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Original Article

The Effects of Human Development and Economic Growth on Income Inequality: Evidence from Three East Asia Countries

Ulfa Keumala Sari [a] and Srinita Srinita [a,*]

[a] Department of Economics, Faculty of Economics and Business, Universitas Syiah Kuala, Kopelma Darussalam, 23111 Syiah Kuala, Banda Aceh, Aceh, Indonesia; ulfakeumalasari@gmail.com (U.K.S.)
* Correspondence: srinita@usk.ac.id (S.S.)

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Abstract: Income inequality remains a pressing social and economic issue in East Asia, despite rapid economic growth and significant improvements in human development. Countries such as China, Japan, and South Korea have experienced divergent patterns of inequality due to variations in social policies, labor market structures, and the distribution of economic growth. While prior studies have examined the relationship between economic growth, human development, and income inequality, there is limited consensus regarding the relative influence of human development versus economic expansion, particularly in the context of East Asia. This research addresses this gap by investigating the impact of the Human Development Index (HDI) and economic growth on income inequality across three East Asian countries from 2003 to 2022. A quantitative panel data approach was employed, using balanced data from 60 observations over 20 years. The study applied the Fixed Effect Model (FEM) with cross-sectional dummy variables to account for country-specific heterogeneity. Descriptive statistics, panel regression diagnostics, and robustness tests were conducted to ensure model validity. The results indicate that HDI has a significant negative effect on income inequality, suggesting that improvements in education, healthcare, and living standards contribute to more equitable income distribution. In contrast, economic growth shows a positive but statistically insignificant effect, implying that growth benefits are unevenly distributed and may not substantially reduce inequality. Among the countries studied, China exhibits the highest individual effect on income inequality, followed by Japan and South Korea. These findings underscore the crucial role of human development in reducing income disparities. Policy implications include prioritizing investments in education, healthcare, and social safety nets, alongside the implementation of inclusive growth strategies to ensure equitable economic benefits. Future research should expand the analysis to other regions and explore sectoral and micro-level mechanisms linking human development to income inequality.

Keywords: Income Inequality; Human Development Index; Economic Growth; East Asia Countries.

1. Introduction

Income inequality is one of the key social and economic challenges faced by many countries, both developed and developing. East Asian nations, including China, Japan, and South Korea, exhibit different patterns of income disparity. In China, inequality has risen due to uneven economic growth, particularly between urban and rural areas (World Bank,

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2015). In contrast, South Korea and Japan have successfully reduced inequality through strong social security systems, better access to public services, and equitable fiscal policies (Dollar, 2007).

