

Panel Data Analysis: Population Size and Development Inequality in Relation to Poverty in East Kalimantan Province

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Abstract

Poverty remains a critical socioeconomic challenge in East Kalimantan Province despite its abundant natural resources. This study aimed to analyze the effects of population size and regional development inequality on poverty levels across 10 districts/cities in East Kalimantan during the 2022–2025 period. A quantitative approach using panel data regression analysis was employed, utilizing secondary data obtained from the Central Statistics Agency (BPS). The sample consisted of 40 observations selected through saturated sampling. The analysis was conducted using EViews 13 software, with the Common Effect Model (CEM) selected as the most appropriate model based on the Chow, Hausman, and Lagrange Multiplier tests. The results indicated that both population size and development inequality had positive and significant effects on poverty levels, both partially and simultaneously. The regression coefficient for population size (0.004198, $p = 0.0006$) indicated that a 1% increase in population size was associated with a 0.41% increase in poverty levels, while the development inequality coefficient (43.37810, $p = 0.0003$) demonstrated a stronger influence on poverty. The adjusted R^2 value of 50.1% indicated that the two variables explained approximately half of the variation in poverty levels. These findings support Malthusian theory and Kuznets' hypothesis while aligning with recent studies on the development paradox in East Kalimantan. Poverty alleviation strategies should prioritize equitable development policies and improvements in human resource quality, particularly in disadvantaged areas, to achieve sustainable poverty reduction in East Kalimantan.

INTRODUCTION

National development is achieved when a country is able to improve the welfare of its people in a fair, equitable, and sustainable manner. Community welfare is reflected through high economic growth, income equality, low unemployment and poverty rates, and high-quality human resources. Welfare is one of the primary objectives pursued by countries worldwide. Both communities and governments continuously strive to improve living standards, while governments establish policies and regulations to support national development. Economic development implemented by a country or region primarily aims to improve people's welfare (Wahidin et al., 2022). Successful economic development can reduce unemployment and poverty while improving overall welfare (Egharevba et al., 2016; Harsono et al., 2023; Purwanti, 2024). However, development processes do not always occur evenly across regions, resulting in development inequality that may contribute to persistent poverty (Rahmadi, 2019). Poverty remains a fundamental challenge in national development, as it limits the ability of individuals or households to improve their quality of life.

Poverty is one of the major obstacles to achieving community welfare. It is a deeply rooted problem that developing countries continue to face (Taiwo, 2016). Addressing poverty requires appropriate and sustainable strategies because it is a complex issue influenced by various interconnected factors. These factors include economic growth, labor productivity, wage levels, employment types, working hours, employment opportunities, inflation, household size, healthcare facilities, household consumption, access to clean water, transportation, agricultural land ownership, and education (Kurniawan, 2017).

Poverty remains a major issue faced by various regions in Indonesia, including East Kalimantan Province. Although the province possesses abundant natural resources and relatively high economic growth, these advantages do not necessarily guarantee low poverty levels. East Kalimantan Province contributes significantly to the national economy through the mining, oil and gas, and plantation sectors. Furthermore, the plan to establish the Capital City of the Archipelago (Ibu Kota Nusantara/IKN) in this region provides new opportunities for accelerating regional economic development. However, existing economic growth has not fully translated into poverty reduction. Several districts/cities still experience relatively high poverty rates compared with other regions (Harahap et al., 2025; Purmini & Rambe, 2021). This condition indicates that the benefits of development have not yet been distributed evenly across the population (Loda & Yasa, 2024).

The novelty of this research lies in the application of panel data analysis involving 10 districts/cities in East Kalimantan Province during the four-year period from 2022 to 2025, using the Williamson Index to measure regional inequality more accurately. This study integrates Malthusian theory with Kuznets' concept of development inequality and empirically examines the simultaneous effects of population size and development inequality on poverty levels. This approach differs from previous studies that generally examined these factors separately or applied different analytical methods. The use of panel data enables the analysis to capture variations across regions and over time, providing a more comprehensive understanding of poverty determinants in East Kalimantan.

In recent years, the poverty rate in East Kalimantan Province has ranked third among provinces in the Kalimantan region. East Kalimantan consists of 10 regencies/cities. One factor contributing to population migration from rural to urban areas is the availability of broader employment opportunities and better infrastructure facilities. However, this urbanization trend may also create challenges for regional development, including increasing poverty rates in certain areas of East Kalimantan Province. Malthus' theory explains that population growth exceeding production growth can place pressure on economic resources and consequently increase poverty (Malthus, 1798). High population growth without corresponding improvements in economic productivity may contribute to rising poverty levels. The development of poverty rates in East Kalimantan Province is presented in the following table.

