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ORIGINAL ARTICLE

The Effect of Special Autonomy Fund Allocation for Education and Health on Human Development in Aceh Province, Indonesia

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Abstract

Aceh is one of the three provinces in Indonesia that receive special autonomy funds, which function as a stimulant to accelerate development. This study aims to analyze the effect of these funds in education and health on human development in Aceh Province. It uses secondary data obtained from Bappeda Aceh Province and the Statistics of Aceh Province. The type of data used is panel data, with the cross-section consisting of 23 districts/cities in Aceh Province and the time series spanning from 2011 to 2022. Panel data regression and Moderated Regression Analysis (MRA) methods were employed to analyze the data and achieve the research objectives. The findings of this study indicate that special autonomy funds for education have a significant positive effect on the Human Development Index (HDI), while special autonomy funds for health have a significant negative effect on HDI in Aceh Province. Additionally, economic growth does not moderate the effect of special autonomy funds in education and health on HDI in Aceh Province. It is recommended that the Aceh Provincial Government implement more intensive policies, such as monitoring and evaluating the progress of education and health programs, and involving community participation in these programs to achieve optimal targets.

Introduction

Aceh is a special province located in the westernmost region of Indonesia. Aceh Province had previously experienced two historical events, namely conflict and the natural disaster of the tsunami, which succeeded in changing the regional development order [1]. Both conditions had an impact on the destruction of basic infrastructure in almost all areas of Aceh Province, as well as a decrease in socio-economic conditions such as security, education levels, health levels, income, and mortality rates [2–4]. Therefore, rehabilitation and reconstruction in all aspects, such as infrastructure development of public facilities, socio-economic strengthening of the community, and human development, are trying to be improved by the government [5–7]. These things can be achieved with the support of the central government, which made Aceh one of the provinces that received special autonomy funds to accelerate the development process [8,9].

Special autonomy funds are allocated to finance regional development, one of which is to improve the quality of education and public health. Based on data obtained from the Aceh Regional Planning and Development Agency (Bappeda), special autonomy funds distributed by the central government from 2008 to 2022 tended to continue to increase, as did special autonomy funds in the health and education sectors. In 2008, Aceh's special autonomy funds amounted to 3,590.14 billion, increasing by more than 100 percent to 7,560 billion in 2022. According to Aceh's Qanun No. 5/2008 on the organization of education, mandatory education in Aceh's special autonomy fund is at least 20 percent, and according to Aceh's Qanun No.

4/2010 on Health, mandatory health in Aceh's special autonomy fund is at least 10 percent of the total special autonomy fund disbursed.

One indicator that can be used to see the implications of special autonomy funds on economic development in Aceh Province is the human development index (HDI) [10,11]. The HDI explains how the population can access the results of development in obtaining income, health, and education [12,13]. Based on HDI data published by the Statistics of Aceh Province, during 2010-2022, the HDI of Aceh Province showed an increase from year to year, starting from 67.09 in 2010 to 72.8 in 2022. However, the increase in HDI in Aceh Province is still below the national average, whereas Indonesia showed an increase in HDI of 6.38 points from 2010 to 2022. In addition, the HDI value of Aceh Province is almost always below the value of Indonesia's HDI. This indicates a problem, as Aceh Province receives a transfer that not all provinces receive, with a value of 2 percent of the total national DAU, so interventions to increase the HDI value in the province are easier to carry out.

