

Poverty traps in Indonesia: A dynamic panel analysis of demographic and economic factors



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ABSTRACT

Article History

Received: 12 December 2025

Revised: 17 February 2026

Accepted: 25 February 2026

Published: 5 March 2026

Keywords

GMM estimation
Inclusive growth
Government Spending
Indonesia
Poverty dynamics
Structural transformation.

JEL Classification:

I32; O10; P23; H54.

This paper examines the factors driving poverty dynamics in Indonesia for the period 2014–2023 across 34 provinces, using a balanced panel model. The outcomes reveal high levels of poverty perpetuation, and that past deprivation has a significant impact on present levels of poverty. An increase in population over a short period contributes to poverty when employment and human capital development are low. Improvements in education always decrease poverty, while increases in unemployment lead to poverty growth. With endogeneity controlled using valid instruments (lagged investment terms and a novel instrumental approach: interactions between industry–education and industry–electricity), economic growth was found to have a positive, significant impact. This implies that the recent capital-intensive growth, without structural transformation, has been neither inclusive nor sustainable; it exacerbates poverty by increasing inequality, displacing urban labor, and driving inflation. Government spending and private-sector investment both help reduce poverty, but this depends on fiscal restraint and sectoral allocation. Poverty reduction is linked to industrial development, and in this case, the importance of attracting industry is highlighted. The paper suggests coordinated policies that combine demographic management with specific fiscal reforms and structural change towards labor-intensive growth, with investments in education and effective public expenditure.

Contribution/ Originality: This study presents a novel synergy-based instrument to show how industry, electricity, and education interact using a GMM approach to explain poverty trends in Indonesia. The findings of this study contribute to poverty alleviation over time and clarify how economic strength and human resource skills help reduce poverty.

1. INTRODUCTION

Poverty is an unending economic problem faced by developing countries. It remains difficult to alleviate, even as the economy grows, suggesting the presence of a poverty trap. A poverty trap is a socio-ecological situation in which self-reinforcing mechanisms keep individuals or communities in persistent poverty (Haider, Boonstra, Peterson, & Schlüter, 2018). In other words, poverty breeds poverty (Kraay & McKenzie, 2014) so that current poverty becomes the cause of future poverty, making it difficult for one to escape poverty in the long term. Poverty traps occur across various countries, including sub-Saharan Africa (Wang, Hua, Tao, & Moldovan, 2021) and Kenya (Noritomo & Takahashi, 2020). Several provinces in Indonesia, such as Aceh, Gorontalo, Maluku, and East Nusa Tenggara, have also experienced high poverty rates (more than 16%) over the past 20 years. In West Papua Province, which became

its own province only in 2007, the average poverty rate has consistently been above 20%. The difficulty of reducing poverty in provinces with high poverty rates indicates the occurrence of a poverty trap in Indonesia. As the poverty trap hinders improvements in people's welfare, it is necessary to analyze the causes of persistent poverty in Indonesia.

The issue of poverty cannot be separated from demographic aspects, such as population size and human resources. Poverty is impacted by population growth (Zhang, Peng, Zheng, Wu, & Wang, 2021) and population density (Dang, Dhongde, Do, Nguyen, & Pimhidzai, 2025); policies are needed to control population growth to escape poverty. The second critical aspect is human resources, especially education, as low levels of education are recognized as a cause of poverty. Policies that aim to improve public education are therefore essential; in fact, there is ample evidence supporting the role of education in reducing poverty in various countries, such as Portugal (Firoiu, Ionescu, Pîrvu, Bădîrcea, & Patrichi, 2022), Pakistan (Iqbal, Siddiqui, & Zafar, 2020), China (Zuo, Li, Ge, & Chen, 2023), the United States (Panyi, Whitacre, & Young, 2025), and 26 European countries (Hidalgo-Hidalgo & Iturbe-Ormaetxe, 2018). Higher-educated populations have opportunities for higher-paying jobs. Therefore, people need to pursue higher education to obtain better jobs, earn higher incomes, and escape poverty.

Unemployment also contributes to poverty by directly limiting household income. Studies report a positive relationship between unemployment and poverty (Aderounmu et al., 2021; Mansi, Hysa, Panait, & Voica, 2020; Meo et al., 2023; Pohlan, 2024). Unemployment contributes to the spread of poverty in several countries, such as Indonesia (Muthalib, Adam, Saenong, & Suriadi, 2018) and China (Gustafsson & Sai, 2020).

Another determinant of poverty is economic performance, which results from the activities of government, companies, and society as a whole. In the context of government efforts to alleviate poverty, economic performance results from government policies, programs, and spending. Government spending can reduce poverty (Anderson, d'Orey, Duvendack, & Esposito, 2018; Westmore, 2018); therefore, all government policies, programs, and spending allocations should be pro-poor to ensure successful poverty alleviation efforts.

Economic policies and government programs, as reflected in government spending, can be effective in alleviating poverty if government spending is allocated appropriately and utilized efficiently. Previous studies show that government spending on cash assistance to the community (social spending) helps reduce poverty in Indonesia (Yusuf, 2018). Other studies note that spending types that help reduce poverty include social protection (Fonayet, Belzunegui Eraso, & De Andrés Sánchez, 2020) and development (Ambarkhane, Singh, & Venkataramani, 2020). In addition, a combination of several spending types also helps eliminate poverty (Babatunde, 2018; Taruno, 2019), sometimes grouped as "pro-growth" expenditures, including health, education, transportation, and communication (Adeosun & Tabash, 2022; Wandeda, Masai, & Nyandemo, 2021).

Another aspect of economic performance is investment. According to the vicious circle of poverty (Nurkse, 1953), low investment is one of the causes of poverty. A country becomes poor because of low savings and investment, even though it is poor because of low savings and investment (Škare & Družeta, 2016). Therefore, additional investment has the potential to reduce poverty. Previous studies found the investment types that can reduce poverty are the following: domestic investment (Soegoto, Soegoto, & Meyer, 2022), foreign direct investment (Anetor, Esho, & Verhoef, 2020; Dagume, 2021), infrastructure investment (Medeiros, Ribeiro, & do Amaral, 2021; Xiao, Zheng, & Xie, 2022), and physical investment or gross fixed capital formation (Akobeng, 2017; Rambe, Purmini, Alfansi, Armelly, & Yusnida, 2023).

Economic performance is also reflected in economic growth; a higher economic growth can reduce poverty (Benedetti & Crescenzi, 2023; Cruz & Ahmed, 2018; Kouadio & Gakpa, 2022). However, other studies found that growth is insufficient to alleviate poverty in Nigeria (Dauda, 2017) and the United Kingdom (Lee & Sissons, 2016) due to several variables such as distribution channels, labor market dynamics, and price effects.

