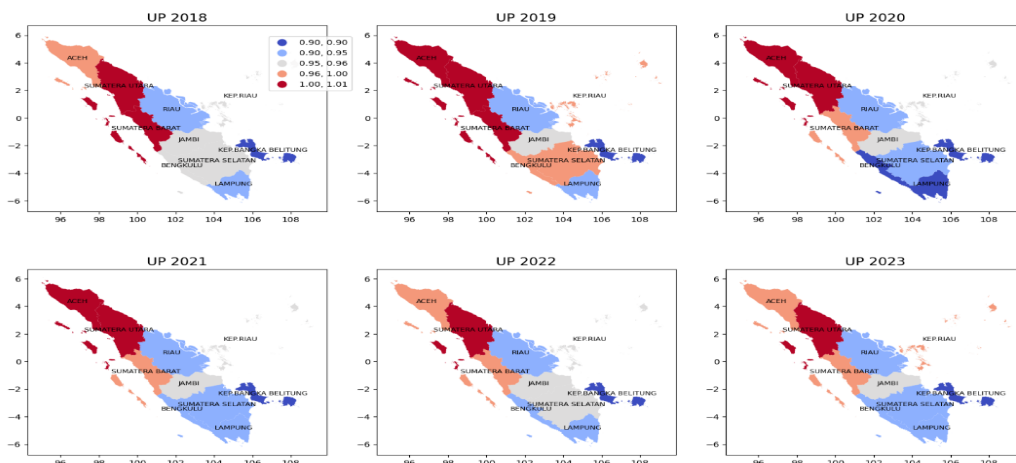


Figure 6.
Ratio of Productive Age of Men and Women on the Island of Sumatra 2018-2023

In 2021, there was a significant decline in the ratio of male to female LFPR in North Sumatra. This decline was closely related to the socio-economic impacts of the post-COVID-19 pandemic recovery period. Many women were forced to leave the workforce to return to domestic roles, particularly caring for children during distance learning and handling increased household burdens. Furthermore, sectors that rely on female labor—such as trade, tourism, and the service industry—experienced a slower recovery than other sectors dominated by men. This situation demonstrates that the global health crisis has exacerbated gender inequality in the labor market and highlights the importance of gender-responsive policies in responding to emergencies and recovering from them.

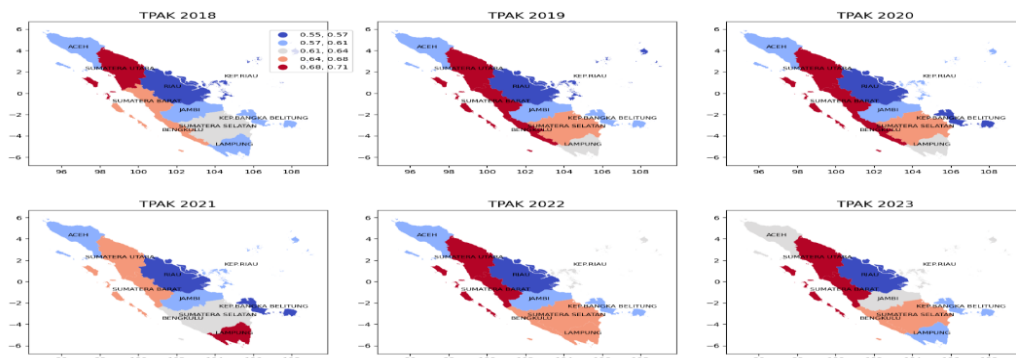


Figure 7.
Ratio of Male and Female Labor Force Participation Rates on the Island of Sumatra 2018-2023

In practice, there is fluctuation in political parties' commitment to strengthening women's roles in the legislative sphere. At certain times, parties appear more proactive in

encouraging female cadres to advance and become actively involved in politics, while at other times, this enthusiasm and support tend to wane. This variation suggests that women's representation in parliament depends not only on formal policies but also on internal party dynamics, electoral strategies, and responses to social and political pressures at any given time.