The relationship between special autonomy funds and HDI is theoretically significant. Fiscal decentralization, including special autonomy funds, is essential in national development [14]. Special autonomy funds can be essential to improve human development conditions in special autonomous regions. The HDI is an index that measures education, health, and the economy and is used as an indicator to assess human development [15,16]. Special autonomy funds the central government provides to the regions will improve people's welfare [17]. The existence of special autonomy funds, especially in the education and health sectors, will improve the quality of education and improve health service facilities. Special autonomy funds will be an additional fund for special autonomous regions to develop the quality of life of their population. The level of HDI can be used to assess the effectiveness of special autonomy funds [12,18]. Thus, improving the quality of education and health supported by special autonomy funds will improve the quality of HDI [19]. In addition, economic growth plays a vital role in moderating the effect of special autonomy funds on HDI. Regions with high economic growth tend to be able to allocate and manage special autonomy funds more efficiently, thus increasing HDI [20]. On the other hand, high economic growth regions allow people to access better education and health services, even without the direct use of special autonomy funds [21]. Therefore, the impact of special autonomy funds on improving HDI may be more effective in regions with low or moderate economic growth [22].

Research on the relationship between Aceh Province's special autonomy funds and HDI has been conducted previously by Isnadi & Fikriah [23] and Abrar et al. [24]. They found that Aceh's special autonomy funds did not affect HDI growth. In addition, Darmawan [25] found that Aceh Province is very dependent on special autonomy funds, and the existence of these funds has a positive and significant impact on increasing HDI in Aceh Province. However, this research will be conducted from a different perspective and has never been conducted in Aceh Province with the latest research year, namely looking at the relationship between special autonomy funds in education and health with HDI in Aceh Province. This type of research was conducted by Tamberan et al. [26], Fadilah et al. [27], and Maharda & Aulia [28], and the results showed that special autonomy funds in the fields of education and health have a significant positive effect on HDI. This is in contrast to what was found by Widodo et al. [29], where education expenditure is not significant to HDI. Study by Razmi et al. [30], Miranda-Lescano et al. [31], and Ndaguba & Hlotywa [32] found that health expenditure significantly positively affects HDI.

It is expected that using variables that focus on increasing HDI components can answer questions about HDI in Aceh Province from a different perspective. Aceh Province is privileged with special autonomy funds from the central government, thus accelerating the development process, especially in education and health. However, the high autonomy of special allocation funds for education and health has yet to raise Aceh's HDI above the national average. This study aims to investigate this phenomenon. Therefore, this study aims to investigate the effect

of special autonomy funds for education and health on HDI in Aceh Province. In addition, this study will also use economic growth as a moderating variable that can show the economic conditions of the people in each district/city in Aceh Province.

Materials and Methods

A quantitative approach was applied in this study to analyze the effect of allocation and special autonomy funds for education and health on HDI in Aceh Province (Model I). In addition, this study also examines whether economic growth moderates the effect of special autonomy funds for education and health on HDI (Model II). The type of data used in this study is panel data, which is a combination of time series and cross-section. The time series data used is data from 2011 to 2022, and the cross-section consists of 23 districts/cities in Aceh province. The data was obtained from the Aceh Regional Planning and Development Agency (Bappeda Aceh) and the Statistics of Aceh Province (SAP). The determination of the research year adjusts to the determination of HDI values using the new method and the determination of economic growth using the 2010 series.

Table 1. Operational definition of variables.

Status	Variable	Symbol	Definition	Unit	Source
Dependent	Human Development Index	HDI	HDI is calculated from the geometric mean of the health, education, and expenditure indices.	Point	SAP
Independent	Education special autonomy fund	EDU	Special autonomy funds for education according to the Aceh Government Budget Team's agreement on the mandatory ceiling for education.	Billion IDR	Bappeda Aceh
	Health special autonomy fund	HLT	Special autonomy funds in the health sector are measured from the composition of mandatory health to total regional revenue.	Percent	Bappeda Aceh
Moderation	Economic growth	EG	Economic growth is calculated based on GRDP growth at constant prices.	Percent	SAP

The research method used in this study is the panel data regression method and Moderated Regression Analysis (MRA). MRA is a data analysis method that assesses whether the relationship between the independent and dependent variables is affected by a third moderator variable [33,34]. Moderation regression analysis differs from other methods because it cannot meaningfully examine main and interaction effects. Moderation regression analysis offers several advantages in research. It makes it possible to examine how the relationship between the independent and dependent variables may vary based on the moderator variable [35]. Overall, moderation regression analysis provides a comprehensive approach to understanding how variables interact and influence outcomes by including main effects, interaction effects, and potential curvilinear relationships. Moderation regression analysis is a powerful tool for increasing the depth and accuracy of statistical analysis.