Industrialization can also alleviate poverty by creating employment opportunities for the community, as the value added from industry and manufacturing plays an important role in poverty alleviation (Enongene, 2024). However, in Indonesia, some industrial expansion has been concentrated in capital-intensive sectors that require higher skills,

thereby limiting job opportunities for unskilled workers. This has resulted in widening poverty. Thus, the nature of industrialization, labor-intensive versus capital-intensive needs to be considered in poverty alleviation efforts.

However, industrialization, through job creation, does not reduce poverty by itself. Successful labor absorption in the industrial sector can be shaped by moderate conditions, especially labor education and access to electricity. Industries established in a specific region can adjust existing labor education to reduce poverty in that region; higher education can develop local skills that better match industrial demand, and at the same time, the industry can adapt to these newly developed skills. Such an approach would enable industrialization to reduce poverty more effectively. The availability of electricity also moderates the industry's ability to reduce poverty, given that electricity is fundamental to industrial activity; in fact, all technological developments in industry today are electricity-based. Affordable access to electricity across the region, including rural areas, would support the emergence of industries with stronger pro-poor characteristics.

This study analyzes the relationships among demographic factors, economic performance, and industry using a dynamic panel framework estimated by Generalized Method of Moments. The interactions between industry and labor education, and between industry and electricity, serve as instruments to overcome potential endogeneity and capture the moderating roles of these supporting factors. However, studies on "industrial synergy" as an instrumental and moderating mechanism in poverty alleviation are still limited. Therefore, this study contributes by clarifying whether and under what conditions industry can be made more effective in reducing poverty through complementary investments in human resources and infrastructure.

Thus, the objectives of this study are: (1) to assess the effect of demographic factors on poverty reduction; (2) to examine the impact of economic performance on poverty reduction; (3) to evaluate the combined influence of demographic and economic performance factors on poverty eradication; and (4) to analyze how industrial synergy through labor education and electricity moderates the influence of demographic and economic performance on poverty. The results of this research will contribute to the literature on poverty reduction strategies in developing countries.

This paper is organized as follows. It begins with the background and rationale for analyzing the influence of demographics, economic performance, and industrial synergy on poverty (Section 1), followed by a literature review that underlies the selection of demography and economic performance as independent variables influencing poverty (Section 2). The following section elaborates on the research method (Section 3). The research and discussion results are then described (Section 4). This paper closes with conclusions, research implications, and recommendations for further research (Section 5).

2. LITERATURE REVIEW

2.1. Poverty Traps

Beech, Ford, Thorpe Jr, Bruce, and Norris (2021) mentioned that poverty is characterized as an undesirable and intolerable condition, referring to material scarcity and involving economic hardship, lack of basic consumer goods, education, or access to health. Studies done in Mexico (Loría, 2020) and Sub-Saharan African countries (Wang et al., 2021) found that the economic conditions have been trapped in poverty. In the short term, poverty in the previous year has a considerable association with current poverty. Mogess, Eshete, and Alemaw (2023) also highlight the sustainability of poverty traps and the difficulties they pose for poverty alleviation.

H: Poverty in the previous year had a positive effect on the current poverty level.

2.2. Demographic Aspects and Poverty

Demographic aspects relate to human resources. The first is population size, which is related to community welfare, including the poverty rate. Population growth, when accompanied by job availability, can positively affect welfare.

Wietzke (2020) notes that global poverty has sharply declined in recent decades, alongside rapid improvements in demographic indicators such as lower child mortality and fertility rates. There are two different results regarding the effect of population size on poverty levels. Nabi et al. (2020) found a negative relationship between population growth and poverty at various poverty thresholds. Population growth increases the number of poor people and leads to environmental degradation. However, Cruz and Ahmed (2018) found that population growth can positively affect poverty alleviation when the composition of the productive population changes and the dependency ratio decreases.

H₅: population has a positive effect on poverty levels.

Education increases employment and employability (Kovářová & Vašenková, 2024) and thus significantly reduces poverty (Liu, Li, Zhang, Ngo, & Iqbal, 2021; Quispe-Mamani, Hanco-Gomez, Aguilar-Pinto, Ulloa-Gallardo, & Ponce-Quispe, 2025). However, if education level and employment are misaligned, the resulting wage disparities and dissatisfaction would reduce its effectiveness in reducing poverty (Chekol, 2024). Thus, in countries with dualistic economic structures, poverty tends to persist due to unequal access to education (Morris, 2024). This makes education a crucial instrument for achieving fair income distribution and improving the quality of life (Spada, Fiore, & Galati, 2024). In relation to industrialization, Zeytoon-Nejad (2024) emphasizes that education is only effective in reducing poverty when accompanied by inclusive industrialization policies and the creation of productive jobs.

H₆: Education has a negative impact on poverty.

Another demographic aspect that affects poverty is unemployment. A high unemployment rate indicates that many people of productive age have no income, and will push the poverty rate higher. In South Africa (Mackett, 2020) found that poverty and unemployment are inextricably linked.

The studies by Meo et al. (2023) and Ngubane, Mndebele, and Kaseeram (2023) indicate a non-linear relationship with a positive effect of the unemployment rate on the poverty rate. Gustafsson and Sai (2020) showed that the risk of experiencing relative poverty in urban areas of China was positively associated with unemployment among adult household members. Meanwhile, Pohlig (2021) noted that unemployment contributes to poverty by reducing income and weakening social stability.

H₇: Unemployment has a positive effect on the poverty rate.

2.3. Economic Performance and Poverty

Aspects that influence poverty reduction include government spending, investment, and economic growth. Government spending is found to reduce poverty rates (Adelusi, Adelusi, Omodero, Akintoye, & Akinde, 2025; Nechifor, Boysen, Ferrari, Hailu, & Beshir, 2024). In particular, government spending encourages growth and alleviates poverty when it is allocated to education and healthcare (Agussalim et al., 2024; Wang et al., 2021), the infrastructure sector (Sasmal, Das, & Sasmal, 2024), and fund transfers to the community (Nawaz & Iqbal, 2021).

Mackett (2020) shows that government cash assistance is one of the efforts to reduce poverty rates in South Africa. In the context of rising poverty resulting from the COVID-19 pandemic in Indonesia, the government must allocate spending effectively to pro-growth policies and poverty alleviation (Rambe, Purmini, Armelly, Alfansi, & Febriani, 2022).

Different conditions were found in Sub-Saharan African countries, where health and education spending had no impact on reducing poverty rates (Olaoye et al., 2024). These findings suggest a limited allocation of economic resources to the health and education sectors.

H₈: Government spending has a negative effect on the poverty rate.

Investment is found to be the most significant factor in alleviating poverty (Rambe et al., 2023). The role of foreign investment is supported by the findings of research (Arogundade, Biyase, & Bila, 2022; Topalli, Papavangjeli, Ivanaj, & Ferra, 2021). Castillo and Chiatchoua (2022) mentioned that foreign investment variables contribute to reducing poverty through multinational companies. There is an indirect influence of foreign, domestic, and government investment on poverty levels through economic growth.

