

The Impact of Socioeconomic and Demographic Factors on P0, P1, and P2 Poverty in Central Sulawesi

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Abstract

This research investigates the factors influencing poverty incidence (P0), poverty depth (P1), and poverty severity (P2) in 13 regencies and municipalities of Central Sulawesi Province over the period 2017–2024. The empirical analysis was conducted using panel data regression techniques through three estimation models: a common effect model, a fixed effect model, and a random effect model. The study utilizes secondary data sourced from the official publications of the Central Sulawesi Provincial Statistics Office (BPS). The results of the study show that real Gross Regional Domestic Product (GRDP) significantly affects P0 but has no significant impact on P1 and P2. Education significantly influences P1 and P2, while its effect on P0 is insignificant. Health conditions significantly affect P0 and P1 but not P2. Labor force participation shows no significant relationship with any poverty indicator, while demographic factors significantly influence P0 but not P1 or P2. These findings suggest that poverty alleviation efforts must be carefully tailored by strengthening economic expansion, enhancing educational outcomes, improving public health conditions, and addressing demographic dynamics. Conversely, labor market policies should place greater emphasis on improving job quality rather than merely expanding labor force participation, thereby strengthening its contribution to poverty reduction.

Keywords: Central Sulawesi, Demographic Characteristics, Economic conditions, Poverty, Social factors

Abstrak

Penelitian ini menyelidiki faktor-faktor yang memengaruhi kejadian kemiskinan (P0), kedalaman kemiskinan (P1), dan tingkat keparahan kemiskinan (P2) di 13 kabupaten dan kota di Provinsi Sulawesi Tengah selama periode 2017–2024. Analisis empiris dilakukan menggunakan teknik regresi data panel melalui tiga model estimasi: model efek umum, model efek tetap, dan model efek acak. Studi ini menggunakan data sekunder yang bersumber dari publikasi resmi Badan Pusat Statistik (BPS) Provinsi Sulawesi Tengah. Hasil penelitian menunjukkan bahwa Produk Domestik Regional Bruto (PDRB) riil secara signifikan memengaruhi P0 tetapi tidak memiliki dampak signifikan pada P1 dan P2.

Pendidikan secara signifikan memengaruhi P1 dan P2, sedangkan pengaruhnya terhadap P0 tidak signifikan. Kondisi kesehatan secara signifikan memengaruhi P0 dan P1 tetapi tidak P2. Partisipasi angkatan kerja tidak menunjukkan hubungan yang signifikan dengan indikator kemiskinan apa pun, sedangkan faktor demografis secara signifikan memengaruhi P0 tetapi tidak P1 atau P2. Temuan ini menunjukkan bahwa upaya pengentasan kemiskinan harus disesuaikan dengan cermat dengan memperkuat ekspansi ekonomi, meningkatkan hasil pendidikan, memperbaiki kondisi kesehatan masyarakat, dan mengatasi dinamika demografis. Sebaliknya, kebijakan pasar tenaga kerja harus memberikan penekanan yang lebih besar pada peningkatan kualitas pekerjaan dibandingkan sekedar memperluas partisipasi angkatan kerja, sehingga memperkuat kontribusinya terhadap pengentasan kemiskinan.

Kata Kunci: Faktor Sosial, Karakteristik Demografis, Kemiskinan, Kondisi Ekonomi, Sulawesi Tengah

INTRODUCTION

Poverty persists as a global concern affecting nations at all stages of development. Despite the wide range of viewpoints and policy frameworks that have been implemented, effective and comprehensive solutions have yet to be achieved. As a deeply rooted and multidimensional problem, poverty remains one of the most persistent and challenging issues confronting countries around the world, Including Indonesia (Purnomo, 2021). Poverty refers to a state where individuals or families experience insufficient income and restricted ability to obtain the economic resources necessary to maintain an acceptable and dignified quality of life (United Nations, 2019). From an economic standpoint, the Statistics Indonesia (BPS) conceptualizes poverty in terms of a household's capacity to meet minimum basic requirements, encompassing both food and non-food necessities, as reflected in expenditure levels. Within this framework, the likelihood that disadvantaged households can break free from persistent poverty is largely determined by whether their income is adequate to finance these essential living costs.