The transformed model equation in this study, based on the study of the basic equation of the panel data regression model, is as follows.

$$\text{Model I}: HDI_{it} = \beta_0 + \beta_1 EDU_{it} + \beta_2 HLT_{it} + \varepsilon_{it} \quad (1)$$

Furthermore, this study tests whether economic growth moderates the effect of special autonomy funds for education and health on HDI. Thus, the form of the regression equation with moderating variables is as follows.

$$\text{Model II}: HDI_{it} = \beta_0 + \beta_1 EDU_{it} + \beta_2 HLT_{it} + \beta_3 EDU * EG_{it} + \beta_4 HLT * EG_{it} + \varepsilon_{it} \quad (2)$$

Where HDI is human development, EDU refers to special autonomy funds in education, HLT indicates special autonomy funds in health, and EG is economic growth. β_0 is a constant, β_1 - β_4 are regression coefficients, and ε is the *error term*. i denotes the i-th subject, and t denotes the t-th year.

To estimate data with the panel regression method, several steps must be taken before the regression results are analyzed as research results. First, testing three-panel data models such as the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). Furthermore, one of the three best models must be selected to serve as the basis for analyzing the results. To determine the best panel model, the Chow test, Hausman test, and Lagrange Multiplier (LM) test need to be conducted. The Chow test was conducted to choose between CEM and FEM. The Hausman test was tested to determine the best model between FEM and REM. LM test is estimated to choose between CEM and REM. In addition, to test the robustness of the model, this study tests the classical assumption tests consisting of normality, heteroscedasticity, and multicollinearity tests [36]. A data normality test is conducted to see if the residuals are normally distributed [37,38]. A heteroscedasticity test is conducted to determine whether the variance is not constant or changing. A multicollinearity test is conducted to show whether there is a strong relationship between independent variables. If all classical assumption tests are met, the best unbiased linear estimator will be produced.

Results and Discussion

Descriptive Statistics

Descriptive statistics provide overall data information in mean, median, maximum, and minimum data, standard deviation, and number of research observations. Table 2 presents descriptive statistics of all variables in this study, namely HDI, special autonomy funds for education and health, and annual economic growth from 2011-2022 for 23 districts/cities. It is known that each variable has 276 observations. The average HDI in Aceh Province is 69.34 points. The average autonomy of funds for education is 23.69 billion IDR, and the composition of mandatory health to local revenue is 1.32 percent. Finally, the average economic growth was 3.73 percent. The largest data of each variable can be seen from the maximum value and the minimum value to see the smallest data. The standard deviation of each variable, which is smaller than the mean, indicates that the deviations in the data are small.

Table 2. Descriptive statistics.

Descriptive Statistics	**HDI** (Point)	**EDU** (Billion IDR)	**HLT** (Percent)	**EG** (Percent)
Mean	69.34	23.69	1.32	3.73
Median	68.92	22.44	1.14	4.10
Maximum	86.28	50.50	3.70	13.23
Minimum	59.34	9.84	0.48	-3.39
Std. Dev.	5.02	7.12	0.62	1.70
Obs	276	276	276	276

Results of Panel Regression Model Selection

To determine which of the three-panel data models is the best, the Chow test, Hausman test, and Lagrange Multiplier test must be conducted. The test results for determining the best model are presented in Table 3.

Chow test is conducted to determine the best model among CEM and FEM that will be used to estimate panel data. For Model I, the obtained prob value on the Cross-section Chi-square is smaller than alpha (α) (0.0000 < 0.05), then H_0 is rejected. This result indicates that FEM is better than CEM. The next test is the Hausman test. This test aims to select the most appropriate model between the fixed effect model and the random effect model that will be used to estimate panel data. The Hausman test results show that the prob value on the random cross-section is

smaller than alpha (α) (0.0040 < 0.05), which means that H_0 is rejected, so it is confirmed that the FEM is more appropriate to use than the random effect model. Thus, the best panel model result that can be selected for Model I is the FEM.