H₆: Investment has a negative effect on the poverty rate.

Economic growth contributes to poverty alleviation (Balasubramanian, Burchi, & Malerba, 2023; Benedetti & Crescenzi, 2023; Cruz & Ahmed, 2018; Kouadio & Gakpa, 2022; Majeed, Abbas, Kadhim, & Kzar, 2025; Nguyen-Van, Pham, & Le, 2019; Nurlina, Ridha, Syahputra, & Muda, 2024) by creating jobs and raising people's income. A study by Marrero and Servén (2022) found that economic expansion tends to lead to a general reduction in poverty. Kyara, Rahman, and Khanam (2022) and Sasmal et al. (2024) found that economic growth accompanied by income equality encourages poverty alleviation. A study conducted by Dávila (2023) concluded that, in both the short- and long-term, economic growth contributes significantly to escaping the poverty trap.

H₇: Economic growth has a negative impact on poverty levels.

3. DATA AND METHODOLOGY

This paper relies on annual panel data from 34 Indonesian provinces between 2014 and 2023. All data were obtained from the Central Bureau of Statistics and the Ministry of Finance. The dependent variable is the poverty rate, representing the percentage of people living in poverty in each province relative to the total population.

Independent variables were selected based on empirical evidence regarding the determinants of poverty in developing countries. Population is the total number of inhabitants (thousand people). The education level of the workforce is the number of workers with the highest education level who have graduated with a diploma or bachelor's degree (thousand people) and is considered a proxy for the quality of human resources, where education is important in increasing productivity and poverty alleviation (Becker, 1964). Unemployment is measured by the open unemployment rate (percentage), as employment opportunities directly affect the purchasing power of poor households (Zizzamia, 2020). Local government expenditure based on total expenditure (million USD) is used as a measure of fiscal intervention that can increase people's access to essential services (Sanogo, 2019). Physical capital accumulation is proxied by Gross Fixed Capital Formation (in million USD) as an investment. Gross Domestic Product growth rate (percent) is generally considered an indicator of economic growth and is often associated with improved welfare of the population (Ravallion & Chen, 1997). The industrial sector is an indicator of structural change highlighted by Kaldor (1966), measured by its contribution to total GDP.

Empirical equations are created based on human capital theory (Becker, 1964): poverty is closely related to the quality of human resources, particularly education levels and labor market participation. From a macroeconomic and public finance perspective, poverty is also influenced by economic capacity and fiscal intervention. The poverty trap theory (Nurkse, 1953) is the main conceptual basis, arguing that the interaction between human capital constraints and economic performance constraints leads to poverty.

This study uses a dynamic panel model to examine the dynamics of poverty, with the lagged dependent variable as a predictor. Initially, an estimation of the demographic aspect model will be carried out, with the model specification developed as follows.

$$Pov_{it} = \beta_0 + \beta_1 Pov_{it-1} + \beta_2 Educ_{it} + \beta_3 Unemp_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

Using the same approach of the dynamic panel model, it is applied to aspects of economic performance which equations are expressed as follows:

$$Pov_{it} = \beta_0 + \beta_1 Pov_{it-1} + \beta_2 GS_{it} + \beta_3 Invest_{it} + \beta_4 EG_{it} + \beta_5 Ind_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

To deepen the analysis of the determinants of poverty, a synthesis of the two aspects is undertaken, as presented in Equation 3.

$$Pov_{it} = \beta_0 + \beta_1 Pov_{it-1} + \beta_2 Educ_{it} + \beta_3 Unemp_{it} + \beta_4 GS_{it} + \beta_5 Invest_{it} + \beta_6 EG_{it} + \beta_7 Ind_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

The third equation was developed to construct a fourth model that incorporates instrumental variables, including lagged (t-1) investment, industry–electricity synergies, and industry–education synergies. Here, Pov_{it} denotes the

poverty level of province i in year t ; μ_i represents fixed heterogeneity across provinces; λ_t captures the annual time effects; and ε_{it} is the error term.

Estimation was carried out using the Generalized Method of Moments (GMM) (Arellano & Bover, 1995; Blundell & Bond, 1998). This method was chosen because GMM has advantages in addressing problems of simultaneous endogeneity, unobserved heterogeneity, and serial correlation (Roodman, 2009).

The instruments used in the estimation consist of internal instruments in the form of differentiated lag from endogenous variables, as well as external instruments that include: (i) investment-lag-1, (ii) the interaction of industrial contribution with electricity consumption ($\text{Ind}_{it} \times \text{Elec}_{it}$), and (iii) the interaction between industry and education ($\text{Ind}_{it} \times \text{Educ}_{it}$).

The use of investment lag is based on the argument that the impact of investment on poverty reduction is indirect. Instead, it takes time to generate infrastructure, job opportunities, and inclusive growth (Amponsah, Agbola, & Mahmood, 2023; Fagbemi, Osinubi, & Adeosun, 2022). The electricity consumption variable was chosen as a proxy for the industrial sector's production capacity, in line with findings that energy access can be a catalyst for productive growth and poverty reduction (Dinkelman, 2011).

The Hansen J-test (Hansen, 1982) was used for testing the validity of the instrument, while the Arellano-Bond test for AR (2) is applied to check serial correlation. Significance tests were also conducted on interaction variables to assess the extent to which the linkages among industry, electricity, and education strengthen the structural impact on poverty. In addition, finite sample bias correction to standard errors is applied according to the recommendations of Windmeijer (2005) to ensure efficient estimation at intermediate sample sizes.

4. RESULTS AND DISCUSSION

The portrait of poverty in Indonesia faces significantly different challenges during the 2014-2018 period compared to 2019-2023. The period 2014-2018 can be characterized as a period dominated by structural poverty that was gradually reduced through various development initiatives, while the interval of 2019-2023 faced poverty exacerbated by significant external shocks, especially the COVID-19 pandemic, which adversely affected many sectors of the economy, in addition to global geopolitical disruptions that generated inflationary pressures (see Figure 1).

In 2019-2024, Indonesia's poverty map has undergone significant changes and trends. Several provinces (Particularly on the island of Sumatra) have reduced their poverty levels and been reclassified as the low-poverty group (Instead of the previously middle-poverty group). This success demonstrates the effectiveness of various national government programs, such as the Family Hope Program (PKH) and Non-Cash Food Assistance (BPNT), as well as improvements in economic infrastructure (Such as the construction of toll roads). Infrastructure development outside Java has begun to show benefits, though they are not yet evenly distributed across all regions. Meanwhile, provinces in eastern Indonesia (Papua, West Papua, and NTT) remain classified as severely poor, showing that while the national trend has improved, regional disparities remain a challenge. This further emphasized that the development gap between Western and Eastern Indonesia is a byproduct of the economic concentration that continues to be centered in Java and specific areas of Sumatra. The theory of regional development by Myrdal (1957) proposes a cumulative, cause-and-effect phenomenon in which developed areas tend to experience increased development as a result of backwash and unbalanced dissemination effects.