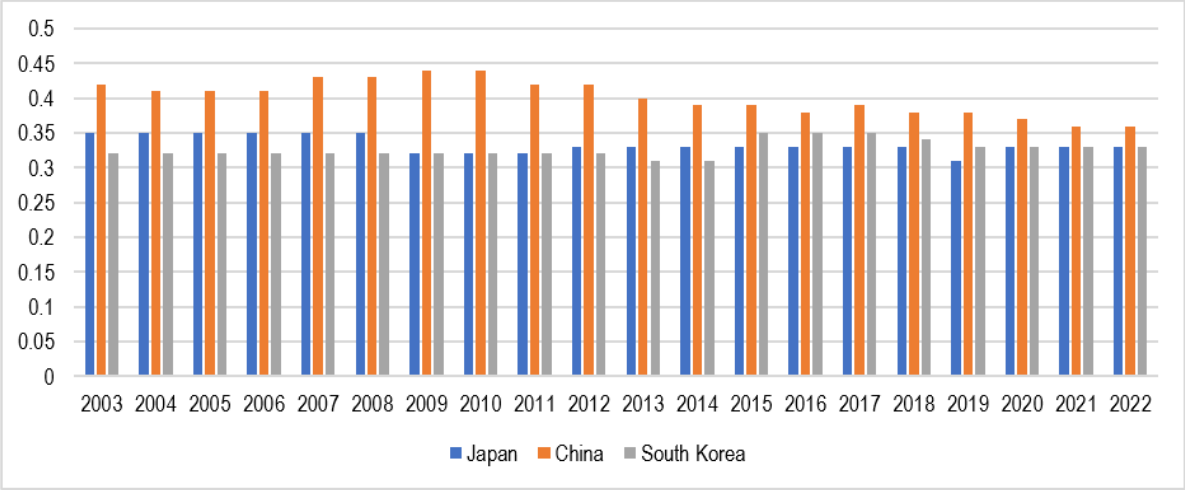

Figure 1. Trends in the Gini Coefficient of East Asian Countries, 2003–2022

Figure 1 displays that Japan's Gini coefficient has remained relatively stable, averaging 0.35 between 2003 and 2022. This figure indicates that income inequality in Japan has generally stayed within the same range over this period, with a slight decline to 0.31 in 2019. This trend reflects the effectiveness of Japan's economic policies in maintaining income stability. Meanwhile, China's Gini coefficient declined modestly from 0.42 in 2003 to 0.36 in both 2021 and 2022. This reduction suggests that income distribution has improved in recent years, largely driven by government efforts to reduce inequality through social welfare programs and redistributive policies (Yang & Zhao, 2024). South Korea's Gini coefficient, on the other hand, shows a slight upward trend, rising from 0.32 in 2003 to 0.33 between 2019 and 2022. This data highlights the country's ongoing efforts to maintain a relatively stable income distribution.

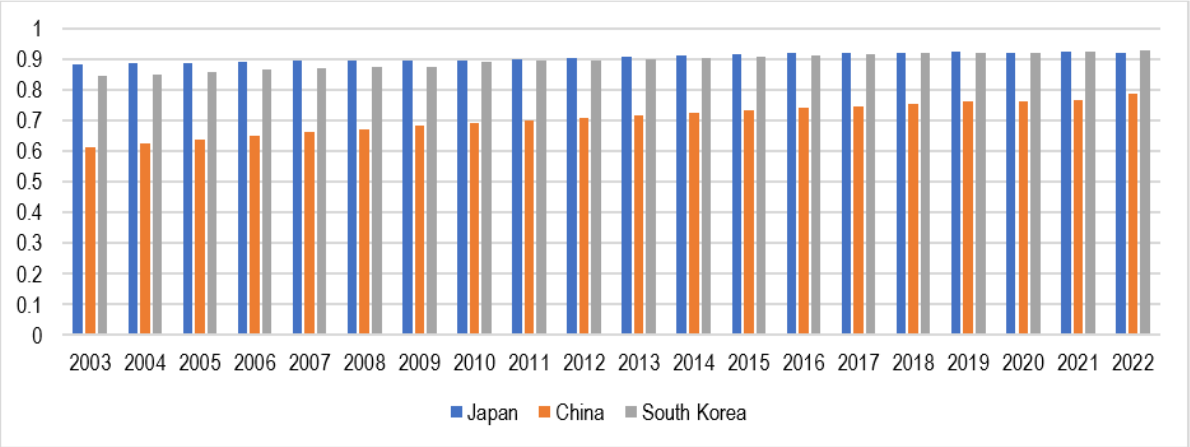

Figure 2. Human Development Index in East Asia, 2003–2022

Figure 2 illustrates how the Human Development Index (HDI) and unemployment rates in three East Asian countries, namely Japan, China, and South Korea, evolved between 2003 and 2022. Among the developed nations, Japan consistently ranks among the highest in terms of its very high HDI. During this period, Japan's HDI ranged between 0.884 and 0.920. Although relatively stable, it experienced a slight decline in 2021, dropping from 0.925 in 2020 to 0.920 in 2022. This minor decrease can be attributed to several factors, including shifts in economic policies, demographic changes, or external shocks such as the COVID-19 pandemic, which affected both public health and the economy. Nevertheless, Japan's HDI remains very high, reflecting a strong quality of life, high levels of education, and a long life expectancy (Miranda-Lescano et al., 2023).

China, the world's second-largest economy, demonstrated steady growth in its HDI between 2003 and 2022. Overall, China's HDI rose from 0.615 in 2003 to 0.788 in 2022. This increase highlights progress in various aspects of human development, including education, healthcare, and living standards. The rise in China's HDI can be linked to

government initiatives aimed at strengthening the health and education sectors, as well as poverty reduction programs and broader development policies (Charles et al., 2014). South Korea also recorded significant growth in its HDI, increasing from 0.844 in 2003 to 0.929 in 2022. This improvement reflects the country's success in enhancing its citizens' quality of life through expanded access to healthcare, education, and sustained economic growth. Furthermore, the creation of new jobs in the technology, manufacturing, and service sectors has contributed to reducing unemployment. These advancements demonstrate South Korea's economic and social transformation, driven by strategic policies and technological innovation, which are key pillars of the nation's growth (Kim & Kim, 2025).

