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Assessing the Relationship of Human Development Index (HDI) and Government Expenditure on Health and Education in Selected ASEAN Countries

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Abstract - *Various studies exhibited the importance of government spending in developing human capital. It can enhance income distribution and employment opportunities, reduce extreme poverty, and increase the consumption of essential services like healthcare and education. The study aims to analyze the relationship between government spending on education and healthcare on the Human Development Index (HDI) of five Southeast Asian countries: the Philippines, Thailand, Malaysia, Indonesia, and Singapore, using the Panel Least Squares method. The study proves that government expenditure on education significantly and positively impacts HDI. In contrast, government spending on health exhibits a positive yet statistically insignificant influence on HDI. These findings imply that directing resources toward education efficiently enhances human capital in the examined countries. However, the same efficiency does not hold true for government allocation to health.*

Keywords*: Government expenditure, Health, Education, HDI.*

I. INTRODUCTION

The United Nations (UN) aims to end poverty and improve the people's overall well-being globally through improvement in education, health, economic growth, and reduction in inequality. To pursue these objectives, the organization has established the Sustainable Development Goals (SDGs). Among the 17 SDGs, two key objectives are improving health and well-being and promoting quality education. Recent studies conducted in both developed and developing countries indicated that government expenditure on education and health has a positive and significant impact on the human development index of the country (Fadilah et al., 2018; Barro & Lee, 1997; Gupta et al., 2004; Fattah & Muji, 2012; Nurvita et al., 2022; Edeme, 2014). This aligns with the Endogenous Growth Theory, which suggests that investing in human capital development and technological advancement can foster economic growth and development (Romer, 1994).Effective public spending can enhance income distribution and employment opportunities, reduce extreme poverty, and increase the consumption of essential services like healthcare and education (Selowsky, 2010; OECD, 2019; Muley, n.d.; Akinlo & Sulola, 2019; Reddy & Narsi Reddy, 2019; Agarwal, 2015). As a result, it is crucial for governments to spend money on education, healthcare, and job training to ensure that people have the knowledge and skills they need. Through government expenditure, the government's investment in human capital can be quantified. Additionally, an increase in government expenditure on education, health, infrastructure, and research and development can sustain long-term economic growth (Barro & Sala-i-Martin, 1995). This is highlighted in the study of Gomanee et al. (2005), which states that the government should thoroughly study its allocation and efficiency in spending on the condition that its objectives are poverty alleviation and an increase in the welfare of citizens. This can help a country benefit from new technologies and ideas that are created worldwide.

However, some studies have also highlighted discrepancies in government expenditure on healthcare and its impact on the human development index. For instance, the healthcare system in Southeast Asian countries such as Indonesia, Malaysia, and the Philippines has been subjected to privatization, resulting in the inefficient implementation of public health sectors (Ramesh & Wu, 2008). Additionally, the World Health Organization (WHO) described the healthcare of ASEAN countries wherein the out-patient care in Southeast Asia is lower than in high-income countries, the healthcare is inaccessible to urban poor, the basic amenities for primary healthcare (PHC) are lacking, and the private sector is the main source of PHC.

According to the OECD (2022), the average education spending of ASEAN countries on education is relatively low, with only a few countries meeting the recommended 4 percent of GDP spending on education (UNESCO Bangkok, 2022). Inadequate education spending has resulted in a lack of qualified teachers, insufficient learning materials, and limited access to technology and other educational resources. These challenges hinder the achievement of Sustainable Development Goals 3 and 4, which aim to ensure healthy lives, promote well-being, and provide inclusive and quality education for all. The study provided insights into the effectiveness of government spending on healthcare and education in the region. The study also contributed to developing more effective policies and strategies to achieve sustainable development in ASEAN countries by identifying areas where government spending can be increased or redirected to improve healthcare and education outcomes.

The growing demand for human capital emphasizes the essential allocation of the government budget. Given the importance of investing in human capital, this paper aimed to analyze the relationship between government spending on education and healthcare and the HDI of five Southeast Asian countries: the Philippines, Thailand, Malaysia, Indonesia, and Singapore.

II. LITERATURE

2.1. Human Development

Human development is a complex and multi-dimensional concept encompassing various aspects of life, such as health, education, and income. The United Nations Development Programme (2015) defines human development as a process of expanding people's choices and improving their well-being, which requires sustained investments in education, healthcare, and social protection. To quantify the country's average improvements in health, knowledge, and standard of living, UNDP formulated the Human Development Index (HDI). Sen's (1999) capabilities approach also emphasizes that human development is not solely about economic growth but also about expanding individuals' capabilities and opportunities, including health, education, and freedom. By considering multiple dimensions, human development provides a more holistic view of a society's progress toward well-being and prosperity.