The data on the relationships between poverty and population aspects, as well as between poverty and economic performance aspects, are depicted in the bubble charts (Figures 2a, 2b, 3a, 3b). In the bubble charts, these 34 provinces are grouped per region with different colors: green for provinces in Java and Bali, yellow for provinces in the Sumatra region, blue for provinces in the Kalimantan region, purple for provinces in the Sulawesi region, and black for provinces in the Nusa region, red for provinces in the Papua region, and brown for provinces in the Maluku region.

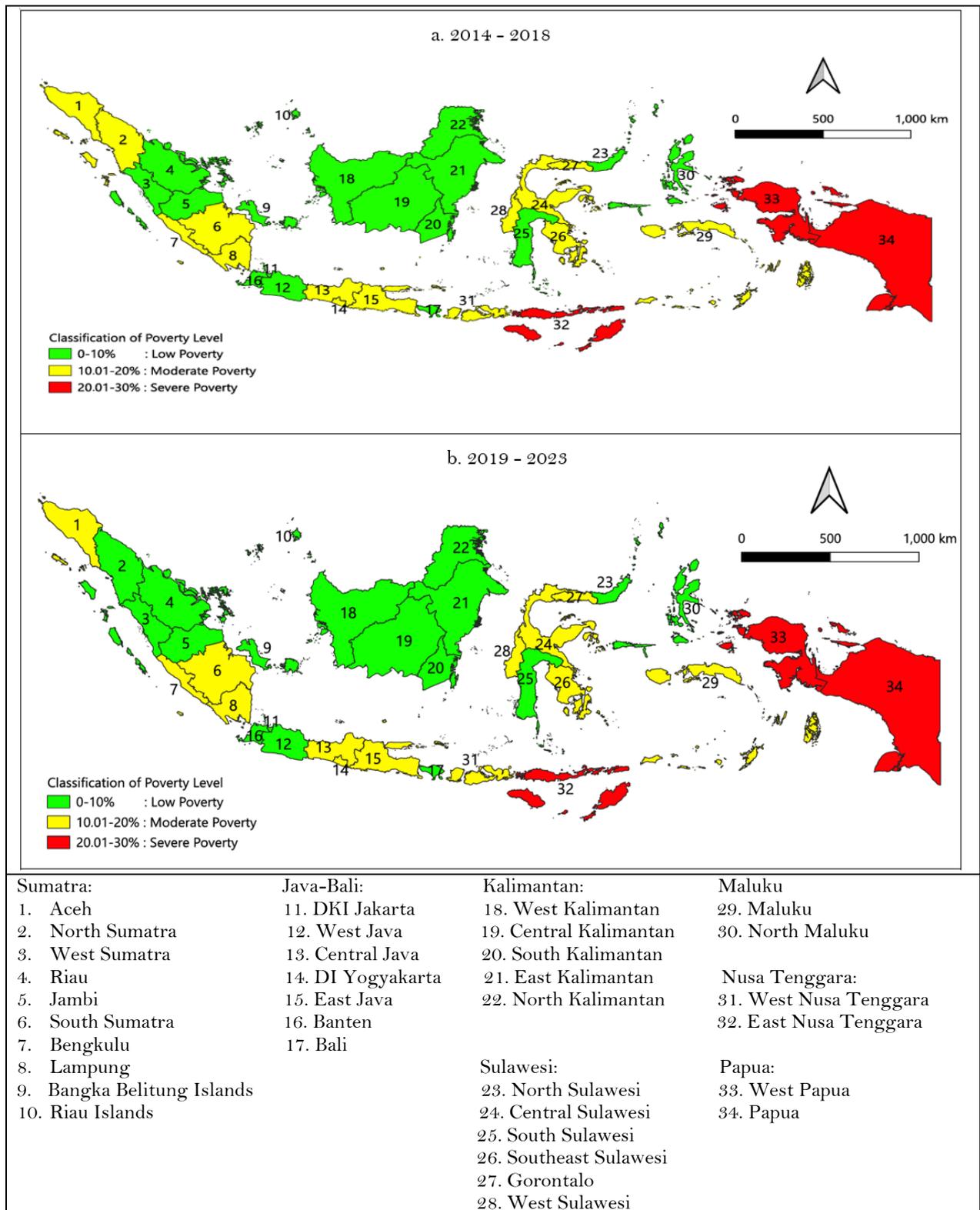


Figure 1. Portrait of Regional Poverty in Indonesia.

In Figures 2a and 2b, bubble size indicates the number of highly educated workers in each province. The larger the bubble size, the more highly educated the workers in the province tend to be. This bubble chart also informs the population through patterns, represented by plain symbols (< 10 million people), horizontal lines (10 million ≤ n < 20 million people), vertical lines (20 million ≤ n < 30 million people), and squares (≥ 30 million people). Figure 2a and 2b present the average conditions of poverty and population in Indonesia for the periods 2014-2018 and 2019-2023.

During 2014-2018, the average national poverty rate was 11.4%, the unemployment rate was 5.3%, and the number of higher education workers was 423,000, with a population of 7.79 million. From Figure 2a, it is known that the poverty rate is lower than the national poverty rate in only Kalimantan. The highest unemployment rate in the province in the region is 7.9%. On the other hand, areas with high poverty rates are located in Papua and Nusa Tenggara. Meanwhile, the area with the highest number of highly educated workers is the Java-Bali region (Most provinces in this region have large bubble sizes).

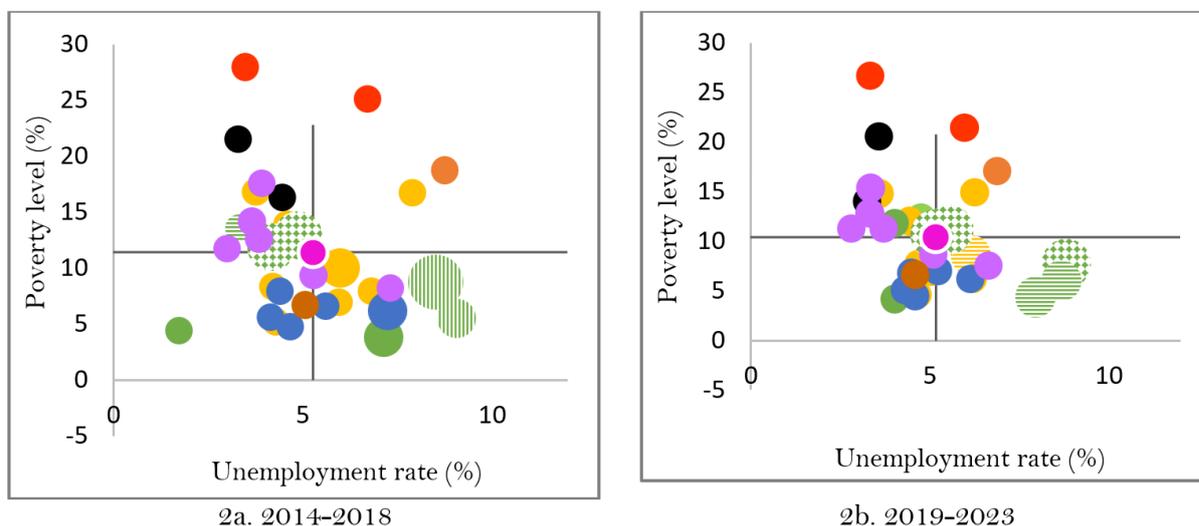


Figure 2. Poverty and demography aspect.

