The Long-Run Impact of Educational Expansion on Income Inequality in ASEAN Countries

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How to Cite: Khusaini, K., Putro, T. W., Arifin, S., Putra, M. H. I., Amalia, F., & Syafawi, L. (2025). The long-run impact of educational expansion on income inequality in ASEAN countries. *Journal of ASEAN Studies, 13*(1), 161-185. https://doi.org/10.21512/jas.v13i1.12204

Abstract

Over the past two decades, global income inequality has tended to increase, particularly in developing countries within the ASEAN region. Global, regional, and national efforts to narrow income inequality have been ongoing, as have research endeavours. The correlation between educational expansion and income inequality remains debatable. This research aimed to re-investigate the impact of educational expansion on income inequality across ASEAN countries. The researcher utilized panel data from 11 ASEAN member states for the period 2010 to 2021. Using Panel Fully Modified Least Square (FMOLS) analysis, the research finds that educational expansion, proxied by average years of schooling, significantly contributes to reducing income inequality in the long run. Additionally, the gross enrollment rates in secondary and higher education were found to have a strong effect on narrowing income inequality among the populations of ASEAN countries in the long term, in contrast to the impact of gross enrollment rates in primary education. These findings further reinforce the theory and previous research that education is a key factor in reducing income inequality. Therefore, governments in each country should focus on accelerating the expansion and development of secondary and higher education.

Journal of ASEAN Studies, Vol. 13, No. 1 (2025), pp. 161−185
P-ISSN 2338-1361/ E-ISSN 2338-1353
Received: 20th September 2024/ Revised: 20th June 2025/ Accepted: 12th August 2025

Keywords: educational expansion, enrollment, mean years of schooling, income inequality

Introduction

Income inequality has become a common issue in developing countries (Makhlouf, 2023), but not in developed nations. The growing income disparity reflects an increasing gap between high-income and low-income populations. In recent decades, both global and national policymakers have made various efforts to curb the rise of income inequality, particularly in developing countries (Chancel et al., 2022; Mijs, 2021), through programs, financial assistance, empowerment initiatives, mentoring, and regulations. The increase in income inequality has implications for hindering economic growth, exacerbating poverty, affecting public health, education, and overall societal well-being (Adjor & Kebalo, 2018; Alesina & Perotti, 1996; Kuznets, 1963; McGregor et al., 2019; Munir & Kanwal, 2020; Stiglitz et al., 2018) and can even lead to insecurity and political instability (Batuo et al., 2022; Bourguignon, 2004).

Global income inequality has recently shown a tendency to rise (World Bank, 2023), although the gap has become smaller and remains lower than global wealth inequality. This is evidenced by the fact that the poorest half of the global population possesses almost no wealth, holding only 2% of the total global wealth. On the contrary, the wealthiest 10% of the world's population owns 76% of all wealth. The poorest half of the global population has a purchasing power parity (PPP) of €2,900 per adult, or USD 4,100, while the top 10% own an average of € 550,900 or USD 771,300 (Chancel et al., 2022). Meanwhile, income inequality in developing countries has also been on the rise, despite more progress in economic growth (Batuo et al., 2022; Bicaba et al., 2017; Kebalo & Zouri, 2024). In Asia and the Pacific, rapid growth and poverty reduction have been accompanied by a rise in income inequality (Zhuang, 2023). Similarly, the prevalence of income inequality in ASEAN countries reflects comparable conditions, disproportionately affecting low-income populations, low-skilled workers, minorities, immigrants, and women (United Nations Development Programme, 2022). A 1% increase results in an additional 15% of the population, or approximately 152 million people, falling into poverty in the ASEAN region (United Nations Economic and Social Commission for Asia and the Pacific, 2021).

Previous researchers have paid considerable attention to the various determinants of income inequality reduction. One of the key factors determining income inequality is education. Ghosh et al. (2023) argue that economies with lower levels of education and lower degrees of trade openness fail to reduce income distribution inequality. A significant research is conducted by Checchi (2001) which demonstrates that expanding education can increase earning opportunities for the poorest segments of the population, thereby reducing income inequality. Another research also find that income inequality is not solely determined by economic growth; education is one of the most powerful instruments in addressing it (Rodríguez-Pose & Tselios, 2009). Other research works have shown that expanding

education contributes significantly to reducing income inequality (Coady & Dizioli, 2018; Lee & Lee, 2018), with some findings even showing a significant nonlinear pattern (Xu et al., 2023).

Recent research works in Asia and the Pacific indicate that globalization, technological advancements, deregulation, and market-oriented reforms have created new business opportunities. However, it is crucial to note that many companies prioritize capital over skilled labour, which has not contributed to reducing income inequality (Zhuang, 2023). Using a different approach (outer space perspective), earlier research found that regional inequality and economic development in the ASEAN region exhibit an inverted-N relationship (Chen & Zhang, 2023). Overall, regional inequality in this area is primarily driven by uneven development among countries.

Previous research works at the national level in Southeast Asia have demonstrated a correlation between education and income inequality, as seen in Indonesia (Akita & Miyata, 2024; Setyadharma et al., 2021; Siburian, 2023; Thye et al., 2022), in Malaysia (Ismail, 2000; Koh et al., 2022; Mohd et al., 2014; Sulaiman et al., 2017; Tey et al., 2019), in Thailand (Mercado et al., 2024; Paweenawat & Liao, 2023), and in Timor-Leste (Aldar et al., 2021). Education also serves as an instrument for wealth accumulation, as observed in Vietnam (Pham et al., 2024; Vo & Ho, 2022), Philippines (Akita et al., 2023; Akita & Miyata, 2021, 2024; Mercado et al., 2024; Yee, 2024), Vietnam (Ho et al., 2020; Pham et al., 2024; Vu, 2020) , and Singapore (Ngoc & Hai, 2024; Widjaya, 2016). Other studies at the national level, including those from Myanmar and Cambodia, have also produced significant findings (Thein & Akita, 2019; Win et al., 2023). A previous research evaluating the impact of education (human capital) on income inequality in three ASEAN countries find that education plays an important role in decreasing the rural-urban divide, with a difference ranging between 30% and 40%(Akita & Miyata, 2021). However, another research has found a strong and nonlinear long-term relationship between education and inequality (Vo et al., 2024).

Hendel et al. (2005) also emphasize that in regions inhabited by individuals with higher levels of education, the quality of life improves more rapidly; however, affordable education tends to exacerbate income inequality. Other studies similarly demonstrate that the role of education, as proxied by increased government spending on education, actually contributes to widening income inequality (Checchi, 2001; Makhlouf & Lalley, 2023). Medgyesi (2014) and Muszyńska and Wędrowska (2023) also find that there is a significant income disparity among households with different educational levels of the household head. The findings indicate that the impact of educational differences on income inequality tends to be relatively high and relatively low in most EU-15 countries. Results for developing countries in ASEAN (including other Asian countries) show that an increase in the number of highly educated individuals does not reduce income inequality in the long term (Arshed et al., 2019; Vo et al., 2024), with Malaysia exhibiting similar results (Mohd et al., 2014). In fact, Koh et al. (2022) also report that education significantly widens income inequality in Asia and the Pacific. Policymakers continue to expand access to education for young people in an effort to narrow the income gap, but this has, in effect, widened the inequality (Lui, 2021).

Income inequality has become a persistent issue in developing countries. Despite various efforts by global and national policymakers, as well as research findings, income inequality continues to widen. The expansion of education has been identified as a factor that either reduces or exacerbates income inequality (Akita & Miyata, 2021; Koh et al., 2022; Lui, 2021; Makhlouf & Lalley, 2023; Xu et al., 2023). Existing research present mixed findings: some researchers conclude that educational expansion decreases inequality, while others find the opposite. Previous studies focused on the direct correlation between educational expansion and income inequality in a single country or a few countries. This research provides a holistic perspective that integrates recent trends and policy implications. Moreover, this research offers a novel contribution by analyzing the long-run impact of education on income inequality in ASEAN countries and employing a panel dataset covering 2010 to 2021. Additionally, this study aims to strengthen the theoretical consistency regarding the correlation between educational expansion and income inequality. Ultimately, the research seeks to provide empirical insights for policymakers in each country and the ASEAN Secretariat on the importance of expanding secondary and higher education.

Literature Review

In general literature, there is a common belief that education can play an essential role in reducing income inequality. Education produces human capital, which is utilized in the production process. The better the educational outcomes or the quality of human capital, the the greater their influence on individual income. However, the formation of socially underdeveloped human capital may be constrained by income inequality, thereby affecting the fairness of income distribution and potentially creating a vicious cycle (Cappelli et al., 2021). Workers with higher levels of education can help reduce income inequality within an economy (Xu et al., 2023). The expansion of education has undoubtedly contributed to bridging the gap in educational opportunities (Desai & Kulkarni, 2008).