In Indonesia, the government's commitment to poverty reduction is implemented through anti-poverty programs integrated into the national development planning system (Nazamuddin & Amri, 2020). However, their effectiveness remains constrained by structural challenges, as reflected in the persistently high poverty levels across several provinces (Adnan & Amri, 2021). According to Statistics Indonesia (BPS, 2025), poverty levels vary across Sulawesi, with Central Sulawesi ranking among the provinces with the highest poverty. Gorontalo recorded the highest P0 (14.57%), P1 (2.88), and P2 (0.78), while Central Sulawesi ranked second in P0 (11.77%) and P1 (2.21), and third in P2 (0.53), after Gorontalo and Southeast Sulawesi. By contrast, North Sulawesi and South Sulawesi recorded substantially lower values across all three poverty indicators. These findings confirm that poverty remains a major development challenge in Central Sulawesi.

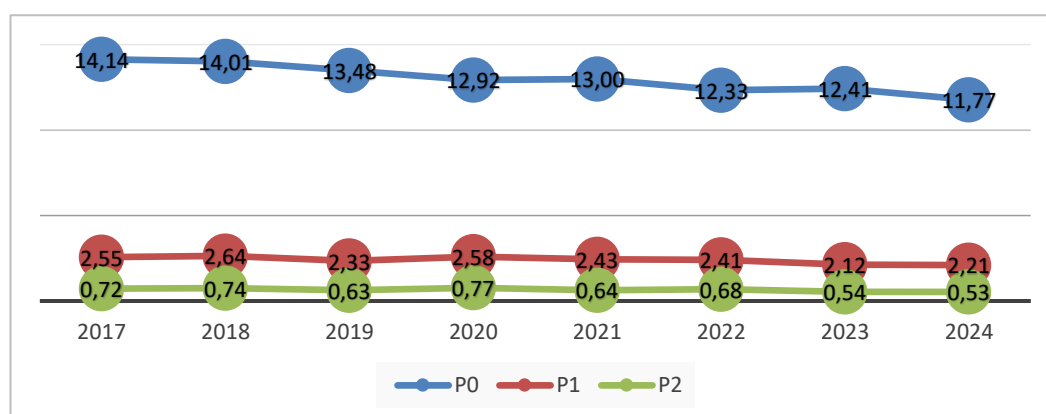


Figure 1. Poverty Levels in Central Sulawesi (P0, P1, and P2)

Source: BPS Central Sulawesi, 2025

Furthermore, Figure 1 illustrates that the headcount poverty ratio (P0), along with the poverty gap (P1) and poverty severity index (P2) in Central Sulawesi fluctuated during the 2017–2024 period. The general trajectory of poverty indicates a slow downward trend. By March 2024, Central Sulawesi continued to register a poverty headcount of 11.77 percent, accompanied by a poverty gap index of 2.21 and a poverty severity index of 0.53. All three indicators persistently exceeded national benchmarks, indicating that poverty remains a serious and unresolved concern for provincial authorities. This condition emphasizes the urgency of implementing more focused and impactful strategies, as well as long-term measures aimed at achieving sustainable poverty reduction and providing a strong empirical basis for investigating the determinants of poverty in the province.

Economic expansion is widely acknowledged as a crucial driver capable of mitigating poverty (Padambo et al., 2021). This perspective is further reinforced by evidence from Iman (2025); Ladjin et al. (2024), which demonstrate that economic expansion has played a substantial role in alleviating poverty in Central Sulawesi. Similarly, Marrero and Servén (2022), their analysis of 158 countries revealed a consistent and significant inverse relationship between economic growth and poverty, suggesting that growth can be regarded as most effective when it directly enhances the well-being of the population and subsequently lowers poverty levels (Fadila & Marwan, 2020). In other words, the poverty-reducing effects of economic expansion depend not only on the growth of economic output but also on how widely its benefits are shared, particularly among poorer segments of the population. As emphasized by Ravallion (1997) it is highlighted that economic expansion effectively reduces poverty only when its gains enhance the well-being of the poor at a faster rate than that of wealthier segments, meaning growth must be both inclusive and oriented toward disadvantaged populations.

Additionally, raising educational attainment is recognized as another key factor in mitigating poverty (Harilinan et al., 2024; Sembiring et al., 2023). Education represents a critical investment in human capital, as enhancing educational quality strengthens individual skills and productivity, which in turn leads to higher income levels and overall improvements in economic well-being (Todaro & Smith, 2006). Evidence in Indonesia, Septadarman and Rambe (2024), in their analysis of poverty across 34 provinces, found that educational attainment plays a significant role in shaping poverty levels. Consequently, focusing on the advancement of the education sector is vital, as improvements in educational quality can both elevate living standards and

contribute directly to poverty reduction (Bloom et al., 2006). The Education factor in this study uses the Expected Years of Schooling (EYS) indicator, which reflects the estimated number of years of formal education a child entering school is expected to complete based on current school participation patterns. As a forward-looking indicator, the EYS captures upcoming educational opportunities and human capital accumulation. Greater educational opportunities are expected to increase labor productivity and earning capacity, thereby contributing to poverty reduction.