Furthermore, there was a decrease in poverty from 2019 to 2023, with an average national poverty rate of 10.4%. Areas with high poverty are still located in Papua and Nusa Tenggara. Population development has also improved, with the unemployment rate declining to 5.2%. During 2019-2023, there was an increase in highly educated workers (more big bubbles than in 2014-2018). The average number of highly educated workers also increased to 515 thousand per province. However, the demographic aspect remains a challenge due to the significant population growth. This development remains a challenge due to the province's annual population growth rate of 1.2%, resulting in an average population of 7.88 million.

Next, Figures 3a and 3b are described, which present the relationship between poverty and aspects of economic performance. The provincial color of each region in the figure is the same as the coloring in the previous Figures (Figures 2a and 2b). However, the bubble size in Figures 3a and 3b represents the average annual local government spending in each province. The larger the bubble size, the greater the local government's spending. This bubble chart also informs investment through a bubble pattern, which consists of 4 patterns, namely plain (investment < 5000 USD million), horizontal line ($5000 \text{ million} \leq \text{investment} < 10000 \text{ USD million}$), vertical line ($10000 \text{ USD million} \leq \text{investment} < 15000 \text{ USD million}$), and square line (investment $\geq 15000 \text{ USD million}$). The average investment per year for the period 2014-2018 and 2019-2023 is 5813 USD million and 6737 USD million, respectively. Thus, most provinces have low investment (investment < 5000 USD million). Investments of more than \$6,737 million are concentrated in the Java-Bali region. In 2019-2023, there has been no rapid increase in investment compared to 2014-2018. However, it can be seen that provinces with significant investments have a high average industrial ratio, with a poverty rate per year ranging from 4% (Jakarta) to 11.14% (Central Java) during the 2019-2023 period.

This figure also shows the province's average economic growth. Provinces with economic growth above the national average are highlighted in black. Provinces with economic growth below the national average are bubbles without borders. The average national economic growth per year for 2014-2018 and 2019-2023 is 5.49%, and 3.76%. One cause of the decline in economic growth is that most provinces experienced economic contraction during the

COVID-19 pandemic. This is evident in the growing number of provinces with average economic growth exceeding the national average.

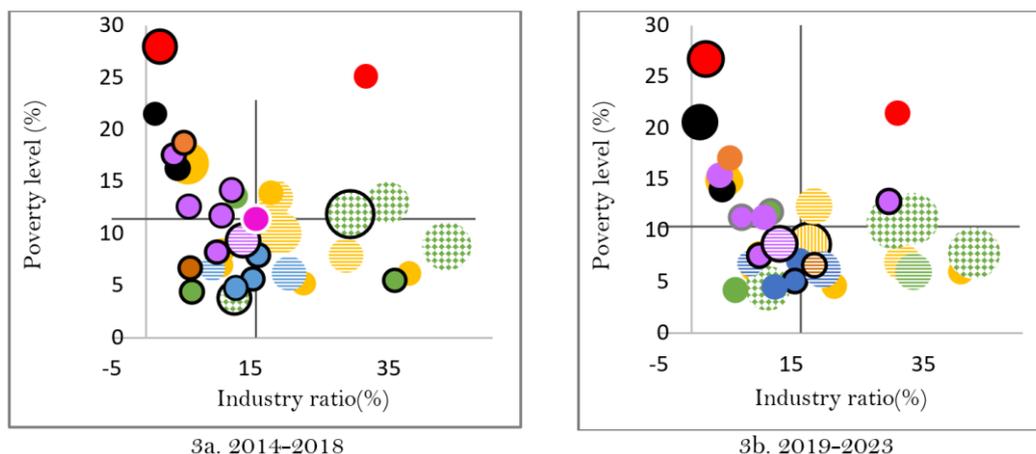


Figure 3. Poverty & economic performance aspects.

Before estimating, the correlation between variables is tested to detect potential multicollinearity. Table 1 presents test results indicating that the value remains below the commonly used threshold of 0.80-0.90 for identifying multicollinearity (Gujarati & Porter, 2020), suggesting the model is free of multicollinearity. In addition, data stationarity tests were also conducted to prevent spurious regression and produce more consistent estimates and accurate predictions. The data stationarity test used was the Augmented Dickey-Fuller (ADF) root unit test.

Table 1. Correlation matrix.

Variable	Pop	Educ	Unmp	GS	Invest	EG	Industry
Pop	1.000	0.619	0.252	0.799	0.548	-0.043	0.537
Educ	0.619	1.000	0.149	0.708	0.575	-0.046	0.238
Unmp	0.252	0.149	1.000	0.283	0.339	-0.221	0.457
GS	0.799	0.708	0.283	1.000	0.736	-0.112	0.467
Invest	0.548	0.575	0.339	0.736	1.000	-0.044	0.365
EG	-0.043	-0.043	-0.221	-0.112	-0.044	1.000	0.001
Industry	0.537	0.238	0.457	0.467	0.365	0.001	1.000

Table 2 presents the test results, displaying five of the eight variables, with stationary data at the 5% significance level. Two variables, including one stationary variable in the first differences and another stationary variable in the second differences, are all at the 5% level. The mixed integration condition has important implications for the estimation method. The Generalized Method of Moments (GMM) approach, which is more flexible in handling dynamic panel data with variables of different degrees of integration and can overcome the potential endogeneity and heteroscedasticity, is the right choice.

Table 2. Data stationary test results.

Variable	Intercept	Prob.	Test for unit root in
Poverty (Pov)	128.353	0.000	First Differences
Population (Pop)	376.424	0.000	Level
Education (Educ)	108.257	0.001	Level
Unemployment (Unmp)	144.535	0.000	Level
Government Spending (GS)	109.528	0.001	Level
Investment (Invest)	99.802	0.007	Second Differences
Economic Growth (EG)	90.805	0.033	Level
Industry	117.866	0.000	First Differences

The results of GMM regression estimation are presented in Table 3. In general, the model demonstrates the instrument's consistency based on the Hansen test, which fails to reject the null hypothesis; therefore, the instrument can be considered valid. Additionally, the Arellano–Bond test indicates the absence of second-order autocorrelation, confirming that the model specifications are appropriate. In general, these findings confirm that poverty is persistent and is influenced by the quality of human resources, the structure of the labor market, the dynamics of economic growth, as well as fiscal policies and industrial transformation.