The literature further reinforces the role of education in shaping income inequality. Schultz (1961) argues that one way to reduce income inequality is by increasing the educational attainment of the population (as a measure of human capital quality). Higher income levels will subsequently reduce inequality. Other theories suggest that education (human capital) is a key determinant of income disparities (Becker, 1964; Chiswick, 1974; Mincer, 1958, 1974). Moreover, Marin and Psacharopoulos (1976) emphasize a negative nexus between levels and income inequality.

Arshed et al. (2018) apply a cointegration approach using data from 1990 to 2015 and a group of selected SAARC countries, including Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka. The findings show that participation in primary and secondary school has a quadratic correlation with income inequality, with higher levels of school participation exacerbating the inequality. Other findings indicate that high levels of educational participation in India, Sri Lanka, the Maldives, and Nepal have a negative effect on income inequality. Also, Lee and Lee (2018) find that a more equitable distribution of education significantly contributes to reducing income inequality in East Asia. Continuing

their research in developing Asian countries from 1960 to 2015, Arshed et al. (2019) conclude through FMOLS analysis that participation in primary, lower secondary, upper secondary, and higher education increased inequality, with a non-linear relationship observed by using a similar cross-country approach (Lee & Vu, 2020).

Shukla and Mishra (2020) confirm a U-shaped relationship between average education levels and per capita income inequality in rural sectors of India, but not in urban areas. Their findings also show no significant relationship between education levels and income inequality in rural sectors, while income inequality is positively associated with the proportion of school graduates in the urban workforce. Vu (2020) conducts a study in Vietnam and supports previous findings that there is also no correlation between education and income inequality. Meanwhile, a study in Indonesia finds that higher education reduces rural income inequality (Setyadharma et al., 2021). Education serves as an important instrument in reducing income disparities in rural areas of Indonesia.

Scripcar and Ciobanu (2021) demonstrate that education plays a crucial role in reducing income inequality within the European Union (2000–2019). Akita & Miyata (2021) found that narrowing the urban-rural education gap in Indonesia and the Philippines can reduce expenditure inequality in both urban and rural areas. Taresh et al. (2021), using the SVAR method for panel data from 33 Indonesian provinces from 2005 to 2018, conclude that income inequality negatively impacts educational growth and human development. In the long-run, education and the human development index can reduce income inequality.

Vo and Ho (2022), using data from the Vietnam Household Living Standards Survey between 2008 and 2018, show that educational attainment has become a key indicator of individuals' success in raising income and wealth, thereby reducing wealth accumulation inequality in Vietnam. Meanwhile, Koh et al. (2022) conduct a study on 19 Asian countries from 1990 to 2019. Their panel GMM method shows that controlling for national income levels, increasing trade openness, and improving institutional quality can reduce income inequality in the Asia-Pacific region. However, educational attainment worsens income inequality. A broader study in Asia and the Pacific by Zhuang (2023) finds that technological advancements, globalization, deregulation, market-oriented reforms, and financialization have created numerous new opportunities. However, these developments tend to benefit capital more than labor, skilled workers more than unskilled workers, and contribute to the expansion spatial inequality, ultimately leading to a greater concentration of wealth among the affluent.

Xu et al. (2023), utilizing the NARDL model, find that positive shocks to secondary and higher education are negatively correlated with the long term Gini coefficient of income in China during 1975–2020. Siburian (2023) estimate a dynamic panel from 2001 to 2018, providing evidence that higher levels of fiscal decentralization weaken the impact of years of schooling on income inequality in Indonesia. Furthermore, Muszyńska and Wędrowska (2023) demonstrate that most countries with a high proportion of educated individuals also exhibit lower levels of inequality at the lower end of the distribution. A study in Myanmar using regression analysis found that educational attainment and labour force participation

significantly impact poverty reduction (Win et al., 2023). Vo et al. (2024) find that human capital reduces income inequality in the short term in ASEAN-7 countries. However, in the long term, human capital can increase income inequality in these countries.

Recent studies also yield diverse findings. Ngoc and Hai (2024) analyze the relationship between three key macroeconomic variables and income inequality, finding that human capital negatively impacts income inequality in Singapore. In addition, Pham et al. (2024) discovered that higher education levels significantly enhance household wealth accumulation in Vietnam for the years 2008 and 2020. Finally, Yee (2024) conduct a research in the Philippines using a multinomial logit model and find that despite sustained expansion in education, disparities in the completion of secondary and higher education increasingly correlate with social background.

The literature review illustrates that research on the relationship between education and income inequality produces varied findings, with education having complex effects across different regions, countries, and internationally. However, it can be stated that educational inequality significantly reduces income inequality, although some findings indicate the opposite or even a non-linear relationship. Therefore, it is crucial to ensure a more equitable distribution of income and to expand access to education from primary through higher education. Findings that suggest education does not reduce inequality often point to other influencing factors such as fiscal decentralization, national income levels, poverty, unemployment, and institutional quality, which are also highly significant.

Studies focusing on various developing countries and regions in Asia, as mentioned by Arshed et al. (2018) and Vo et al. (2024), conclude that there is a quadratic correlation between education and income inequality. In contrast, studies in other developed and developing countries, such as those by Lee and Lee (2018) and Makhlouf and Lalley (2023), emphasize the importance of equitable income distribution and educational expansion to reduce income inequality, despite findings indicating long-term relationships. Overall, education is an important instrument for reducing income inequality, and policies should be designed considering this factor, along with other aspects, to effectively narrow income disparities.

Research Methods

This research investigates the impact of educational expansion on income inequality in ASEAN countries in the long-run. The researchers establish a FMOLS panel model and complemented it with a static model. The researchers also apply an Autoregressive Distributed Lag (ARDL) panel data model as a robustness test, utilizing data from World Income Inequality Database (WIID), World Development Indicator (WDI), UNESCO, the ASEAN Secretariat, and annual statistical report of each country. The analysis includes data from 11 ASEAN member countries, covering the period from 2010 to 2021. Accordingly, the panel data utilizes in this research consist of a cross-section dimension (i) of 11 individuals and a time-series dimension (t) of 12 years ($i \times t$). So, the panel data are 132. Given the limitations of the data provided by WIID, it is complemented with data from other sources,

United Nations Development Programme (UNDP), using the same approach. The researchers estimate the analysis model by utilizing EViews 12 software. Meanwhile, the research variables are described in Table 1.

Table 1. Description of Variables and Data Sources

Variables	Codes	Description	Source
Income Inequality [Gini Coefficient] Goh et al., 2022; Koh et al., 2022; Makhlouf & Lalley, 2023; Shukla & Mishra, 2020; Xu et al., 2023; Yee, 2024	*gc*	Measure the difference in income distribution/ (%)	WIID, UNDP, Statistical Years Book, ASEAN Secretariat
Education expansion [means years of schooling] (Khusaini et al., 2023; Makhlouf & Lalley, 2023; Setyadharma et al., 2021; Shukla & Mishra, 2020; Siburian, 2023; Vo & Ho, 2022)	*mys*	The average years of schooling for the population aged 25 and over/(year)	UNESCO, Statistical Year Book
Gross enrollment rate (Batuo et al., 2022; Mohd et al., 2014; Nizar et al., 2023).	*gerpe*	Number of students any groups who enrolled in primary education expressed as a percentage of the official primary school age population/ (%)	WDI, UNDP
	gersec	Number of students of any general groups who are enrolled in secondary education expressed as a percentage of the official secondary school age population/ (%)	WDI, UNDP
	gerter	Number of students all age groups enrolled in tertiary education expressed as a percentage of the official tertiary education age population/ (%)	WDI, UNDP
Real income per capita (Koh et al., 2022; Makhlouf, 2023; Nawaz & Ghulam, 2024; Vo et al., 2024)	*lgdpcap*	US $ (2015 constant prices)/logarithm	WDI
Gross fixed capital formation (Batuo et al., 2022; Koh et al., 2022; Makhlouf & Lalley, 2023; Xu et al., 2023),	*gfcf*	The ratio gross fixed capital formation to GDP (2015 constant price) /%	WDI
Gender development index (Alawin & Sbitany, 2019; Ali et al., 2023; Ashraf et al., 2023)	*gdi*	It measures the gender gap in human development in the dimensions of health, education and living standards between men and women/ (%)	WDI
Economic openness (Koh et al., 2022; Makhlouf & Lalley, 2023; Ridzuan et al., 2021)	*open*	the sum of imports and exports of goods and services as percentage of GDP (2015 constant prices)/(%)	WDI

The FMOLS panel modelling aims to estimate the long-term cointegration correlation between educational expansion and income inequality. Before applying FMOLS, two

conditions must be met to ensure that the equation is suitable for further testing. The model requires stationarity at the first difference and the presence of a long-term relationship. Additionally, FMOLS is effective for addressing endogeneity and autocorrelation issues using a non-parametric approach. The steps involved in using this model include cross-sectional dependence tests, unit root tests, cointegration tests, and asymptotic *N* and *T* (Pesaran, 2015). Another advantage of FMOLS is its robust estimation results.

