
THE EFFECT OF GOVERNMENT SPENDING IN THE EDUCATION AND HEALTH SECTORS ON THE HUMAN DEVELOPMENT INDEX (HDI) IN INDONESIA: AN ARDL APPROACH



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ABSTRACT

This study aims to analyze the effect of government spending on education and health on the Human Development Index (HDI) in Indonesia by including population size, open unemployment rate, and gender ratio as control variables. The analysis method used is Autoregressive Distributed Lag (ARDL) using time series data for the period 1990–2023 obtained from the Central Statistics Agency (BPS) and the Ministry of Finance of the Republic of Indonesia. The results show that in the short term, education expenditure has a positive and significant effect on the HDI, while health expenditure and population size have a negative and significant effect. Meanwhile, the open unemployment rate and gender ratio have a negative but insignificant effect. In the long term, education expenditure has a positive but insignificant effect, while health expenditure, population size, and gender ratio have a negative and significant effect on HDI. These findings indicate that HDI improvement is not solely determined by the amount of government spending, but rather by the effectiveness of budget management, population growth control, expansion of employment opportunities, and improvement of gender equality as prerequisites for sustainable human development.

Keywords : Government Expenditure, Education, Health, Population, Unemployment Rate, Gender Ratio, HDI, ARDL

INTRODUCTION

Economic development aims to improve people's welfare by improving their quality of life, one of which is indicated by an increase in per capita income. However, the sustainability of development is also influenced by external factors and institutional effectiveness in ensuring adequate access to education and health services (Arisman, 2018). To comprehensively assess the success of development, the Human Development Index (HDI) is used, which covers the dimensions of health, education, and decent living standards (Amalia et al., 2022). The HDI is an important evaluation tool to see the extent to which economic growth has actually improved the quality of life of the community (Hadiyanto et al., 2022).

(Ojo et al., 2022) The Human Development Index (HDI) is an indicator developed by the UNDP to assess the quality of life in a country through three main dimensions: health, education, and decent living standards (Susanti & Ghidayat, 2020). The health dimension is measured through Life Expectancy (LE), education through Expected Years of Schooling (EYS) and Average Years of Schooling (AYS), and decent living standards through Real Expenditure per Capita (REPC). These three indicators provide a comprehensive picture of the success of human development (Ningrum et al., 2020).

Based on data from BPS (2024), Indonesia's HDI shows consistent improvement in the period 1990–2023. Life expectancy increased from 63.18 to 72.13 years, expected years of schooling from 10.16 to 13.98 years, and average years of schooling from 3.22 to 8.77 years. Real per capita expenditure also increased from USD 4,184 to USD 12,046, reflecting improvements in the national economy. Overall, the HDI rose from 0.526 in 1990 to 0.749 in 2023. Despite this progress, Indonesia still ranks in the middle globally and within the ASEAN region, meaning that equitable development remains a challenge.

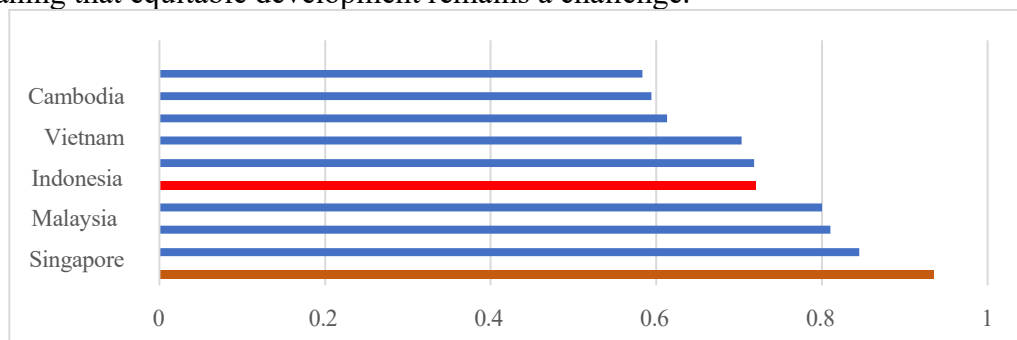


Figure 1
Human Development Index (HDI) of ASEAN Countries in 2023
Source: UNDP (data processed, 2024)

Figure 1 shows that in 2023 Indonesia ranked fifth in HDI in the ASEAN region with a value of around 0.74, below Singapore, Brunei Darussalam, Malaysia, and Thailand. This position reflects Indonesia's progress in education, health, and living standards, although challenges remain. The increase in Indonesia's HDI during 1990–2023 was mainly driven by increased government expenditure in the education and health sectors, which contributed to an increase in life expectancy, expected years of schooling, and mean years of schooling.

According to data from the Ministry of Finance's Directorate General of Budget (DJA Kemenkeu) (2024), Indonesian government spending in the education and health sectors during 1990–2023 showed an upward trend as a form of commitment to human development. Health spending increased from 0.35 trillion rupiah in 1990 to a peak of 312.4 trillion rupiah in 2021, before declining in 2022–2023. Education spending also increased consistently from 2.91 trillion rupiah in 1990 to 574.90 trillion rupiah in 2022, and declined slightly to 513.80 trillion rupiah in 2023. Despite fluctuations in recent years, the increase in the budget for both sectors confirms the government's commitment to strengthening the quality of education and health.