Table 3. Results of GMM panel data estimation.

Variable	1st Regression (Human aspect)		2nd Regression (Economic performance aspect)		3rd Regression (Both aspects)		4th Regression (Both aspects with instrumental variable)	
	Coeff.	T Stat.	Coeff.	T Stat.	Coeff.	T Stat.	Coeff.	T Stat.
Pov (-1)	0.8648	48.19***	0.6625	69.42***	0.6846	24.32**	0.7376	71.922***
Pop	0.0002	6.07***			-2.95E-05	-0.50	2.21E-05	2.490***
Educ	-0.0008	-2.57***			0.0013	1.68*	-0.0005	-2.150***
Unmp	0.4215	43.29***			0.5237	11.84***	0.4506	43.237***
EG			-0.0329	-29.56***	0.038	6.72***	0.027	100.24***
GS			-0.0009	-30.23***	-0.0004	-6.63***	-0.0002	-8.469***
Invest			-3.87E-09	-2.10**	-3.55E-09	-1.048	-2.3E-10	-18.168***
Industry			-0.0407	-3.44***	-0.0465	-2.37***	-0.013	-11.369***
Diagnostic Statistics								
No. of obs.	272		272		272		272	
AR (2)	0.8157 (0.4147)		-0.0329 (0.9737)		0.4769 (0.6334)		0.9788 (0.3277)	
J-statistic	32.9371 (0.3252)		32.4966 (0.2985)		29.8272 (0.2748)		26.5202 (0.4348)	

Note: Asterisk *, **, and *** indicate significance at 10%, 5%, and 1% levels, p values are in parentheses.

The poverty trap has been proven to exist in Indonesia. Poverty in the previous period (Pov(-1)) has a positive and significant sign in all model specifications, with a coefficient range of 0.66–0.86. The coefficient of 0.66 explains that current poverty is determined by 66 percent by previous poverty, with the dependence becoming even stronger at 0.86, indicating that more than 4/5 of poverty originates from the past. This figure explains that poverty is at a low equilibrium level; if a province experiences a 1 percent decline in poverty in a given period, then without structural changes, 0.66–0.86 percent of poverty will return in the following period. The findings of this study are consistent with previous studies (Loría, 2020; Wang et al., 2021) where this phenomenon is often explained through the poverty trap framework, in which economically disadvantaged households face significant challenges in overcoming their poverty due to inadequate human resources, limited access to productive assets, and limited opportunities for social mobility (Chang, Zhang, & Li, 2024; Wang, Xiao, & Liu, 2023). Poverty traps are perpetuated by inadequate infrastructure, insufficient asset accumulation, limited access to credit, and weaknesses within the institutional framework (Chavez & Lufin, 2022; Janz, Augsburg, Gassmann, & Nimeh, 2023; Radosavljevic, Haider, Lade, & Schlüter, 2021). For Indonesia, this shows that short-term interventions such as cash assistance are not enough; a long-term strategy is needed that invests in education, health, and financial inclusion.

Regarding the other independent variables, the level of significance of their influence on poverty varied across the four models. In the first model (Demographic aspect), population has a positive effect on poverty. The coefficient value indicates that an increase of 100,000 residents causes poverty to rise by 0.02. The results of this study are parallel to previous studies by Dang et al. (2025) and Nabi et al. (2020). High population growth will limit resources and exacerbate poverty; conversely, slowing population growth can lower poverty as average incomes increase and the burden of dependency decreases. Meanwhile, Indonesia's demographic condition is currently in a phase in which the proportion of the productive-age population (15–64 years) exceeds that of the non-productive-age population. According to data from the Central Bureau of Statistics, more than 68% of Indonesia's population falls within the working-age category. However, population growth is not accompanied by an improvement in the quality of human

resources or investment in economic infrastructure, which exacerbates poverty. Population growth slows per capita income growth, increases competition for resources, raises unemployment, and worsens poverty (Wietzke, 2020). Poverty becomes even harder to escape when people lack access to basics like electricity and schools (Kuddus, Tynan, & McBryde, 2020).

The education variable (Educ) has a significant negative influence on poverty, especially in models 1 (-0.0008) and 4 (-0.0005). This small coefficient value reinforces the poverty trap argument, as it shows that an increase of 100,000 highly educated workers reduces poverty by 0.08 percent. This study supports the findings of Sun, Li, Li, and Feng (2022) and Masrizal, Zulham, Aliasuddin, and Dawood (2024) and aligns with human resource theory, which posits that improving the quality of education can increase labor productivity and expand opportunities to obtain jobs with adequate wages (Becker, 1964). Education remains a key mechanism in reducing poverty by improving individuals' employability, thereby increasing their chances of finding work and raising their income. This statement is supported by research conducted by Hofmarcher (2021) and Zeytoon-Nejad (2024), which highlights the effectiveness of education in reducing poverty.

Similarly, Spada et al. (2024) explain that, to improve quality of life and achieve fair income distribution an important prerequisite for realizing a sustainable economy education plays a crucial role in combating poverty. In addition, Chekol (2024), in his analysis conducted in Ethiopia, found that inequality between education levels and employment opportunities leads to wage gaps and dissatisfaction, which has the potential to undermine the effectiveness of education in poverty alleviation. Basically, achieving higher education alone is not enough; structural reforms that facilitate labor market integration are also needed. Evidence from Indonesia shows that vocational education significantly reduces the vertical mismatch between educational qualifications and employment opportunities, enabling graduates to earn a decent income. Therefore, structural reforms such as inclusive industrialization, the creation of appropriate employment opportunities, and education policies that prioritize relevance and quality are essential to ensure that education effectively facilitates poverty alleviation.

The unemployment variable (Unmp) consistently shows a positive and significant influence on poverty (0.42–0.52). A 1 percent increase in unemployment raises the poverty rate by 0.42–0.52 percent. This confirms unemployment's role in reinforcing the poverty trap, which can be understood through declining household income and a corresponding decrease in individual consumption capacity. Gebel and Gundert (2023) emphasize that unemployment has a direct impact on poverty through reduced income and an indirect impact through the erosion of social stability. In the Indonesian context, this issue is highly relevant, given the prevalence of the informal sector, which often fails to provide adequate social protection. Therefore, creating formal employment opportunities, particularly through the expansion of labor-intensive industries, is a strategic initiative to reduce poverty.

