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The Impact of Government Spending on Health and Education on the Human Development Index in Eastern Indonesia: A Panel Data Regression Analysis for 2015–2024

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ABSTRACT

This study analyzes the effects of government spending on health, government spending on education, economic growth, and poverty rates on the Human Development Index (HDI) in Eastern Indonesia during the 2015–2024 period. The study uses balanced panel data consisting of 10 provinces with 100 observations. Estimations were performed using panel data regression approaches via the Common Effects Model, Fixed Effects Model, and Random Effects Model. Model selection based on the Chow test, Breusch–Pagan Lagrange Multiplier test, and Hausman test indicated that the Fixed Effects Model was the most appropriate specification. Diagnostic tests identified the presence of heteroscedasticity, autocorrelation, and cross-sectional dependence; therefore, parameter estimates were calculated using Driscoll–Kraay robust standard errors to ensure consistent inferences. The results show that education spending has a significant negative effect on the HDI, while the poverty rate also has a significant negative effect on the HDI. Conversely, health spending and economic growth do not show a significant effect. These findings indicate that improvements in the HDI in Eastern Indonesia are determined not only by the level of public spending but also by the effectiveness of budget allocation and socioeconomic conditions across provinces.

INTRODUCTION

Human development is one of the key indicators for evaluating a country's development success because it reflects society's achievements in leading healthy, knowledgeable lives and enjoying a decent standard of living. This concept is measured through the Human Development Index (HDI), which integrates the dimensions of health, education, and income into a single composite measure (Yola et al., 2026). Therefore, an increase in the HDI depends not only on economic growth but also on the effectiveness of public policies in improving the quality of human capital. Within the framework of human capital theory, government investment in the education and health sectors is viewed as a strategic tool for enhancing productivity, well-being, and long-term economic development (Nyasha & Odhiambo, 2019).

In Indonesia, human development has shown a steadily increasing trend over the past decade. However, this improvement has not been fully accompanied by equitable development across regions. Eastern Indonesia still faces various development challenges characterized by disparities in the quality of education, access to health services, relatively high poverty rates, and limited infrastructure compared to Western Indonesia (Oki et al., 2023). These conditions indicate that increased government spending allocations do not necessarily result in a proportional improvement in the quality of human development, making the effectiveness of public spending a critical issue in the evaluation of regional fiscal policies (Organisation for Economic Co-operation, 2023).

Conceptually, government spending on the health sector is expected to improve public health through the provision of better health services, while spending on education contributes to improving the quality of human resources through access to and the quality of education. On the other hand, economic growth reflects an increase in production capacity and public income, which has the potential to improve quality of life, while a reduction in poverty rates expands public access to basic services. Thus, the relationship between government spending, economic growth, poverty, and human development is a critical issue to analyze from the perspective of regional development policy (Nyasha & Odhiambo, 2019).

Although numerous studies have examined the determinants of the Human Development Index (HDI), the existing literature remains inconclusive regarding the extent to which government expenditure contributes to human development. Previous empirical studies have reported positive, insignificant, and even context-specific effects of government spending on education and health. These differences suggest that the relationship between public expenditure and human development is not determined solely by the amount of fiscal resources allocated, but may also depend on expenditure composition, implementation effectiveness, institutional capacity, and socioeconomic conditions. Consequently, evidence from one geographical or institutional context cannot necessarily be generalized to other regions.(Bhanumurthy et al., 2016)

A second gap concerns the geographical context of existing research. Much of the empirical literature has examined Indonesia at the national level or has concentrated on relatively more developed western regions. Evidence

specifically focusing on Eastern Indonesia remains comparatively limited, despite the region's distinctive development characteristics, including geographical barriers, uneven infrastructure, disparities in access to public services, and persistently higher levels of poverty. These structural conditions may affect the extent to which government expenditure is translated into improvements in human development. Therefore, examining Eastern Indonesia as a distinct regional context is important for understanding whether conventional relationships between fiscal expenditure and HDI remain applicable in areas characterized by persistent structural disparities (Baltagi, 2005).

A third gap is methodological. Previous studies using regional panel data have frequently relied on conventional panel estimators without explicitly addressing the simultaneous presence of heteroscedasticity, serial correlation, and cross-sectional dependence. Such problems are particularly relevant in regional panel datasets because provinces may experience common macroeconomic shocks, interconnected fiscal conditions, and similar policy responses. Ignoring these dependence structures may result in unreliable standard errors and misleading statistical inferences. This methodological issue creates a need for an estimation strategy that provides more reliable inference under the specific characteristics of regional panel data.

