Panel Data Regression Modelling on The Analysis of The Influence of Fiscal Decentralization to Poverty in Maluku, 2020-2024

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Abstract. Maluku Province persistently records one of the highest poverty rates in Indonesia, despite sustained fiscal transfers from the central government. This study examines the relationship between fiscal decentralization and poverty reduction in Maluku from 2020 to 2024 through a panel data regression approach, enabling simultaneous analysis of spatial and temporal variations across districts. Poverty data were sourced from Badan Pusat Statistik (BPS) and fiscal variables from Direktorat Jenderal Perimbangan Keuangan (DJPK). The empirical results demonstrate that Regional Original Revenue (PAD), general allocation funds (DAU), and village funds (DD) exert statistically significant negative effects on poverty rates, with DD showing the strongest marginal impact. By focusing on a structurally disadvantaged province, this study contributes to the empirical literature by providing region-specific evidence on the effectiveness of fiscal decentralization mechanisms in reducing poverty. The findings underscore the importance of strengthening local fiscal capacity and optimizing the allocation of intergovernmental transfers to achieve more equitable and sustainable poverty alleviation.
Keyword: Fiscal Decentralization, Panel data regression, Poverty.

1. Introduction

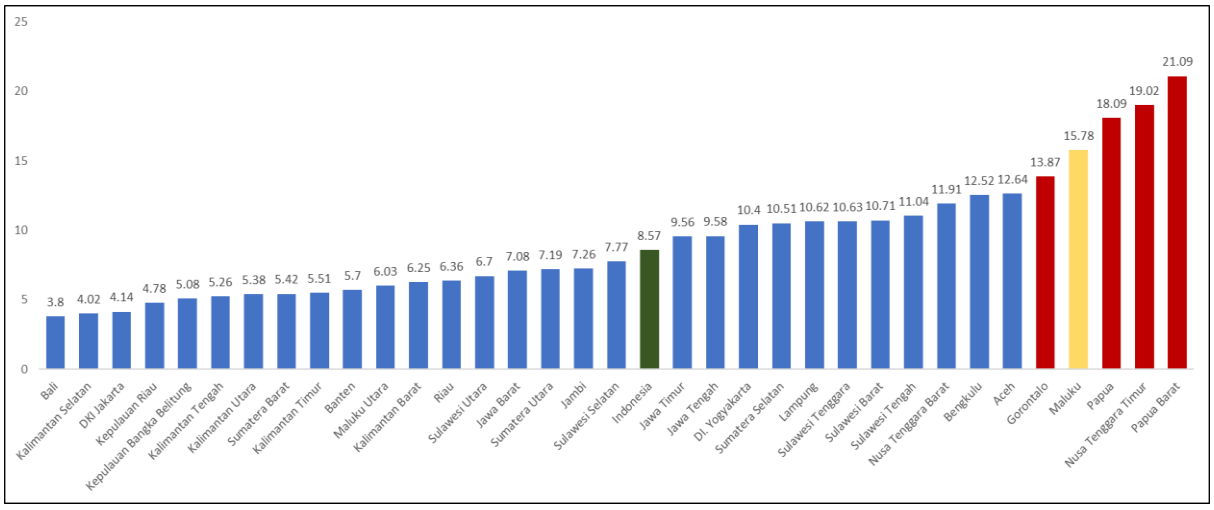
Poverty reflects the level of a population's welfare in a country. When poverty rates are high, it points to a lack of well-being. According to [1], poverty refers to the incapacity to fulfill fundamental food and non-food necessities. This definition implies that poverty is defined based on economic aspects. Residents are categorized as poor if their average monthly per capita expenditure is below the poverty line. In March 2024, the national poverty line was recorded at IDR 582,932 per capita per month, with food needs accounting for IDR 433,906 (74.44%) and non-food needs amounting to IDR 149,026 (25.56%). During the same period, the percentage of Indonesia's poor population was recorded at 9.03%, reflecting a decline of 0.33 percentage points relative to March 2023. In March 2024, the total number of individuals living in poverty reached 25.22 million, representing a reduction of 0.68 million compared to the figure recorded in March 2023. However, despite the decrease, the poverty rate still presents a significant challenge in poverty alleviation efforts in Indonesia.

The large number of people categorized as poor requires vigilance, as it can cause widespread problems across various dimensions of life, such as social, economic, health, and even political.