After analyzing the findings from Model 1, we moved to Model 2 to better understand the correlation between poverty variables from an economic performance perspective. The initial variables related to economic performance were identified as economic growth, which had a significant negative effect on poverty (coefficient = - 0.0329), indicating that a 1 percent increase in growth decreased poverty by 0.033 percent, supporting the growth-poverty nexus hypothesis. Zhang, You, Yi, Zhang, and Xiao (2025), using data from 158 countries, found that every 10 percent decrease in poverty rates is accompanied by an annual increase in GDP per capita of 0.5 percent to 1.2 percent, indicating that, in general, economic development leads to a decrease in poverty rates. In Vietnam, Zhu, Bashir, and Marie (2022) reported a significant decline in poverty rates during the period 2014 to 2016 in line with substantial annual GDP growth.

Government spending (GS) shows a significant negative correlation with poverty levels, with a coefficient of - 0.0009, indicating that an additional USD 1 billion in government spending will reduce poverty by 0.9 percent. These findings are consistent with previous studies (Adelusi et al., 2025; Masrizal et al., 2024; Nechifor et al., 2024). In addition, these findings support the theoretical argument that prudent fiscal expansion can reduce poverty through direct and indirect channels. Directly, the impact of fiscal expansion is visible in social welfare programs, educational

opportunities, and health subsidies that directly reduce household vulnerability. Indirectly, the impact can be seen in public investment in infrastructure and the economy, which can drive growth and reduce the structural barriers faced by individuals living in poverty. Kitole, Msoma, and Sesabo (2025), in their research in Tanzania, noted that government spending has consistently reduced poverty in both the short- and long-term. Comparative data from Vietnam also support the redistributive capacity of public spending, which not only promotes growth but also reduces poverty (Nguyen, Giang, Tran, & Do, 2021). Similarly, Indonesia has followed this trend through the expansion of conditional cash transfer programs (the Family Hope Program) and health insurance coverage (BPJS Kesehatan). Meanwhile, government spending on education has had a positive impact on poverty alleviation in Indonesia, especially in areas with poor or non-existent labor markets.

Investment shows a negative relationship with poverty (-3.87×10^{-9}), indicating that a USD 1 billion increase in investment will reduce poverty by 0.00000387 percent, *ceteris paribus*. Although the amount is quite small, the result is interesting in the sense that, theoretically, investment, both public and private, is considered an important driver of inclusive economic growth. Results that prove otherwise indicate structural problems that undermine the role of investment in combating poverty. First, investment is often concentrated in capital-intensive sectors such as mining, energy, and extensive infrastructure, which do not always produce direct spillover effects on job creation. In Indonesia, substantial investments in the extractive sector boost macroeconomic growth but do not directly improve the welfare of poor households. Second, domestic and foreign investment can contribute to poverty reduction if directed toward labor-intensive sectors. Investment in the agricultural sector in developing countries is one of the most effective tools for ending extreme poverty and increasing shared prosperity (Djokoto, Agyei Henaku, & Badu-Prah, 2022), mainly because the sector remains the primary employer of the poor. Thus, the impact of investment on poverty becomes small when the allocation is more to sectors with high productivity but low capital density. Third, the limited impact of investment on poverty can also be attributed to spatial inequality and the quality of institutions. Fourth, a negative but small relationship can also be associated with the time lag effect. Investment, especially in infrastructure and human capital, will only have a significant impact on poverty in the medium- to long-term.

The industrial sector has a significant negative impact on poverty, underscoring the importance of economic structural transformation. The coefficient values range from -0.01 to -0.04, indicating that a 1 percent increase in the industrial ratio reduces poverty by 0.01 percent, strengthening to 0.04 percent. The development of the industrial sector creates jobs, increases productivity, and expands income for the general public. Industrialization is a driver of economic growth, not only increasing output but also contributing to upward social mobility; this has been proven by Forero and Tena-Junguito (2024) and Mateko (2025). More importantly, Mateko (2025) shows that in the early stages of economic development in developing countries, industrialization is a more effective driver of poverty alleviation than the service sector. This highlights the importance of improving the manufacturing sector and processing natural resources downstream to rapidly reduce poverty in Indonesia.

The analysis developed into model 3, a combination of demographic and economic performance aspects. Interesting results were obtained when the two aspects were combined in a single equation. The population variable (pop) also showed a negative relationship with poverty levels, but this effect was not significant when the economic performance variable was added to the equation along with demographic factors. It is important to read these results carefully; when population growth is accompanied by increases in domestic demand and production capacity, this can have a scale effect that reduces poverty. However, based on development theory and demographic dynamics, this can be explained by a number of rational explanations. The negative relationship indicates that population growth, especially among the working-age population, can increase the labor supply and stimulate economic growth. The insignificance of the effect of population size after the independent variable of economic performance is included in the equation suggests that the relationship between population and poverty is primarily mediated by economic factors. This is to say that population growth does not necessarily lead to poverty reduction. Inclusive economic growth is

the only way that large numbers of people will become more than just statistics that will not really make a difference in poverty reduction.

The Educ variable is significant at the 10 percent level with a positive effect, in contrast to model 1, which has a negative effect. This implies that there is a stronger correlation between increases in highly educated people and poverty levels in Indonesia than is apparent. According to demographic analysis, the higher the level of education, the better the human resources, and therefore the greater the likelihood of reducing poverty rates. These findings are consistent with economic theory, which considers education as a means of increasing skill levels, productivity, and income. However, the situation is different when economic performance indicators are considered in the analysis, including economic growth, government spending, investment, and industry. The number of college graduates exceeds the rate of job creation, and the economy still has sectors depending on low-productivity informal employment (Abelha, Fernandes, Mesquita, Seabra, & Ferreira-Oliveira, 2020). This has led many graduates to end up in jobs unrelated to their qualifications; some have to work for lower wages than they anticipated, while others become completely unemployed. There are also differences in the quality of education across regions, leading to a mismatch between the skills acquired with a bachelor's degree and industry demands.

Statistical analysis findings confirm this point of view. The effect of education on poverty can be reversed after the inclusion of economic performance variables; an increase in highly educated people no longer guarantees a reduction in poverty, but rather the opposite (Panyi et al., 2025). This scenario highlights the importance of higher education, but its effectiveness depends on good economic growth, the creation of good employment opportunities, and equitable development across regions. Programs to alleviate poverty must combine improvements in education with economic policies that can effectively absorb and utilize the input of a highly educated workforce.

Economic growth has a positive effect, in contrast to model 2, with the negative effect. In this combined model, the growth coefficient becomes positive, reflecting the growth paradox: economic growth does not automatically reduce poverty when benefits are not evenly distributed. Growth that does not seep evenly to all levels of society but is enjoyed by only a particular group, and is generally a rich group, due to ineffective institutions, so that a reduction does not follow this economic growth in poverty (Kouadio & Gakpa, 2022). To overcome this, inclusive growth is needed, not only limited to poverty reduction and income equality, but also includes other dimensions of immorality and economic, political, and social discrimination (Albagoury, 2021). Thus, Indonesia's development strategy must ensure growth that is not only quantitative but also inclusive, by increasing the poor's participation in productive economic activities.