(Mongan, 2019) In addition to public spending, demographic dynamics also influence human development achievements. Indonesia's population has continued to increase from 183 million in 1990 to more than 281 million in 2023, putting pressure on public services. The unemployment rate showed significant fluctuations, especially in the early 2000s, while the sex ratio remained relatively stable throughout the period. These variables are important to consider because they have the potential to affect quality of life and HDI achievement.

Based on these conditions, this study analyzes the effect of government spending in the education and health sectors on Indonesia's HDI in the short and long term for the period 1990–2023 using the ARDL method, as well as including population size, unemployment rate, and gender ratio as control variables to obtain a more comprehensive understanding of the factors that influence human development in Indonesia.

REVIEW OF LITERATURE

Human Development Index (HDI)

(Mongan, 2019) Human development aims to improve quality of life through education, health, access to resources, and security in order to achieve equitable and sustainable prosperity (BPS, 2023). The Human Development Index (HDI) measures this progress based on three main dimensions: a long and healthy life, knowledge, and decent living standards (UNDP, 2023). The HDI is used as a reference in development policies.

(Abdillah & Primitasari, 2023) The concept of human development, introduced by the UNDP in 1990, emphasizes that people are the goal of development, not merely tools of production. This approach focuses not only on economic growth, but also on expanding human capabilities and choices. The components of the HDI consist of:

1. Life Expectancy Index: Describes health levels through Life Expectancy Figures (AHH).
2. Education Index: Based on Average Length of Schooling (ALS) and Expected Length of Schooling (ELS).
3. Decent Living Standard Index: Measures economic well-being through real per capita expenditure or real GDP per capita.

The HDI is calculated using the geometric mean of these three dimensions. The HDI calculation method was updated by the UNDP in 2010, replacing the education indicator and improving the aggregation method to prevent compensation between dimensions.

HDI Formula (BPS, 2020)

The formula for calculating the HDI according to BPS (2020) is as follows:

$$IPM = \sqrt[3]{X_1 \times X_2 \times X_3} \times 100$$

Where:

- X1 is the Life Expectancy Index, which measures the level of public health based on life expectancy (AHH),
- X2 is the Education Index, which is measured based on Average Length of Schooling (ALS) and Expected Length of Schooling (ELS), and
- X3 is the Decent Living Standard Index, which measures economic welfare based on real per capita expenditure or real GDP per capita.

The HDI provides an overview of the quality of life of people in a country or region, covering aspects of health, education, and economy. Based on the calculated HDI value, the results are grouped into the following categories: very high ($HDI \geq 80$), high ($70 \leq HDI < 80$), medium ($60 \leq HDI < 70$), and low ($HDI < 60$). These categories are used to assess progress in human development and form the basis for the formulation of development policies (Sunani et al., 2024).

Government Expenditures in the Education Sector

(Raghupathi & Raghupathi, 2020a) Government spending in the education sector is the allocation of state funds for the implementation of education, as stipulated in Law No. 27 of 2014 and the mandate of the 1945 Constitution Article 31 paragraph (4), which requires a minimum allocation of 20% of the state budget/regional budget. This policy has been implemented since 2010 as an effort to improve the quality of human resources. However, Wahid (2012) notes that local governments still face obstacles such as fiscal constraints, inefficient budget distribution, and delays in fund absorption.

(Dayyan & Mohammed, 2014a) Education funding plays an important role in improving the quality of human development. In addition to meeting the budget percentage, the government must ensure the effectiveness of its use, especially for the development of educational infrastructure, improving teacher competence, expanding access, and equalizing educational services. Winarti (2014) emphasizes that optimal education spending can increase education participation, workforce skills, and economic productivity. Thus, government investment in the education sector is key to promoting welfare and sustainable development.

Government Expenditures in the Health Sector

(Tjodi et al., 2019) Government spending in the health sector is the allocation of funds for health services in accordance with Law No. 36 of 2009 and Article 28H of the 1945 Constitution, which states that health is a basic right of the people. In developing countries, the government plays an important role due to the limited ability of the community to purchase private health services, so that health facilities are considered public goods. Health, including nutrition and calorie intake, greatly affects human quality (Astri et al., 2013). State that productivity increases with adequate health budgets. In accordance with Law No. 36 of 2009, the central government is required to allocate a minimum of 5% of the national budget and local governments a minimum of 10% of the regional budget for health (Fahmi, 2018).

(Wijayanto, 2015) However, the effectiveness of the budget depends on planning, implementation, and distribution of funds. If the budget is used more for curative or administrative spending, the impact on the quality of public health will be less than optimal. Increases in health spending often occur when health conditions deteriorate, so the relationship between health expenditure and HDI can be negative. Therefore, the effect of health expenditure on HDI depends on the effectiveness of budget use and the ability of institutions to manage financing efficiently.

Population

(Muliza et al., 2017) The population according to BPS (2020) includes all people who have lived in Indonesia for more than 6 months or plan to settle there. Population is an important factor in human development because it affects the need for basic services such as education, health, and employment. High population growth can reduce HDI achievements if it is not balanced with an increase in the budget and quality of public services. However, a large population can also be a potential if it is managed properly, especially through the utilization of the demographic bonus.

Malthus' theory explains that population growth is exponential, while food production increases arithmetically, which can lead to crises such as famine and poverty. Malthus proposed two ways to control population growth: preventive (delaying marriage and limiting births) and repressive (famine, disease, war). Although widely criticized for not taking technological advances into account, Malthus' theory remains relevant in the study of population and resource sustainability (Hatta et al., 2022).