Health is another critical factor that can substantially influence poverty reduction, as there is a well established link between population health and levels of poverty (Mushkin, 1962). Illness can perpetuate poverty throughout an individual's life, from one generation to the next, and across various environments, illustrating the multiple ways in which effective health systems can help mitigate poverty (O'Donnell, 2024). In settings with limited resources, investments in healthcare systems are typically motivated by the anticipation that enhancing health services will produce widespread advantages, such as lowering poverty rates (Jamison et al., 2013). Studies in developing and emerging economies have shown that improving health can help reduce poverty in both developing and emerging economies (Ifa & Al Maidah, 2023; Firdaus et al., 2021). Consequently, enhancing public health should be viewed as a strategic investment that not only strengthens human capital but also promotes economic growth and plays a crucial role in alleviating poverty.

A higher labor force participation rate enables a larger share of the working-age population to engage in productive economic activities, which enhances workforce utilization and economic productivity. As more individuals earn labor income, household welfare improves, ultimately contributing to poverty reduction (Saputro & Arif, 2024). Consistent with these findings, Darmawan and Ayuningsasi (2021), using data from 32 provinces in Indonesia, reported that higher labor force participation significantly reduces poverty. This effect is more likely to be realized when workers have access to higher-quality employment opportunities Fields et al. (2003), underscoring the importance of promoting decent work as a key labor market policy priority in developing countries (Cazes & Verick, 2013). A large proportion of the poor continue to be engaged in insecure or vulnerable forms of employment (Gammarano, 2018). Therefore, it is important to examine workforce participation in the study region more closely to determine whether engagement in the labor market effectively contributes to poverty reduction, or if the relationship operates in the opposite direction.

Beyond the previously discussed factors, demographic characteristics particularly population size can also affect poverty levels. While population growth can serve as both a catalyst and an obstacle for development, in many developing countries, persistent increases in population often present significant challenges to achieving economic and social progress (Azam et al., 2020). As Malthus (1798) argued that population often grows at a geometric rate, whereas food production typically expands more slowly, following an arithmetic progression, which can create constraints on available resources and hinder economic development. Malthus also highlighted the critical need to manage population growth, warning that uncontrolled increases could result in food scarcity and, consequently, heightened poverty and hardship. These ideas are further corroborated by the findings of Sholikhati (2020), found that in Central Java Province the area with the highest poverty levels on Java Island between 2011 and 2016 population growth exerted a significant and positive influence on poverty. This indicates that the adverse effects of population

increases can be alleviated when adequate economic resources are available, helping to prevent households from descending into poverty.

Although research on the determinants of poverty has advanced considerably, several important gaps remain. First, most previous studies have focused exclusively on P0 as the primary measure of poverty (Iffa and Al Maidah (2023); Ladjin et al. (2024); Septadarman and Rambe (2024), overlooking P1 and P2, potentially leading to incomplete policy conclusions. Second, studies examining P0, P1, and P2 in Indonesia have mainly relied on provincial-level data (Choiriyah et al. (2020)), which may conceal substantial socioeconomic and demographic disparities across regencies and municipalities. Third, empirical evidence estimating separate regression models for P0, P1, and P2 to assess whether economic, social, and demographic determinants affect each poverty dimension differently remains limited. To address these gaps, this study employs the Foster–Greer–Thorbecke (FGT) indices (Foster et al. (1984)), comprising P0, P1, and P2. Central Sulawesi was selected because, despite recording one of Indonesia's highest economic growth rates 9.89% in 2024, poverty remains a persistent development challenge. Moreover, to the best of the author's knowledge, no previous study has simultaneously examined the effects of economic, social, and demographic factors on P0, P1, and P2 at the regency and city levels in Central Sulawesi. By estimating separate regression models for each poverty dimension, this study provides a more comprehensive assessment of poverty, identifies heterogeneous determinants across P0, P1, and P2, and offers stronger empirical evidence to support more effective and better-targeted poverty alleviation policies.