This makes poverty in Indonesia a complex problem that remains unresolved [2]. High poverty has a broad and pervasive impact on various aspects of human life. Economically, poverty hinders access to decent employment opportunities, education, and skills development, which in turn reduces productivity and economic growth [3]. In the health sector, people living in poverty tend to have limited access to qualityhealth services, leading to high rates of illness and death from undiagnosed or untreated conditions [4]. In the political sphere, poverty can affect political participation and citizens' understanding of social issues, ultimately reducing the power of the public's voice in decision-making that influences development policy [5]. Overall, these impacts are interrelated and not only affect individuals, but can also slow down national growth and stability [6].

The considerable effects of poverty have attracted global concern and strengthened the Indonesian government's resolve to take concrete steps in tackling the issue. Poverty eradication, in particular, remains a critical objective within the framework of the Sustainable Development Goals (SDGs). The SDGs' poverty-related objectives are listed in the first pillar, namely ending poverty in all its forms everywhere [7]. Indonesia has also enacted Law Number 13 of 2011 concerning Poverty Alleviation as a manifestation of the government's commitment to poverty alleviation efforts. In its implementation, the Indonesian government is also committed to reducing poverty rates. Poverty alleviation is one of the main targets of the 2025-2029 National Medium-Term Development Plan (RPJMN), which targets a reduction in the national poverty rate to 4.5–5 percent by 2029 and the elimination of extreme poverty by 2026 through a holistic and data-driven approach.

In addition to showing a decline in poverty that tends to stagnate from year to year, Figure 1 shows that Maluku occupies the highest position with a poverty rate reaching 15.78 percent, which places this province in 4th place with the highest poverty percentage. Furthermore, this region ranks 9th nationally in terms of the Poverty Depth Index (P_1), recorded at 2.95 percent (Appendix 1) and the Poverty Severity Index (P_2), recorded at 0.59 percent (Appendix 2). This indicates that Maluku is included in the group of provinces with very high poverty rate, including its depth and severity, much higher than most other provinces. This figure reflects the major challenge for Maluku in reducing poverty rates, which certainly requires more attention in terms of economic development, infrastructure, and more effective social programs to improve the welfare of the people in the region. In fact, the amount of transfer funds received by regions in the province of Maluku is not a small transfer of funds.



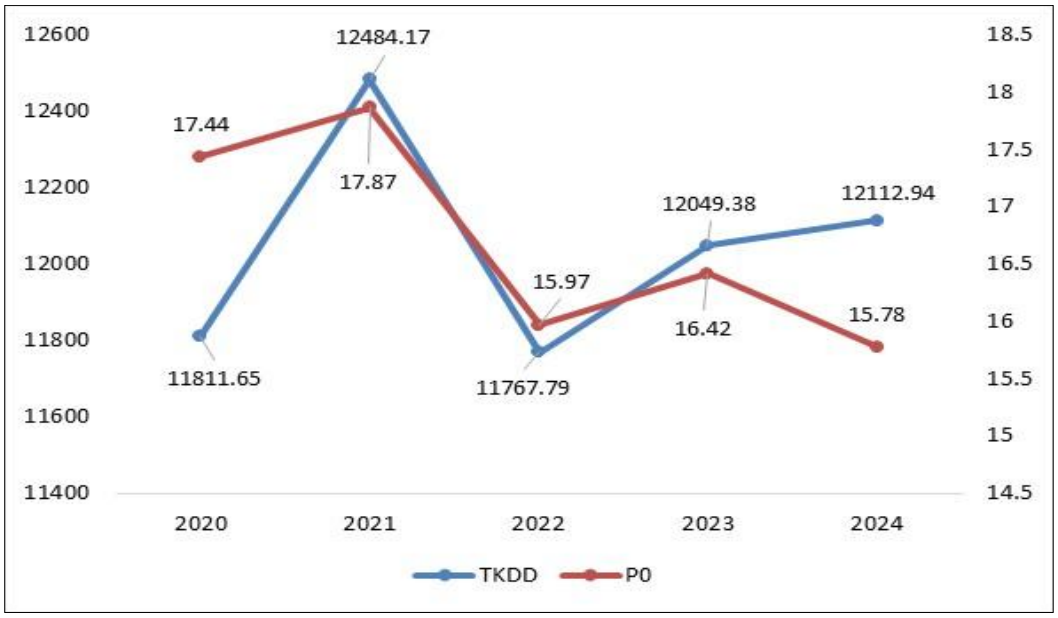
Source: BPS Statistics Indonesia

Figure 1. Percentage Poor Population (P_0) in 2024.