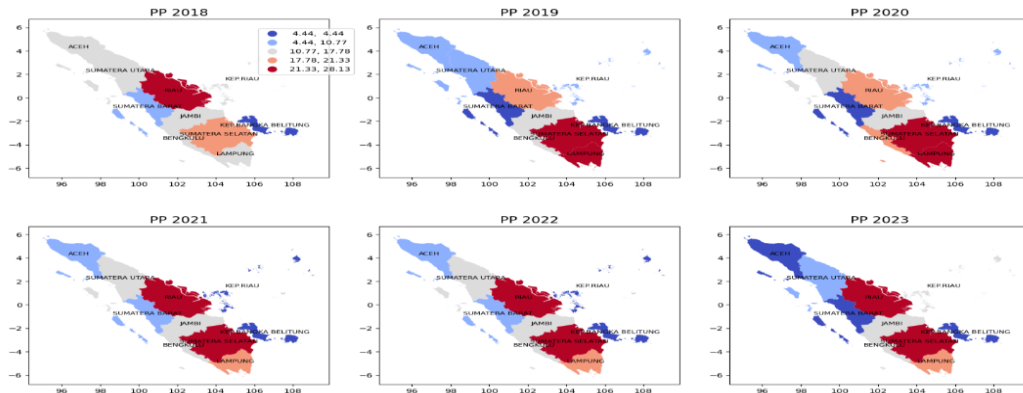


Figure 8.
Women's involvement in parliament on the island of Sumatra 2018-2023

The initial steps taken to select the best model using panel data analysis include the Common Effects Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) using the Chow test, Hausman test, and BP-LM test. In this study, the best model was the Random Effects Model (REM). The following table shows the p-values of the test results in determining the best model.

Table 2.
Results of the Best Model Selection Test

Testing	p-value	Decision	Conclusion
Chow Test	2.2x 10 ⁻¹⁶	Reject H ₀	FEM is better than CEM
Hausman test	0.6983	Failed to Reject H ₀	REM is better than FEM
Lagrange Multiplier Test	1.012x 10 ⁻¹²	Reject H ₀	REM is better than CEM

Source: Processed Data

Based on the information provided in the table, the best model used in this study is the Random Effect Model.

There are two key assumption tests that are important in panel data regression analysis: the heteroscedasticity test and the multicollinearity test. The multicollinearity test

checks for strong linear relationships between independent variables that could confound the regression coefficient estimates. Conversely, the heteroscedasticity test looks for residual variances that do not remain constant across observations. Both tests are necessary to ensure the correctness of the regression model and the absence of bias in the estimation of research results (Basuki & Yuliadi, 2014: 183; Napitupulu et al., 2021: 120).

Table 3.
Multicollinearity Test Output

Variables	VIF
HDI	3.46
IPG	2,229
IKG	2,366
RLS	3,547
UP	1,375
TPAK	1,727
PP	1,164

Source: Processed Data

Based on Table 3 presented above, the VIF value of each independent variable is <10, indicating that the independent variable does not experience multicollinearity symptoms. The heteroscedasticity test was conducted to identify whether there is inhomogeneity in the residual variance across all observations in the regression model. In other words, this test aims to ensure that the error variation (residual) remains consistent across the range of independent variable values. When the residual variance is not constant or there is a certain pattern, this can cause the model estimation to be inefficient and biased. Based on the Breusch-Pagan-Godfrey test, the p-value obtained is 0.541, indicating failure to reject H0, so the Random Effect Model does not show symptoms of heteroscedasticity.

Table 5.
Coefficient of Determination

R-Squared	0.73825
Adj. R-Squared	0.70301
Chisq	146,661

Source: Processed Data

The R-Squared value in the panel data regression model using the Random Effects Model (REM) method and taking into account individual effects (cross-section) was obtained at 0.73825 (Table 5). This indicates that factors such as the Human Development Index, Gender Inequality Index, Gender Development Index, Average Years of Schooling for both

men and women, Labor Force Participation Rate Ratio (RTPAK), men and women, Productive Age, and Number of Women in Parliament can explain approximately 73.825% of the change in the Per Capita Income variable on the island of Sumatra.

Table 6.
Results of the F-test of the Random Effect Model estimation

R-Squared	0.73825
Chisq	146,661
P-Value	2.22x 10-16

Source: Processed Data

The test results show that the F test statistic has a p-value of $2.22 \times 10^{-16} < 0.05$. Thus, H_0 is rejected, meaning that all independent variables tested together have a significant influence on the dependent variable. This means that all independent variables tested together help explain changes in the dependent variable.

Table 7.
Interpretation of Random Effect Model Output Results

Variables	Std.Error	P-Value	Estimate
Intercept	1,015	6.046x 10-16	7,9243
HDI	0.005	1.927x 10-5	0.0224
IPG	0.134	0.9067	0.0015
RLS	0.352	0.03	0.7634
IKG	0.14	0.615	-0.0706
TPAK	0.101	0.0836	-0.1758
UP	0.297	0.2278	0.359
PP	0.001	0.067	-0.0031

Source: Processed Data

Based on the results of the output of table 7 presented above, the general panel data regression model is obtained as follows with a coefficient of determination value of 0.73825

$$\text{Income Per Capita} = 7.9243 + 0.2244 \text{ IPM} + 0.0015 \text{ IPG} + 0.7634 \text{ RLS} - 0.0706 \text{ IKG} - 0.1758 \text{ RTPAK} + 0.3590 \text{ RUP} - 0.0031 \text{ PP} + e$$

Using the Random Effect Model estimation method, the estimation results show a positive and significant influence of the HDI and the ratio of male and female years of schooling on per capita income in Sumatra Island during 2018–2023. This can be explained because both variables are important indicators of the quality and equality of human resources. Improvements in both aspects will increase labor productivity, encourage

economic growth, and directly increase the per capita income of a region. Therefore, provinces with a higher HDI and the ratio of average male and female years of schooling tend to have higher per capita income because they are supported by superior human capital.