METHODOLOGY

This research investigates the dynamics of poverty across 13 districts and cities within Central Sulawesi Province. The area was selected due to its poverty rate consistently surpassing the national average, making it a representative example of regions in Indonesia with relatively high poverty levels. The districts and cities included in the analysis are Banggai Kepulauan. The study covers Banggai, Banggai Laut, Poso, Donggala, Tolitoli, Buol, Parigi Moutong, Tojo Una-Una, Sigi, Morowali, North Morowali, and Palu City. This study uses three dependent variables: the Poverty Ratio, poverty depth, and poverty severity, which represent the three Foster–Greer–Thorbecke poverty indices. The independent variables comprise real Gross Regional Domestic Product (GRDP) measured at constant 2010 prices, education (expected years of schooling), health (life expectancy), labor force participation (labor force participation rate), and demographics (total population). The analysis uses data from the period 2017–2024, sourced from the official publications of the Statistics Indonesia (BPS). The study period was chosen to ensure data availability and consistency, particularly because complete information for 2016 was missing for a key variable: the Labor Force Participation Rate (LFPR).

This research utilizes a quantitative methodology to examine how real GRDP, education, health, demographic factors, and employment influence poverty. According to Sekaran and Bougie (2016), quantitative research focuses on the analysis of numerical data, employing mathematical or statistical methods to examine patterns and relationships. This approach was selected because it enables objective, measurable testing of causal links between variables through econometric techniques. In panel data analysis, fixed-effects and random-effects models tend to generate reliable estimates when the number of cross-sectional units (N) exceeds the number of time

periods (T). However, if the time periods (T) outnumber the cross-sectional units (N), the resulting estimates may be biased and less efficient, This issue can compromise the validity of the analysis results (Baltagi, 2015). In the present study, the natural logarithm transformation was applied to real GRDP at Constant 2010 Prices ($\ln GRDP$) and Total Population ($\ln TP$) to stabilize variance and improve the normality of the data distribution (Wooldridge, 2010). The data analysis was performed using EViews 13, and the panel data model equation applied in this research is presented below.

$$P0_{it} = \alpha + \beta_1 \ln(GRDP_{it}) + \beta_2 EYS_{it} + \beta_3 LE_{it} + \beta_4 LFPR_{it} + \beta_5 \ln(TP)_{it} + \varepsilon_{it} \quad (1)$$

$$P1_{it} = \alpha + \beta_1 \ln(GRDP_{it}) + \beta_2 EYS_{it} + \beta_3 LE_{it} + \beta_4 LFPR_{it} + \beta_5 \ln(TP)_{it} + \varepsilon_{it} \quad (2)$$

$$P2_{it} = \alpha + \beta_1 \ln(GRDP_{it}) + \beta_2 EYS_{it} + \beta_3 LE_{it} + \beta_4 LFPR_{it} + \beta_5 \ln(TP)_{it} + \varepsilon_{it} \quad (3)$$

Notes:

$P0$ = Poverty Headcount Ratio (in percentage)

$P1$ = Poverty Gap (in index)

$P2$ = Poverty Severity (in index)

$\ln GRDP$ = Real Gross Regional Domestic Product (in billion rupiah)

EYS = Expected Years of Schooling (in year)

LE = Life Expectancy (in year)

$LFPR$ = Labor Force Participation Rate (in percentage)

$\ln TP$ = Total Population (in thousand people)

α = Constant

ε = Standard error

i = 13 districts and cities

t = Period 2017-2024

Three common approaches are typically used to estimate regression models: the common effect model (CEM), the fixed effect model (FEM), and the random effect model (REM). The CEM assumes that there are no differences in characteristics either across units or over time and is estimated using the Ordinary Least Squares (OLS) method. The FEM accounts for differences between units by permitting variation in the intercepts, commonly implemented through the Least Squares Dummy Variable (LSDV) method. Conversely, the REM considers these differences as random elements within the error term and estimates the model using Generalized Least Squares (GLS). Choosing the most suitable model requires a set of diagnostic tests to identify the optimal specification for the dataset. In panel data analysis, the Chow test is used to detect differences across cross-sectional units, providing guidance on whether the CEM or the FEM is more appropriate (Chow, 1960). The Lagrange Multiplier (LM) test is applied to evaluate the importance of random effects, helping to determine whether CEM or the REM is more suitable (Breusch & Pagan, 1980). The Hausman test, on the other hand, assesses the consistency of estimators by comparing the FEM and the REM, specifically testing whether the individual effects are correlated with the independent variables (Hausman, 1978).