Figure 2 shows the development of Regional Transfers and Village Funds (TKDD) and the percentage of the poor (P_0) in Maluku Province from 2020 to 2024. In general, TKDD fluctuated, with the highest increase in 2021 at 12,484.17 billion rupiah, while the percentage of the poor also peaked in

the same year at 17.57%. After 2021, there was a decrease in both TKDD and P_0, although they rose again in 2023. In 2024, TKDD increased to 12,112.94 billion rupiah, but P_0 actually decreased to 15.78%. This indicates that the poverty situation in Maluku for the 2020-2024 period has not yet met the poverty percentage target stated in the 2020-2024 National Medium-Term Development Plan (RPJMN), even though the amount of TKDD received by regions in Maluku has increased every year.

Addressing poverty requires collaborative efforts from both the central and regional governments. Fiscal decentralization serves as one of the government's strategies to combat poverty by granting regions the autonomy to manage governmental affairs and address the needs of their populations [8]. This initiative is rooted in Law Number 25 of 1999 on Fiscal Balance between the Central and Regional Governments, subsequently amended by Law Number 33 of 2004. Through fiscal decentralization, regional governments are provided with adequate financial resources and the authority to allocate them, including Regional Original Revenue (PAD) and transfer funds from the central government such as Revenue Sharing Funds (DBH), General Allocation Funds (DAU), Special Allocation Funds (DAK), and Village Funds (DD) [9], [10]. Nevertheless, the financial dependency of regional governments on central transfers remains substantial, limiting the incentives for regional stakeholders to enhance their locally generated revenues [11].



Source: BPS Statistics Indonesia

Figure 2. TKDD and Percentage Poor Population (P_0) of Maluku Province in 2024.

Poverty remains a persistent and complex development challenge in Maluku Province, which consistently records one of the highest poverty rates in Indonesia. In 2024, the poverty rate in Maluku reached 15.78 percent, far above the national average, reflecting serious structural barriers to improving community welfare. This situation underscores the urgent need for more effective and context-specific poverty reduction strategies in the region. One of the key government approaches to address this issue is fiscal decentralization, which aims to enhance local government capacity to manage resources and design development programs suited to regional needs [9], [10]. However, despite substantial fiscal transfers, poverty rates in Maluku remain high, raising questions about the effectiveness of fiscal decentralization in this specific context.

Previous studies have produced mixed findings regarding the relationship between fiscal decentralization and poverty. Several works have shown that fiscal balancing funds can significantly reduce poverty levels [12], [13], [14], [15]., whereas others, such as [16], found contrasting effects that local revenue (PAD) was associated with a decline in poverty, but regional original funds (DAU) were

linked to an increase. These inconsistencies suggest that the impact of fiscal decentralization is not uniform across regions and may depend on local governance capacity, economic structure, and program implementation effectiveness.

To address this gap, this study specifically examines Maluku Province by employing panel data regression to analyze the effects of fiscal decentralization on poverty rates across districts and over time. This method allows the simultaneous analysis of cross-sectional and time-series variations, while controlling for unobserved, time-invariant district-specific characteristics, thereby minimizing omitted variable bias and producing more robust estimates [17]. Focusing on Maluku provides new empirical insights into how fiscal decentralization mechanisms operate in regions facing persistent poverty. The findings are expected to inform both central and regional governments in formulating targeted, evidence-based poverty alleviation strategies suited to Maluku's unique socioeconomic conditions.

2. Research Method

2.1. Poverty

In Indonesia, the Statistics Indonesia [1] uses the cost of basic needs approach to measure poverty, calculating the cost of food consumption that meets the minimum nutritional standard of 2,100 kcalories per capita per day, plus essential non-food consumption components based on the results of the 2004 Basic Needs Commodity Package Survey (SPKKD). The primary data comes from the National Socioeconomic Survey (Susenas), which includes 52 types of food commodities and 51 types of non-food commodities for urban areas and 47 types for rural areas.

Based on the concept of the "vicious circle of poverty" proposed by Ragnar Nurkse, poverty is caused by interrelated factors such as low productivity resulting in low income, which in turn can lead to low investment and savings, further exacerbating low productivity and maintaining a region's poverty [18], [19]. This concept emphasizes the interconnected nature of poverty and the need for comprehensive development across all sectors simultaneously to break the cycle of poverty [20]. According to [21], poverty in developing countries can be attributed to six interrelated structural factors: persistently low national income and sluggish economic growth, stagnant per capita income, pronounced income inequality, a high proportion of the population living in absolute poverty, inadequate health infrastructure coupled with elevated infant mortality rates, and insufficient and poorly aligned educational facilities.