Against these gaps, this study investigates the determinants of human development in ten provinces of Eastern Indonesia over the 2015–2024 period by examining government expenditure on health and education alongside economic growth and poverty. The study contributes to the literature in three ways. First, it provides region-specific empirical evidence on the determinants of HDI in Eastern Indonesia, a context that remains relatively underexamined despite its persistent development disparities. Second, it integrates fiscal, economic, and socioeconomic factors within a single analytical framework, allowing the role of government expenditure to be assessed alongside broader structural determinants of human development. Third, the study applies a Fixed Effects Model with Driscoll–Kraay Robust Standard Errors after accounting for heteroscedasticity, autocorrelation, and cross-sectional dependence. This approach strengthens the reliability of statistical inference and provides a methodological contribution to empirical research on regional human development (Driscoll J & Kraay A, 1998)

Therefore, this study aims to examine the effects of government expenditure on health and education, economic growth, and poverty on the Human Development Index (HDI) in ten provinces of Eastern Indonesia during the 2015–2024 period. Using panel data regression with a Fixed Effects Model and Driscoll–Kraay Robust Standard Errors, this study seeks to provide empirical evidence on the extent to which fiscal and socioeconomic factors contribute to human development in a region characterized by persistent development disparities.

LITERATURE REVIEW

1. Human Capital Theory

Human Capital Theory, introduced by Becker (1964), posits that education and health are strategic forms of investment that enhance individual productivity, increase earnings, and generate long-term economic growth. From a macroeconomic perspective, governments play a central role in accumulating human capital by allocating public expenditure to education and health sectors. Such investments improve the quality of human resources, strengthen labor productivity, promote innovation, and ultimately contribute to higher levels of social welfare and human development. Therefore, Human Capital Theory provides a strong theoretical foundation for explaining how government expenditure can improve the Human Development Index (HDI) through its education and health dimensions (Oki et al., 2023)

Empirical evidence generally supports this theoretical proposition. Studies have shown that government expenditure on health contributes to higher life expectancy, lower mortality rates, and better access to healthcare services, while expenditure on education improves educational attainment, average years of schooling, and expected years of schooling, which are key components of the HDI. These findings indicate that sustained public investment in human capital plays an important role in improving human development outcomes (Miranda-Lescano et al., 2023).

Furthermore, investments in education often produce benefits only in the long term (time-lag effect), whereas improvements in health outcomes may be observed more rapidly (Bhanumurthy et al., 2016). Consequently, Human Capital Theory should be interpreted within specific regional contexts, where differences in development capacity may influence the extent to which government expenditure translates into improvements in human development.

Considering the persistent disparities in education, healthcare access, and socioeconomic conditions across provinces in Eastern Indonesia, re-examining the relationship between government expenditure and human development in this regional context is essential. Based on the theoretical arguments and empirical evidence, the following hypotheses are proposed:

H1: Government spending on health has a positive effect on the Human Development Index.

H2: Government spending on education has a positive effect on the Human Development Index.

2. Synthesis of Previous Studies

The empirical literature generally supports the theoretical proposition that public expenditure on education and health can contribute to human development; however, the magnitude and direction of these effects are not uniform across countries and regions. Government expenditure on health is theoretically expected to improve life expectancy and access to health services, while education expenditure is expected to enhance educational attainment and the accumulation of human capital. Nevertheless, empirical evidence indicates that the relationship between public expenditure and HDI is highly context-dependent. Differences in institutional capacity, expenditure efficiency, service

accessibility, and socioeconomic conditions may determine whether fiscal resources are effectively converted into human development outcomes.

The evidence on education expenditure is particularly mixed. Some studies report a positive relationship between education expenditure and human development, whereas others find insignificant or dimension-specific effects. (Miranda-Lescano et al., 2023), for example, found that education expenditure was associated more directly with the educational dimension of human development rather than with HDI as a whole. Similarly, (Ivanovic et al., 2023)demonstrated that the relationship between education expenditure and human development varies across developing-country contexts

Economic Development Theory

Economic Development Theory emphasizes that development should be understood more broadly than economic growth alone. According to the development perspective of Todaro and Smith, development involves improvements in the quality of life, expansion of economic opportunities, reduction of poverty, and improvement in access to basic services. Economic growth can create additional income and employment opportunities and increase the resources available to households and governments. Nevertheless, economic growth does not automatically translate into improvements in human development when its benefits are distributed unevenly (Maharda & Aulia, 2020). From this perspective, economic growth is expected to contribute positively to HDI because increasing economic activity can improve household income, employment opportunities, and access to goods and services. Higher economic capacity may also increase the fiscal resources available to governments for financing education, health, infrastructure, and social protection (Human Development, 2024). Therefore, high economic growth does not necessarily lead to an increase in the Human Development Index (HDI) if income inequality and poverty rates remain high. Conversely, a reduction in poverty rates will improve people's access to public services, thereby potentially enhancing the quality of human development (Becker, 1975).