Classical assumption tests are performed to identify potential problems within the regression model. The normality assumption specifically requires that the residuals follow a normal distribution, which is critical for the validity of statistical inferences made using t-tests and F-tests.

Multicollinearity arises when two or more independent variables exhibit a strong linear relationship, this can lead to unstable regression coefficients and inflate the variance of the estimators. Heteroscedasticity arises when the error term's variance is not consistent across observations, which may render the estimators inefficient and result in biased standard errors, Conversely, autocorrelation occurs when the error terms in one period are correlated with those in another period. This issue is common in time series data and can result in misleading conclusions in hypothesis testing because the standard errors may be inaccurate (Gujarati, 2009).

DISCUSSION AND FINDINGS

As shown in Table 1, the panel data model selection tests-including the Chow, Hausman, and LM tests-revealed different optimal models for each poverty indicator. For the poverty headcount (P0), the Chow test yielded a significant F-statistic at the 1% level, indicating that the Fixed Effect Model (FEM) is more suitable than the Common Effect Model (CEM). Furthermore, the Hausman test for P0 was also significant, reinforcing that the Fixed Effect Model (FEM) is the most appropriate choice for analyzing this indicator. For P1 and P2, the significance of both the Chow and LM tests suggested that a panel data model is preferable to the Common Effect Model (CEM). Meanwhile, the Hausman test results for P1 and P2 were not significant, indicating that the Random Effect Model (REM) provides more efficient and consistent estimates than the Fixed Effect Model (FEM). Consequently, REM was chosen as the most appropriate model for analyzing P1 and P2.

Table 1.
Model Selection Test

Dependent Variable	Chow Test (F-statistic)	Hausman Test (chi-square)	LM Test (chi-square)	Best Model
P0	111.759223***	13.904450**	276.6079***	FEM
P1	9.228724***	6.281859	70.35959***	REM
P2	4.168773***	7.404299	14.88503***	REM

Notes: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.
Source: Eviews 13 Output

A normality test was performed following the (Jarque & Bera, 1980) method. As presented in Table 2, the probability value is greater than 0.05, which means the null hypothesis cannot be rejected. This indicates that the model's residuals are normally distributed. Meeting this assumption ensures the validity of the coefficient estimates and the reliability of the associated statistical tests, these results confirm that the overall poverty indicator model is appropriate for making empirical inferences.

Table 2.
Normality Test

Dependent Variable	Jarque Bera	Probability
P0	1.870759	0.392437
P1	2.912382	0.233123
P2	0.380249	0.826856

Source: Eviews 13 Output

Multicollinearity was evaluated using the correlation matrix among the variables, shown in Table 3. Since all correlation coefficients are below 0.8, there is no indication of problematic collinearity (Gujarati & Porter, 2009). Furthermore, as shown in Table 4, all Variance Inflation Factor (VIF)

values fall well below the standard critical value of 10 Chatterjee and Hadi (2015) and do not surpass the more conservative threshold of 5 (Hair Jr et al., 1998). This confirms that multicollinearity is not an issue in the regression models.

Table 3.
Correlation Matrix Test

Variable	InGRDP	EYS	LE	LFPR	InTP
InGRDP	1.000000				
EYS	0.293885	1.000000			
LE	0.480516	0.537035	1.000000		
LFPR	-0.210525	-0.152060	0.078912	1.000000	
InTP	0.541778	0.321008	0.246965	0.165819	1.000000

Source: Eviews 13 Output

Table 4.
Multicollinearity Test

Variable	InGRDP	EYS	LE	LFPR	InTP
VIF	2.207808	1.691344	1.970600	1.415549	1.841049

Source: Eviews 13 Output

Heteroscedasticity was evaluated using the method developed by (Glejser, 1969). As presented in Table 5, the probability values for all independent variables are greater than 5%, indicating that the model's residuals exhibit homoscedasticity.