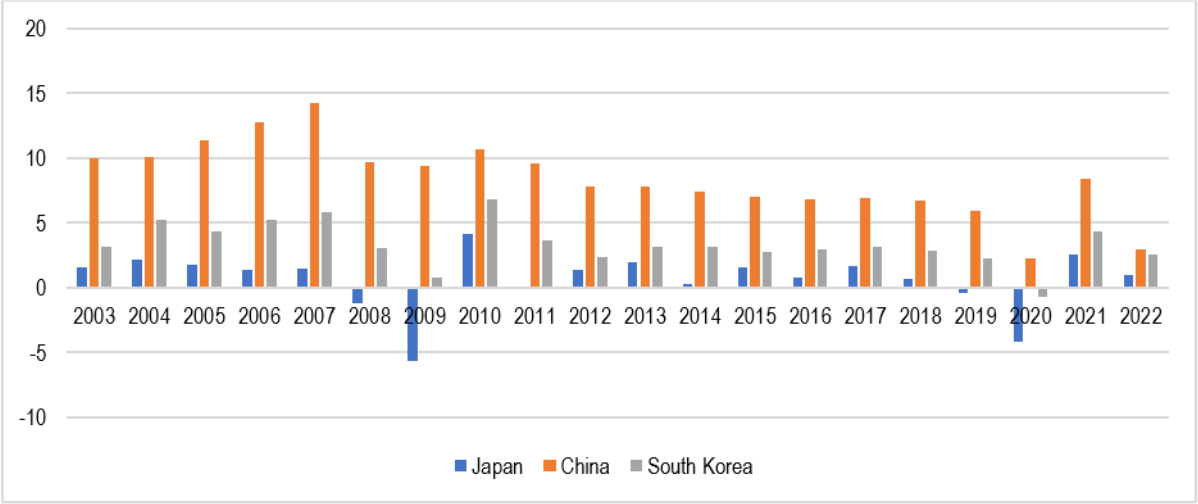

Figure 3. Economic Growth in East Asia, 2003–2022

Figure 3 illustrates the impact of the COVID-19 pandemic, which triggered a global decline in economic activity due to social restrictions, reduced global demand, and disruptions in supply chains. The economic growth of each East Asian country varied significantly in 2020 (Miranda-Lescano et al., 2023). Japan's industrial and export-driven economy was substantially affected, with its growth rate plummeting to– 4.15% in 2020. Although growth returned to positive levels in 2021 (2.56%) and 2022 (0.95%), the recovery remained modest, indicating a gradual return to normal following the pandemic. By contrast, China had experienced relatively steady growth from 2003 to 2019. In 2020, its economy slowed to 2.24 percent but remained positive, reflecting China's resilience during the crisis. Aggressive fiscal and monetary policies, combined with a rapid rebound in industry and exports, enabled the country to maintain overall stability (Wang et al., 2023). In subsequent years, China experienced a sharp recovery in 2021 with growth of 8.45 percent, before slowing again to 2.99 percent in 2022 amid persistent global economic downturns and market uncertainty. South Korea was also affected, recording a contraction of –0.71 percent in 2020. However, the economy rebounded strongly in 2021 with a growth rate of 4.3 percent, driven largely by its technology and export sectors, which serve as key engines of growth (Yue, 2011). In 2022, however, growth slowed to 2.61 percent, mirroring global economic headwinds and ongoing market volatility.

While previous studies provide valuable insights, the literature reveals inconsistent and sometimes contradictory findings regarding the interplay between human development, income inequality, and economic growth. Some studies emphasize the role of HDI as a driver in reducing inequality, while others suggest its effects are negligible or statistically insignificant. Similarly, research on economic growth yields mixed results, with some findings suggesting a positive correlation with reduced inequality. In contrast, others argue that growth can intensify disparities depending on the inclusiveness of development. This inconsistency raises an important issue: the lack of clarity on how these three dimensions interact under varying development conditions. The research gap lies in the limited empirical evidence that simultaneously examines the triangular relationship between HDI, income inequality, and economic growth in the East Asian context, where rapid development, demographic transitions, and diverse policy interventions create unique dynamics. Therefore, the primary objective of this study is to examine the triangular relationship between human development, income inequality, and economic growth in East Asia, with the aim of determining whether development strategies effectively contribute to reducing inequality in the region.