Empirical findings from various developing countries indicate that poverty has a consistent negative relationship with human development, whereas the impact of economic growth often depends on the quality of the distribution of development outcomes (Organisation for Economic Co-operation, 2023).

Based on this theoretical framework, the research hypotheses are formulated as follows.

H3: Economic growth has a positive effect on the Human Development Index.
H4: The poverty rate has a negative effect on the Human Development Index.

3. Government Expenditure and Human Development

The empirical relationship between government expenditure and human development remains inconclusive. Theoretically, expenditure on health and education should improve the corresponding dimensions of HDI. Nevertheless, empirical studies indicate that the magnitude and direction of these relationships

can differ across countries, regions, expenditure categories, and estimation periods. One explanation for these differences is that public expenditure should be evaluated not only in terms of its nominal amount but also in terms of its effectiveness and composition. Government spending becomes relevant to human development when it is successfully transformed into accessible and high-quality public services. Differences in fiscal capacity, institutional quality, geographical accessibility, and implementation capacity may therefore cause similar expenditure levels to generate different human development outcomes (Ivanovic et al., 2023)

The regional context is particularly important for Eastern Indonesia. The region is characterized by substantial geographical variation, differences in infrastructure and public-service accessibility, and disparities in socioeconomic conditions. Consequently, the effectiveness of government expenditure may vary considerably across provinces. The relationship between expenditure and HDI should therefore be examined using a framework capable of controlling for province-specific characteristics.

In addition, government expenditure may have effects that are not immediately observable within the same period. Health interventions may require time before producing measurable improvements in life expectancy and health outcomes, while education investment may require even longer periods before improvements in educational attainment become reflected in HDI. Therefore, a contemporaneous regression coefficient should be interpreted as the short-term or same-period statistical relationship rather than definitive evidence that expenditure has no long-term developmental effect (Ann et al., 2023).

METHODOLOGY

Research Design

This study employs a quantitative explanatory research design to examine the relationship between government spending on health, government spending on education, economic growth, poverty, and the Human Development Index (HDI) in Eastern Indonesia. The quantitative approach is appropriate because the study aims to estimate the magnitude and statistical significance of the relationships between the variables using panel econometric techniques (Pesaran, 2004).

The study uses panel data, which combine cross-sectional observations across provinces and time-series observations across years. The use of panel data allows the analysis to account for unobserved characteristics that differ across provinces while simultaneously capturing changes occurring over time. This approach provides greater variation in the data and allows province-specific heterogeneity to be incorporated into the estimation framework (Baltagi, 2005a)

The unit of analysis in this study is 10 provinces in Eastern Indonesia observed over the 2015–2024 period, resulting in a balanced panel of 100 observations. The unit of analysis consists of 10 provinces in Eastern Indonesia observed annually from 2015 to 2024. The dataset therefore forms a balanced panel consisting of 100 province-year observations. The 2015–2024 period was selected to provide a sufficiently broad medium-term observation period and to

capture changes in regional fiscal conditions and human development before, during, and after the COVID-19 pandemic.

Data Sources

This study uses secondary data obtained from official Indonesian government sources. Data on the Human Development Index, economic growth, and poverty were obtained from the Central Statistics Agency (Badan Pusat Statistik/BPS). Data on actual regional government expenditure on health and education were obtained from the Directorate General of Fiscal Balance (Direktorat Jenderal Perimbangan Keuangan/DJPK), Ministry of Finance of the Republic of Indonesia. The use of official government data ensures that the variables are measured using standardized statistical and fiscal definitions. All observations were organized into a province-year panel dataset covering the 10 provinces and 10 years of observation.

Research Variables and Operational Definitions

The study consists of one dependent variable and four independent variables. The selection of the explanatory variables is based on the theoretical framework and empirical literature discussed in the previous section.

The Human Development Index (HDI) is used as the dependent variable because it represents a multidimensional measure of human development covering health, education, and a decent standard of living. Government spending on health and education is included because these expenditures represent public investment in human capital. Economic growth is included as an indicator of regional economic performance and the potential expansion of income and economic opportunities. Poverty is included because socioeconomic deprivation may directly constrain households' access to education, health services, and adequate living standards.

Table 1. Operational Definitions of Variables

Variable	Symbol	Measurement
Human Development Index	HDI	Human Development Index (HDI) (%)
Government Spending on Health Care	LnKes	Natural logarithm of health spending
Government Spending on Education	LnPend	Natural logarithm of education spending
Economic Growth	PE	GRDP growth rate (%)
Poverty	KMS	Percentage of the population living in poverty (%)

A natural logarithmic transformation is applied to health and education expenditure. The transformation is used because government expenditure data generally have substantial differences in scale across provinces and may exhibit skewed distributions. Log transformation also reduces the influence of extreme observations and allows the estimated relationship between expenditure and HDI to be interpreted in a more stable functional form (Becker, 1975).