Table 1. Poverty rate in Regencies/Cities of East Kalimantan Province (Percentage)

Regency/City	Year			
	2022	2023	2024	2025
Paser Regency	9.43	9.11	8.63	8.13
West Kutai Regency	10.2	9.72	9.56	8.72
Kutai Kartanegara Regency	7.96	7.61	7.28	6.72
East Kutai Regency	9.28	9.06	8.81	8.07
Berau Regency	5.65	5.54	5.08	4.44
North Penajam Paser Regency	7.25	6.97	6.69	5.78
when. Lady Owl	11.55	11.38	10.75	10.09
Balikpapan City	2.45	2.31	2.23	1.97
Samarinda City	4.85	4.81	4.3	3.45
Bontang City	4.54	4.11	3.74	3.21

Source: Central Bureau of Statistics, 2025

One of the factors affecting poverty rates is population size. Increasing population concentration in urban areas can create dynamic development pressures because cities must accommodate the needs of growing populations. The rising population density in urban areas may also intensify competition among communities due to limited access to resources that could otherwise support income generation. This condition makes poverty reduction a critical concern for regional development. High population growth is also closely associated with urbanization. Although urbanization may initially increase poverty due to rapid migration and inadequate urban infrastructure, in the long term, it has the potential to reduce poverty if managed effectively through planned and inclusive development policies (Bashir, 2023).

Poverty

Poverty refers to a condition in which individuals or groups experience limitations in fulfilling basic needs, such as food, clothing, housing, healthcare, education, and access to other resources that support welfare. Poverty represents the inability of individuals or groups to achieve the minimum standard of living applicable within a society or region (Todaro & Smith, 2020). From an economic perspective, poverty reflects limited resource ownership and inadequate capacity to fulfill basic needs (Murjana, 2008, as cited in Dewanto, 2021). Kuncoro (2006) identified three main factors contributing to poverty: (a) poverty resulting from unequal patterns of resource ownership, which lead to income inequality; (b) poverty arising from differences in human resource quality; and (c) poverty caused by differences in access to resources and capital.

Total Population

Developing countries have generally experienced significant population growth rates. This rapid growth creates various development challenges because population increases are not always accompanied by proportional employment opportunities. The labor force continues to expand, while the capacity of developing countries to provide sufficient employment opportunities remains limited. This imbalance may contribute to demographic pressures, rising unemployment, excessive urbanization, and other socioeconomic challenges (Wahed et al., 2021). Malthus' population trap theory argues that because societies have limited land resources, marginal contributions to food production will eventually decline as population pressure increases (Malthus, 1798). This theory is consistent with the findings of Salsabil (2023), which demonstrate that population growth has a positive effect on poverty,

meaning that increases in population size tend to raise poverty levels in a region. Population growth increases the demand for basic needs faster than the availability of resources, creating additional pressure on economic capacity.

Regional Inequality

Uneven development among regions is a common phenomenon in the economic development process of a country (Kutscherauer et al., 2010). Differences in geographical characteristics and regional potential result in variations in each region's capacity to promote development. In the early stages of development, regional inequality tends to increase; however, as development progresses continuously, inequality levels may decline (Sjafrizal, 2008, as cited in Fahma & Hendarto, 2022). Factors influencing regional inequality include differences in natural resource potential, demographic structures, limited mobility of goods and services, and disparities in development budget allocation among regions (Nisa et al., 2025). Regional inequality is commonly measured using statistical indicators that describe disparities among regions. The Gini coefficient is generally used to measure income distribution inequality, whereas the Williamson Index is used to measure regional development inequality based on differences in regional income levels. A higher Williamson Index value indicates a greater level of regional inequality (Azzahra, 2026).

METHOD

This study employed a quantitative methodology with a causal associative research design to examine the effects of population size and regional inequality on poverty in East Kalimantan Province. The study used secondary data obtained from the Central Statistics Agency (BPS) in the form of panel data covering the period from 2022 to 2025. The units of analysis consisted of 10 regencies/cities in East Kalimantan Province, resulting in a total of 40 observations.

The dependent variable in this study was poverty, measured by the percentage of the poor population. The independent variables were population size and regional inequality, with regional inequality measured using the Williamson Index. The data were analyzed using panel data regression analysis. The selection of the appropriate panel data regression model was conducted through the Chow test, Hausman test, and Lagrange Multiplier (LM) test. Classical assumption tests were also performed to evaluate the reliability of the regression model. Data processing was conducted using EViews 13 software. The panel data regression model equation was formulated as follows:

$$Kit = \beta_0 + \beta_1 JP_{it} + \beta_2 KW_{it} + \varepsilon_{it}$$

Description:

K = Poverty

JP = Total Population

KW = Regional Inequality

E = error term

B0 = *Konstanta*

B1-2 = *Partial coefficient of the JP variable, KW*

i = 1,2,3,4... (data cross section of districts/cities in East Kalimantan Province)

t = 1,2,3,4 (data time series 2022-2025)

RESULTS AND DISCUSSION

Table 2. Chow Test Results

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.851780	(9, 38)	0.0903
Cross-section Chi-square	18.182809	9	0.0331

Chow's test findings indicate a cross-section probability value of F of 0.0903, which is above the significance threshold of 0.05. Thus, the most feasible model to use for regression estimation is the Common Effect Model (CEM).