2.2. Relationship between Government Expenditure on Health and Human Development

Doryan (2001) emphasized that health must be viewed in relation to alleviating poverty, access to education, and other aspects of human development as it increases the capacity of the individuals. Jiang (2021) highlighted the need for governments to increase expenditures on health to promote residents' consumption, reduce medical expenses, and improve immediate consumption. Yu, Peng, and Pu (2022) emphasized the importance of government health expenditure in improving the quality, accessibility, and equity of national medical and health services. Banik, Roy, and Hossain (2022) argued that the governance quality of an economy plays a critical role in the effectiveness of government health expenditure, which can contribute to improved human development through channels such as increased labor productivity, economic growth, reduced mortality, and increased engagement in learning and education. Additionally, Miranda-Lescano et al. (2022) stated that the government could improve the welfare of the citizens by allocating more resources to healthcare.

Various studies show the relationship between Health Government Expenditure and Human Development. The budget allocation for healthcare in Southeast Asian countries has a weak relationship with healthcare goals. Similarly, in long-term growth, life expectancy at birth and adult mortality rate have no correlation with government expenditure on health in Namibia (Shafuda, C. P. P., & De, U. K., 2020). These countries face different health problems, such as HIV/AIDS, Malaria, and other diseases. Hence, there are possible underlying problems with allocating budget in health.

Additionally, the study of Rajkumar and Swaroop (2008) stated that the impact of public spending on education and health varies in the quality of governance. Good governance will ensure a positive relationship between public spending and the welfare of the citizens. In contrast, public spending in poorly governed countries will have no impact on the education and health of the citizens. Despite these disparities, there is a strong positive relationship between the allocation of budget and healthcare coverage, improvements in life expectancy, and reduction in infant mortality rates (Behera & Dash, 2020). Moreover, Gupta, Verhoeven, and Tiongson (2002) showed that the impact of government expenditure on health is more significant on the poor since they rely primarily on public health. This is also highlighted by Lanjouw and Ravallion (1999), which evaluated the benefits of public spending reforms for the poor. Therefore, efficient allocation of the budget is still necessary to improve citizens' healthcare coverage.

Further studies show that the Granger causality test results in Razmi et al. (2012) suggest that health expenditure has a one-way relationship with human development, with health expenditure causing human development. In Asian countries, government spending on health has a significant positive effect (Ruzima & Veerachamy, 2023; Ho, 2022; Herianingrum et al., 2019; Fattah & Muji, 2012; Pahlevi, 2017; Fatria, 2020). Conversely, Prasetyo and Zuhdi (2013) compared government expenditure efficiency in 81 countries, and among the countries analyzed, only Singapore and Zambia showed positive improvements in efficiency over time. However, Maharda and Aulia (2020) argued that government expenditure on health has no positive relationship with HDI. However, Poulliere et al. (2002) stated that the relationship between expenditure on health varies depending on the country. In Nigeria, it was investigated that government expenditure on health has a direct relationship with HDI in the short run but an inverse relationship in the long run, according to Okafor et al. (2017).

Meanwhile, Omodero (2019) suggested that recurrent government expenditure has a strong and significant positive impact on HDI, while Innocent (2017) found that despite a long-run relationship between government expenditure and HDI in Nigeria, government spending has had a largely insignificant effect on human capital development. Moreover, Craigwell et al. (2012) inferred that public expenditure on healthcare is crucial for achieving human development and economic growth, recommending equitable allocation investment in preventive healthcare measures. Finally, Linhartova (2020) found that spending on recreation, culture, and religion had the greatest impact on developing human capital in the Czech Republic, while health expenditure ranked lower concerning its contribution to human development.

2.3. Relationship between Government Expenditure on Education and Human Development

Villela and Paredes (2022) and Valero (2021) claimed that education is crucial for a country's economic success, with investment in education being a commonly used instrument to achieve economic growth. Education expenditure prepares citizens for science, research, and technology. Patel and Annapoorna (2019) emphasized the importance of education in societal and global advancement, requiring government involvement in least-developed countries to function effectively. According to Shi Mei-ling (2015), individual education outlay has an income elasticity of 1.074, and health outlay has an income elasticity of 1.539, indicating that educating people can significantly promote economic growth.