3.4 Analysis Model

The relationship between the dependent variable and the independent variables was analyzed using a panel data regression model formulated as follows (Baltagi, 2005).

$$IPM_{it} = \beta_0 + \beta_1 LnKes_{it} + \beta_2 LnPend_{it} + \beta_3 PE_{it} + \beta_4 KMS_{it} + \varepsilon_{it} \quad (1)$$

dengan:

- IPM_{it} : The Human Development Index for the i-th province in the t-th year;
- $LnKes_{it}$: The natural logarithm of government spending on health care;
- $LnPend_{it}$: The natural logarithm of government spending on education;
- PE_{it} : Economic growth;
- KMS_{it} : Poverty rate;
- β_0 : Intercept;
- $\beta_1, \beta_2, \beta_3, \beta_4$: Regression coefficient;
- ε_{it} : Faulty component.

The panel regression model was chosen because it can accommodate heterogeneous characteristics across provinces that cannot be observed directly (time-invariant heterogeneity) while also accounting for variations in the data across observation periods (Astuti et al., 2025).

3.5 Panel Model Selection

Parameter estimation was performed using three approaches, namely:

- Common Effect Model (CEM)

  The Common Effect Model assumes that all cross-sectional units share the same intercept and slope coefficients (Baltagi, 2005a).

  $$Y_{it} = \beta_0 + \beta_1 X_{1it+} \beta_2 X_{2it} + \varepsilon_{it} \quad (2)$$

- Fixed Effect Model (FEM)

  The Fixed Effect Model allows each cross-sectional unit to have a different intercept while the slope coefficients remain constant (Baltagi, 2005a).

  $$Y_{it} = \beta_0 + \alpha_i + \beta_1 X_{1it+} \beta_2 X_{2it} + \varepsilon_{it} \quad (3)$$

  α_i = Individual-specific intercept capturing unobserved heterogeneity.

- Random Effect Model (REM).

  The Random Effect Model assumes that individual-specific effects are random variables (Baltagi, 2005a).

  $$Y_{it} = \beta_0 + \beta_1 X_{1it+} \beta_2 X_{2it} + \mu_i + \varepsilon_{it} \quad (4)$$

  where:

  μ_i = Random individual effect;

ε_{it} = Diosyncratic error term.

The composite error term is expressed as:

$$\mu_{it} = \mu_i + \varepsilon_{it}$$

Thus

$$Y_{it} = \beta_0 + \beta_1 X_{1it+} \beta_2 X_{2it} + \mu_{it}$$

The best model is selected through the following steps.

a. Chow Test

The Chow Test is used to determine whether the Fixed Effects Model provides a better model fit than the Common Effects Model (Baltagi, 2005b).

The hypotheses being tested are:

H_0: "Common Effects Model"

H_1: "Fixed Effects Model"

If the p-value is less than 0.05, then the Fixed Effects Model is selected.

b. Lagrange Multiplier Test

The Lagrange Multiplier (LM) Test is used to compare the Common Effects Model with the Random Effects Model (White H, 1980) .

The hypotheses being tested are:

H_0: "Common Effects Model"

H_1: "Random Effects Model"

If the p-value is less than 0.05, then the Random Effects Model is more appropriate than the Common Effects Model.

c. Hausman Test

The Hausman test is used to select the best model between the Fixed Effects Model and the Random Effects Model (Greene W, 2020)

The research hypotheses are:

H_0: REM is "consistent"

H_1: FEM is "more accurate"

If the p-value is less than 0.05, then the Fixed Effects Model is selected as the final estimation model. Based on the results of these three tests, this study uses the Fixed Effects Model (FEM) as the best model.

3.6 Diagnostic Testing

Before interpreting the parameters, the model is evaluated through a series of diagnostic tests (Anderson et al., 2014) .

Multicollinearity Test

Multicollinearity is tested using the Variance Inflation Factor (VIF).

The model is considered free of multicollinearity if VIF < 10(Cameron A & Trivedi P, 2005).

Heteroscedasticity Test
Heteroscedasticity was tested using the Breusch–Pagan test.
Hypotheses

$$H_0: \sigma_i^2 = \sigma^2$$
$$H_1: \sigma_i^2 \neq \sigma^2$$

Autocorelation Test
Autocorrelation was tested using the Breusch–Godfrey/Wooldridge test. The purpose of this test is to determine whether the residuals are correlated across observation periods (Wooldridge J, 2010).