Table 3. Chow test, Hausman test, and Lagrange Multiplier test results (Models I and II).

Model	Test	Effects Test	Statistic	d.f.	Prob.
Model I	Chow Test	Cross-section F	173.81	(22,251)	0.0000
		Cross-section Chi-square	769.25	22	0.0000
	Hausman Test	Cross-section random	10.956	2	0.0040
Model II	Chow Test	Cross-section F	131.68	(22,249)	0.0000
		Cross-section Chi-square	700.05	22	0.0000
	Hausman Test	Cross-section random	8.1934	4	0.0850
	Lagrange Multiplier Test	Breusch-Pagan	1057.1		0.0000

For Model II, based on the Chow Test results, the FEM is better used to estimate panel data because the prob value of the Cross-section Chi-square obtained is smaller than alpha (α) (0.0000 < 0.05), then H_0 is rejected. This means that the FEM is better to use than the Common Effect Model. Meanwhile, the Hausman test results show that the REM is more appropriate to use than the FEM. The prob value on the random cross-section is greater than alpha (α) (0.0850 > 0.05). Likewise, the Lagrange Multiplier test results show that the prob value at random cross-section is smaller than alpha (α) (0.0000 < 0.05), which means that H_0 is rejected, so it is confirmed that the REM is more appropriate to use than the CEM. Therefore, it was determined that Model II should use the REM to estimate the research results.

Results of Panel Data Regression

Model I shows that the best panel regression model that can be chosen is the FEM. This model was estimated to partially and simultaneously see the effect of special autonomy funds in the education sector and special autonomy funds in the health sector on HDI in Aceh Province. Meanwhile, Model II shows that the best model to choose is the REM. Model II uses moderated regression analysis to test whether economic growth moderates the effect of special autonomy funds for education and health on HDI in Aceh Province. Moderated regression analysis is conducted to determine whether the moderating variable can strengthen or weaken the effect of the independent variable on the dependent variable. Table 4 provides the results of the panel data model estimation for Model I and Model II.

Based on Table 4 and Model I, it can be interpreted that special autonomy funds for education have a significant positive effect on the HDI in Aceh Province, with a coefficient of 1.11. Meanwhile, the health sector special autonomy fund variable has a negative and significant effect on HDI with a coefficient of -4.83. This result suggests that every increase in special autonomy funds for education by 1 billion will increase HDI by 1.11 points and vice versa. Furthermore, a 1 percent increase in health autonomy funds will decrease HDI by 4.83 points due to the negative effect.

In addition, Model II informs us that the probability value for the moderating variable EDU*EG is 0.1705 > 0.05. This result indicates that the interaction of special autonomy in education and economic growth does not influence the HDI. In addition, the moderating variable HLT*EG has a probability of 0.3811 > 0.05, which also means that the interaction of special autonomy funds in education and economic growth does not influence the HDI in Aceh Province.

Table 4. Panel data regression results of model I and II.

Model	Independent Variable	Coefficient	Std. Error	t-Statistic	Prob.
Model I	C	66.727***	1.2614	52.901	0.0000
	EDU	1.1197***	0.4090	2.7374	0.0060
	HLT	-4.8322***	0.1994	-24.231	0.0000
	R-squared	0.9623			
	Adjusted R-squared	0.9587			
	F-statistic	261.71***			
	Prob(F-statistic)	0.0000			
Model II	C	73.156***	0.9065	80.705	0,0000
	EDU	0.0274	0.0295	0.9267	0.3549
	HLT	-3.2493 ***	0.4760	-6.8264	0.0000
	EDU*EG	-0.0071	0.0520	-1.3742	0.1705
	HLT*EG	0.0937	0.1068	0.8773	0.3811
	R-squared	0.6276			
	Adjusted R-squared	0.6221			
	F-statistic	114.18***			
	Prob(F-statistic)	0.0000			

Note: *** indicates a 1% significance level.