Open Unemployment Rate

(Hendrati & Perdana, 2021) The open unemployment rate shows the number of workers who are actively seeking employment but have not yet found it. Unemployment is caused by limited job opportunities and an imbalance between labor supply and demand. Therefore, the

government needs to allocate funds for labor-intensive programs and MSME empowerment. High unemployment has a negative impact on the Human Development Index (HDI) because it reduces purchasing power, worsens access to education and health, and hinders the fulfillment of basic needs.

(Wardhana et al., 2021) In theory, the relationship between unemployment and human development is explained through the new economic growth theory, which emphasizes the importance of investing in human capital to increase productivity and create job opportunities. Okun's Law also states that an increase in unemployment will reduce GDP, which in turn slows economic growth and HDI achievements. The open unemployment rate is used in this study as a control variable to see the effect of labor market conditions on the relationship between government spending and HDI.

Sex Ratio (SR)

(Dayyan & Mohammed, 2014b) The sex ratio is the ratio of males to females per 100 females. An imbalance in the sex ratio can affect access to education, employment opportunities, and social dynamics. Changes in the SR are influenced by factors such as birth and death rates, cultural preferences for male children, reproductive health, and migration. Although the term sex ratio is more biologically accurate, gender ratio is often used in popular literature (Our World in Data, 2023). This ratio balance is important in HDI because it reflects the equitable access to basic services, with countries that achieve gender equality tending to have better human development outcomes.

(Raghupathi & Raghupathi, 2020b) HDI is influenced by the quality of education, health, and living standards, where government spending in the education and health sectors plays a major role. Spending in these sectors improves the competence, productivity, and health of the population, although its effectiveness depends on budget management and equitable service distribution. The variables of population size, open unemployment rate, and gender ratio are used as control variables, as they can affect public service capacity and community welfare.

RESEARCH METHOD

This study analyzes the effect of government spending in the education and health sectors on the Human Development Index (HDI) in Indonesia for the period 1990–2023 using the ARDL method to identify short-term and long-term relationships. The control variables used are population size, open unemployment rate, and gender ratio. The data used are annual time series secondary data from official government sources, including BPS, the Ministry of Finance, the Ministry of Education and Culture, the Ministry of Health, and Bank Indonesia.

Three types of variables were used in this study: dependent variables (HDI), independent variables (government spending on education and health), and control variables (population size, open unemployment rate, and sex ratio). HDI is a composite measure of human development quality, while education and health spending refers to the total central and local government budgets for each sector per year. Control variables include population size, open unemployment rate, and sex ratio.

RESULTS AND DISCUSSION

Stationarity Test

Stationarity in this study was tested using the Augmented Dickey-Fuller (ADF) method to ensure that the time series variables were free of unit roots. The test was conducted on the IPM, EDU, HEA, JPD, APT, and RGD variables. If the ADF p-value was < 0.05 , the variable was stationary. If the p-value is greater than 0.05, the variable is non-stationary and first differentiation is performed. The ADF test is repeated on the differentiated data, and the

variable is declared stationary if the p-value is less than 0.05. This process ensures that the variables meet the I(0) or I(1) integration requirement for use in the ARDL model.

Table 1.
Augmented Dickey-Fuller (ADF) Level Stationarity Test Results

Variable	Probability		Description
	I(0)	I(1)	
IPM (Y)	5,623611111	0.000	I(1)
EDU (X1)	6,908333333	0.0002	I(1)
HEA (X2)	4,88263889	0.0472	I(1)
JPD (Z1)	0,58402778	0.0000	I(1)
APT (Z2)	1,68819444	0.0007	I(1)
RGD (Z3)	6,91458333	0.0000	I(1)

Source: Eviews 10 (data processed, 2025)

The stationarity test in this study was conducted using the Augmented Dickey-Fuller (ADF) method to ensure that the time series variables were free from unit roots. The results of the ADF test at the level showed that all variables—IPM, EDU, HEA, JPD, APT, and RGD—had p-values > 0.05, indicating that these variables were non-stationary and contained unit roots. Therefore, first differentiation was performed to stabilize the mean and variance of the data, and the ADF test was repeated on the differentiated data. After the first differentiation, all variables showed p-values < 0.05, indicating that they were stationary and integrated of order one (I(1)), meeting the requirements for time series analysis and allowing further modeling such as ARDL, ECM, or cointegration tests without producing biased estimates.

Cointegration Test

The cointegration test aims to determine whether non-stationary variables have a stable long-term relationship. Although they may fluctuate in the short term, cointegrated variables move together toward equilibrium. This test is important to prevent spurious regression and ensure that the long-term relationship in the model is econometrically valid.

Table 2.
Cointegration Test Results (Bound Test)

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	7.386556	10	2.08	
k	5	5%	2.39	3
		2.5	2.7	3.38
		1	3.06	3.73
Finite Sample: n=35				
Actual Sample Size	32		2.331	4.15
		10	2,804	3,417
		5	3.9	4,013
		1	3.9	4,013
Finite Sample: n=30				
		10	2.407	5,419
		5	2.91	3.517
		1%	4,134	4,193
				5,761

Source: Eviews 10 (data processed, 2025)

The Bound Test cointegration test results show an F-statistic value of 7.386556, which is higher than the upper limit (I(1)) at all significance levels. This confirms the existence of a cointegration relationship between the variables in the model. Although each variable is non-stationary, there is a stable long-term relationship between HDI and its explanatory variables (EDU, HEA, JPD, APT, and RGD). With this cointegration, the analysis can be continued using the Error Correction Model (ECM) to capture the short-term relationship and the adjustment process towards long-term equilibrium.