2. Literature Review

Significant investments in human capital have enabled countries such as South Korea, Japan, and Singapore to achieve rapid economic development while simultaneously reducing income inequality. Ghifara et al. (2022), Grimm et al. (2008) and Sinaga (2020) demonstrated that improvements in the Human Development Index (HDI) have a positive

influence on income distribution. These findings are consistent with Ersad et al. (2022), who observed that while positive changes in HDI exist, they are not statistically significant in reducing inequality. This is largely because the main economic sectors contributing substantially to GDP in certain regions, such as agriculture, mining, and labor-intensive industries, do not directly rely on HDI indicators. Moreover, HDI itself is not directly associated with income distribution, which diminishes its statistical significance in explaining income inequality.

However, other studies present contrasting perspectives on the relationship between HDI and income inequality. (Miranda-Lescano et al., 2023) found that income inequality can negatively impact economic growth, a conclusion supported by Yuldashev et al. (2023), who argued that HDI can reduce inequality by enhancing employment opportunities and income in developing countries, particularly when investment is directed toward labor-intensive sectors that rely on local workers. Similarly, Sarkodie & Adams (2020) asserted that higher levels of income inequality are associated with lower HDI achievements. Inequality leads to an uneven distribution of resources, restricting access to essential services such as education, healthcare, and adequate living standards, thereby diminishing overall human development outcomes.

Other strands of literature explore the link between economic growth and income inequality. Sholikah & Imaningsih (2022) found that while economic growth exerts a positive influence on inequality, the effect is statistically insignificant. Putri & Anggraini (2024) similarly noted that economic growth may exacerbate inequality because the benefits of growth are not evenly distributed across society. Much of the economic gains are concentrated among specific groups, such as business owners and workers in established formal sectors, resulting in a limited overall impact on reducing inequality. Conversely, Fukawa et al. (2007) contended that economic expansion can have a negative impact on inequality, arguing that inclusive growth reduces disparities by generating higher aggregate income and creating more job opportunities. Kunenengan et al. (2023) supported this view that equitable growth significantly reduces inequality, whereas uneven development exacerbates disparities.

While previous studies provide valuable insights, the literature reveals inconsistent and sometimes contradictory findings regarding the interplay between human development, income inequality, and economic growth. Some studies highlight HDI as a driver of reduced inequality, while others suggest its effects are statistically insignificant. Similarly, research on economic growth shows both positive and negative associations with inequality, depending on the inclusiveness of development. This inconsistency highlights a research gap: there is a lack of empirical evidence that simultaneously examines the triangular relationship between HDI, income inequality, and economic growth in the East Asian context, where rapid development, demographic shifts, and policy interventions have created unique dynamics. Addressing this gap is essential for understanding whether human development initiatives and economic growth strategies in East Asia effectively contribute to reducing income inequality.

3. Materials and Methods

This study employs both time-series and cross-sectional data with an annual frequency, covering the period from 2003 to 2022. The research uses secondary data and adopts a quantitative approach. The primary variables analyzed include the Human Development Index (HDI) and economic growth as explanatory factors of income inequality. Data were obtained from various institutional publications, including the World Bank and countryeconomy.com. Research variables are defined as elements studied to obtain relevant information. Specifically, the variables in this study are:

Table 1. Summary of Variables, Measurements and Sources

Variable(s)	Unit of Measurement	Source(s)
Income Inequality (KP)	Ratio	World Bank
Human Development Index (HDI / IP)	Index	Country Economy
Economic Growth (PE)	Growth (%)	World Bank

The study employs panel data regression analysis, which is particularly suitable for datasets that combine cross-sectional and time-series dimensions. This method enables the control of unobserved heterogeneity across units (such as countries) while capturing both temporal and individual variations. By incorporating both fixed effects and random effects specifications, panel regression provides more robust estimates compared to traditional cross-sectional or time-series models. Mathematically, the general panel regression model can be expressed as follows:

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + \mu_i + \epsilon_{it} \quad (1)$$

Where: KP = Income Inequality; IP = Human Development Index; PE = Economic Growth; α = Constant; β = Regression Coefficient; i = Cross-section; t = Time-series and ε = Error term (model disturbance).

4. Results and Discussion

4.1. Descriptive Statistics Analysis

Descriptive statistics are employed to summarize and present the key characteristics of the data, making it easier to identify patterns, distributions, and variations before conducting further analysis. The descriptive results include the mean, median, maximum, minimum, and standard deviation of the variables under study.