The Prob (F-Statistics) value of Model I and Model II shows that at the one percent significance level, the independent variables simultaneously affect the dependent variable and can be proven statistically. It is clarified by the Adjusted R-Squares value of Model I of 0.9587, which shows that 96 percent of the HDI variable is influenced and can be explained by the two independent variables in this study, namely the special autonomy fund variable in the education sector and the special autonomy fund in the health sector, while the other 4 percent is influenced by other variables not included in the model. Meanwhile, Model II shows that the adjusted r-squared value is 0.6221, which means that HDI is explained by the special autonomy funds for education and health and their interaction with economic growth by 62.21 percent, while other variables outside this study explain the other 37.79 percent.

Classical Assumption Test Results

The results of the classical assumption test in this study for both Model I and Model II have been obtained. This study shows that there is no violation of the classical assumption test for Model I, which means that there are no problems with data that are not normally distributed, heteroscedasticity, autocorrelation, and multicollinearity. The normality test results explain that the residual value of the regression model is normally distributed. This is evidenced by the Jarque-Bera Probability value of 0.054, which is greater than alpha (α) (prob > 0.05). Basically, the EViews program does not accommodate heteroscedasticity testing on panel data, but by regressing the independent variables with absolute residuals (RESABS), this test can be performed. The heteroscedasticity test results in Model I show a probability value greater than alpha (α) (prob > 0.05), so it can be concluded that the model is free from heteroscedasticity symptoms.

Table 5. Heteroscedasticity test results.

Model	Variable	Coefficient	Std. Error	t-Statistic	Prob.
Model I	EDU	-0.0042	0.0031	-1.3628	0.1742
	HLT	0.0017	0.0015	1.1664	0.2446
Model II	EDU	-0.0289	0.0128	-2.2635	0.2440
	HLT	0.3465	0.2275	1.5228	0.1290
	EDU*EG	0.0018	0.0025	0.7145	0.4755
	HLT*EG	-0.0276	0.0520	-0.5305	0.5962