Optimum Lag Test

The Optimum Lag Test is used to determine the best number of lags in the ARDL model so that the dynamics of the relationship between variables can be captured accurately without overfitting or underfitting. The selection of the optimum lag is done using the Akaike Information Criterion (AIC). In this study, the selection of the optimum lag ensures that the model can accurately describe the short-term and long-term relationships between HDI and variables such as education expenditure, health expenditure, population, open unemployment rate, and gender ratio.

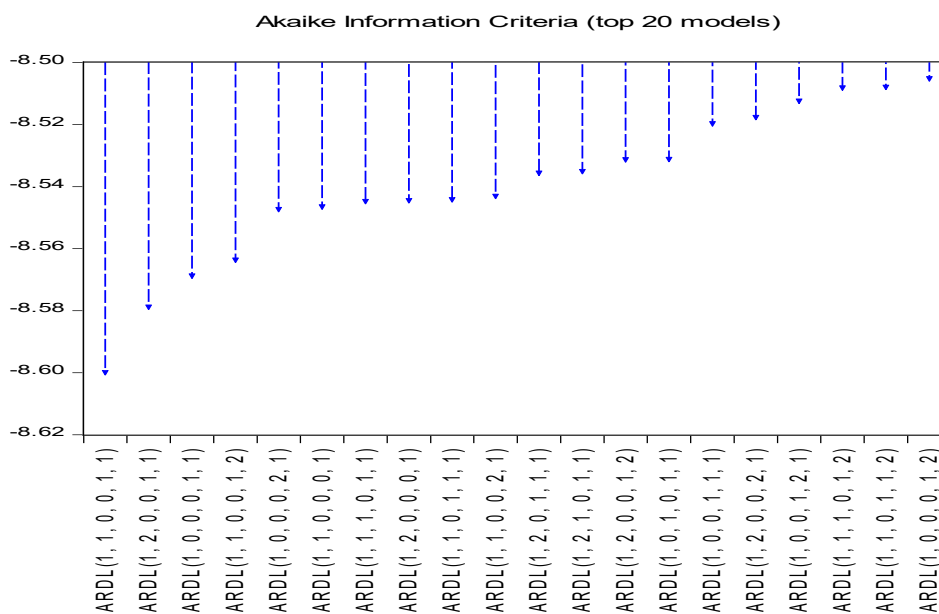


Figure 2.
Optimal Lag Test Results
 Source: Eviews 10 (data processed, 2025)

Based on the results of the optimum lag test in Figure 3, the 20 best models were obtained, and the model with the lowest AIC value was ARDL(1,1,0,0,1,1). This model uses one lag on the dependent variable (Y), one lag on X1, no lag on X2 and X3, and one lag on X4 and X5. This combination of lags was chosen because it produced the smallest AIC value, so it was considered the most efficient and suitable for further analysis in the study.

Stability Test

Model stability testing was performed using CUSUM and CUSUM of Squares (CUSUMQ) to ensure that the ARDL model remained stable throughout the research period. These two tests detect possible structural changes in the model. If the CUSUM and CUSUMQs are within critical limits, the model is declared stable and valid for use in analyzing the long-term relationship between government spending and HDI.

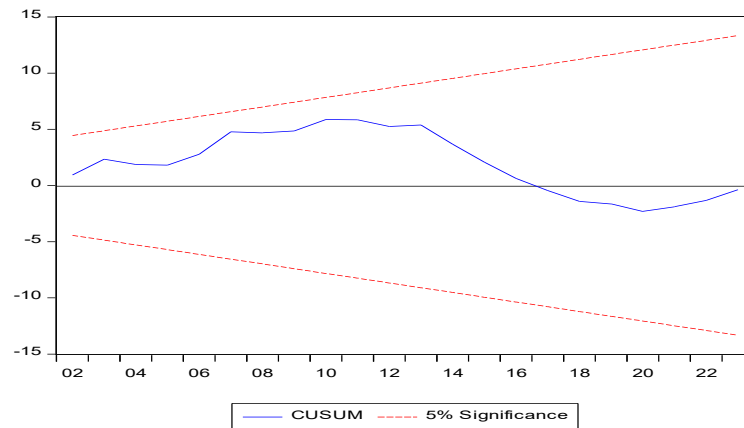


Figure 3.
Model Stability Results (CUSUM Test)
 Source: Eviews 10 (data processed, 2025)

The CUSUM stability test results show that the test line remains within the 5% significance limit, indicating that the model did not undergo structural changes throughout the 1990–2023 period. This indicates that the model parameters are stable and reliable for explaining the long-term relationship between education and health spending and HDI. The CUSUM of Squares (CUSUMQ) test was then used to evaluate the stability of the model's residual variance.