Cross-Sectional Dependence Test
Cross-sectional dependence among provinces was tested using the Pesaran Cross-Sectional Dependence (CD) Test.
This test is important because regional panel data often exhibit spatial and economic interdependencies among regions, meaning that the assumption of residual independence is no longer met (Pesaran, 2004).

3.7 Robust Estimation

The results of diagnostic tests indicate the presence of heteroscedasticity, autocorrelation, and cross-sectional dependence. These conditions cause the covariance of the conventional estimator in the Fixed Effects Model to no longer yield consistent standard errors, potentially leading to biased parameter significance tests. To address this issue, this study uses Driscoll–Kraay Robust Standard Errors as the covariance estimator. This estimator is capable of producing consistent standard errors even when the residuals exhibit heteroscedasticity, temporal autocorrelation, and cross-sectional dependence. Therefore, all hypothesis tests in this study are based on the estimation results of the Fixed Effects Model using Driscoll–Kraay Robust Standard Errors (Baltagi, 2005a).

3.8 Software

The entire analysis process was conducted using R software, version 4.5.1, via the plm, lmtest, sandwich, car, and psych packages. The use of open-source software supports the transparency of the analysis, the reproducibility of the research results, and the implementation of state-of-the-art panel econometric methods (Nyasha & Odhiambo, 2019).

RESEARCH RESULT

1. Descriptive Statistics

Descriptive statistical analysis was conducted to provide an overview of the characteristics of each research variable prior to performing panel data regression estimates. The variables analyzed include the Human Development Index (HDI), government spending on health, government spending on education, economic growth, and poverty rates in 10 provinces in Eastern Indonesia during the 2015–2024 period.

Table 2. Descriptive Statistics of the Research Variables

Variabel	Mean	SD	Min	Max
Human Development Index (HDI)	68,44	3,82	57,25	75,03
Health Ln	26,48	0,62	25,05	27,81
Education Ln	27,38	0,80	25,63	29,05
Economic Growth	6,20	5,02	-15,74	22,94
Poverty	8,69	3,56	2,78	17,79

Source: Data processed using R Studio (2026).

Based on Table 2, the average provincial HDI value in Eastern Indonesia during the study period was 68.44 with a standard deviation of 3,82, indicating variation in human development levels across provinces. The lowest HDI value recorded was 57,25, while the highest reached 75,03. Government spending on health had a logarithmic mean of 26,48, while spending on education had a mean of 27.=,38. The economic growth variable showed considerable variation, with a minimum value of −15,74% and a maximum of 22,94%, reflecting economic contraction during some observation periods. The poverty rate had a mean of 8.69%, with values ranging from 2,78% to 1779%.

2. Correlation Analysis

Before performing the regression analysis, a Pearson correlation analysis was conducted to identify linear relationships among the independent variables.

Table 3. Correlation Matrix of Independent Variables

Table 3. Correlation Matrix of Independent Variables

Variabel	Ln Kes	Ln Pend	PE	Kemiskinan
Ln Kes	1,000	0,638	0,036	-0,365
Ln Pend	0,638	1,000	-0,103	-0,321
PE	0,036	-0,103	1,000	0,028
Poverty	-0,365	-0,321	0,028	1,000

Source: Data processed using R Studio (2026).

The correlation coefficients between the independent variables range from −0,365 to 0,638, indicating that the relationships are not very strong. In general, correlation coefficients below 0.80 indicate that the potential for multicollinearity is relatively low.

3. Panel Data Regression Model Selection

Model selection was performed using the Chow Test, the Lagrange Multiplier Test, and the Hausman Test.

Table 4. Results of the Panel Model Selection

Test	Statistic	p-value	Decision
Chow Test	F = 18,286	<0,001	Fixed Effect

LM Test	χ^2 = 115,010	<0,001	Random Effect lebih baik daripada Common Effect
Hausman Test	χ^2 = 34,426	<0,001	Fixed Effect

Source: Data processed using R Studio (2026).

The results of the Chow Test show an F-value of 18,286 with a p-value < 0.001, indicating that the Fixed Effects model is more appropriate than the Common Effects model. Furthermore, the LM Test indicates that the Random Effects model is better than the Common Effects model. However, the Hausman Test yields a χ^2 value of 34,426 with a p-value < 0,001, so the null hypothesis is rejected, and the Fixed Effects Model (FEM) is selected as the final estimation model.

4. Diagnosctic Test

Before interpreting the regression coefficients, the model was evaluated using several diagnostic tests.

Table 5. Diagnostic Test Results

Testing	Results	Conclusion
VIF	1,03–1,81	There is no multicollinearity
Breusch–Pagan	p <0,001	There is heteroscedasticity
Breusch–Godfrey	p <0,001	There is autocorrelation
Pesaran CD	p <0,001	Cross-sectional dependence occurs

Source: Data processed using R Studio (2026).