Cross-sectional dependence (CD) tests in the data and first-generation unit root tests (Levin et al., 2002) and Fisher panel unit root tests (Choi, 2001) are conducted. To complement the first-generation stationarity tests, the researcher performs second-generation panel unit root tests, or cross-sectional augmented Im-Pesaran-Shin (CIPS) panel unit root tests (Pesaran, 2007). Cross-sectional dependence (Pesaran, 2004) can be expressed in Equation (1). Then, the CIPS panel unit root test, as developed by Pesaran (2007), can be expressed in Equation (2). The equations refer to N as the number of Southeast Asian countries (11) within panel data set, *T* as the number of time series data (13, corresponding to the period 2010-2022), and ρ_{ij} as the pairwise residuals correlation. The CD test statistic is assumed to be normally distributed as *N* and *T* approach infinity.

$$CD = \sqrt{\frac{2t}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\rho_{ij}\right) \rightarrow N(0,1) \quad (1)$$

$$CIPS(N,T) = \frac{1}{N}\sum_{i=1}^{N} t_i\,(N,T) \quad (2)$$

To ensure that all estimated coefficients are homogeneous across all cross-sections, a homogeneity test of the slopes is also required (Pesaran & Yamagata, 2008). The hypothesis for the slope homogeneity test can be stated as follows: $\beta_1 = \beta_2 = \ldots = \beta_n$. Then, the equation can be expressed as Equation (3) and Equation (4). Here, *S* and Δ refer to the test statistic, β_i refers to the estimated coefficient, β_W refers to estimate obtained from the weighted combined estimator, χ_i refers to the matrix of independent variables in deviations from the mean, M_T stands for the identity matrix, ρ_i^2 refers to estimation ρ_i^2, and *x* refers to the number of independent variables.

$$S = \sum_{i=1}^{N}(\beta_i - \beta_w)' \frac{\chi_i' M_T \chi_i}{\rho_i^2}(\beta_i - \beta_W) \quad (3)$$

$$\Delta = \sqrt{N}\left(\frac{\frac{1}{N}S - x}{\sqrt{2x}}\right) \quad (4)$$

The second-generation unit root test is essential to perform using the panel t-statistics for CIPS for each cross-sectional unit (Im et al., 2003), and the cross-sectional augmented Dickey-Fuller (CADF) test for the average individual statistics (Pesaran, 2007). According to Pesaran (2007), the unit-root test can be expressed in Equation (5).

$$x_{it} = \alpha_{it} + \beta_i x_{it-1} + \rho_i t + \sum_{j=1}^{n}\varphi_{ij}\,\Delta x_{i,t-j} + \varepsilon_{it} \quad (5)$$

Here, a_{it} refers to constant, t refers to time horizon, Δ refers to the difference operator, x_{it} refers to variables used in the research, and ε_{it} refers to error term. The null hypothesis H_0 states that the time series under investigation is non-stationary, while the alternative hypothesis H_1 states that the time series under investigation is stationary. Therefore, the test results are expected to reject H_0.

The most commonly used panel cointegration test is based on testing the unit root of the residuals from ordinary least squares (OLS) regressions, commonly known in the literature as the Engle-Granger (EG) t-cointegration test. Pedroni (2004) proposed a framework for developing panel cointegration tests based on the EG procedure. Based on residual estimation, he obtained seven different test statistics. Similar to the panel unit root tests based on Augmented Dickey-Fuller (ADF), Pedroni's seven test statistics can be differentiated into two categories: those assuming a common process, often referred to as 'pooled' or 'within-dimension' tests, and those assuming an individual process, referred to as the test of the 'grouped' or 'between-dimension.'

Additionally, the panel cointegration test using FMOLS also applies the Kao cointegration test (Kao, 1999) to complement the limitations of the Pedroni panel cointegration test (Pedroni, 2000, 2004). This method considers the heterogeneity of specific effects, slope coefficients, and individual linear trends across regions/countries. Typically, the cointegration vectors may differ among the panel members. The initial step proposed by Pedroni (2004) on panel cointegration test is the specified cointegration equation (see Eq.6)

$$y_{it} = \alpha_i + \beta_i x_{it} + u_{it} \tag{6}$$

The y_{it} is the dependent variable for i-unit and t-time. Meanwhile, x_{it} is independent variable for i-unit and t-time. The a_i is intercept specific for unit i. The β_i is the cointegration coefficient that measures the long-term relationship between y_{it} and x_{it}.

Then, estimating the parameter β_i by modifying the variables, namely Equation (7) and Equation (8).

$$\tilde{y}_{it} = y_{it} - \hat{\gamma}_{it}\hat{u}_{it} \tag{7}$$

$$\tilde{x}_{it} = x_{it} - \hat{\gamma}_{it}\hat{v}_{it} \tag{8}$$

The $\tilde{y}_{it}$ represents the corrected dependent variable and $\tilde{x}_{it}$ represents the corrected independent variable. The $\hat{\gamma}_{it}$is the simultaneity bias correction factor, while $\hat{u}_{it}$ and $\hat{v}_{it}$ is the residual from the initial OLS regression. The $\hat{\gamma}_{it}$ is used as a weighting factor for the corrections y_{it} and x_{it}. $\tilde{y}_{it}$ and $\tilde{x}_{it}$, which are free from bias, are applied in the FMOLS estimator, allowing for consistent and efficient estimation of long-run cointegration parameters.

The $\hat{\gamma}_{it}$is the simultaneity bias correction, while $\hat{u}_{it}$ and $\hat{v}_{it}$ is the residual from the initial OLS regression. To obtain the long-run cointegration parameter estimate $\hat{\beta}_{FMOLS}$ the panel FMOLS method is Equation 9. In other words, $\hat{\beta}_{FMOLS}$ is the parameter estimation result that bridges the theoretical cointegration model with the empirical model specifications.

Moreover, the empirical model is based on panel cointegration approach of FMOLS by Pedroni (2004) and the equation can be expressed as Equation (10) and Equation (11).

$$\hat{\beta}_{FMOLS} = \left(\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{x}_{it}\tilde{x}'_{it}\right)^{-1}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\tilde{x}_{it}\,\tilde{y}_{it}\right) \quad (9)$$

$$gc_{it} = \alpha_0 + \alpha_1 mys_{it} + \alpha_2 lgdpcap_{it} + \alpha_3 gfcf_{it} + \alpha_4 gdi_{it} + \alpha_5 open_{it} + \varepsilon_{it} \quad (10)$$

$$gc_{it} = \alpha_0 + \alpha_1 gerpe_{it} + \alpha_2 gersec_{it} + \alpha_3 gerter_{it} + \alpha_4 lgdpcap_{it} + \alpha_5 gfcf_{it} + \alpha_6 gdi_{it} + \alpha_7 open_{it} + \varepsilon_{it} \quad (11)$$

The *gc* is the gini coefficient, *mys* is mean years of schooling, *gerpe* is gross enrollment rate in primary education, *gersec* is gross enrollment rate in secondary education, and *gerter* is gross enrollment rate in higher education. The *lgdpcap* represents per capita income, while *gfcf* stands for gross domestic fixed capital formation, *gdi* is gender development index, and *open* is economic openness. Meanwhile, ε stands for estimation error, i is the country-i, t is the t-year and $\alpha_i = \alpha_0, \alpha_1, \ldots, \alpha_7$ (estimated parameters).

Pedroni (1996, 2001) recommends the use of FMOLS in panel cointegration analysis. The FMOLS estimators include 'Pooled,' 'Pooled Weighted,' and 'Group Mean' estimators. The researcher utilizes the 'Pooled' estimation method. Model validation for the panel FMOLS is conducted using the Wald test.

For assessing the robustness of the model, the researcher applies the same variables but with a different model, namely the Panel Autoregressive Distributed Lag (ARDL). This method does not require the data to be stationary at I(0) or I(1), or a combination of both (Pesaran & Shin, 1999). Following previous literature on dynamic panel models, the researcher applies this estimator to test the long-term consistency of the impact of educational expansion on inequality using the Pooled Mean Group (PMG) approach (Pesaran et al., 1999). The PMG model allows for long-term equilibrium to be homogeneous but does not impose homogeneity in the short term, focusing instead on the specific heterogeneity of each country. Each country has distinct characteristics related to policy responses, shocks, external factors, and so forth. The empirical Panel ARDL model can be expressed as Equation (12). By reparameterizing Equation (12), Equation (13) is obtained.

$$gc_{it} = \alpha_i + \sum_{l=1}^{p}\beta_0 gr_{i,t-1} + \sum_{l=0}^{q}\beta_1\, mys_{i,t-1} + \sum_{l=0}^{q}\beta_2\, x_{i,t-1} + u_{it} \quad (12)$$

$$\Delta gc_{it} = \alpha_i + \vartheta_i\left(gr_{i,t-1} - \gamma_1 mys_{i,t-1} - \gamma_2 x_{i,t-1}\right) + \sum_{l=1}^{p-1}\varphi_{il}\,\Delta gr_{i,t-1} + \sum_{l=0}^{q-1}\varphi'_{il}\,\Delta mys_{i,t-1} + \sum_{l=0}^{q-1}\varphi^{"}_{il}\,\Delta x_{i,t-1} + u_{it} \quad (13)$$

The i and t represent each country and time, and x represents the control variables including per capita, gross fixed capital formation to GDP ratio, gender development index, and economic openness. The notations $\varphi, \varphi', \varphi^{"}$ are the coefficients for the lagged variables of independent and control variables in the short-term. In the long term, the coefficients for educational expansion are represented by γ_1 and γ_2. Meanwhile, the speed of adjustment is denoted by ϑ_i.