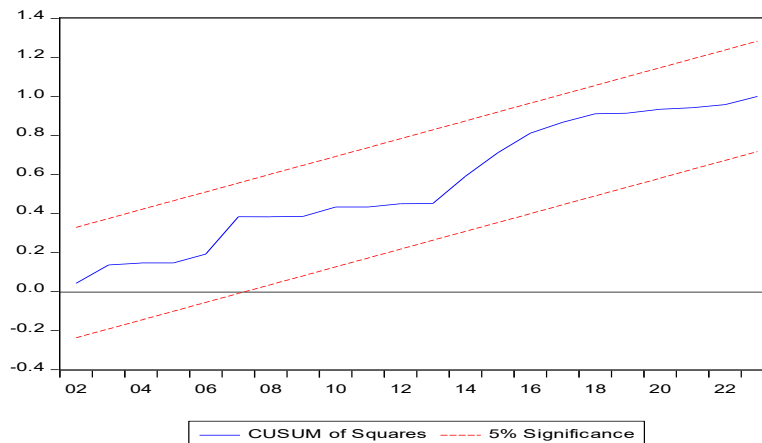


Figure 4.
Model Stability Results (CUSUM of Squares Test)
 Source: Eviews 10 (data processed, 2025)

The CUSUM of Squares test results show that the test line remains within the critical limit of 5%, indicating that the residual variance is stable and does not change during the observation period. This means that there is no heteroscedasticity and the model has a constant error variance. This reinforces the validity of the ARDL model because the estimates are considered stable and free from fluctuating variance disturbances.

Results of the Short-Term ARDL Model Estimation Test

The short-term equation estimates for the ARDL (1, 1, 0, 0, 1, 1) model are presented in Table 3. below:

Table 3.
Results of the Short-Term Equation Estimation Test for the ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(IPM(-1))	0.051166	0.164711	0.310642	0.7590
D(EDU)	6.82E-05	2.05E-05	3.327876	0.0031
D(EDU(-1))	-3.75E-05	2.29E-05	-1.633167	0.1167
D(HEA)	-0.000114	4.06E-05	-2.809809	0.0102
D(JPD)	-0.002464	0.000646	-3.815189	0.0009
D(APT)	-0.000543	0.000647	-0.838563	0.4107
D(APT(-1))	0.001132	0.000728	1.554299	0.1344
D(RGD)	-0.023064	0.018160	-1.270077	0.2173
D(RGD(-1))	-0.037378	0.019109	-1.956084	0.0633
C	0.019229	0.003598	5.344913	0.0000

Source: Eviews 10 (Data processed, 2025)

The best model is determined based on the lowest AIC value, so ARDL(1,1,0,0,1,1) is selected as the optimal model. The resulting short-term equation is:

$$D(IPMt) = 0.0192 + 0.512D(IPMt-1) + 6.82 D(EDUt) - 3.75 D(EDU t-1) - 0.000114D(HEAt) - 0.00247 D(JPDt) - 0.0005 D(APT t) - 0.0011 D(APT t-1) - 0.023 D(RGDt) - 0.0373 D(RGDt-1)$$

The Effect of Government Expenditure in the Education Sector on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

The results of the short-term ARDL estimation show that government spending in the education sector has a positive and significant effect on the Human Development Index (HDI) in Indonesia for the period 1990–2023 (coefficient D(EDU) = 0.0000628; p = 0.0001). Increased education budgets have a direct impact on the HDI through improvements in school infrastructure, teacher quality, and educational assistance. However, previous years' spending had no effect due to slow fund absorption and the long-term nature of educational benefits. These findings emphasize the importance of program implementation effectiveness, bureaucratic efficiency, and policy targeting. Previous studies support this, such as Maulina & Andriyani (2020), who emphasized the need for governance and equitable access, and Paidi et al. (2025), who highlighted budget efficiency as a key factor in human development. Overall, an increase in the education budget can boost the HDI in the short term if accompanied by good policy implementation.

The Effect of Government Expenditure in the Health Sector on the Human Development Index (HDI) in Indonesia for the Period 1990-2023.

The results of the short-term ARDL estimation show that government spending in the health sector has a negative and significant effect on HDI in Indonesia (coefficient 0.000114; p=0.0102), contrary to the hypothesis assuming a positive effect. This negative impact is due to the nature of health programs, which take a long time to show results, delays in budget realization, low efficiency, and uneven distribution of facilities. These findings are in line with studies in several regions showing that health spending does not always increase HDI without effective governance, although other studies show a positive impact if program management and implementation are good. Thus, health spending requires time, efficiency, and program effectiveness in order to have a positive impact on HDI.

The Effect of Government Expenditure in the Health Sector on the Human Development Index (HDI) in Indonesia for the Period 1990-2023.

Based on short-term ARDL estimates, government spending in the health sector has a negative and significant effect on the Human Development Index (HDI) in Indonesia (coefficient 0.000114; $p = 0.0102$), contrary to the hypothesis assuming a positive effect. This negative impact is due to the nature of health programs, which take a long time to show results, delays in budget realization, low efficiency, and uneven distribution of facilities. These findings emphasize that health spending is only effective in improving the HDI if it is accompanied by good governance, efficient distribution of resources, and a focus on targeted preventive programs. Previous studies support this, such as Amrullah (2022) in Madura Island and Hidayati & Imaningsih (2022) in Yogyakarta, who found that health expenditure had a negative or insignificant effect due to weak governance. Conversely, Maryozi et al. (2022) in Riau, Sari et al. (2022), and Nursita et al. (2025) in Bandung reported positive and significant impacts because local governments successfully channeled funds effectively to priority sectors, particularly maternal and child health and basic service facilities. In addition, Paidi et al. (2025) emphasized that only a few provinces were able to achieve high health budget productivity, while Banik et al. (2023) stressed that the effectiveness of health spending was highly dependent on governance and program management.