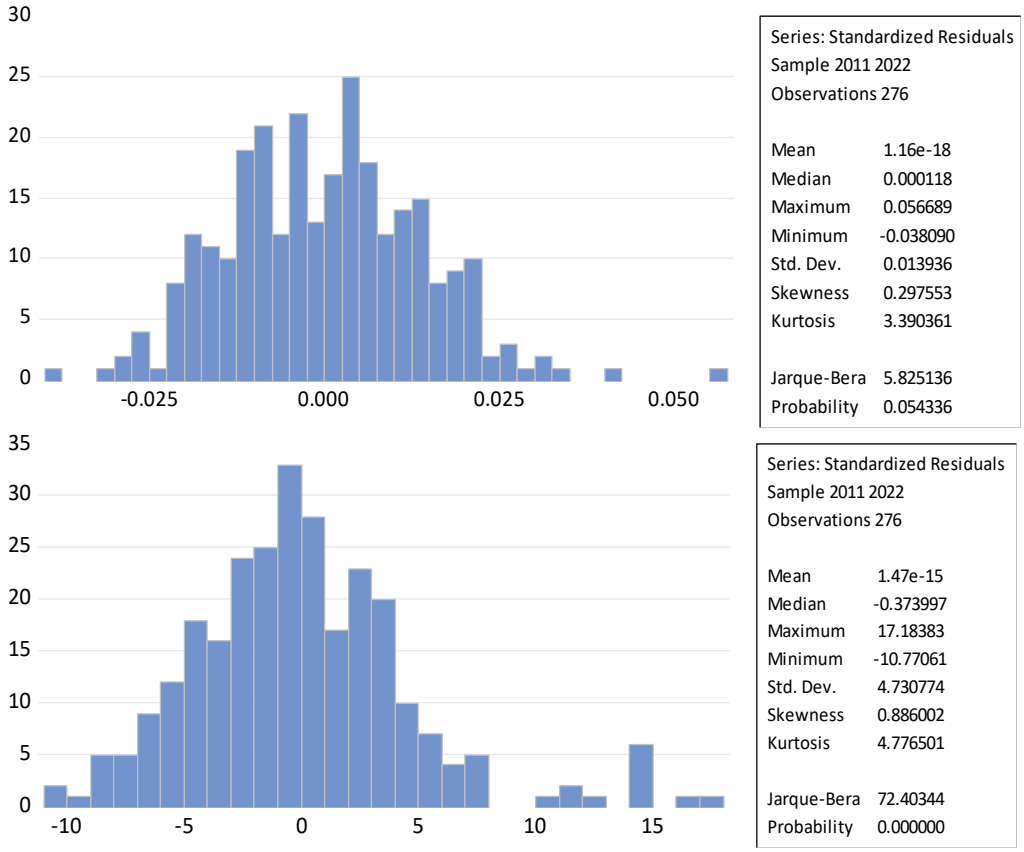

Figure 1. Model I and Model II normality test results.

Model II shows normality test results with non-normally distributed regression model residuals. This is evidenced by the Probability Jarque-Bera value, which is smaller than alpha (α) (prob < 0.05). However, because this study uses more than 100 data, it can be said that all data is normally distributed in accordance with the assumptions of the Central Limit Theorem. The theory states that if the number of observations is more than 100 data, the normality test does not need to be carried out Haque & Khan [39] and Kousar et al. [40]. Furthermore, the results of the heteroscedasticity test show a probability value greater than alpha (α) (prob > 0.05). So, it can be concluded that the model is free from heteroscedasticity symptoms.

Table 6. Multicollinearity test results.

	EDU	HLT	EDU*EG	HLT*EG
EDU	1			
HLT	0.3270	1		
EDU*EG	0.6670	0.3300	1	
HLT*EG	0.3270	0.8450	0.6690	1

Multicollinearity testing shows that the correlation value obtained is below the value of 0.900, namely 0.327, which means that the variables of special autonomy funds in the education sector and special autonomy funds in the health sector are free from multicollinearity problems. The correlation value obtained for multicollinearity is below the value of 0.900 for the other variables, which means that this research data is free from multicollinearity problems in the second regression model. Since there are no classical assumption deviations in either the data or the model, the analysis can be continued.

Discussion

Special autonomy funds for education have a positive and significant effect on HDI in Aceh Province. The special autonomy of funds for education allocated by the central government in

Aceh Province can improve the HDI of the people of Aceh, especially children in school. The special autonomy funds allocated to education are efficiently used to build educational infrastructure in Aceh, such as constructing new schools, repairing educational facilities, and procuring educational equipment. In addition, special autonomy funds for education can be used to train and improve the quality of teachers. Professional development programs can improve teachers' competence in teaching and directly impact the quality of education received by students. Special autonomy funds for education in Aceh are also often used to help students access education, such as providing scholarships for underprivileged children. Therefore, special autonomy funds for education can contribute positively to improving the quality of HDI.

The study's result, showing that the special autonomy fund for education has a positive effect on HDI, is in line with Fadilah et al. [27] and Haque & Khan [39], who conducted research in Saudi Arabia with the results of the study that spending on education made the largest contribution to increasing HDI. They are corroborated by Maharda & Aulia [28], who found that government spending on education can significantly increase HDI in Indonesia. Even research conducted by Tamberan et al. [26] also has research results that the special autonomy fund variable in the field of education has a significant positive effect on the HDI in Papua Province, in line with the empirical results found by Kousar et al. [40] in Pakistan.