Results and Discussion

Statistical Summary and Unit Root Test

Table 2 shows that the average value of the Gini coefficient is 0.383, meaning that the income inequality level in the ASEAN region countries is low (Gini, 1912). The average value of the mean years of schooling is 7.65, which corresponds to the average still in lower secondary education (ISCED 2) (UNESCO Institute for Statistics, 2012). Table 2 also shows that the average gross enrolment rate for primary education is very high, for lower secondary education it is high, and for upper secondary education it remains low.

Table 2. Statistical Summary

Variables, n=132	Mean	Std. Dev.	Max	Min
Gini coefficient (*gc*)[a]	0.383	0.049	0.496	0.278
Mean years of schooling (*mys*)	7.655	2.258	12.328	3.598
Gross enrollment rate for primary education (*gerpe*)	107.980	8.540	131.001	90.610
Gross enrollment rate for secondary education (*gersec*)	82.715	18.978	130.934	84.506
Gross enrollment rate for tertiary education (*gerter*)	32.582	20.587	97.098	11.054
Log GDP per capita (*lgdpcap*)	9.339	1.078	11.572	7.904
Contribution of gross capital formation to GDP (*gfcf*)	28.577	7.681	70.331	14.445
Gender development index (*gdi*)	0.962	0.032	1.013	0.893
Open economy (*open*)	1.172	0.810	3.791	0.239

Note: authors calculation (Timor Leste: 2011-2012 and 2015-2016; Laos: 2013-2016; Myanmar: 2010-2014)

Table 3 presents the CD test, with the null hypothesis being the cross-sectional independence of the error terms across cross-sections. Generally, given that the p-value is < 0.01, the researcher rejects the null hypothesis. This indicates cross-sectional dependence at the 1 percent level. Subsequently, the researcher must employ second-generation panel unit root tests.

Table 3. The Results of the CD Test

Variables	Breusch-Pagan LM	Pesaran Scaled LM	Bias-Corrected Scaled LM	Pesaran CD
gc	188.276***	12.707***	12.207***	2.085**
mys	442.212***	36.919***	36.419***	16.999***
gerpe	396.925***	32.601***	32.101***	6.517***
gersec	255.940***	19.159***	18.659***	4.634***
gerter	235.029***	17.165***	16.665***	4.613***
lgdpcap	389.538***	31.897***	31.397***	14.646***
gfcf	125.830***	6.753***	6.253***	0.645
gdi	263.079***	19.839***	19.339***	11.377***
open	239.797***	17.619***	17.120***	0.538

Note: ***sig.=1%, **sig.=5%, *sig.=10%

Table 4 shows that the results of the second-generation panel unit root tests using various methods, including the Levin, Lin and Chu test; Im, Pesaran, and Shin; Fisher ADF; Phillips and Perron; and Breitung tests. The empirical results from these second-generation unit root tests indicate that the data has become stationary at the first difference, I(1), although some variables are stationary at the level (I(0)). Subsequently, the researcher proceeds with the cointegration test.

Table 4. The Results of the Unit Root Panel Test

Variables	Method	Intercept		Intercept and Trend	
		Level	First difference	Level	First difference
gc	LLC	-5.034***	-8.706***	-6.867***	-8.172***
	IPS	-1.802**	-6.049***	-2.264**	-3.425***
	ADF	37.512**	73.812***	41.974***	61.559***
	PP	32.627*	114.907***	62.059***	111.810***
	Breitung	-	-	-0.903	-1.568**
mys	LLC	-4.998***	-13.697***	-9.163***	-12.633***
	IPS	-1.947***	-4.743***	-3.208***	-3.112***
	ADF	40.589***	50.069***	48.370***	41.263***
	PP	30.578***	57.007***	42.905***	43.005***
	Breitung	-	-	-3.613***	3.732
gerpe	LLC	-1.2231	-6.487***	-5.032***	-5.520***
	IPS	2.001	-3.942***	-1.223	-1.399*
	ADF	11.470	52.357***	30.589	34.243**
	PP	8.688	63.641***	40.967	51.640***
	Breitung	-	-	0.962	-0.393
gersec	LLC	-5.066***	-5.039***	-2.725***	-5.947***
	IPS	0.246	-4.327***	-0.736	-2.795***
	ADF	35.053***	59.809***	32.282*	49.678***
	PP	33.727*	75.499***	32.873*	82.990***
	Breitung	-	-	1.904	-0.856
gerter	LLC	-3.782***	-10.182***	-4.645***	-9.139***
	IPS	-1.815**	-6.273***	-1.231	-2.896***
	ADF	37.045**	76.350***	31.432*	52.437***
	PP	38.662**	100.842***	40.165**	98.427***
	Breitung	-	-	-0.295	-3.543***
lgdpcap	LLC	-1.771**	-4.395***	-1.039	-5.339***
	IPS	0.548	-3.110***	-0.184	-1.338*
	ADF	19.108	51.058***	29.598	35.322**
	PP	56.571***	64.186***	61.839***	55.951***
	Breitung	-	-	5.979	1.564
gfcf	LLC	-1.320*	-7.487***	-6.952***	-6.659***
	IPS	-0.455	-5.283***	-1.987**	-2.634***
	ADF	27.161	66.785***	36.867**	45.908***
	PP	30.670	70.362***	41.438***	58.969***
	Breitung	-	-	0.329	-0.327
gdi	LLC	-7.184***	-10.225***	-13.253***	-7.283***
	IPS	-3.167***	-5.034***	-2.515***	-2.196**
	ADF	47.347***	68.357***	35.949**	51.766***
	PP	3.899***	107.620***	34.902**	132.909***
	Breitung	-	-	1.362	-3.905***
open	LLC	-2.243***	-8.078***	-3.103***	-7.444***
	IPS	0.244	-4.482***	0.195	-1.790**
	ADF	21.612	67.821***	27.250	47.695***
	PP	17.731	80.195***	25.759	74.115***
	Breitung	-	-	0.723	-0.183

Note: ***sig.=1%, **sig.=5%, *sig.=10%. LLC = Levin, Lin & Chu t, IPS = Im, Pesaran and Shin W-stat, ADF = ADF-Fischer Chi-square, PP = PP-Fisher Chi-square

Panel Cointegration Test

To identify the correlation between educational expansion and control variables with income inequality in the long-run, panel cointegration tests proposed by Pedroni and the Kao residual test are required (Kao & Chiang, 2001; Pedroni, 1999, 2004). Table 5 shows that educational expansion has a cointegrating relationship with income inequality among the populations of ASEAN countries.

Table 5. The Results of the Panel Cointegration Test [Assumption: No Deterministic Trend]

Model	Individual AR coefs. (between-dimension)			Individual AR Coefs. (between-dimension)	
	Stat. types	Stat.	Weighted Stat.	Stat. Types	Stat.
FMOLS 1	Panel v - statistic	-2. 610	-3.281	Group rho - statistic	5.134
	Panel rho - statistic	3.665	3.918	Group PP - statistic	-18.706***
	Panel PP - statistic	-11.017***	-12.270***	Group ADF - statistic	-5.372***
	Panel ADF - statistic	-4.862***	-4.143***		
FMOLS 2	Variables > 7, in compatible (see Kao residual test)				
FMOLS 3	Panel v - statistic	-2.142	-2.499	Group rho – statistic	4.181
	Panel rho - statistic	2.943	2.871	Group PP - statistic	-15.302***
	Panel PP - statistic	-10.626***	-11.500***	Group ADF - statistic	-5.522***
	Panel ADF - statistic	-4.865***	-5.149***		

Note: ***sig.=1%, **sig.=5%, *sig.=10%.

Meanwhile, the results are also complemented by the Kao residual cointegration test (see Table 6), which shows identical outcomes. Therefore, the use of the FMOLS panel analysis has met the requirements. Further details are provided in Table 6.