Table 5.
Heteroscedasticity Test

Variabel	P0	P1	P2
C	0.0847	0.2861	0.7293
InGRDP	0.8687	0.7199	0.6524
EYS	0.2977	0.8224	0.4926
LE	0.9132	0.3307	0.5176
LFPR	0.7339	0.1234	0.0589
InTP	0.8270	0.7155	0.8622

Source: Eviews 13 Output

Table 6 presents a summary of the outcomes from the three estimation models. In the FEM model for P0, the variables LNGRDP, LE, and LNTP are statistically significant at the 1% level. For the P1 model, the REM results indicate that EYS has a significant impact at the 1% level, while LE is significant at the 10% level. Finally, in the P2 model, only the EYS variable demonstrated a statistically significant effect at the 1% level. According to the R-squared values, the P0 model explains 97.59% of the variation in the dependent variable through the included independent variables, leaving 2.41% of the variation attributable to factors not captured by the model. For the P1 model, the R-squared value is 27.32%, indicating that the independent variables included in the model account for this proportion of the variation in the dependent variable, while the remaining 72.68% is determined by factors outside the model. Similarly, the P2 model has an R-squared value of 19.85%, with the remaining 80.15% of the variation attributed to variables not captured in the model. Moreover, all of the estimated regression models were jointly significant at the 1% level. Meanwhile, the Durbin-Watson statistic ranges between 1 and 3, indicating that the residuals do not exhibit significant serial autocorrelation. As a result, the assumption of residual independence is considered to be met (Nerlove & Wallis, 1966); (Savin & White, 1977). This suggests that the estimated models are appropriate for examining the relationships among the

variables within the panel data framework employed in this study.

Table 6.
Best Model Result

Variable	P0 (FEM)	P1 (REM)	P2 (REM)
Constant	69.13782***	15.84627***	4.395509***
lnGRDP	-2.189643***	-0.252359	-0.050731
EYS	0.930842	-0.413535***	-0.139240***
LE	-1.053970***	-0.102451*	-0.024952
LFPR	0.024261	-0.008768	-0.007291
lnTP	4.072855***	0.301189	0.122588
R-squared	0.975903	0.273268	0.198567
Adjusted R-squared	0.971140	0.236190	0.157678
F-statistic	204.8788	7.370065	4.856206
Prob(F-statistic)	0.000000	0.000007	0.000520
Durbin Watson Stat	1.275672	1.895500	1.831410

Notes: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Eviews 13 Output

Real GRDP has a statistically significant negative effect on P0, while its effects on P1 and P2 are not statistically significant. This finding indicates that higher levels of regional economic activity are associated with a lower proportion of the population living below the poverty line, although they do not significantly affect the depth and severity of poverty. The negative relationship suggests that increased economic activity may contribute to poverty reduction through greater employment opportunities (Iman, 2025). This result is consistent with Ladjin et al. (2024), who found that economic expansion reduces poverty in Central Sulawesi, and with Marrero and Servén (2022), who reported a significant negative association between economic activity and poverty across 158 countries. These findings suggest that higher levels of real GRDP constitute an important factor associated with reductions in poverty incidence, although such an association does not extend significantly to the depth and severity dimensions of poverty.

Nevertheless, the effects of real GRDP on P1 and P2 are not statistically significant. This finding suggests that the benefits of increased regional economic activity are not distributed evenly across different dimensions of poverty. As emphasized by Ravallion (1997), economic growth can effectively reduce poverty only when its benefits improve the welfare of poor households at a faster rate than that of better-off groups. In other words, the gains from economic activity must be inclusive and oriented toward disadvantaged populations. In developing countries characterized by high levels of inequality and relatively low economic growth, improving income distribution may represent a more effective strategy for reducing poverty than relying on economic growth alone (Yerrabati, 2022). The insignificant relationship between real GRDP and both P1 and P2 is consistent with the findings of Aminda et al. (2024), who likewise reported that economic growth does not make a significant contribution to poverty reduction. Therefore, to maximize the poverty-reducing impact of economic growth across the districts and municipalities of Central Sulawesi Province, economic growth should be more inclusive, ensuring that its benefits are distributed equitably among poor households.

The insignificant effect of education on P0 indicates that the contribution of educational attainment to poverty reduction has not yet been fully realized. This finding can be explained by the fact that P0 captures only the incidence of poverty by classifying households as either poor or non-poor

relative to the poverty line. Consequently, when educational attainment improves household income but the resulting income gains remain insufficient to lift households above the poverty line, P0 remains unchanged. In contrast, such income improvements may still reduce P1 and P2. This finding contradicts the theoretical view that education is a key investment in human capital. By improving educational quality, education is expected to strengthen individuals' skills and productivity, which in turn enhances income-generating capacity and contributes to higher levels of economic welfare (Todaro & Smith, 2006). Conversely, this finding is in line with the evidence reported by Fayza et al. (2025); Arka (2022), who likewise found that education has not yet contributed significantly to improvements in household welfare.