Special autonomy funds in the health sector have a negative effect on HDI. This result contradicts the theory that special autonomy funds should positively affect HDI. This result can be obtained due to several reasons, such as failure to achieve the expected targets in the health sector in Aceh by using special autonomy funds for health. This could result in less than optimal quality of health services in Aceh, reducing access or quality of health services and potentially lowering HDI. Poor health can affect HDI indicators such as life expectancy and welfare. In addition, the mismatch between programs and community needs can also be a cause. For example, programs implemented using the health special autonomy fund may not match the health needs of the people of Aceh. For example, if the programs do not address Aceh's most pressing health issues, such as child nutrition in terms of stunting prevention, then the impact of health autonomy funds on public health could be limited. In addition, Aceh may also need a qualified health workforce or adequate health infrastructure to handle the significant autonomy of funds. If there are not enough medical personnel or adequate health facilities to effectively manage the special autonomy fund, the benefits of the allocation may be limited or may even lead to a decline in health services.

The result of this study, which shows a negative influence of the health special allocation fund on HDI, is in line with found by Fahmi [41], Mongan [42], Harsono et al. [43], and Saputra et al. [44]. The negative effect of health expenditure indicates that an increase in health function expenditure is not accompanied by an increase in health expenditure efficiency [33]. A large part of the health sector budget is used for the procurement of health facilities and infrastructure, such as the construction of hospitals and health centers [42]. The majority of the health sector budget is used for the procurement of health facilities, such as the construction of hospitals and health centers [42], and still relies on curative spending (healing) rather than preventive (prevention) [45].

In addition, using moderate regression analysis, it is known that the interaction of the special autonomy fund variable in education and economic growth does not affect HDI in Aceh Province. Economic growth is not able to moderate the effect of special autonomy funds in the field of education on HDI in Aceh Province. Likewise, the interaction of the special autonomy fund variable in the health sector and economic growth does not affect HDI in Aceh Province. This shows that economic growth is not able to moderate the effect of special autonomy funds in the health sector on the HDI in Aceh Province. Such results are possible because special autonomy funds are often allocated for specific, predetermined purposes, for example, to build new schools and improve health services or infrastructure that support the quality of life of

communities. Economic growth only affects the effectiveness or distribution of special allocation funds in Aceh unless overall economic management is excellent. General allocation funds are utilized for specific purposes, such as improving HDI. This is different from the main objective of economic growth, which is not to improve the quality of HDI. This leads to the inability of economic growth to moderate the effect of special autonomy funds on HDI. Thus, although economic growth is an essential component of development, it does not mean that economic growth automatically moderates or directly changes the effect of special autonomy funds on HDI.

Conclusions

This study aims to analyze the effect of special autonomy funds in education and health on the HDI in Aceh Province using economic growth as a moderating variable, using panel data from 2011 - 2022 covering 23 districts/cities. This study uses panel data regression models and Moderated Regression Analysis to estimate data and achieve research objectives. Based on the results of the study, it was found that: 1) Special autonomy funds in the education sector have a significant positive effect on the HDI in Aceh Province, while special autonomy funds in the health sector have a negative and significant effect on HDI; and 2) Economic growth is not able to moderate the effect of special autonomy funds in the education sector and special autonomy funds in the health sector on the HDI in Aceh Province.

Based on the results of this study, the following suggestions can be made: 1) The Aceh Provincial Government is advised to conduct more intensive policies, such as continuing to monitor and evaluate the progress of education and health programs, as well as involving community participation in programs in order to achieve optimal targets; 2) The programs that can be carried out by the Government of Aceh for education, such as improving educational infrastructure, the quality of teachers, providing scholarships and tuition assistance, especially for underprivileged children, developing character education, and increasing educational accessibility for children with special needs. In addition, to improve the quality of health, the Aceh government can build and strengthen basic health facilities such as health centers that the entire community can access, increase primary health care coverage in remote areas, campaign for a healthy lifestyle, and improve the competence of health workers; and 3) for researchers who want to research in the same field, in order to add other variables and use a larger sample size, so as to produce better, more in-depth research and get a solution to the problem of unemployment and income inequality.

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