Table 6. The Kao Residual Cointegration Test Results

Panel	ADF stat	Sig.	Conclusion
FMOLS 1	-1.835	0.033	Cointegrated correlation
FMOLS 2	-2.139	0.016	Cointegrated correlation
FMOLS 3	-2.007	0.022	Cointegrated correlation

Regression Results

The researchers apply two analytical models to examine the effect of educational expansion on income inequality in ASEAN countries. The first model is a panel fixed effect GLS model, which is suitable for addressing issues of heteroscedasticity and autocorrelation. The second model is the FMOLS panel model, used to investigate the long-term effects of educational expansion on income inequality.

Table 7. Regression Results (Dependent Variable: Gini coefficient)

Variables, n=132	Fixed effect GLS		FMOLS	
	Model 1	Model 2	Model 1	Model 2
mys	-0.011***	-	-0.012**	-
	(0.003)		(0.006)	
gerpe	-	-0.0002	-	0.0003
		(0.0003)		(0.004)
gersec	-	-0.0004**	-	-0.001*
		(0.0002)		(0.0003)
gerter	-	-0.001**	-	-0.002***
		(0.0003)		(0.001)
lgdpcap	-0.028***	-0.037***	-0.041**	-0.051***
	(0.005)	(0.007)	(0.018)	(0.017)
gfcf	-0.0004**	-0.001***	-0.001**	-0.001**
	(0.0002)	(0.0002)	(0.0005)	(0.0005)
gdi	0.329	0.276*	0.612*	0.902***
	(0.136)	(0.158)	(0.321)	(0.327)
open	0.008	0.011	0.006	0.003
	(0.006)	(0.007)	(0.017)	(0.016)
Constant	0.391***	0.509***	-	-
	(0.126)	(0.152)		
R^2	0.950	0.943	0.891	0.898
Adjusted R^2	0.932	0.934	0.876	0.881
F-stat	121.637	111.607	-	-
Prob(F-stat)	0.000	0.000	-	-
Chi-square	-	-	17.228	24.932
Wald test	-	-	0.004	0.000
Chow test	Yes	Yes	-	-
Hausman test	No	No	-	-

Note: ***sig.=1%, **sig.=5%, *sig.=10%.

Table 7 explains that in the static model (Fixed effect GLS - Model 1), the coefficient for educational expansion is -0.011 and significant at the 1% level. This means that each additional year of schooling results in a 0.011% decrease in income inequality among the populations of ASEAN countries, holding other factors constant. In static Model 2, the coefficients for the gross enrollment rates in secondary and higher education are -0.0004 and -0.001, respectively, with a significance level of 5%. This implies that a 1% increase in the gross enrollment rate in secondary education leads to a 0.0004% reduction in income inequality, and a 1% increase in the gross enrollment rate in higher education leads to a 0.001% reduction in income inequality, holding other factors constant.

In the long term (FMOLS Model 1), the coefficient for educational expansion is -0.012 and is significant at the 1% level. This indicates that each additional year of schooling results in a 0.012% decrease in income inequality among the populations of ASEAN countries in the long term, holding other factors remain constant. In Model 2, the coefficients for the gross enrollment rates in secondary and higher education are -0.001 and -0.002, with significance levels of 10% and 5%, respectively. This indicates that each 1% increase in the gross enrollment rate in secondary education results in a 0.001% reduction in income inequality, and each 1% increase in the gross enrollment rate in higher education results in a 0.002% reduction in

income inequality in the long term, holding other factors remain constant. Meanwhile, the control variable that contributes to widening income inequality is gender development. On the other hand, per capita income and gross fixed capital formation (representing investment) make a significant contribution to reducing income inequality, with significance levels of 1%, 5%, and 10% across all models.

Discussion

This research further emphasizes the importance of educational expansion as it effectively reduces income inequality among populations in ASEAN countries. Equitable education can enhance human capacity, promote mobility, create a just society, and foster equality among country's population. As a result, increasing education levels will boost current and future earnings, thereby narrowing income disparities. However, education has a certain lag effect, impacting individuals who are undergoing the educational process, which means that its benefits may not be immediately felt. To achieve equitable education, each country must implement policies to provide educational infrastructure, such as school buildings, raise public awareness, and offer scholarships. The educational conditions of each country show different developments, resulting in different impacts on reducing income inequality. The results of the graphic visualization show that, in general, there is a negative tendency between the average length of schooling and the level of income inequality. This means that countries with higher lengths of schooling tend to have lower income inequality (see Figure 1).

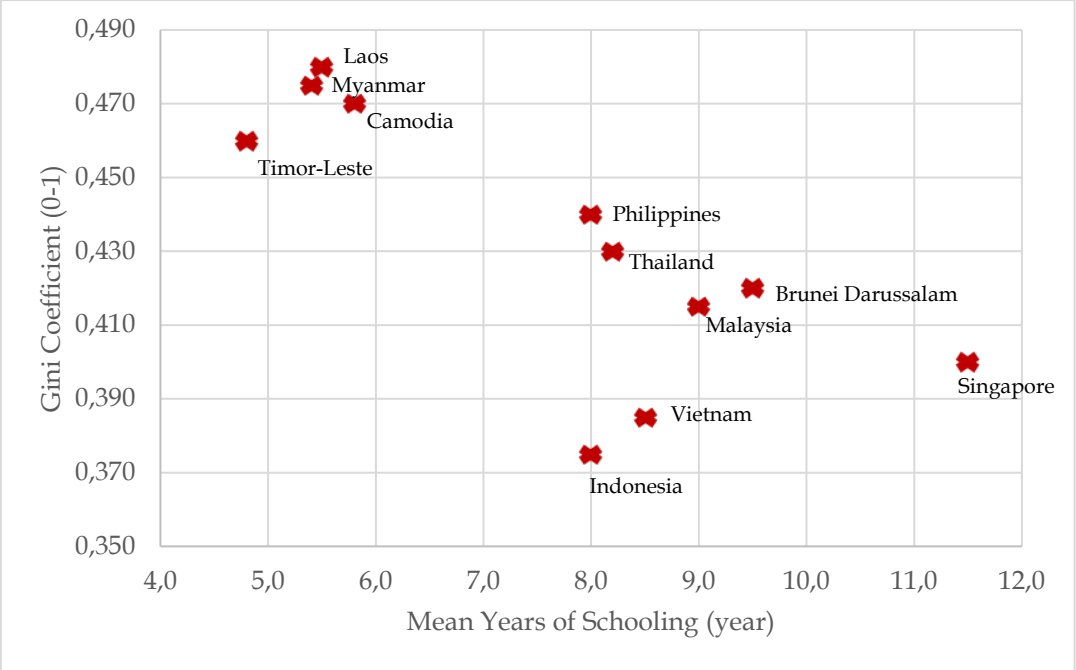

Figure 1. Mean Years of Schooling vs Gini Coefficient (ASEAN 2010-2021)

Based on Figure 1, Singapore and Brunei Darussalam are in a condition where the mean years of schooling is the highest and the Gini coefficient is relatively low (Ngoc & Hai, 2024; Widjaya, 2016). It illustrates that a more even distribution of income is in line with the high average level of education among the population. On the other hand, countries such as Laos, Myanmar, and Cambodia have a lower average length of schooling and tend to show a higher Gini coefficient, reflecting greater inequality (Thein & Akita, 2019; Win et al., 2023). Vietnam, Thailand, the Philippines, and Malaysia are in the middle position, showing a moderate combination of access to education and income distribution (Akita & Miyata, 2024; Koh et al., 2022; Mercado et al., 2023; Paweenawat & Liao, 2023; Pham et al., 2024; Yee, 2024). Meanwhile, Indonesia shows a relatively balanced position. It shows that the level of education among the population is quite good, but it still faces challenges in reducing income inequality (Siburian, 2023; Thye et al., 2022). Therefore, increasing the educational expansion can reduce income inequality among ASEAN countries. This research findings support previous theories regarding the correlation between education and income distribution (Becker, 1964; Chiswick, 1974; Marin & Psacharopoulos, 1976).

The educational levels that have a direct impact on reducing income inequality are secondary and higher education, as represented by the gross enrollment rates. Students who are still enrolled in secondary and higher education have the potential to improve their prospects. There is a necessary time lag for individuals to reach higher education levels and secure suitable employment, leading to a gradual reduction in income inequality among specific groups within ASEAN countries. Once appropriate employment is attained, wages are determined by the terms of employment contracts. This means that equitable education is effective and significant in reducing income inequality through the wages earned from employment resulting from increased education in the long term. Both developing and developed ASEAN countries have seen substantial increases in secondary and higher education participation, although some countries are experiencing slow growth in education participation. This delay is due to high dropout rates, slow responses to technological advancements, and inadequate school infrastructure.