The Effect of Population Size on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

The results of the short-term ARDL estimation show that population size ($D(JPD)$) has a negative and significant effect on the Human Development Index (HDI) in Indonesia for the period 1990–2023 (coefficient = -0.002464 ; $p = 0.0009$), which means that population growth tends to directly reduce the HDI. This negative impact is caused by an imbalance between population growth and the capacity of public services, such as education, health, and employment, which adds pressure on infrastructure and quality of life. These findings are in line with Khadijah et al. (2022) in Simalungun Regency, Risdiana (2020) in East Java, and Hutasoit et al. (2024), which show that population growth without equitable public facilities lowers the HDI. Conversely, Kiha et al. (2021) in Belu Regency and Khairunnisa et al. (2023) in South Sumatra report a positive effect of population size on the HDI, provided that population growth is managed productively. Thus, in the short term, population growth in Indonesia has the potential to suppress the HDI if it is not balanced with policies for equitable development, increased employment, and adequate access to education and health care.

The Effect of Open Unemployment Rates on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

The results of the short-term ARDL estimation show that the open unemployment rate ($D(APT)$) has a negative but insignificant effect on the Human Development Index (HDI) in Indonesia for the period 1990–2023 (coefficient = -0.000543 ; $p = 0.4107$). Although an increase in unemployment tends to lower the HDI, the effect is not immediately apparent because unemployment is not a direct component of the HDI and is influenced by the informal sector, the social assistance program " " (cash for work), and minimum wage policies. These findings are in line with Tumbuan et al. (2023) in Manado and Prahasta et al. (2023), which show that unemployment does not have a significant impact on the short-term HDI. Conversely, Naibaho & Nabila (2021) and Khumaerah (2023) found a significant negative effect, emphasizing that high unemployment reduces purchasing power, access to education, and health quality. These findings indicate that reducing unemployment requires time and appropriate policies to have a positive impact on human development.

The Effect of Gender Ratio on the Human Development Index (HDI) in Indonesia 1990-2023

The results of the short-term ARDL estimation show that the gender ratio has a negative

but insignificant effect on the Human Development Index (HDI) in Indonesia (coefficient = -0.023064; $p = 0.2173$). This indicates that gender inequality in access to education, employment, and development resources has not had a significant impact on the HDI in the short term, although a delayed effect is beginning to emerge ($D(RGD(-1))$, $p = 0.0633$). These findings are supported by Mansha et al. (2022) and Ewubare et al. (2024), who emphasize the long-term impact of gender equality. Conversely, Deris et al. (2022), Fauziyyah et al. (2022), and Novitasari & Lestari (2023) found a significant effect, depending on the region and the implementation of gender policies. Although the short-term effect is not yet significant, the negative direction of the gender ratio indicates the need to strengthen gender equality to improve the HDI.

Long-Term ARDL Model Estimation Results

The long-term equation estimates for the ARDL (1, 1, 0, 0, 1, 1) model are presented in Table 4 below:

Table 4.
Long-Term ARDL Model Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EDU)	3.24E-05	3.33E-05	0.975040	0.3401
D(HEA)	-0.000120	4.26E-05	-2.818064	0.0100
D(JPD)	-0.002597	0.000842	-3.083939	0.0054
D(APT)	0.000621	0.000968	0.641327	0.5279
D(RGD)	-0.063701	0.029134	-2.186466	0.0397
C	0.020266	0.003977	5.096298	0.0000

The Effect of Government Expenditure in the Education Sector on the Human Development Index () in Indonesia for the Period 1990-2023

The long-term ARDL estimation results show that government spending in the education sector has a positive effect on the Human Development Index (HDI) in Indonesia, although it is not statistically significant ($D(EDU) = 3.24E-05$; $p = 0.3401$). This finding confirms that education investment requires time to show its impact on human resource quality through improvements in learning, graduate competencies, and employment opportunities. Previous studies, support these results, as do Rahim et al. (2021) and Lantion et al. (2023), which show the positive impact of education spending on the HDI, although it is only visible in the long term. Conversely, Maulina & Andriyani (2020) and Anantika & Sasana (2021) emphasize the importance of effective governance for education spending to have an impact on HDI. Paidi et al. (2025) add that many provinces have not optimized budget productivity. Overall, education spending plays an important role in long-term human development, provided it is supported by good governance and effective evaluation.

The Effect of Government Expenditure in the Health Sector on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

Long-term ARDL estimation results show that government spending in the health sector has a negative and insignificant effect on the Human Development Index (HDI) in Indonesia, with coefficients of -0.000543 ($p = 0.2043$) and -0.000120 ($p = 0.0100$). Increased health budgets have not had a tangible impact on the quality of life of the community, due to inefficient allocation of funds, the dominance of spending on curative services, unequal distribution of facilities, and a lack of focus on preventive programs. These findings are in line with Kaadafi & Asnidar (2023), who point to weak policy planning and oversight of budget distribution in the health sector. Similar results were also reported by Amrullah (2022) and Hidayati & Imaningsih (2022), who found low efficiency in health spending. Conversely, Maulina & Andriyani (2020), Obayori & Akpan (2022), and Anantika & Sasana (2021) show

that health expenditure can increase HDI if accompanied by transparent budget management and targeted planning. Overall, although the impact is negative and insignificant, health sector spending can have a positive impact on HDI if supported by institutional reform, budget efficiency, and equitable distribution of facilities.