2.2. Fiscal Decentralization

Fiscal decentralization is a crucial component of decentralization, involving the autonomous transfer of revenues or fundraising by lower-level governments [22]. This process enables local governments to create independent spending and financial policies, aiming to improve the efficiency and productivity of public spending and revenues [23]. These efforts are realized through government policies, programs, and budget allocations, particularly through financial transfers to local governments.

In the context of fiscal decentralization, poverty reduction is closely tied to the fiscal capacity of local governments. When regional authorities are equipped to manage revenue and expenditure effectively, they are better positioned to implement targeted and responsive policies. As a result, fiscal decentralization can become a strategic mechanism for breaking the vicious cycle of poverty and enhancing community welfare [24].

Regional Original Revenue (PAD)

According to Law Number 33 of 2004 in [25], defines Regional Original Revenue (PAD) as income obtained from local taxes, levies, the management of regionally separated assets, and other lawful regional revenue sources. This provision aims to enable regions to exercise greater flexibility in mobilizing financial resources to support regional autonomy in line with the decentralization principle.

Balancing Fund

The Balancing Fund is the distribution of revenue from the central government to the regions to carry out government functions in each autonomous region within a decentralized framework. According to Law No. 33 of 2004 concerning Fiscal Balance between the Central Government and Regional Governments, the Balancing Fund is a fund sourced from the State Budget (APBN) allocated to regions to finance regional needs in implementing decentralization. The Balancing Fund consists of Revenue Sharing Funds (DBH), General Allocation Funds (DAU), Special Allocation Funds (DAK), and Village Funds (DD), which are defined as follows [26]:

a. Revenue Sharing Funds (DBH) are derived from State Budget (APBN) revenues allocated to resource-producing regions based on a predetermined percentage. This mechanism aims to minimize disparities in financial capacity between the central government and regional administrations.
b. The General Allocation Fund (DAU) originates from APBN revenues and is distributed to regions to balance financial capacities among them, enabling adequate funding for the implementation of regional decentralization.
c. The Special Allocation Fund (DAK) is drawn from the APBN and directed to regions to support specific activities within government affairs that fall under regional authority, as outlined in Article 39 of Law No. 33 of 2004.
d. Village Funds (DD) are financial resources from the APBN allocated to individual villages to support governance, development, community empowerment, and the enhancement of villagers' welfare. These funds aim to accelerate rural development and reduce interregional disparities, as regulated in Law No. 6 of 2014 on Villages.

2.3. Panel Regression Method

The analytical method employed in this study is inferential analysis, which aims to examine the influence of Regional Original Revenue on poverty levels in Maluku through panel data regression. As introduced by [17], panel data regression is applied to assess the relationship between independent and dependent variables at a 5 percent significance level. This method is considered more appropriate than conventional multiple linear regression because it simultaneously captures both cross-sectional and temporal variations, allowing for a more comprehensive analysis of fiscal policy impacts on poverty across districts and over time. Moreover, panel regression effectively controls for unobserved, time-invariant district-specific characteristics thereby minimizing omitted variable bias and producing more efficient and reliable estimates. By accounting for these dimensions, panel regression provides a more robust empirical foundation for understanding how fiscal instruments shape poverty dynamics in Maluku. In general, the panel data regression model specifications adopted in this research are presented as follows:

Common Effect Model (CEM)

Regression model with the CEM model is as in equation (1).

$$y_{it} = \beta_0 + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3it} + \beta_4 X_{4_{it}} + \beta_5 X_{5it} + v_{it} \quad (1)$$

Fixed Effect Model (FEM)

The FEM model can be written as in equation (2).

$$y_{it} = (\beta_0 + u_i) + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3it} + \beta_4 X_{4_{it}} + \beta_5 X_{5it} + v_{it} \quad (2)$$

Random Effect Model (REM)

The following is the REM model as in equation (3).

$$y_{it} = (\beta_0 + u_i) + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3it} + \beta_4 X_{4_{it}} + \beta_5 X_{5it} + (u_{it} + v_{it}) \quad (3)$$

where,

y_{it} : dependent variable

β_0 : intercept

$\beta_1, \beta_2, \ldots, \beta_5$: slope coefficient of each independent variable

$X_1, X_2, \ldots, X_5$: independent variable

u_{it} : error term

v_{it} : random effects

i : individual (districs); $i = 1,2, \ldots, 11$

t : period (from 2020-2024)

Three panel models were considered: the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Model selection was guided by standard statistical procedures. The Chow test was used to determine whether FEM provides a better fit than CEM. When the Chow test rejected the null hypothesis, the Hausman test was applied to compare FEM and REM. If FEM and REM were not significantly different, REM was selected as the more efficient estimator. Finally, the Lagrange Multiplier (LM) test assessed whether the random effects model was appropriate.