For countries experiencing rapid growth in educational participation, especially in secondary and higher education, this presents a significant advantage. It accelerates the development of a more knowledgeable (educated) and skilled workforce, increasing productivity and income, which in turn narrows income inequality in the long term. This research aligns with previous research, which indicates that expanded education contributes to a decrease in income inequality over the long term (Akita & Miyata, 2024; Siburian, 2023). Enhanced education increases wealth accumulation (Pham et al., 2024; Vo & Ho, 2022), which helps reduce the widening of income disparities. Another research also supports this finding, suggesting that improving educational levels is essential for reducing income inequality (Lee & Lee, 2018; Yee, 2024). However, this research contrasts with previous research that found educational expansion could exacerbate income inequality in ASEAN-7 countries in the long term and have no significant effect in the short term (Makhlouf & Lalley, 2023). Additionally, previous research has shown that increasing educational levels could worsen income inequality in the long term (Arshed et al., 2019; Koh et al., 2022; Vo et al., 2024). These

differences in findings are attributed to variations in sample selection and analytical models used.

Robustness Test

The researcher tests robustness using a different model from the previous ones, namely the panel ARDL model. The coefficient value for the Error Correction Term (ECT, cointeq01) is negative and significant at the 5% level, indicating convergence in the long term with an adjustment speed of 49.5% (-0.495). The test results show that educational expansion has a significant long-term impact on reducing income inequality in ASEAN countries (see Table 8). The finding is consistent with previous research conducted on seven ASEAN countries (Vo et al., 2024).

Table 8. Results of Robustness Check

Variable, n=121	Coefficient	Std. Error	Prob.
Long run equation			
mys	-0.043	0.001	0.000
lgdpcap	0.055	0.003	0.000
gfcf	0.0002	0.00004	0.000
gdi	-0.464	0.013	0.000
open	0.028	0.001	0.000
Short run equation			
cointeq01	-0.495	0.198	0.016
d(*mys*)	-0.018	0.113	0.878
d(*lgdpcap*)	-0.043	0.018	0.024
d(*gfcf*)	-0.001	0.001	0.407
d(*gdi*)	-0.125	0.176	0.481
d(*open*)	-0.045	0.034	0.189
constant	0.299	0.131	0.026

Furthermore, the short-term estimates for each country show that educational expansion significantly reduces income inequality in Laos, Malaysia, the Philippines, and Singapore. Conversely, in Indonesia and six other ASEAN countries, educational expansion appears to exacerbate income inequality in the short term (see Table 9). These results suggest that educational expansion policies are not yet uniformly implemented across countries, leading to varying outcomes.

Table 9. Short-Term Estimation Results for Each Country

Country/Variable	cointeq01	d(*mys*)	d(*lgdcap*)	d(*gfcf*)	d(*gdi*)	d(*open*)	constant
BRN	(-), (yes)	(+), (yes)	(-), (yes)	(-), (yes)	(-), (yes)	(+), (yes)	(+), (yes)
KHM	(-), (yes)	(+), (yes)	(-), (yes)	(+), (yes)	(+), (no)	(-), (yes)	(+), (yes)
TLS	(-), (yes)	(+), (yes)	(-), (yes)	(+), (yes)	(+), (yes)	(-), (yes)	(+), (yes)
IDN	(-), (yes)	(+), (yes)	(-), (yes)	(+), (yes)	(+), (no)	(+), (yes)	(+), (yes)
LAO	(-), (yes)	(-), (yes)	(-), (yes)	(-), (yes)	(-), (yes)	(-), (yes)	(+), (yes)
MYS	(-), (yes)	(-), (yes)	(-), (no)	(-), (yes)	(-), (no)	(-), (yes)	(+), (yes)
MMR	(-), (yes)	(+), (yes)	(-), (yes)	(-), (yes)	(+), (yes)	(-), (yes)	(-), (yes)

PHL	(-), (yes)	(-), (yes)	(+), (yes)	(-), (yes)	(-), (no)	(+), (yes)	(-), (yes)
SGP	(-), (yes)	(-), (yes)	(+), (yes)	(-), (yes)	(-), (no)	(-), (yes)	(+), (yes)
THA	(-), (yes)	(+), (yes)	(-), (yes)	(+), (yes)	(+), (yes)	(-), (yes)	(+), (yes)
VNM	(+), (yes)	(+), (yes)	(-), (yes)	(-), (yes)	(-), (no)	(+), (yes)	(-), (yes)

Notes: BRN = Brunei Darussalam, KHM = Cambodia, TLS = Timor Leste, IDN = Indonesia, LAO = Laos, MYS = Malaysia, MMR = Myanmar, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Vietnam, (-/+) = direction of relationship, yes = sig. 5%, and no = insignificant

Conclusion

The researchers apply a dynamic panel FMOLS model, using a sample of 11 ASEAN countries from 2010 to 2021, to estimate the long-term impact of educational expansion on income inequality. The estimation results show that, in the long term, educational expansion significantly contributes to reducing income inequality. Education is viewed as a primary tool for addressing income inequality in ASEAN countries. Increased levels of education enhance job opportunities and social mobility across the population, theoretically leading to a reduction in income inequality as access to and consumption of education improve. Although the relationship between educational expansion and income inequality has been hypothesized in the literature, the countries sampled in this study have largely implemented policies that promote educational expansion, thereby contributing to a reduction in income disparities.

This research implies that policymakers should recognize that educational expansion is a viable solution for addressing income inequality among populations in ASEAN countries. The long-term relationship between educational expansion and income inequality is significant. Therefore, policymakers should prioritize accelerating the development of educational infrastructure across all regions, expanding scholarship programs (particularly for low-income populations), making higher education more affordable, and implementing other populist policies related to education expansion. These measures aim to reduce the gap between the rich and the poor within society. The findings also reinforce previous theories about the relationship between educational expansion and income inequality. Despite some differences in findings, the consistency of results strengthens the literature on education as a long-term investment for society. Diversification could include investing in forms of post-secondary education, which often face funding shortages compared to higher education.

This research has a weakness in the aspect of using a relatively short data series due to limited data availability. Future research should consider expanding the panel sample in terms of both years and individuals and conducting cross-country comparisons to identify the sources of income inequality in each country. The use of school years as a variable has overlooked populations not engaged in the production process, as it remains tied to average years of schooling data. Similarly, school participation rates pertain to individuals who are still active in the educational process and may not yet be earning income. The impact on reducing income inequality may not be immediate since income is typically realized only after graduation and employment. Therefore, future research should incorporate proxies for

educational expansion, such as the average years of schooling for both formal and informal workers, to enhance the comprehensiveness and quality of the education-related analysis.

Acknowledgement

The authors extend their deepest appreciation to all researchers who contributed to this study for their commitment and collaboration. We are also grateful to the editors and anonymous reviewers for their constructive comments and valuable suggestions, which have significantly enhanced the clarity and quality of this manuscript. Their efforts and professional guidance are sincerely acknowledged.

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References

Adjor, D. M., & Kebalo, L. (2018). Does corruption matter for unemployment in SADC countries? *Review of Economic and Business Studies*, *11*(2), 65–92.

Akita, T., Celeste, R., & Miyata, S. (2023). Why has inequality in the Philippines declined? A two-stage hierarchical inequality decomposition analysis by location and education. *Journal of the Asia Pacific Economy*, *29*(4), 1940–1959. https://doi.org/10.1080/13547860.2023.2220262

Akita, T., & Miyata, S. (2021). Urban and rural dimensions of the role of education in inequality: A comparative analysis between Indonesia, Myanmar, and the Philippines. In A. A. Batabyal, Y. Higano, & P. Nijkamp (Eds.), *Rural–Urban Dichotomies and Spatial Development in Asia* (pp. 127–166). Springer Singapore. https://doi.org/10.1007/978-981-16-1232-9_6

Akita, T., & Miyata, S. (2024). Education and expenditure inequality in Indonesia and the Philippines: A comparative analysis in an urban and rural dual framework. In B. P. Resosudarmo & Y. Mansury (Eds.), *The Indonesian economy and the surrounding regions in the 21st century: Essays in honor of Iwan Jaya Azis* (pp. 191–218). Springer Singapore. https://doi.org/10.1007/978-981-97-0122-3_10

Alawin, M., & Sbitany, N. (2019). Gender inequality and economic development in the MENA region. *Applied Econometrics and International Development*, *19*(1), 81–94.

Aldar, D., Zagdbazar, M., & Altangerel, M. (2021). Assessment of the subjective well-being during the COVID-19 pandemic in Timor-Leste : Evidence from a Nationwide Household Survey. *The Senshu Social Well-Being Review*, *8*, 79–95.