The Effect of Population Size on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

Long-term estimates show that population growth has a negative and significant effect on Indonesia's Human Development Index (HDI), with a coefficient of -0.002597 and a p-value of 0.0054 (<0.05). This finding indicates that high population growth puts pressure on economic capacity and public services such as education, health, and employment, which can reduce quality of life if not balanced with increased productivity and equitable development. This finding is in line with Simanjuntak & Andriyani (2021), who state that an increase in population without equitable development reduces the HDI. Naibaho & Nabila (2021) and Ristika, Primandhana, & Wahed (2021) also support the view that demographic dynamics affect human development achievements. From a demographic bonus perspective, an increase in the productive age population can drive economic growth if managed with targeted policies. Therefore, population growth control, family planning programs, increased access to education, and community economic empowerment need to be policy priorities to support sustainable human development.

The Effect of Open Unemployment Rates on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

Long-term estimates show that the open unemployment rate (APT) has a positive but insignificant effect on the Human Development Index (HDI) in Indonesia, with a coefficient of 0.000621 and a p-value of 0.5279 (>0.05). This indicates that changes in the open unemployment rate do not have a significant impact on the HDI, because the informal sector, which is dominant in Indonesia, is not recorded in official unemployment data. This finding is in line with Prahasta et al. (2023), who found a positive effect of unemployment on the HDI in Kalimantan, but differs from Sania, Balafif, and Imamah (2021) in East Java, who reported a significant negative effect. From a human capital perspective, improving the skills and education of the workforce is key to increasing productivity and community welfare. Therefore, unemployment reduction policies need to focus on improving the quality of the workforce and expanding productive employment opportunities to promote sustainable HDI improvement.

The Effect of Gender Ratio on the Human Development Index (HDI) in Indonesia for the Period 1990-2023

Long-term estimation results show that the gender ratio (RGD) has a negative and significant effect on the Human Development Index (HDI) in Indonesia, with a coefficient of -0.063701 and a p-value of 0.0397 (<0.05). This indicates that gender inequality, particularly the gap in access between men and women to education, health, and employment, significantly reduces the HDI. These findings are in line with Mansha et al. (2022) and Ewubare et al. (2024), who show that gender inequality has a negative impact on the HDI and that gender equality can promote an increase in the HDI. Research by Deris et al. (2022) and Fauziyyah et al. (2022) also supports this, while Simanjuntak and Andriyani (2021) found that the Gender Empowerment Index (GEI) had no significant effect. Theoretically, these results support the Human Capital Theory, which emphasizes the importance of equal access to maximize human resource potential. Therefore, strengthening gender equality through affirmative policies in the education, health, and labor market sectors is an important strategy for promoting sustainable human development in Indonesia.

CONCLUSION

Based on the results of the short-term analysis, government spending in the education sector has a positive and significant effect on the Human Development Index (HDI), while spending in the health sector has a negative and significant effect, indicating inefficiency in budget absorption. Population size has a negative and significant effect on the HDI, while the open unemployment rate has a negative but insignificant effect. The gender ratio also has a negative and insignificant effect, indicating that gender inequality still hinders the achievement of human development in the short term.

In the long term, education spending continues to have a positive but insignificant effect, indicating that increases in the education budget have not had a real impact on the quality of human development. Health spending has a negative and significant effect, indicating that the allocation of the health sector budget has not been managed effectively. Population size continues to have a negative and significant impact, where high population growth without an improvement in human resource quality lowers HDI achievement. The open unemployment rate has a positive but insignificant impact, as most people work in the informal sector. The gender ratio has a negative and significant impact, proving that gender inequality is an obstacle to HDI achievement in Indonesia.

Suggestions

The government needs to improve the effectiveness of the education budget by focusing on improving teacher quality, equalizing facilities, and providing access to education in disadvantaged areas to boost the Human Development Index (HDI). Health budget management must also be improved by strengthening preventive programs and supervision so that available funds are more efficient and have an impact on the quality of life of the community. Population growth control is important through the strengthening of family planning programs and improving the quality of human resources, so that population growth becomes a force for development, not a burden. In addition, expanding employment opportunities and skills training can reduce unemployment and improve community welfare. Finally, gender equality must be strengthened by providing women with greater access to education, health services, employment, and public decision-making in order to achieve sustainable and inclusive human development in Indonesia.

REFERENCES

- Abdillah, I. I., & Primitasari, N. (2023). Pengaruh Pengeluaran Pemerintah Sektor Pendidikan, Kesehatan, Dan Infrastruktur Terhadap Pertumbuhan Ekonomi Di Wilayah Indonesia Bagian Timur. *Jurnal Ilmu Ekonomi Jie*, 7(03), 494–503. <https://doi.org/10.22219/jie.v7i03.28265>
- Arisman, A. (2018). Determinant of Human Development Index in ASEAN Countries. *Signifikan Jurnal Ilmu Ekonomi*, 7(1), 113–122. <https://doi.org/10.15408/sjie.v7i1.6756>
- Astri, M., Nikensari, S. I., & W., H. K. (2013). Pengaruh Pengeluaran Pemerintah Daerah Pada Sektor Pendidikan Dan Kesehatan Terhadap Indeks Pembangunan Manusia Di Indonesia. *Jurnal Pendidikan Ekonomi Dan Bisnis (Jpeb)*, 1(1), 77. <https://doi.org/10.21009/jpeb.001.1.5>
- Dayyan, M., & Mohammed, M. O. (2014a). Public Perception on Government Spending in Aceh: An Analysis Based on Maqasid Performance Pairwise Matrix (Mppm). *Share Jurnal Ekonomi Dan Keuangan Islam*, 3(2), 102. <https://doi.org/10.22373/share.v3i2.1344>
- Fahmi, A. (2018). Pengaruh Good Governance, Belanja Fungsi Pendidikan Dan Kesehatan, Dan PDRB Perkapita Terhadap Ipm. *Jurnal Manajemen Keuangan Publik*, 2(1), 23–34. <https://doi.org/10.31092/jmkp.v2i1.285>