The VIF values for all variables are below 10, indicating that the model is free from multicollinearity. Conversely, the Breusch–Pagan, Breusch–Godfrey, and Pesaran CD tests indicate the presence of heteroscedasticity, autocorrelation, and interprovincial dependence. Therefore, parameter estimation was performed using Driscoll–Kraay Robust Standard Errors to ensure consistent statistical inference.

5. Estimation Results of the Fixed-Effects Model with Driscoll–Kraay Robust Standard Errors

Table 6. Panel Data Regression Estimation Results

Variable	Coefficient	Robust SE	t-statistics	p-value
Health Care	0,773	0,509	1,518	0,133
Education Spending	-1,185	0,362	-3,272	0,002**
Economic Growth	0,001	0,049	0,030	0,976
Poverty	-1,058	0,193	-5,468	<0,001***

Description: **p < 0,01; *p < 0,001.

Based on the estimation results, government spending on health has a coefficient of 0,773, but it is not statistically significant (p = 0,133). This indicates that an increase in health spending has not led to a significant change in the HDI during the observation period. The variable for government spending on education has a coefficient of −1,185 and is significant at the 5% level (p = 0,002). This finding indicates a significant relationship between education spending and the HDI. The negative sign of the coefficient suggests that an increase in education spending during the same period is not always followed by an increase in the HDI. These results may reflect a time lag in the benefits of education spending, variations in the effectiveness of budget management, or differences in the quality of policy implementation across provinces. The economic growth variable did not have a significant effect on the HDI (p = 0,976), indicating that changes in the economic growth rate during the study period were not directly related to changes in the HDI. In contrast, the poverty rate had a significant negative effect on the HDI (β = −1,058; p < 0,001). These results indicate that an increase in the percentage of the poor population tends to lower the quality of human development in Eastern Indonesia.

DISCUSSION

The Impact of Government Health Expenditure on the Human Development Index

The estimation results show that government health expenditure has a positive but statistically insignificant effect on the Human Development Index (HDI). This suggests that increased health spending during 2015–2024 was not immediately translated into measurable improvements in human development in Eastern Indonesia. However, the finding does not imply that health expenditure is ineffective, as its impact may depend on the quality, composition, accessibility, and efficiency of spending.

Health expenditure affects HDI through mechanisms such as health infrastructure, health worker availability, preventive programs, maternal and child health services, and life expectancy, which may require time to generate measurable outcomes. In Eastern Indonesia, geographical fragmentation, limited infrastructure, and unequal access to health services may further delay the conversion of fiscal resources into health outcomes. Thus, contemporaneous estimates may not fully capture the longer-term effects of health investment.

The finding differs from the international evidence reported by Miranda-Lescano, Muinelo-Gallo, and Roca-Sagalés (2023), who examined 57 developed and developing countries over 2000–2018 and found that central and subnational government health expenditure had a positive effect on HDI and its major components. The difference may be explained by the substantially different analytical contexts. Their cross-country sample captures variation in institutional capacity and public-service systems across countries, whereas the present study focuses specifically on provinces in Eastern Indonesia, where geographical accessibility and fiscal implementation capacity are more heterogeneous. Thus,

the positive but insignificant coefficient obtained in this study may reflect a situation in which additional fiscal resources are necessary but not sufficient to generate immediate improvements in human development.

This interpretation is also consistent with the broader argument that the effectiveness of public expenditure should not be assessed solely from its nominal size. Similar levels of government spending can generate different outcomes when implementation capacity, service quality, infrastructure availability, and targeting differ across regions. Therefore, the insignificant effect of health expenditure in this study should be interpreted as evidence of a possible gap between fiscal allocation and the effective delivery of health services rather than as evidence that health investment has no developmental value.

The Impact of Government Education Expenditure on the Human Development Index

Government education expenditure has a coefficient of −1.185 and is statistically significant ($p = 0.002$). This indicates that, after controlling for health expenditure, economic growth, poverty, and province-specific effects, higher education expenditure was associated with lower HDI during the observation period. Although this finding contrasts with Human Capital Theory, it should not be interpreted as evidence that education spending reduces human development. Rather, the result may indicate that increased expenditure was not immediately translated into improvements in HDI.

Several mechanisms may explain this finding. First, education spending may involve a time lag, as expenditures on infrastructure, teacher remuneration, administration, and institutional strengthening may require several years to generate measurable improvements in educational attainment. Second, the composition and efficiency of expenditure may matter more than its nominal size. Large budgets may be allocated to routine or indirect expenditures whose effects on HDI are limited or delayed. Third, the effectiveness of education spending may vary across provinces due to differences in infrastructure, teacher distribution, geographical accessibility, implementation capacity, and socioeconomic conditions. These constraints may reduce the ability of local governments in Eastern Indonesia to convert additional fiscal resources into immediate improvements in educational outcomes.