Table 2. Descriptive Statistics (N=60)

Variable(s)	Mean	Median	Maximum	Minimum	Std. Dev.
KP (Income Inequality)	0.353833	0.335000	0.440000	0.310000	0.382720
IP (Human Development Index)	0.836267	0.889500	0.929000	0.615000	0.098090
PE (Economic Growth)	4.131833	3.080000	14.23000	-5.690000	3.964995

Table 2 presents the descriptive statistics of the key variables. The average income inequality (KP) in the three East Asian countries during the study period was 0.3538, with a median of 0.3350. The highest level of inequality recorded was 0.4400, while the lowest was 0.3100. The standard deviation of 0.3827 indicates relatively low dispersion across the dataset, suggesting that although inequality exists, it tends to remain within a narrow range in these countries. This stability could reflect consistent policy interventions and structural economic conditions that prevent extreme fluctuations in inequality. The Human Development Index (IP) shows an average value of 0.8363 with a median of 0.8895, highlighting generally high human development levels in the region. The maximum HDI observed was 0.9290, while the minimum was 0.6150, representing differences in development stages among countries.

A standard deviation of 0.0981 suggests that HDI values were relatively stable over time and across countries, with only modest variation. This reflects East Asia's overall strong performance in health, education, and living standards, despite existing gaps between more advanced and emerging economies. Economic Growth (PE) demonstrates greater variability. The mean growth rate was 4.1318, with a median of 3.0800, consistent with East Asia's reputation as one of the world's fastest-growing regions. However, the maximum value of 14.2300 and the minimum of -5.6900 highlight periods of extraordinary expansion as well as sharp contractions. These extreme values can be linked to external shocks such as the global financial crisis and the COVID-19 pandemic, which disproportionately affected open economies in the region. The relatively high standard deviation of 3.9650 further underscores the volatility of economic growth compared to the more stable indicators of inequality and human development.

4.2. Selection of The Best Model

4.2.1. Chow Test

The purpose of the Chow test is to determine whether the regression coefficients differ significantly across groups. If the test results indicate that the random effects model yields a probability value (p-value) of less than 0.05, then the fixed effects model (FEM) is considered more appropriate.

Table 3. Result of Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	5.533628	(2,55)	0.0065
Cross-section Chi-square	11.000405	2	0.0041

The Chow test results in Table 3 show that the fixed effects model is the most suitable estimation model for the panel regression. Both the Cross-section F and Cross-section Chi-square values are statistically significant, with probabilities of 0.0065 and 0.0041, respectively, which are less than the significance level of 0.05. This leads to the rejection of the null hypothesis (H_0), confirming the appropriateness of the fixed effects model.

4.2.2. Hausman Test

The Hausman test is used to determine whether the fixed effects model (FEM) or the random effects model (REM) is more appropriate for panel data analysis. The test examines whether the independent variables are correlated with the random effects. If the p-value is less than 0.05, the null hypothesis that the REM is more suitable is rejected, and FEM is preferred. Conversely, if the p-value is greater than 0.05, the REM is selected as the better model.

Table 4. Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	11.067257	2	0.0040

As shown in Table 4, the Hausman test results indicate a probability value of 0.0040, which is less than the 0.05 significance level. This result rejects the null hypothesis and confirms that the fixed effects model (FEM) is the appropriate model for this study. Since both the Chow and Hausman tests confirm the suitability of the fixed effects model, further testing with the Lagrange Multiplier (LM) test is unnecessary. Thus, the fixed effects model (FEM) is chosen over both the common effects model (CEM) and the random effects model (REM) for the panel data regression analysis.

4.3. Classical Assumption Tests

4.3.1. Normality Test

The first stage in classical assumption testing is to assess normality. This determines whether the data are normally distributed. The Jarque-Bera (JB) test is used to examine the normality of residuals. If the JB probability value is less than 0.05, the residuals are considered non-normal; if greater than 0.05, they are considered normally distributed. The results are presented in Figure 4.