Conversely, the benefits of educational attainment are more evident in reducing P1 and P2. These findings imply that improvements in productivity and skills can help increase the income of poor households, thereby narrowing their income gap relative to the poverty line. Likewise, education contributes to enhancing the quality of human capital among the most disadvantaged groups, enabling the poorest households to generate additional income and reducing disparities within the poor population. Consequently, prioritizing the advancement of the education sector is strategically important for improving social welfare and alleviating poverty by strengthening human capital (Bloom et al., 2006). This finding is consistent with the studies of Septadarmam and Rambe (2024); Shi and Qamruzzaman (2022), which reported an inverse relationship between education and poverty. Nevertheless, the results suggest that educational improvements in Central Sulawesi have not yet been sufficient to reduce poverty in its entirety. Therefore, a more integrated and inclusive policy approach is needed to ensure that the benefits of higher educational attainment are shared across all segments of poor households and contribute to sustainable poverty alleviation.

The estimation results indicate that health, measured by life expectancy, has a statistically significant negative effect on P0 and P1. This inverse relationship suggests that improvements in health not only reduce the proportion of households living below the poverty line but also improve the welfare of households that remain poor by narrowing their expenditure gap relative to the poverty line. This observation is consistent with Mushkin (1962), who emphasized the close relationship between health and poverty. Furthermore, Bloom and Canning (2008) argued that investments in health enhance labour productivity, income, and household consumption, thereby improving overall household welfare. Healthier individuals possess greater productive capacity and are better able to utilize available economic opportunities, ultimately reducing their risk of falling into poverty (Darma et al., 2026). This finding is further supported by Ifa and Al Maidah (2023); Firdaus et al. (2021), who likewise highlighted the significant role of health in reducing poverty.

In contrast, the effect of health on P2 is statistically insignificant, indicating that improvements in health alone are insufficient to reduce poverty severity among the poorest households. This finding suggests that households experiencing the most severe forms of poverty continue to face substantial barriers in accessing and benefiting from healthcare services. The government's limited ability to finance healthcare services is attributable to the need to prioritize budget allocations across various public service sectors (Puji Hastuti & Lestari, 2020). Consequently, persistent disparities in access to healthcare services limit the ability of the poorest households

to fully benefit from improvements in health, thereby reducing its effectiveness in lowering P2 (Gounder & Xing, 2012). This interpretation is consistent with the findings of Ringga (2024), who likewise reported that poverty severity in Aceh could not be significantly reduced through improvements in education. Therefore, without more equitable access to and effective utilization of healthcare services among the poorest households, improvements in average health conditions are unlikely to produce a significant reduction in P2.

The estimation results indicate that the Labor Force Participation Rate has no statistically significant effect on P0, P1, or P2. Although higher labor force participation is generally expected to improve household welfare, its poverty-reducing effect largely depends on the quality of employment available (Kusumawardhani et al., 2023). These findings suggest that a higher labor force participation rate does not automatically translate into improved living standards. This highlights that, in Central Sulawesi, the increase in the labor force participation rate is largely associated with a greater proportion of the population working in the low-productivity informal sector rather than the formal sector. According to Statistics Indonesia (BPS), informal employment accounted for 66.10% of total employment in Central Sulawesi in 2025, whereas formal employment represented only 33.90% in 2025, indicating the continued dominance of relatively low-productivity jobs. Although informal employment may contribute to poverty reduction to some extent, its impact remains considerably more limited than that of formal employment (Torres, 2020). This is because informal-sector workers are predominantly engaged in low-skilled, low-productivity activities and generally receive lower wages while lacking adequate job security, resulting in unstable and uncertain incomes (Sheikh et al., 2020).

Therefore, higher labor force participation is likely to contribute to poverty reduction only when accompanied by greater labor productivity. As emphasized by Rammohan and Tohari (2023); Erumban and de Vries (2024), the combination of increased labor force participation and higher labor productivity is essential for achieving meaningful poverty reduction. Accordingly, policy efforts should prioritize the creation of more productive and higher-quality employment opportunities capable of increasing the incomes of poor households while encouraging greater labor force participation. These findings are consistent with those of Nurhaila (2024); Widyawati et al. (2025), who likewise reported that LFPR alone does not have a significant effect on poverty reduction. Conversely, this finding is inconsistent with the results reported by Darmawan and Ayuningsasi (2021), who found that the labor force participation rate significantly influences poverty.