The finding is therefore not necessarily inconsistent with the broader literature. Education expenditure had a more direct relationship with the educational dimension of human development rather than with HDI as a whole (Miranda-Lescano et al., 2023). Similarly, demonstrated that the relationship between education expenditure and human development varies across developing-country contexts (Ivanovic et al., 2023). These findings suggest that the effect of education expenditure depends on the specific outcome being measured, the institutional and socioeconomic environment, and the mechanism through which expenditure is translated into human capital outcomes.

The Impact of Poverty on the Human Development Index

In contrast to health expenditure and economic growth, poverty has a strong and statistically significant negative effect on HDI, with a coefficient of

−1.058 ($p < 0.001$). This result indicates that an increase in the proportion of the population living in poverty is associated with a substantial decline in human development in Eastern Indonesia. Among the explanatory variables examined in this study, poverty therefore represents one of the most consistent socioeconomic constraints on human development.

The negative relationship can be explained through the cumulative disadvantages experienced by poor households. Limited income reduces the ability of households to finance education, obtain adequate nutrition, access health services, and maintain living conditions that support productive participation in the economy. These disadvantages can accumulate across generations, reducing educational attainment, weakening health outcomes, and ultimately limiting the improvement of HDI. Poverty should therefore be understood not merely as an income problem but as a multidimensional constraint on people's capabilities.

The finding is consistent with international evidence showing that the relationship between economic conditions and multidimensional human well-being is complex. Research covering 91 low- and middle-income countries demonstrates that economic growth can reduce multidimensional poverty, but the magnitude of the effect varies across countries and depends on initial poverty conditions. This supports the argument that reducing deprivation requires more than increasing aggregate economic output; policies must ensure that economic opportunities and public services reach disadvantaged populations.

Synthesis of Findings and Contribution of the Study

Taken together, the findings indicate that human development in Eastern Indonesia depends not only on government expenditure and economic growth but also on the effectiveness of policy implementation and local conditions. Health expenditure and economic growth have positive but insignificant effects on HDI, education expenditure has a negative effect, while poverty has a strong negative effect.

International evidence similarly suggests that the effects of public expenditure and economic growth vary across institutional and socioeconomic contexts. Thus, differences between international findings and the present results are not necessarily contradictory but reflect the context-dependent nature of human development policies.

In Eastern Indonesia, geographical barriers, uneven infrastructure, limited local government capacity, unequal access to public services, and persistent poverty may weaken the conversion of fiscal resources into human development outcomes. Therefore, policy should focus not merely on increasing budgets but on improving expenditure quality, service delivery, accessibility, and poverty reduction. Stronger alignment between fiscal resources and provincial socioeconomic conditions is essential to ensure that public spending generates tangible improvements in human capabilities and well-being.

Policy Implications

The empirical findings provide several policy implications for human development in Eastern Indonesia. First, the insignificant effect of health expenditure suggests that increasing budgets alone may not be sufficient to improve HDI. Policy should therefore prioritize expenditure effectiveness, preventive and essential health services, equitable distribution of facilities and health workers, and performance-based budgeting linked to measurable outcomes.

Second, the negative association between education expenditure and HDI should not be interpreted as a reason to reduce education spending. Instead, it highlights the need to improve the quality, composition, targeting, and implementation of educational expenditure. Governments should ensure that additional funding translates into better access, infrastructure, teacher distribution, learning quality, and educational attainment, while evaluating outcomes over the medium and long term.

Third, the insignificant effect of economic growth indicates that economic expansion does not automatically improve human development. Regional development policies should therefore promote inclusive growth that expands employment, household income, and access to basic services, while integrating economic policies with education, health, and social protection.

Fourth, the significant negative relationship between poverty and HDI highlights poverty reduction as a central policy priority. Poverty alleviation should be integrated with improvements in education, healthcare, nutrition, employment, and basic infrastructure, with targeted social protection focused on vulnerable populations and regions experiencing persistent deprivation.

Research Limitations

Despite its methodological and empirical contributions, this study has several limitations. First, the analysis covers only ten provinces in Eastern Indonesia during 2015–2024, resulting in 100 province-year observations. The relatively small number of cross-sectional units may limit the generalizability of the findings to other regions or countries.

Second, the model focuses on health and education expenditure, economic growth, and poverty, while excluding other factors that may influence HDI, such as income inequality, unemployment, fiscal capacity, governance, demographic characteristics, and public service quality. Therefore, the findings should be interpreted within the scope of the variables included.

Third, health and education expenditure are measured by spending levels rather than expenditure quality, composition, or efficiency. Thus, the model cannot distinguish between productive and routine expenditures, which is particularly relevant when interpreting the negative effect of education expenditure.