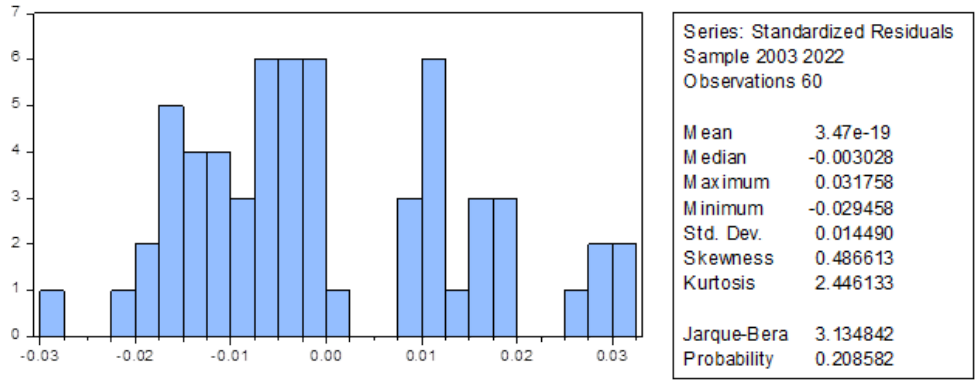

Figure 4. Normality Test

The Jarque-Bera statistic is 3.134842, with a probability value of 0.208582, which is greater than 0.05. This indicates that the residuals of the study data are normally distributed, supporting the validity of the regression model.

4.3.2. Multicollinearity Test

The second classical assumption test examines multicollinearity, which occurs when independent variables are highly correlated. A viable regression model should not exhibit multicollinearity.

Table 5. Result of Multicollinearity Test

Variable(s)	IP	PE
IP (Human Development Index)	1.000000	-0.851943
PE (Economic Growth)	-0.851943	1.000000

As shown in Table 5, the correlation coefficient between the independent variables IP and PE is –0.851943, higher than the threshold of 0.85. This indicates that there is no significant multicollinearity among the independent variables in the regression model.

4.3.3. Heteroskedasticity Test

The third classical assumption test evaluates heteroskedasticity, i.e., whether the residuals have constant variance. A regression model without heteroskedasticity is considered reliable.

Table 6. Result of Heteroskedasticity Test

Variable(s)	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002831	0.032389	-0.087404	0.9307
IP (Human Development Index)	0.015164	0.037051	0.409274	0.6839
PE (Economic Growth)	0.000512	0.000546	0.937437	0.3526

The results in Table 6 indicate that all variables have a p-value greater than 0.05. Therefore, there is no evidence of heteroskedasticity in the regression model, indicating that the model meets the assumption of constant variance.

4.4. Estimation of the Fixed-Effect Model Regression Function

To select the most appropriate approach among the common effects model, fixed effects model, and random effects model for panel data analysis, the fixed effects model (FEM) is applied following the Chow and Hausman tests. The panel data regression was conducted using Panel Least Squares with income inequality (KP) as the dependent variable, covering three East Asian countries (China, Japan, South Korea) over the period 2003–2022, resulting in a balanced panel with 60 observations. The model included cross-section fixed effects (dummy variables) to account for country-specific heterogeneity.

Table 7. Result of Panel Data Regression (Fixed Effect)

Dependent Variable: KP
Method: Panel Least Squares
Sample: 2003 2022
Periods included: 20
Cross-sections included: 3
Total panel (balanced) observations: 60

Variable(s)	Coefficient	Std. Error	t-Statistic	Prob.
C	0.513722	0.063082	8.143754	0.0000
IP (Human Development Index)	-0.199604	0.072163	-2.766038	0.0077
PE (Economic Growth)	0.001702	0.001063	1.601406	0.1150
R-squared	0.856645	Mean dependent var		0.353833
Adjusted R-squared	0.846220	S.D. dependent var		0.038272
S.E. of regression	0.015008	Akaike info criterion		-5.480790
Sum squared resid	0.012388	Schwarz criterion		-5.306261
Log likelihood	169.4237	Hannan-Quinn criter.		-5.412522
F-statistic	82.16597	Durbin-Watson stat		0.546373
Prob(F-statistic)	0.000000			

Table 7 presents the fixed-effect panel regression model, which demonstrates strong explanatory power for income inequality across the three East Asian countries studied, with an R-squared of 0.8566 and an adjusted R-squared of 0.8462, indicating that approximately 85% of the variation in income inequality is accounted for by the model. The standard error of the regression (0.0150) and the sum of squared residuals (0.0124) suggest a good fit of the model to the data, while the log-likelihood value of 169.4237 supports the overall robustness of the estimation. The F-statistic (82.166, $p < 0.01$) confirms that the model is statistically significant, demonstrating that the independent variables collectively have a meaningful impact on income inequality.