CONCLUSION

The Human Development Index and the ratio of years of schooling between males and females have a positive and significant influence on per capita income on the island of Sumatra, 2018-2023.

Theoretically, the HDI is an aggregation of three main dimensions: health (life expectancy), education (expected and average years of schooling), and a decent standard of living (real income per capita). An increase in the HDI reflects improvements in the quality of human resources (HR), which directly impacts labor productivity and competitiveness. Individuals with good health and adequate education tend to have better job opportunities and are able to produce higher economic output. This finding aligns with the view of Todaro and Smith (2012), who stated that human development is not only the ultimate goal of development but also a primary means of accelerating long-term economic growth. Empirically, Indonesian provinces with high HDI values, such as DKI Jakarta, Yogyakarta, and Bali, also recorded higher per capita incomes than other provinces (BPS, 2023).

Scientifically, increasing women's RLS has implications for increasing women's economic participation, increasing labor productivity, and strengthening the family's economic structure. Equal education between genders also has a multiplier effect on the quality of the next generation, particularly in aspects of children's health, nutrition, and education. Therefore, gender equality in education is not only a social issue but also has a significant impact on economic growth. This finding is supported by a study by Klasen and Lamanna (2009), which found that gender inequality in education and labor force participation leads to lost economic growth potential in developing countries. Furthermore, data from the Central Statistics Agency (BPS) (2023) shows that regions with high female RLS, such as DKI Jakarta and the Riau Islands, have higher per capita incomes than regions with large gender education gaps.

A positive GDI coefficient indicates that the smaller the gender gap, the greater the

potential contribution of women to economic development. However, statistical insignificance indicates that the increase in the GDI is not structurally strong enough to increase per capita income in Sumatra. Women's economic participation remains limited in terms of quality. Many women in Sumatra work in the informal sector, subsistence agriculture, or domestic work that does not contribute directly to GDP. Patriarchal culture and traditional social norms in most parts of Sumatra tend to limit women's roles in the formal economy and decision-making positions. Limited infrastructure supporting women's work, such as access to childcare services, safe transportation, and guaranteed employment protection, also poses a barrier. A study by Tzannatos (1999) also states that without real access to labor and financial markets, gender equality in education alone is insufficient to drive income growth.

The positive coefficient on the RUP variable indicates that an increase in the ratio of productive-age women to men has the potential to boost per capita income. However, its insignificance indicates that this demographic potential has not been fully utilized in the production process and economic development on the island of Sumatra. Underutilization of female labor: Although demographically, women are of productive age, many of them are economically inactive due to domestic burdens or social norms. Limited quality employment opportunities: Many regions in Sumatra still rely on the primary sector (agriculture, plantations), which does not optimally absorb female labor. Lack of training and access to technology for productive-age women so their potential contribution to regional income remains low.

The GCI has a negative and insignificant effect. The GCI indicates gender inequality and, logically, should negatively impact per capita income due to the reduced contribution of women to economic development. The dominance of the informal and agricultural sectors, where women's contributions are not always recorded in formal data, biases the relationship between the GCI and per capita GDP. Gender inequality is long-term structural, while per capita income can be influenced by short-term factors (e.g., commodity prices, regional investment). The lack of integration of gender data in regional development planning means that the effects of gender inequality are not clearly reflected in regional economic output.

The RTPAK has a negative and insignificant effect. Women's participation in the

labor force is predominantly in the informal sector or unpaid work, so it does not directly impact per capita income as measured by formal economic indicators. In the local cultural context of Sumatra, women are often involved in household work or family farming, which is not recorded in formal TPAK statistics.

Women's participation in parliament has a negative and insignificant impact. Representation has not been followed by substantive influence. Many women in parliament still lack influence in strategic decision-making. Gender issues have not been prioritized in regional economic policy. The parliamentary agenda tends to be dominated by political issues and infrastructure development. Quantity does not guarantee quality. Much of women's representation in parliament is symbolic or the result of affirmative action, without being accompanied by an active role in economic or empowerment issues.

The government plays a role in promoting gender equality and increasing per capita income through inclusive and sustainable policies. This includes strengthening regulations, increasing women's access to various sectors, and encouraging their active involvement in the economy and politics. Regular evaluation and synergy between the government, the business sector, and civil society are key to achieving greater gender equality on the island of Sumatra.

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