- Hadiyanto, H., Wulandari, S., Noor, M. A., Sitepu, C. B., & Ningtias, I. P. (2022). Bagaimana Pandemi Covid-19 Memengaruhi Pembangunan? Studi Belanja Pemerintah Dan IPM Di Indonesia Barat Dan Timur. *Indonesian Treasury Review Jurnal Perbendaharaan Keuangan Negara Dan Kebijakan Publik*, 7(4), 301–316. <https://doi.org/10.33105/itrev.v7i4.703>
- Hatta, D., Risna, R., & Assegaf, S. U. (2022). Analisis Fiskal Indikator Kesejahteraan Sosial Di Provinsi Kalimantan Utara. *Jurnal Ekonomi Indonesia*, 11(2), 211–234. <https://doi.org/10.52813/jei.v11i2.226>
- Hendrati, I. M., & Perdana, P. (2021). Education Budget Through Central or Local Government Spending: Which Is More Effective in Improving the Quality of Human Life? *Journal of Accounting and Strategic Finance*, 4(2), 242–255. <https://doi.org/10.33005/jasf.v4i2.227>
- Isbahi, M. B., Zuana, M. M. M., & Toha, M. (2024). The Multi-Social Relation of the Cattle Industry in the Plaosan Subdistrict Animal Market of Magetan Regency. *Malacca: Journal of Management and Business Development*, 1(1), 31–46. <https://doi.org/10.69965/malacca.v1i1.51>
- Mongan, J. J. S. (2019). Pengaruh Pengeluaran Pemerintah Bidang Pendidikan Dan Kesehatan Terhadap Indeks Pembangunan Manusia Di Indonesia. *Indonesian Treasury Review Jurnal Perbendaharaan Keuangan Negara Dan Kebijakan Publik*, 4(2), 163–176. <https://doi.org/10.33105/itrev.v4i2.122>
- Muliza, M., Zulham, T., & Seftarita, C. (2017). Analisis Pengaruh Belanja Pendidikan, Belanja Kesehatan, Tingkat Kemiskinan Dan PDRB Terhadap Ipm Di Provinsi Aceh. *Jurnal Perspektif Ekonomi Darussalam*, 3(1), 51–69. <https://doi.org/10.24815/jped.v3i1.6993>
- Ningrum, J. W., Khairunnisa, A. H., & Huda, N. (2020). Pengaruh Kemiskinan, Tingkat Pengangguran, Pertumbuhan Ekonomi Dan Pengeluaran Pemerintah Terhadap Indeks Pembangunan Manusia (IPM) Di Indonesia Tahun 2014-2018 Dalam Perspektif Islam. *Jurnal Ilmiah Ekonomi Islam*, 6(2), 212. <https://doi.org/10.29040/jiei.v6i2.1034>
- Ojo, T., Odusanya, I. A., & Ojo, S. (2022). Health Expenditure, Education and Economic Growth in Nigeria. *Open Journal of Social Science and Humanities (Issn 2734-2077)*, 3(1), 01–17. <https://doi.org/10.52417/ojsch.v3i1.308>
- Raghupathi, V., & Raghupathi, W. (2020b). The Influence of Education on Health: An Empirical Assessment of OECD Countries for the Period 1995–2015. *Archives of Public Health*, 78(1). <https://doi.org/10.1186/s13690-020-00402-5>
- Sunani, Noviandra, Z., & Arifudin, A. (2024). Analysis of Government Expenditure From the Perspective of Islamic Economics on Hdi in West Java Province Period 2013-2018. *Journal of Sharia Economics*, 5(2), 289–302. <https://doi.org/10.22373/jose.v5i2.4712>
- Tjodi, A. M., Rotinsulu, T. O., & Kawung, G. M. (2019). Pengaruh Pengeluaran Pemerintah Sektor Pendidikan, Sektor Kesehatan Dan Belanja Modal Terhadap Indeks Pembangunan Manusia Melalui Pertumbuhan Ekonomi (Studi Di Provinsi Sulawesi Utara). *Jurnal Pembangunan Ekonomi Dan Keuangan Daerah*, 19(8). <https://doi.org/10.35794/jpek.d.23428.19.8.2018>
- Wardhana, A., Nur, Y. H., Kharisma, B., & Adam, A. M. (2021). Analisis Peran Pengeluaran Pemerintah Terhadap Peningkatan Pembangunan Manusia Di Wilayah Metropolitan Indonesia. *Cr Journal (Creative Research for West Java Development)*, 7(01), 1–10. <https://doi.org/10.34147/crj.v7i01.307>
- Wijayanto, A. (2015). The Analysis of Health and Educational Expenditure as Well as PDRB Per Capita's Influence on Human Development Index (Study of Cities/Regencies at East Java Province). *International Journal of Social and Local Economic Governance*, 1(2), 85–95. <https://doi.org/10.21776/ub.ijleg.2015.001.02.1>