The chosen model was further tested to ensure reliability. Residual variance-covariance structure tests were applied to check homoscedasticity and cross-sectional independence. Classical assumption tests, including normality and multicollinearity diagnostics, were also conducted to validate the model's robustness. Model significance was assessed through R-squared, F-tests, and t-tests for each independent variable.

The operational definitions of the variables used in the model are summarized in Table 1. The dependent variable is the poverty rate across districts in Maluku, while independent variables include Regional Original Revenue (PAD), Revenue Sharing Funds (DBH), General Allocation Funds (DAU), Village Funds (DD), and Special Allocation Funds (DAK). This variable structure aligns with the fiscal decentralization framework defined by Indonesian fiscal policy.

This methodological approach is particularly suitable for Maluku because it allows for a nuanced understanding of how fiscal transfers and Regional Original Revenue capacity interact with poverty dynamics across heterogeneous districts. By using REM as the preferred model, the analysis acknowledges variation between districts while maintaining efficient estimation, making it well suited to inform targeted poverty alleviation policies.

2.4. Data and Data Sources

The data used in this study is secondary data sourced from official statistical publications sourced from BPS Statistics Indonesia and the Direktorat Jenderal Perimbangan Keuangan (DJPK) in the 2020-2024 period. Table 1 provides a detailed description of the variables employed in this study.

Table 1. Data and Data Sources.

Variables	Definition Operational	Notation	Data source
Percentage Poverty (P0)	Show percentage population below the poverty line (in percent) in districs of Maluku in 2020-2024	Y	BPS Statistics Indonesia
PAD	PAD value is value PAD realization (in trillions of rupiah) generated by districts in Maluku in 2020-2024 in the period realization as of February 2024.	X_1	DJPK
DBH	The DBH value is value DBH realization (in trillions of rupiah) generated by districts in Maluku in 2020-2024 in the period realization as of February 2024.	X_2	DJPK
DAU	The DAU value is value realization of DAU (in trillions of rupiah) generated by districts in Maluku in	X_3	DJPK

Variables	Definition Operational	Notation	Data source
	2020-2024 in the period realization as of February 2024.		
DD	The VF value is value realization of DD (in trillions of rupiah) generated by district in Maluku in 2020-2024 in the period realization as of February 2024.	X_4	DJPK
DAK	The SAF value is value Realization of DAK (in trillions of rupiah) generated by district in Maluku in 2020-2024 in the period realization as of February 2024.	X_5	DJPK

3. Result and Discussion

3.1. Best Model Selection

The initial test conducted is the Chow test, which examines the relationship between the Fixed Effect Model (FEM) and the Common Effect Model (CEM). If the Chow test rejects the null hypothesis, the analysis proceeds with the Hausman test to evaluate the relationship between FEM and the Random Effect Model (REM). Conversely, if the Chow test fails to reject the null hypothesis, the Hausman test is subsequently applied. The following section provides a detailed explanation of the data testing results obtained.

Table 2. Best Model Selection.

Test	Count Statistics	p-value	Decision
Chow Test	239.110	0.000	Reject H_0*
Hausman test	2.110	0.8336	Failed to Reject H_0

Note. *significant at 5 percent level of significance
Source: data processed

As presented in Table 2, the Chow Test yielded a test statistic of 239.110 with a p-value of 0.000, which is below the significance level of 0.05. Consequently, the null hypothesis (H_0) is rejected, suggesting that the Fixed Effect Model (FEM) provides a better fit for the panel data regression compared to the Common Effect Model (CEM). Subsequently, the Hausman Test produced a test statistic of 2.110 with a p-value of 0.8336, which exceeds the 0.05 significance level. Therefore, the null hypothesis cannot be rejected, indicating no significant difference between FEM and the Random Effect Model (REM). This result implies that the REM is more appropriate for the panel data regression in this study.

3.2. Classical Assumption Testing and Detection of Multicollinearity

In the estimation of REM, classical assumptions such as normality must be satisfied. Table 3 reports a Jarque-Bera (JB) statistic of 1.687 with a corresponding p-value of 0.430, which is greater than the 0.05 significance level. Consequently, the null hypothesis (H_0) cannot be rejected, indicating that the residuals are normally distributed. Detecting multicollinearity is important because its presence increases the variance and standard errors of the estimates, making the estimators less precise. Multicollinearity is assessed using the Variance Inflation Factor (VIF) for each independent variable. As indicated in Table 3, none of the independent variables exhibit a VIF exceeding 10, suggesting the absence of multicollinearity in the model.