The estimation results indicate that total population has a significant positive effect on P0, whereas its effects on P1 and P2 are positive but statistically insignificant. The insignificant effects on P1 and P2 imply that although population growth may increase the incidence of poverty, it does not necessarily widen the average expenditure gap between poor households and the poverty line or exacerbate poverty severity. Instead, the depth and severity of poverty are more likely to be determined by household income, human capital, productive assets, and access to economic opportunities than by population growth itself. In contrast, the significant positive relationship between population and P0 indicates that population growth increases the proportion of households living below the poverty line. This finding is consistent with the studies of Sholikhati (2020), which likewise reported a strong positive association between population growth and

poverty. However, these negative impacts can be reduced if population growth is accompanied by skills development and job creation, thus enabling the population to become a productive workforce that supports regional economic growth which ultimately has the potential to lift people out of poverty (Hidayat & Hidayah, 2023). Furthermore, Malthus (1798) argued that uncontrolled population growth may exceed food production capacity, leading to food shortages and, ultimately, higher levels of poverty. This argument is reflected in the case of Central Sulawesi, where statistics published by the Central Sulawesi Statistics Agency (BPS) in 2024 show that the population generally increased between 2019 and 2024, while overall food production declined during the same period.

Furthermore, in low-income regions characterized by high child mortality and limited social protection, households often choose to have more children rather than invest in improving the quality of each child (Becker & Lewis, 1973). This demographic behavior may give rise to a Malthusian trap, whereby persistently high fertility contributes to the continuation of poverty (T. R. Malthus, 2024). In this context, access to family planning services enables households to make informed decisions regarding the number and spacing of their children. Family planning programs help households meet their various living needs by enabling them to regulate the number of children (Loka & Purwanti, 2022). Lower fertility reduces the economic burden on households, thereby decreasing both the likelihood and the severity of poverty (Herrera-Almanza & Rosales-Rueda, 2020). Under such conditions, population growth need not constitute a threat; instead, when accompanied by appropriate population and human capital policies, it can become a potential driver of broader social welfare and sustainable economic development.

CONCLUSION

The findings of this study reveal that the factors influencing poverty across the districts and cities of Central Sulawesi Province from 2017 to 2024 vary depending on the poverty measure used. Both real GRDP and health exert a significant negative effect on the poverty headcount (P0), this suggests that higher economic activity and better health outcomes effectively lower the share of the population living in poverty. In contrast, education does not have a significant impact on P0 but shows a significant negative effect on P1 and P2, indicating that education contributes more to reducing the intensity and severity of poverty than to decreasing the overall number of poor individuals. Labor force participation does not significantly influence any of the poverty measures, implying that mere engagement in work without enhancements in productivity or job quality is inadequate for alleviating poverty. On the other hand, population size has a significant positive effect on P0, highlighting that demographic pressure continues to be a structural factor that elevates the risk of poverty in the region.

These results indicate that poverty reduction policies should be tailored to the specific dimensions of poverty rather than relying on a uniform policy approach. To lower P0, policies should prioritize promoting inclusive, labor-intensive economic growth, with particular emphasis on enhancing productive sectors capable of employing individuals from poor households. In contrast, reducing P1 and P2 requires policies that emphasize strengthening human capital, particularly through improvements in education, as this factor has been shown to enhance the welfare of households living well below the poverty line. Likewise, improvements in health represent a key policy priority for reducing both P0 and P1. Additionally, the lack of a significant impact from the Labor Force

Participation Rate highlights that the critical need to prioritize the quality of employment over simply expanding labor participation. Policy measures should aim to boost productivity, develop workforce skills, and support the shift from informal to formal sector jobs. Moreover, the influence of demographic pressures on P0 poverty underscores the importance of integrated population strategies, including family planning initiatives and the enhancement of regional economic capacity.

This study has several key limitations. First, while the Labor Force Participation Rate serves as a proxy for the engagement of the working-age population in economic activities, it does not reflect variations in job quality, such as distinctions between formal and informal employment. Additionally, the measure does not explicitly differentiate between urban and rural settings. Consequently, additional research is required to gain a deeper and more comprehensive understanding, particularly regarding labor market dynamics and the geographic distribution of poverty. Such studies would enable more accurate estimations of the relationships between variables, providing a stronger foundation for designing effective poverty reduction policies.

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