Alesina, A., & Perotti, R. (1996). Income distribution, political instability, and investment. *European Economic Review*, *40*(6), 1203–1228. https://doi.org/10.1016/0014-2921(95)00030-5

Ali, W., Ambiya, & Dash, D. P. (2023). Examining the perspectives of gender development and inequality: A tale of selected Asian economies. *Administrative Sciences*, *13*(4), 115. https://doi.org/10.3390/admsci13040115

Arshed, N., Anwar, A., Hassan, M. S., & Bukhari, S. (2019). Education stock and its implication for income inequality: The case of Asian economies. *Review of Development Economics*, *23*(2), 1050–1066. https://doi.org/10.1111/rode.12585

Arshed, N., Anwar, A., Kousar, N., & Bukhari, S. (2018). Education enrollment level and income inequality: A case of SAARC economies. *Social Indicators Research*, *140*(3), 1211–1224. https://doi.org/10.1007/s11205-017-1824-9

Ashraf, A., Batool, S. A., & Jasinska, E. (2023). FDI and women empowerment in developing countries: Does the entry heterogeneity matter? *Applied Economics Letters*, *32*(4), 505–509. https://doi.org/10.1080/13504851.2023.2275659

Batuo, M. E., Kararach, G., & Malki, I. (2022). The dynamics of income inequality in Africa: An empirical investigation on the role of macroeconomic and institutional forces. *World Development*, *157*, 105939. https://doi.org/10.1016/j.worlddev.2022.105939

Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis with special reference to education* (1st ed.). National Bureau of Economic Research

Bicaba, Z., Brixiová, Z., & Ncube, M. (2017). Can extreme poverty in Sub-Saharan Africa be eliminated by 2030? *Journal of African Development*, *19*(2), 93–110. https://doi.org/10.5325/jafrideve.19.2.0093

Bourguignon, F. (2004). *The poverty-growth-inequality triangle* (Indian Council for Research on International Economic Relations Working Papers No. 125).

Cappelli, F., Costantini, V., & Consoli, D. (2021). The trap of climate change-induced "natural" disasters and inequality. *Global Environmental Change*, *70*, 102329. https://doi.org/10.1016/j.gloenvcha.2021.102329

Chancel, L., Piketty, T., Saez, E., & Zucman, G (Eds.). (2022). *World inequality report 2022*. World Inequality Lab. https://wir2022.wid.world/www-site/uploads/2022/03/0098-21_WIL_RIM_EXECUTIVE_SUMMARY.pdf

Checchi, D. (2001). *Education, inequality and income inequality* (Discussion Paper No. DARP 52). Suntory and Toyota International Centres for Economics and Related Disciplines https://sticerd.lse.ac.uk/dps/darp/DARP52.pdf

Chen, G., & Zhang, J. (2023). Regional inequality in ASEAN Countries: Evidence from an outer space perspective. *Emerging Markets Finance and Trade*, *59*(3), 722–736. https://doi.org/10.1080/1540496X.2022.2119810

Chiswick, B. R. (1974). The Schooling Model. In B. R. Chiswick (Ed.), *Income Inequality: Regional Analyses within a Human Capital Framework*. National Bureau of Economic Research.

Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance*, *20*(2), 249–272. https://doi.org/10.1016/S0261-5606(00)00048-6

Coady, D., & Dizioli, A. (2018). Income inequality and education revisited: Persistence, endogeneity and heterogeneity. *Applied Economics*, *50*(25), 2747–2761. https://doi.org/10.1080/00036846.2017.1406659

Desai, S., & Kulkarni, V. (2008). Changing educational inequalities in India in the context of affirmative action. *Demography*, *45*(2), 245–270. https://doi.org/10.1353/dem.0.0001

Ghosh, S., Doğan, B., Can, M., Shah, M. I., & Apergis, N. (2023). Does economic structure matter for income inequality? *Quality & Quantity*, *57*(3), 2507–2527. https://doi.org/10.1007/s11135-022-01462-1

Gini, C. (1912). *Variabilità e Mutabilità: Contributo Allo Studio Delle Distribuzioni e Delle Relazioni Statistiche*. Tipogr. di P. Cuppini.

Hendel, I., Shapiro, J., & Willen, P. (2005). Educational opportunity and income inequality. *Journal of Public Economics*, *89*(5–6), 841–870. https://doi.org/10.1016/j.jpubeco.2004.11.004

Ho, C. M., Le, Q. T.-T., Vo, A. T., Vo, D. H., & Ha, D. T.-T. (2020). Does government spending on education affect provincial income in equality in Vietnam? *The Singapore Economic Review*, *66*(04), 1105–1123. https://doi.org/10.1142/S0217590820490065

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, *115*(1), 53–74. https://doi.org/10.1016/S0304-4076(03)00092-7

Ismail, R. (2000). Educational and income inequality in Malaysia. *Humanomics*, *16*(2), 19–40. https://doi.org/10.1108/eb018851

Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics*, *90*(1), 1–44. https://doi.org/10.1016/S0304-4076(98)00023-2

Kebalo, L., & Zouri, S. (2024). Income inequality in developing countries: fiscal policy's role amid uncertainty. *Journal of Applied Economics*, *27*(1), 2316969. https://doi.org/10.1080/15140326.2024.2316969

Khusaini, K., Sentosa, B. M., & Putro, T. R. (2023). Fiscal transfer policies and road infrastructure reduce income inequality in rural-urban areas. *Etikonomi*, *22*(2), 333–356. https://doi.org/10.15408/etk.v22i2.28618

Koh, S. G. M., Lee, G. H. Y., & Siah, A. K. L. (2022). The resurgence of income inequality in Asia-Pacific: The role of trade openness, educational attainment and institutional

quality. *Jurnal Ekonomi Malaysia*, *56*(3), 11–27. https://doi.org/10.17576/JEM-2022-5603-01

Kuznets, S. (1963). Quantitative aspects of the economic growth of Nations: VIII. Distribution of Income by Size. *Economic Development and Cultural Change*, *11*(2), 1–80. https://doi.org/10.1086/450006

Lee, J. W., & Lee, H. (2018). Human capital and income inequality. *Journal of the Asia Pacific Economy*, *23*(4), 554–583. https://doi.org/10.1080/13547860.2018.1515002

Lee, K.-K., & Vu, T. V. (2020). Economic complexity, human capital and income inequality: a cross-country analysis. *Japanese Economic Review*, *71*(4), 695–718. https://doi.org/10.1007/s42973-019-00026-7

Levin, A., Lin, C.-F., & James Chu, C.-S. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, *108*(1), 1–24. https://doi.org/10.1016/S0304-4076(01)00098-7

Lui, H.-K. (2021). Education and income inequality in Hong Kong. In *Oxford research encyclopedia of education*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190264093.013.62

Makhlouf, Y. (2023). Trends in income inequality: Evidence from developing and developed countries. *Social Indicators Research, 165* (1), 213-243. https://doi.org/10.1007/s11205-022-03010-8

Makhlouf, Y., & Lalley, C. (2023). Education expansion, income inequality and structural transformation: Evidence from OECD countries. *Social Indicators Research*, *169*(1–2), 255–281. https://doi.org/10.1007/s11205-023-03161-2

Marin, A., & Psacharopoulos, G. (1976). Schooling and income distribution. *The Review of Economics and Statistics*, *58*(3), 332–338. https://doi.org/10.2307/1924955

McGregor, T., Smith, B., & Wills, S. (2019). Measuring inequality. *Oxford Review of Economic Policy*, *35*(3), 368–395. https://doi.org/10.1093/oxrep/grz015

Medgyesi, M. (2014). *Components of income inequality and its change in EU countries, 2004-2010* (ImPRovE Discussion Paper No. 14/01).

Mercado Jr., R., Park, C.-Y, & Zhuang, J. (2024). Trends and drivers of income inequality in the Philippines, Thailand, and Viet Nam since the early 2000s: A decomposition analysis. *Journal of Asian Economics, 94*. https://doi.org/10.1016/j.asieco.2024.101775

Mijs, J. J. B. (2021). The paradox of inequality: income inequality and belief in meritocracy go hand in hand. *Socio-Economic Review*, *19*(1), 7–35. https://doi.org/10.1093/ser/mwy051

Mincer, J. A. (1958). Investment in Human Capital and Personal Income Distribution. *Journal of Political Economy*, *66*(4), 281–302.

Mincer, J. A. (1974). *Schooling, experience, and earnings: Vol. I*. National Bureau of Economic Research

Mohd, S., Hamat, A. F. C., Idris, M., & Kasim, N. H. (2014). Poverty, Education and Income Inequality in Malaysia: Evidence from the 2009 Household Income Expenditure Survey. *Proceedings of International Conference on Contemporary Economic Issues 2014: Stimulating Economic Growth, Improving Quality of Life & Enhancing Youth Involvement* (pp. 111–118). School of Social Sciences, USM.