Table 3. Assumption Test Classic and Detection of Multicollinearity.

Test	Count Statistics	*p-value*	*Decision*
Assumption Test Normality	1,687	0.430	Failed to Reject H_0
Detection Multicollinearity			
X_1	X_2	X_3	X_4	X_5
1,019	1.415	1.259	1,022	1.171

Note. *significant at 5 percent level of significance
Source: data processed

3.3. Random Effects Model (REM) Modeling

The estimation results presented in Table 4 indicate that, overall, the selected model yields an F-test p-value of 0.000, which is lower than the significance level α (0.05). This finding leads to the rejection of H_0, implying that at least one independent variable exerts a statistically significant effect on the dependent variable in this study. Furthermore, as shown in Table 4, the model achieves an adjusted coefficient of determination (adjusted R^2) of 0.630, suggesting that 63 percent of the variation in educational attainment inequality can be adequately explained by the independent variables included in the model, while the remaining 37 percent is attributable to factors outside the scope of this research.

Table 4. REM Modeling.

Variables	**Coefficient**	***p-value***	**Decision**
Intercept	18,752	0.000	Reject H_0*
X_1	-0.149	0.011	Reject H_0*
X_2	-0.213	0.322	Failed to Reject H_0
X_3	-0.174	0.000	Reject H_0*
X_4	-1.119	0.000	Reject H_0*
X_5	0.013	0.635	Failed to Reject H_0
Statistics Summary			
F Test	97,028	*p-value* (0.000) *	
Adj. R-Squared	0.630		

Note. *significant at 5 percent level of significance
Source: data processed

Table 4 shows a REM equation can be formed as follows in equation (4).

$$P_0 = 18{,}752^{*} - 0.149X_1^{*} - 0.213X_2 - 0.174X_3^{*} - 1.119X_4^{*} + 0.013X_5 \quad (4)$$

Based on Table 4, the results show that in variable X_1, namely PAD, it shows that PAD will reduce the P_0 value by -0.149 percent with a p-value of 0.011 (Reject H_0) which indicates that PAD has a significant effect on P_O at a significance level of 5 percent. The regression results show that every 1 trillion increase in PAD is accompanied by a decrease in the poverty rate (P_0) by 0.149 percent. This indicates that regions with higher PAD tend to be able to provide more resources for social and development programs that can improve community welfare. Regional Original Revenue (PAD) serves as the primary source of income for regions that are not reliant on fiscal transfers from the central government. Consequently, an increase in PAD derived from sources such as local taxes and levies, holds significant potential to enhance the quality of public services aimed at poverty reduction. With greater PAD, local governments gain the flexibility to finance diverse programs, including the provision of healthcare, education, and basic infrastructure, all of which contribute to mitigating economic and social inequalities. The findings of this study are consistent with previous research conducted by [27], [28], [29], [30]

Furthermore, in variable X_3, namely DAU, it shows that the DAU will reduce the P_0 value by -0.174, with a p-value of 0.000 (Reject H_0) which indicates that the DAU has a significant effect on P_0 at a significance level of 5 percent. The regression results show that an increase of 1 trillion DAU is accompanied by a decrease in the poverty rate (P_0) of 0.174 percent. The DAU plays a role in increasing regional fiscal capacity, which allows for more allocations for poverty alleviation programs. The DAU is a fund provided to regions to help improve the distribution of development between regions, especially for less fortunate regions. An increase in the DAU allows regions to increase social spending, such as education, health, and infrastructure, which are directly related to improving the quality of life of the poor. Because the DAU is general in nature, its use is more flexible, allowing local governments to adjust the budget to urgent social and economic needs at the local level. The findings of this study are consistent with previous research conducted by [31], [32].

Furthermore, in variable X_4, namely DD, it shows that DD will reduce the P_0 value by -1.119, with a p-value of 0.000 (Reject H_0) which indicates that DD has a significant effect on P_0 at a significance level of 5 percent. The regression results show that an increase of 1 trillion DD is accompanied by a decrease in the poverty rate (P_0) of 1.119 percent. Village funds play a crucial role in poverty alleviation efforts in rural areas, but their effectiveness depends heavily on proper management and utilization that is appropriate to the needs of the community. Programs funded by village funds, such as infrastructure development, increasing access to education and health, and local economic empowerment, have the potential to reduce poverty rates by improving the quality of life of rural communities. The findings of this study are consistent with previous research conducted by [33], [34], [35], [36].