The investment is not significant, despite the direction of influence being the same in Model 2. Empirical analysis reveals that investment reduces poverty when viewed through the lens of economic performance, as an increase in capital per unit of labor leads to higher output and income. However, this effect is reduced when demographic variables are included in the analysis. The phenomenon of rapid population growth, high dependency ratios, and widespread urbanization has led to a dispersion of capital per worker, creating new areas of urban poverty and placing greater pressure on household resources. The gap between workers' skills and employers' needs, and the capital-intensive nature of investment, has resulted in structural unemployment. Meanwhile, the effects of investment in education, health, and fertility are quite long-lasting. Population dynamics, regional disparities, and delayed social impacts make it difficult to ensure that investments can significantly reduce poverty. Without inclusive social policies and equitable access, investments that lack such support are likely to fail to address poverty holistically (Adeleye et al., 2020).

To obtain a more comprehensive estimate, the analysis of Model 4 is continued by expanding the scope to include instrument variables: Investment in the previous year, industry-electricity synergy, and industry-education synergy. Based on the empirical findings from Model 4, poverty in Indonesia is highly persistent, as indicated by the large lagged poverty coefficient. This continuity implies that temporary policies cannot break the cycle of poverty, and that structural measures are needed in the long term to alleviate the effects of past poverty that cannot be overcome in the

short term. These findings are consistent with previous studies (Visser, Edzes, Merx, & van Lanen, 2022; Wu, Qi, Yang, Ye, & Sun, 2019), which highlight the importance of poverty traps and intergenerational accumulation processes.

The fact that there is a positive correlation between economic growth and poverty indicates the phenomenon of growth without poverty reduction (unemployment growth) or growth with increasing inequality. This situation is typical in developing countries that depend on capital-intensive industries and primary commodities, where GDP growth does not always translate into employment opportunities for low-income groups. This proves the core of Xu, Dong, and Shi (2023) that the quality of growth is far more significant than the growth rate alone. Pro-poor growth policies should focus on labor-intensive industries with broad connections, such as manufacturing and agro-industry.

This is because the main factor causing poverty is the labor market, as unemployment has a huge impact on poverty. The scale of this impact highlights the urgency of job creation policies, not only by developing labor-intensive industries but also by adapting job training programs. Education, which has a substantial negative effect on poverty, improves workforce skills and also increases absorption in the industrial sector. These results validate the Human Capital Theory (Becker, 1964), which states that the main factors in poverty alleviation are the accumulation of skills and education.

The estimates show that industrial activity and investment are the main drivers of poverty alleviation. The link between electricity and industry, as well as between industry and educational instruments, provides indirect evidence that the effectiveness of industrialization in poverty alleviation increases with their interaction. This means that structural transformation involves not only the development of the industrial sector, but also the promotion of energy infrastructure and educational policies aligned with labor-market requirements.

Poverty is also negatively affected by investment, but the coefficient per unit is small because of its scale. When translated into macroeconomic units (e.g., per trillion rupiah), the impact is significant, underscoring the need for policies that promote productive investment, especially in labor-intensive sectors and the local economy.

A positive and significant population coefficient implies that population growth, which is not matched by increased productivity, places additional pressure on poverty. This finding can be linked to the traditional Malthusian argument: an increase in the rate of population growth relative to the growth in productive capacity can lead to a decline in per capita income. However, contemporary demographic literature (Senderowicz & Valley, 2025) shows that this population effect is contextual; when the age structure is dominated by productive ages and a better human capital stock, population growth can lead to a demographic dividend. Conversely, when population growth is not matched by job creation and skills acquisition, population pressure exacerbates poverty. Estimates showing the positive impact of population on poverty indicate that Indonesia has yet to reap the benefits of the demographic dividend. Transforming demographic pressures into growth potential would require population policies such as controlling birth rates through family planning programs, improving access to reproductive health services, and enhancing vocational education.

Another important finding is the adverse effect of government spending on poverty, which means that higher government spending is effective in reducing poverty. However, the effect is relatively moderate, suggesting that other than the amount, the allocation and efficiency of spending are essential for poverty reduction. According to Wang et al. (2023), the significance of the impact of government spending on poverty also depends on the types of spending; for example, investments in basic infrastructure, education, and health typically have a greater effect on poverty reduction than bureaucratic spending or less-targeted subsidies. The quality of governance, levels of corruption, transparency, and institutional capacity also influence the effectiveness of spending. These findings indicate the need to redistribute government budgets to sectors with a greater multiplier effect on the welfare of the poor, including primary health care, primary and secondary education, and rural infrastructure in the Indonesian context. Furthermore, fiscal decentralization policies must be complemented by control systems and regional capacity to ensure that spending truly reaches vulnerable populations.

Overall, these results indicate that poverty alleviation in Indonesia requires complex solutions that combine human resources (including education and reducing unemployment) and structural elements (inclusive growth, inclusive government spending, productive investment, and inclusive industrialization).

5. CONCLUSION

This research aims to broaden the understanding of the poverty trap in Indonesia. The large and significant backward poverty coefficient indicates the presence of a poverty trap, in which past poverty is a major determinant of current poverty. The increase in poverty is more strongly influenced by the unemployment rate; meanwhile, population size, education level, economic growth, government spending, investment, and the industrial sector have various levels of influence as potential mechanisms for alleviating persistent poverty. More specifically, the industrial sector and job creation are the most effective ways to break the poverty trap. On the other hand, economic growth that is not accompanied by job creation and equity will not be able to become a pro-poor instrument.

This study not only provides a new perspective but also has limitations, including the use of provincial-level panel data, which does not fully capture the heterogeneity of poverty at the micro level, such as differences in household characteristics and urban-rural areas. Furthermore, the assumptions used still view the relationship between variables as linear and have not explored the possibility or threshold of nonlinearity. Given these limitations, further research could focus on using microdata to study poverty traps in greater depth and employing nonlinear models or thresholds to identify turning points in poverty eradication.

The findings of this study have policy implications for an integrated, structural approach to poverty alleviation in Indonesia. The recommendations that can be given are: (1) the creation of formal employment through inclusive industrialization and labor-intensive investment; (2) reform of education policy in line with the needs of the labor market and industry; (3) encouraging economic growth that is pro-poor and pro-employment; (4) optimization of transparent and results-based government spending on productive sectors.

Funding: This research was funded by Directorate General of Research and Development, Ministry of Higher Education, Science, and Technology of the Republic of Indonesia, with the contract number 2845/UN30.15/PT/2025.

Institutional Review Board Statement: Not applicable

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by the corresponding author.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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