Table 3. Hausman Test Results

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.730277	2	0.0939

The results of this test showed that the probability of random cross-section was 0.0939, which was above the significance threshold of 5%. Thus, according to Hausman Test, the most suitable approach is the Random Effect Model (REM). Because the two tests produce different conclusions about the best estimation model, additional test stages are required. In this case, the Lagrange Multiplier Test (LM Test) needs to be carried out to determine more convincingly which model is most appropriate to use in the analysis of this panel data, as well as to obtain optimal and accurate estimation results.

Table 4. Lagrange Multiplier Test Results

Lagrange Multiplier Tests for Random Effects
Null hypothesis: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

Metode Uji	Cross-section	Time	Both
Breusch-Pagan	1.665907 (0.1968)	26.79007 (0.0000)	28.45598 (0.0000)
Honda	1.290700 (0.0984)	5.175913 (0.0000)	4.572586 (0.0000)
King-Wu	1.290700 (0.0984)	5.175913 (0.0000)	5.022571 (0.0000)
Standardized Honda	1.484887 (0.0688)	8.060734 (0.0000)	2.739302 (0.0031)
Standardized King-Wu	1.484887 (0.0688)	8.060734 (0.0000)	3.802303 (0.0001)
Gourieroux, et al.	–	–	28.45598 (0.0000)

The findings of this test indicate a Breusch-Pagan probability value of 0.1968, which is above the significance level of 0.05. Thus, the most appropriate model for estimating regression equations is the Common Effect Model (CEM). It can be concluded that the best

model approach used to determine the influence of population and development inequality on poverty in East Kalimantan Province from 2021 to 2025 is the Common Effect Model (CEM). The results of regression estimation using the Common Effect Model (CEM) are presented as follows:

Table 5. Common Effect Model (CEM) Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.86966	3.340677	6.546475	0.0000
X1	0.004198	0.001110	3.781491	0.0004
X2	43.37810	11.11927	3.901165	0.0003

Indikator	Nilai	Indikator	Nilai
R-squared	0.444024	Mean dependent var	6.941800
Adjusted R-squared	0.420365	S.D. dependent var	2.764363
S.E. of regression	2.104614	Akaike info criterion	4.384266
Sum squared resid	208.1818	Schwarz criterion	4.498987
Log likelihood	106.6066	Hannan-Quinn criter.	4.427952
F-statistic	18.76797	Durbin-Watson stat	2.231398
Prob(F-statistic)	0.000001	–	–

$$Y = 21.86966 + 0.004198X1 + 43.37810X2$$

The results of the regression model estimation show that the constant value of = 21.86966 indicates that when the population and development inequality are at zero, then the poverty level is estimated at 21.86966. This indicates that there are other factors outside the model that also affect poverty levels. Furthermore, the regression coefficient of the population was recorded as positive as 0.004198, which indicates that any 1% increase in the number of population, assuming other variables are fixed, will increase poverty by 0.41%. These findings reinforce the evidence that population size has a positive and significant influence on poverty independently. Development inequality has a positive regression coefficient of 43.37810, which means that an increase of 1 unit in development inequality is able to increase poverty by 43.37810. This reflects that inequality in central development is an obstacle in the achievement of economic development.

Table 9. Results of Determination Coefficient (R2) Test and Hypothesis Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.29645	3.412631	6.533508	0.0000
X1	0.003905	0.001039	3.758690	0.0006
X2	45.16183	11.38163	3.967957	0.0003

Statistik Model Fixed Effect

Indikator	Nilai	Indikator	Nilai
R-squared	0.613524	Mean dependent var	6.941800
Adjusted R-squared	0.501649	S.D. dependent var	2.764363
S.E. of regression	1.951473	Akaike info criterion	4.380610
Sum squared resid	144.7135	Schwarz criterion	4.839495
Log likelihood	-97.51524	Hannan-Quinn criter.	4.555356
F-statistic	5.484031	Durbin-Watson stat	3.239820
Prob (F-statistic)	0.000036	–	–

The results of the determination coefficient test showed that the Adjusted R-squared value was recorded at 0.501649. This means that about 50.1% of the variation in the dependent variable, namely poverty, can be explained by the two independent variables analyzed, namely the number of population and development inequality. Meanwhile, the remaining 49.9% was explained by factors outside the model that were not included in the scope of this study.