Within the framework of fiscal decentralization, the DAK and DBH have not shown a significant impact on poverty reduction, primarily due to their characteristics and allocation mechanisms, which are less responsive to the needs of the poor. DAK is earmarked, meaning its use is predetermined by the central government and lacks flexibility to be directed toward programs targeting vulnerable groups. Most DAK is allocated to physical projects such as infrastructure development, whose benefits to community welfare are long-term and do not immediately reduce poverty levels. On the other hand, DBH is generally used for routine expenditures or general development, rather than targeted social interventions. The effectiveness of both instruments is highly dependent on institutional capacity and local governance; when these are weak, the fiscal potential to support poverty alleviation becomes limited. This finding aligns with the study by [37], which indicates that DAK and DBH do not have a significant influence on poverty reduction.

3.4. Idiosyncratic Effects and Individual Effects

The idiosyncratic effect describes unmeasured or unincluded factors in the model that influence poverty rates at the individual observation level. Table 5 shows that the idiosyncratic variance is 0.4102 with a standard deviation of 0.6405. The relatively small value of this idiosyncratic effect (share = 0.016) indicates that most of the variation in poverty rates can be explained by factors in the model, with only a small portion coming from unobserved individual-specific factors. This value indicates that although other factors influence poverty rates, a small portion of the variation in poverty rates cannot be explained by the variables included in the model.

Table 5. Effect Idiosyncratic and Individual Effects.

Effect	Variability	Standard Deviation	Share
Idiosyncratic	0.410	0.640	0.016
Individual	25,174	5.017	0.984

Source: data processed

The individual effect refers to the variability in the poverty rate caused by inter-individual differences. Table 5 shows that the variance of the individual effect is 25.1741 with a standard deviation of 5.0174, and its share or contribution to the total variability is 0.984. This value is very large compared to the idiosyncratic effect. The individual effect has a very large contribution to the total variability in

the PO, with a share reaching 98.4%. This means that almost all of the variation in the poverty rate variable can be explained by inter-individual differences. This indicates that specific characteristics or conditions that distinguish one individual from another significantly influence the poverty rate results. Individual differences such as policies or regional characteristics determine the results of the poverty rate more than other unmeasured variability.

3.5. Individual Random Effects and Time Random Effects

Based on the results of the Lagrange Multiplier Test in Table 6, there are significant indication to existence effect random individuals in the analyzed data. The Lagrange Multiplier test for two way effect show the test statistic is 59,556 with a p-value of 0.000, which indicates that the effect model two way random (good) individual and also time (better than the model without effect random). Next, the test results for effect random individuals also show test statistic 59,547 with *p-value* 0.000, which leads to rejection hypothesis zero and shows that there is difference significant between districs in matter his contribution to the model. This means that variation between area must taken into account in analysis, remembering effect random individual own real influence to the results obtained. On the other hand, the test for effect random time show test statistic of 0.009 and p-value of 0.923, which failed reject null hypothesis. That is, no found sufficient evidence for state that there is effect significant random based on time. The results indicate that variations over time do not exert a significant influence on the observed differences in the data.

Table 6. Testing effect individual random and effects random time.

Test Name	Test Statistics	*p-value*	Decision
Lagrange Multiplier Test - two-way effects	59,556	0.000	Reject H_0*
Lagrange Multiplier Test – individual effects	59,547	0.000	Reject H_0*
Lagrange Multiplier Test - time effects	0.009	0.923	Failed to Reject H_0*

Note. *significant at 5 percent level of significance
Source: data processed

Based on the results of the time random effects analysis in Table 7, it can be seen that the variation in influence between regencies/cities in Maluku is significant in the panel data regression model used to analyze the influence of regional income on poverty. Several regencies/cities show a significant positive random effect, such as Ambon with a value of 7.329 and Southeast Maluku with a value of 8.007, indicating that these regions have a greater contribution to poverty reduction, in line with their high regional income. Conversely, several other regions, such as East Seram (-8.021) and Central Maluku (-5.075), show a negative random effect, meaning these regions tend to have a smaller contribution or even contrary to the expected positive trend, despite having sufficient regional income. This variation emphasizes the importance of considering local factors in the analysis, because regional income is not always directly proportional to poverty reduction in each regency/city.

Table 7. Time Random Effects.