Specifically, the Human Development Index (IP) exhibits a significant negative effect on income inequality ($\beta = -0.1996$, $p = 0.0077$), implying that a one-point increase in HDI is associated with a reduction of approximately 0.1996 points in income inequality, holding economic growth constant. This result highlights the crucial role of enhancing education, healthcare, and living standards in fostering more equitable income distribution. From an economic perspective, a country's income inequality tends to decline as human development improves, encompassing higher standards of living, better health, and broader access to education. In other words, HDI contributes to equitable well-being, particularly in East Asian countries where social development is a key priority.

In contrast, economic growth (PE) has a positive but statistically insignificant effect on income inequality ($\beta = 0.0017$, $p = 0.1150$), suggesting that growth in these countries may disproportionately benefit certain groups, limiting its ability to reduce overall inequality. However, this result is not statistically significant. It suggests that economic growth has a limited empirical effect on income inequality. This may occur because growth in certain East Asian countries

disproportionately benefits specific groups, such as large corporations or urban populations, without substantially altering overall income distribution. Thus, while economic growth has a positive theoretical effect, its empirical impact on inequality is not significant. The Durbin-Watson statistic of 0.546 indicates potential positive autocorrelation in the residuals, which warrants further robustness checks to ensure the reliability of the estimates. Overall, the results highlight that human development plays a more decisive role than economic growth in addressing income disparities in East Asia.

4.5. Estimation of the Individual Effects

Table 8. Result of Fixed Effects Comparison Across Three East Asian Countries

Variable	Coefficient	Individual Effect
C	0.51	
IP	-0.19	
PE	0.00	
Fixed Effects (Cross)		
China	0.01	0.52
Japan	-0.00	0.51
South Korea	-0.01	0.50

Table 8 shows that, assuming economic growth and HDI remain constant at 0, China exhibits the highest individual effect on income inequality at 0.52%. This reflects factors such as gender inequality in employment opportunities, disparities in types of work, educational attainment, and access to well-paying positions in private and international sectors (Gustafsson & Wan, 2020). Despite these challenges, equitable economic growth remains critical to reducing income disparities. Japan ranks second with an individual effect of 0.51%, influenced by shifts toward high-tech industries and services, flexible labor market regulations, limited access to high-quality education, and an aging population that exacerbates wealth inequality and economic pressures, narrowing labor market opportunities and increasing social burdens (Miranda-Lescano et al., 2023). South Korea has the lowest individual effect at 0.50%. In Korea, changes in labor market structure, education levels, and social policies contribute to income inequality, but their influence is less pronounced compared to the aging population (Kim & Kim, 2024).

5. Conclusions

This study demonstrates that the Human Development Index (HDI) has a significant negative impact on income inequality in East Asian countries, suggesting that improvements in human development, achieved through better education, healthcare, and living standards, contribute to reducing disparities. In contrast, economic growth, while theoretically positive, was found to have an insignificant effect on income inequality, suggesting that growth benefits are often concentrated among specific groups rather than evenly distributed across society. Among the three countries analyzed, China exhibited the highest individual effect on income inequality, followed by Japan and South Korea, reflecting differences in social policies, labor market structures, and demographic factors such as aging populations. Despite these insights, the study has several limitations. First, the analysis relies on secondary data, which may not capture all nuances of social and economic disparities. Second, the study focuses on only three East Asian countries, limiting the generalizability of the findings to other regions. Third, the regression model, although robust, cannot fully account for unobserved variables, such as informal sector dynamics, regional policy variations, or cultural factors, that may influence inequality.

The findings have important policy implications. Governments should prioritize investments in human capital, particularly in education and healthcare, to promote more equitable development. Policies aimed at inclusive economic growth, such as support for small and medium enterprises, wage equality measures, and social safety nets, are essential to ensure that economic expansion benefits all social groups. Additionally, addressing structural challenges such as labor market disparities, gender inequality, and aging populations will be crucial to mitigating long-term income inequality. For future research, scholars are encouraged to explore a broader set of countries and regions to assess whether the relationships between HDI, economic growth, and income inequality hold in different contexts. Incorporating micro-level data or sectoral analyses could provide deeper insights into the mechanisms linking human development to income distribution. Furthermore, examining the role of governance, technological change, and globalization on inequality could enhance understanding of how policy and structural factors interact with economic and human development dynamics.

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