The Fcal value is 5.484031 with a probability of 0.000036. At a significance level of 0.05. $p < 0.05$, then, simultaneously the population and development inequality have a significant effect on poverty. Based on the results of the partial test, it was shown that the number of population (X1) had a t value of 3.758690 with $p = 0.0006 (< 0.05)$, so H_1 was accepted. This means that the number of people has a positive and significant effect on poverty. Development inequality (X2) has a t of 3.967957 with $p = 0.0003 (< 0.05)$, so H_2 is accepted. This shows a significant positive influence on poverty.

Population growth that is not balanced with the creation of job opportunities, increased labor productivity, and equitable access to education and health will increase the number of people below the poverty line. This condition is quite relevant to the characteristics of several districts in East Kalimantan that have experienced fairly high population growth due to urbanization and labor mobility, especially since the construction of the Nusantara Capital City (IKN). On the other hand, the ability of the regions to provide quality jobs is not evenly distributed, so some people still work in the informal sector with relatively low income levels.

Theoretically, the results of this study are in line with Malthus's Theory (1798) which states that population growth that is faster than production growth will put pressure on economic resources so as to increase poverty. In addition, Todaro and Smith (2021) explained that high population growth will be a burden on development if it is not accompanied by increased investment, employment opportunities, and the quality of human resources. Thus, an increase in the number of people can increase the number of poor people if the economic capacity of the region does not develop proportionally.

The results of the study also explain that economic development in East Kalimantan is still concentrated in certain areas, such as Balikpapan City, Samarinda City, and parts of Kutai Kartanegara Regency, which have more advanced infrastructure, investment, and economic activities than areas such as Mahakam Ulu, West Kutai, or some other inland areas. This inequality causes disparities in access to education, health services, road infrastructure, electricity networks, information technology, and job opportunities, so that people in disadvantaged areas have a higher risk of poverty. This finding is in accordance with Kuznets' Theory (1955) which explains that in the early stages of development, income inequality and development tend to increase before finally decreasing when development has been evenly distributed. In addition, Todaro and Smith (2021) explained that inequality in development between regions will cause the distribution of economic opportunities to be uneven so that community groups in disadvantaged areas experience limitations in obtaining income.

In the perspective of New Economic Geography put forward by Krugman (1991), economic activities tend to be concentrated in areas that have developed, resulting in gaps between regions if not balanced with equitable development policies. This condition is very

relevant to the characteristics of development in East Kalimantan Province. As a province that has a wealth of natural resources and is the location for the development of the IKN, regional economic growth is relatively high. However, the benefits of development have not been fully felt equally by all districts/cities. Areas that depend on the primary sector, have limited access to transportation, and are far from the center of economic growth still face relatively higher poverty rates than urban areas. Therefore, development inequality is one of the main causes of persistent poverty in several districts in East Kalimantan.

Simultaneously, the results of the study showed an F-statistic value of 5.484031 with a Prob(F-statistic) of 0.000036, so it can be concluded that the population and development inequality together have a significant effect on poverty in districts/cities in East Kalimantan Province. Meanwhile, the Adjusted R-squared value of 0.501649 shows that about 50.1% of the variation in poverty rate can be explained by population and development inequality, while the remaining 49.9% is influenced by other variables outside the model, such as economic growth, unemployment rate, education, investment, inflation, government spending, infrastructure quality, and other socioeconomic factors.

Overall, the results of the study confirm that poverty alleviation efforts in East Kalimantan Province are not enough to focus only on controlling population growth, but must also be directed at equitable development between regions. Local governments need to expand basic infrastructure development, improve access to education and health services, encourage investment in disadvantaged areas, and create productive jobs outside of economic growth centers. Thus, the benefits of development can be felt more evenly by all people in the districts/cities of East Kalimantan Province so that the reduction of poverty levels can take place sustainably.

CONCLUSION

It can be concluded that population size and development inequality had positive and significant effects on poverty levels in districts/cities across East Kalimantan Province. An increase in population size without being accompanied by sufficient employment opportunities, improvements in human resource quality, and equitable distribution of economic opportunities may contribute to higher poverty levels. In addition, development inequality was found to have a more dominant influence on poverty. This condition indicates that uneven development among regions creates disparities in access to infrastructure, education, healthcare services, investment, and employment opportunities. Consequently, relatively underdeveloped areas tend to experience higher poverty rates compared with more developed regions.

Simultaneously, population size and development inequality explained variations in poverty levels among districts/cities in East Kalimantan Province. These findings indicate that poverty alleviation efforts should not only focus on managing population growth but also require more equitable and inclusive development policies. Therefore, local governments need to strengthen balanced regional development through infrastructure improvement, enhancement of human resource quality, expansion of access to basic services, job creation, and equitable investment distribution. These efforts are expected to ensure that development benefits are experienced more broadly by communities and contribute to sustainable poverty reduction.

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