Finally, the model primarily captures contemporaneous relationships and may not fully reflect the long-term effects of human capital investment. Future research could incorporate lagged variables or dynamic panel models to better capture these effects.

Future Research Directions

Future research could extend this study in several directions. First, additional determinants such as income inequality, unemployment, fiscal capacity, governance, institutional quality, demographic characteristics, and public-service quality could be incorporated to provide a more comprehensive explanation of provincial differences in HDI.

Second, lagged variables and dynamic panel models could be employed to capture the delayed effects of health and education expenditure on human development, particularly in explaining the negative contemporaneous effect of education spending.

Third, future studies could disaggregate government expenditure by composition and function, such as personnel, infrastructure, operational, and direct service-delivery spending, to identify which types of expenditure are most effective in improving HDI.

Fourth, spatial panel models could be used to examine regional spillover effects and interdependence across neighboring provinces, particularly given the cross-sectional dependence identified in this study. Finally, comparative studies between Eastern and Western Indonesia or across different development levels could determine whether the observed relationships are region-specific or reflect broader patterns of human development in Indonesia.

CONCLUSIONS

This study examined the effects of government health expenditure, education expenditure, economic growth, and poverty on the Human Development Index (HDI) in ten provinces of Eastern Indonesia during 2015–2024. The Fixed Effects Model with Driscoll–Kraay Robust Standard Errors was selected after accounting for heteroscedasticity, autocorrelation, and cross-sectional dependence.

The results show that health expenditure and economic growth have positive but statistically insignificant effects on HDI, indicating that increased fiscal resources and economic expansion do not automatically translate into improved human development. Education expenditure has a statistically significant negative effect on HDI, which may reflect time lags, expenditure composition, implementation effectiveness, and regional disparities rather than a detrimental effect of education investment itself. Meanwhile, poverty has a significant negative effect on HDI, confirming that socioeconomic deprivation remains an important constraint on human development in Eastern Indonesia.

Overall, the findings demonstrate that human development in Eastern Indonesia is context-dependent and cannot be improved solely through higher government expenditure or economic growth. Policy effectiveness depends on the extent to which fiscal resources are transformed into accessible and equitable public services, while poverty reduction remains essential for improving human development. The study therefore highlights the importance of outcome-oriented public expenditure, effective human capital investment, inclusive economic development, and integrated poverty reduction policies in accelerating HDI improvement in Eastern Indonesia.

RECOMMENDATIONS

Based on the research findings, the following recommendations can be made:

1. Public spending should adopt a performance-based approach focused on measurable outcomes and impacts, ensuring that health and education budgets contribute effectively to human development.
2. Health expenditure should prioritize access and quality of basic health services, equitable distribution of health workers, strengthening facilities in remote areas, and promotive and preventive programs.
3. Education expenditure should focus on improving service quality, teacher competencies, equitable access, and learning quality to support sustainable improvements in human capital.
4. Human development policies should be integrated with poverty reduction through strengthened social protection, community economic empowerment, and employment creation, given the significant negative relationship between poverty and HDI.
5. Future research should consider broader geographic coverage, such as all provinces in Indonesia, and incorporate additional variables including unemployment, income inequality, governance quality, fiscal capacity, and expenditure effectiveness.
6. Methodologically, future studies could employ advanced panel approaches, such as Dynamic Panel Models (GMM), Spatial Panel Regression, or Panel Quantile Regression, to capture dynamic relationships, spatial spillovers, and heterogeneous effects across different levels of human development.

ADVANCED RESEARCH

This study examines the effects of government health and education expenditure, economic growth, and poverty on the Human Development Index (HDI) in ten provinces of Eastern Indonesia during 2015–2024. Using a Fixed Effects Model with Driscoll–Kraay Robust Standard Errors, the study accounts for heteroscedasticity, autocorrelation, and cross-sectional dependence.

The findings show that health expenditure and economic growth have positive but statistically insignificant effects on HDI, while education expenditure has a significant negative effect. Poverty has a significant negative effect, indicating that higher public spending does not automatically translate into improved human development. The effectiveness of fiscal resources depends on expenditure quality, implementation, service accessibility, and the time required for investments to generate outcomes.

These findings suggest that human development policy in Eastern Indonesia should shift from increasing budget allocations toward improving expenditure effectiveness, service quality and accessibility, inclusive economic growth, and poverty reduction. Future research could incorporate additional determinants, dynamic and lagged effects, nonlinear relationships, and spatial spillovers using advanced panel approaches.

Overall, improving HDI requires not merely greater public expenditure, but more effective conversion of fiscal resources into accessible, equitable, and high-

quality public services. This underscores the importance of context-sensitive fiscal and human development policies in addressing persistent regional disparities.

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