Munir, K., & Kanwal, A. (2020). Impact of educational and gender inequality on income and income inequality in South Asian countries. *International Journal of Social Economics*, *47*(8), 1043–1062. https://doi.org/10.1108/IJSE-04-2020-0226

Muszyńska, J., & Wędrowska, E. (2023). Does education affect income inequality? A comparative review of fourteen European countries. *Economy of Regions*, *19*(2), 397–409. https://doi.org/10.17059/ekon.reg.2023-2-8

Nawaz, A. R., & Ghulam, H. (2024). Can innovation stimulate income inequality in South Asia? *Economic Alternatives*, *30*(2), 360–383. https://doi.org/10.37075/EA.2024.2.08

Ngoc, B. H., & Hai, L. M. (2024). Time-frequency nexus between tourism development, economic growth, human capital, and income inequality in Singapore. *Applied Economics Letters*, *31*(4), 259–264. https://doi.org/10.1080/13504851.2022.2130865

Nizar, N. I., Nuryartono, N., Juanda, B., & Fauzi, A. (2023). Can knowledge and culture eradicate poverty and reduce income inequality? The evidence from Indonesia. *Journal of the Knowledge Economy*, *15*, 6425–6450. https://doi.org/10.1007/s13132-023-01398-3

Paweenawat, S. W., & Liao, L. (2023). Educational assortative mating and income inequality in Thailand. *Journal of Demographic Economics*, *89*(2), 283–298. https://doi.org/10.1017/dem.2022.9

Pedroni, P. (2000). Fully modified OLS for heterogeneous cointegrated panels. In B. H. Baltagi, T. B. Fomby, & R. C. Hill (Eds.), *Nonstationary panels, panel cointegration, and dynamic panels*. Emerald Group Publishing Limited. https://doi.org/10.1016/S0731-9053(00)15004-2

Pedroni, P. (2004). Panel cointegration: Asymtptotic and finite sample properties of pooled time series test with an application to the hypothesis. *Econometric Theory*, *20*(3), 597–625. https://doi.org/10.1017/S0266466604203073

Pesaran, M. H. (2004). *General diagnostic tets for cross section dependence in panels* (IZA Discussion Paper No. 1240). https://docs.iza.org/dp1240.pdf

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, *22*(2), 265–312. https://doi.org/10.1002/jae.951

Pesaran, M. H. (2015). Testing weak cross-sectional dependence in large panels. *Econometric Reviews*, *34*(6–10), 1089–1117. https://doi.org/10.1080/07474938.2014.956623

Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed-lag modelling approach to cointegration analysis. In S. Strøm (Ed.), *Econometrics and economic theory in the 20th century: The ragnar frisch centennial symposium* (pp. 371–413). Cambridge University Press. https://doi.org/10.1017/CCOL521633230.011

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, *94*(446), 621–634. https://doi.org/10.1080/01621459.1999.10474156

Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, *142*(1), 50–93. https://doi.org/10.1016/j.jeconom.2007.05.010

Pham, T. T., Lang, N. D., Ho, C. M., & Vo, D. H. (2024). Educational attainment, household income and wealth accumulation in Vietnam. *Social Indicators Research, 172*(2). https://doi.org/10.1007/s11205-024-03321-y

Ridzuan, A. R., Zakaria, S., Fianto, B. A., Yusma, N., Yusoff, M., Fatimah, N., Sulaiman, C., Razak, M. I., & Lestari, A. (2021). Nexus between financial development and income inequality before pandemic covid-19 : Does financial Kuznets curve exist in Malaysia, Indonesia, Thailand and Philippines? *International Journal of Energy Economics and Policy*, *11*(2), 260–271. https://doi.org/10.32479/ijeep.10616

Rodríguez-Pose, A., & Tselios, V. (2009). Education and income inequality in the regions of the European Union. *Journal of Regional Science*, *49*(3), 411–437. https://doi.org/10.1111/j.1467-9787.2008.00602.x

Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, *51*(1), 1–17.

Scripcar, M., & Ciobanu, R. (2021). Can income inequality be reduced through economic development and education? An EU-27 panel analysis. *Cross-Cultural Management Journal*, *23*(2), 157–169.

Setyadharma, A., Oktavilia, S., Utami, S., & Noormalitasari, A. R. (2021). Impacts of education and environmental sustainability on rural income inequality in Indonesia. In P. Juwaidah, M. M. T. Saiyut, & Z. Rozaki (Eds.), *International conference on agribusiness and rural development (IConARD 2020)* (pp. 1–12). EDP Sciences. https://doi.org/10.1051/e3sconf/202123204003

Shukla, V., & Mishra, U. S. (2020). Expansion in education and its impact on income inequality: Cross-sectional evidence from India. *Indian Journal of Labour Economics*, *63*(2), 331–362. https://doi.org/10.1007/s41027-020-00221-w

Siburian, M. E. (2023). The impact of education on inequality in a decentralized Indonesia. *Journal of the Asia Pacific Economy*, 29(4), 1995–2006. https://doi.org/10.1080/13547860.2023.2229653

Stiglitz, J. E., Fitoussi, J.-P., & Durand, M. (2018). *Beyond GDP: Measuring what counts for economic and social performance*. OECD Publishing. https://doi.org/10.1787/9789264307292-en

Sulaiman, N. F. C., Yussof, I., Zaidi, M. A. S., & Sulaiman, N. (2017). Long run relationship between income inequality and economic growth: Evidence from Malaysia. *International Journal of Academic Research in Business and Social Sciences*, *7*(6), 73–88. https://doi.org/10.6007/ijarbss/v7-i6/2945

Taresh, A. A., Sari, D. W., & Purwono, R. (2021). Analysis of the relationship between income inequality and social variables: Evidence from Indonesia. *Economics and Sociology*, *14*(1), 103–119. https://doi.org/10.14254/2071-789X.2021/14-1/7

Tey, N. P., Lai, S. L., Ng, S. T., Goh, K. L., & Osman, A. F. (2019). Income inequality across states in Malaysia. *Planning Malaysia*, *17*(2), 12–26. https://doi.org/10.21837/PM.V17I10.625

Thein, A. T. Z., & Akita, T. (2019). Education and expenditure inequality in Myanmar: An analysis with the 2006 and 2012 Household Income and Expenditure Survey in an urban and rural setting. *Regional Science Policy & Practice*, *11*(1), 55–70. https://doi.org/10.1111/rsp3.12188

Thye, G. L., Law, S. H., & Trinugroho, I. (2022). Human capital development and income inequality in Indonesia: Evidence from a nonlinear autoregressive distributed lag (NARDL) analysis. *Cogent Economics and Finance*, *10*(1). https://doi.org/10.1080/23322039.2022.2129372

UNESCO Institute for Statistics. (2012). *International Standard Classification of Education (ISCED) 2011*. UNESCO Institute for Statistics. https://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf

United Nations Development Programme. (2022). *Reducing inequality in the decade of action to achieve the SDGs and accelerate post- pandemic recovery*. United Nations Development Programme. https://asean.org/wp-content/uploads/2022/08/FINAL-Policy-Brief-on-Reducing-Inequality.pdf

United Nations Economic and Social Commission for Asia and the Pacific. (2021). *Asia and the Pacific SDG progres report 2021*. United Nations Publication. https://www.unescap.org/sites/default/d8files/knowledge-products/ESCAP_Asia_and_the_Pacific_SDG_Progress_Report_2021.pdf

Vo, D. H., & Ho, C. M. (2022). Does educational attainment and gender inequalities affect wealth accumulation? Evidence from Vietnam. *Heliyon*, *8*(12). https://doi.org/10.1016/j.heliyon.2022.e12502

Vo, D. H., Vo, A. T., & Ho, C. M. (2024). The short- and long-run effect of human capital on income inequality: Empirical evidence in the ASEAN region. *PLoS ONE*, *19*(7), . https://doi.org/10.1371/journal.pone.0304678

Vu, H. V. (2020). The impact of education on household income in rural Vietnam. *International Journal of Financial Studies*, *8*(1). https://doi.org/10.3390/ijfs8010011

Widjaya, E. P. O. (2016). Income inequality in Singapore by Pundarik Mukhopadhaya [Review of the book Income Inequality in Singapore, by Pundarik Mukhopadhaya]. *Journal of Southeast Asian Economies*, *33*(3), 421–422.

Win, N. W., Oo, Z., Glutting, J. R., Htun, A., & Kanayde, S. (2023). Inequality in Myanmar: Structural change, policy outcomes and gender dimensions. In H. A. Lee & C. Choong (Eds.), *Inequality and exclusion in Southeast Asia: Old fractures, new frontiers* (pp. 133–168). ISEAS–Yusof Ishak Institute.

World Bank. (2023). *2023 in nine charts: A growing inequality*. World Bank Group. https://www.worldbank.org/en/news/feature/2023/12/18/2023-in-nine-charts-a-growing-inequality.print

Xu, M., Chen, S., Chen, J., & Zhang, T. (2023). Non-linear links between human capital, educational inequality and income inequality, evidence from China. *PLoS ONE*, *18*(8), e0288966. https://doi.org/10.1371/journal.pone.0288966

Yee, K. M. R. (2024). At all costs: educational expansion and persistent inequality in the Philippines. *Higher Education*, *87*(6), 1809–1827. https://doi.org/10.1007/s10734-023-01092-y

Zhuang, J. (2023). Income and wealth inequality in Asia and the Pacific: Trends, causes, and policy remedies. *Asian Economic Policy Review*, *18*(1), 15–41.