City District	Individual Random Effects
Ambon	7,329
Buru	-5.066
South Buru	-3.885
Aru Islands	-2,524
Tanimbar Islands	3.935

City District	Individual Random Effects
Southwest Maluku	3.947
Central Maluku	-5.075
Southeast Maluku	8,007
East Seram	-8.021
West Seram	-4,706
Tual	6,059

4. Conclusion

This study examines the impact of fiscal decentralization on poverty reduction in Maluku Province during the period 2020–2024 through a panel data regression approach, allowing for both spatial and temporal variations to be captured. The findings indicate that PAD, DAU, and DD exert a negative and statistically significant effect on poverty rates, with DD demonstrating the strongest marginal impact. These results highlight the potential of fiscal decentralization instruments to support poverty alleviation in regions facing persistent structural constraints.

From a policy perspective, enhancing local fiscal capacity and improving the governance of intergovernmental transfers, particularly DD, are essential strategies to accelerate poverty reduction. However, the results also emphasize that fiscal decentralization alone is insufficient to address complex poverty dynamics. Institutional quality, local governance capacity, and the effectiveness of program implementation play a critical role in determining policy outcomes.

This study has several limitations, including a limited scope of fiscal variables and the absence of institutional indicators and long-term dynamic effects in the model. Future research should expand the analytical framework by incorporating governance and institutional variables, adopting spatial econometric techniques, and integrating dynamic approaches. Such efforts will provide a more comprehensive understanding of how fiscal decentralization can be effectively leveraged to address multidimensional poverty in developing regions.

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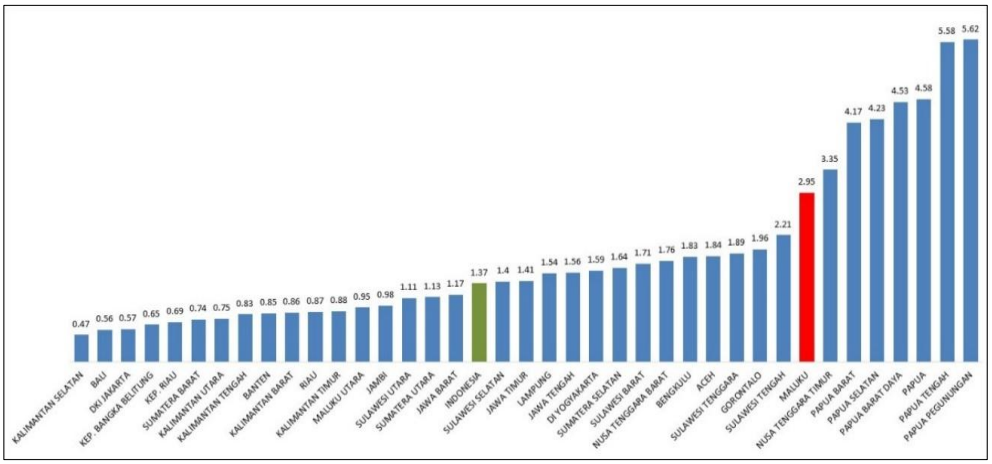
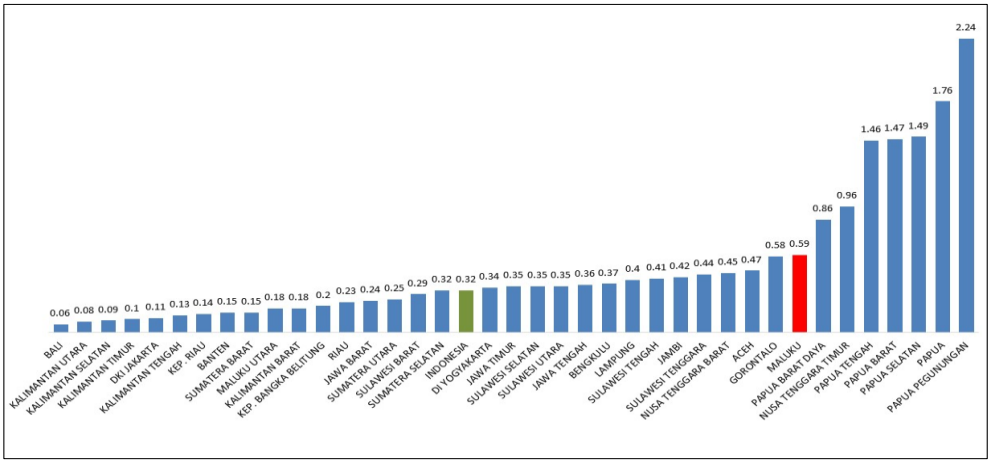
Appendices



Source: BPS Statistics Indonesia

Appendix 1. Poverty Depth Index (P_1) in 2024.



Source: BPS Statistics Indonesia

Appendix 2. Poverty Severity Index (P_2) in 2024.