Several findings have shown the relationship between Government Expenditure on Education and Human Development. Okwu et al. (2022) analyzed the relationship between government education expenditure and human capital development in Nigeria. They recommended increasing educational spending to at least the UNESCO guideline of 26% of annual GDP and ensuring optimal allocation and utilization of funds. Haque and Khan (2019) found that government spending significantly drove economic growth in Saudi Arabia, with education expenditure as a crucial factor contributing to HDI development. Additionally, it was found that government spending on education also has a significant positive effect in Asian countries (Ho, 2022; Maharda & Aulia, 2020; Herianingrum et al., 2019; Haque & Khan, 2019; Pahlevi, 2017; Fattah & Muji, 2012; Fatria, 2020; Asghar et al., 2012). This highlights the importance of education in promoting human development and improving the quality of life for citizens. Moreover, Patel and Annapoorna's (2019) study, employing Granger causality analysis, revealed that the percentage of public spending on education, relative to the total government budget, significantly influences changes in the Human Development Index (HDI). This reinforces the idea that education spending is not just a consequence but a key driver of human development outcomes.

In today's rapidly growing market due to globalization, there is also an increasing demand for mastery of new technological updates. Southeast Asian countries contribute 64 percent of the total global employment in the hard disk drive industry, mainly consisting of labor-intensive and low-skilled products, but only earn 13 percent of the industry's wages (Amsden et al., 2001). This discrepancy was brought about by the supply of high-skilled workers in the western region. Education is vital to the mastery of new skills that are needed for the new methods of production to further economic development. Hence, the government should prioritize funding for both the quality of basic education and the development of higher education to achieve the requirements of the market (Sjoholm & Tongzon, 2004).

Further studies on government expenditure and HDI in Nigeria reveal that while there is a direct relationship between government spending on education and HDI in the short run, this relationship becomes inverse in the long run (Okafor et al., 2017). In the study of Ruzima and Veerachamy (2023), a long-term relationship exists between social spending and HDI, with their findings indicating that public expenditure on education had a negative impact on human development in India. Moreover, recurrent government expenditure has a strong and significant positive impact on HDI, while the government's capital expenditure has an insignificant negative influence (Omodero, 2019). However, despite a long-run relationship between government expenditure and HDI, government spending has had a largely insignificant effect on human capital development in Nigeria (Innocent, 2017). Craigwell et al. (2012) recommended equitable allocation of public expenditure among education levels to achieve human development and economic growth. On the contrary, Linhartova (2020) indicated that while spending on recreation, culture, and religion had the greatest impact on human capital development in the Czech Republic, education expenditure ranked lower in their contribution to human development.

The role of the government in human development was highlighted using government expenditure and human development level using HDI in recent studies (Maharda & Aulia, 2020; Omodero, 2019; Innocent, 2017; Fadilah et al., 2017; Fattah & Muji, 2018). The findings of these studies showed that government expenditure has an essential contribution to human development. Scholars from these studies used various statistical methods. In this study, the authors focus on results obtained from the studies of Maharda & Aulia (2020) and Omodero (2019) that employed the Multiple Regression Model and Ordinary Least Squares (OLS) method, respectively.

Hence, this study aimed to analyze the relationship between the government spending on health and education on the HDI of selected ASEAN countries, namely the Philippines, Thailand, Indonesia, Malaysia, and Singapore, using the multiple regression model. This study presumed that the two independent variables have a direct and positive effect on the Human Development Index.

III. METHOD

This study aimed to determine whether the Human Development Index is affected by the level of government spending on education and healthcare. To achieve this objective, the researchers used a multiple regression model equated:

$$HDI = \beta_0 + \beta_1 GSE + \beta_2 GSH + \varepsilon$$

where HDI is the Human Development Index, GSE is Government Expenditure on Education, and GSH is Government Expenditure on Healthcare.

For the purpose of this study, data on various factors, including government spending on education and healthcare and Human Development Indices, were collected from sources including the United Nations Development Program's Human Development Reports, World Bank, and Governments of developing ASEAN countries. The data was gathered for the years between 2000 and 2019, with the time period being limited to the availability of data.

The authors utilized a multiple regression analysis model using the Panel Least Squares method to examine the relationship between government spending on health and education and the human development index (HDI).

The different tests included in this study were the Panel Unit Root Test, assessing data stationarity; the Pedroni Residual Cointegration Test, identifying cointegrating relationships; the Pairwise Granger Causality Test, determining causal links; and the Panel Least Squares Method, facilitating regression analysis within a panel data framework.

IV. RESULTS AND DISCUSSION

This research aimed to examine the relationship between the government expenditure on health and education on the HDI of five ASEAN countries. The data were collected from the United Nations Development Program's Human Development Reports and World Bank for the years between 2000 and 2019.

To measure the human development in the five ASEAN countries, HDI was utilized in the study. The countries have sustained an increasing rate of HDI from 2000 to 2019. According to the classifications of UNDP, the Philippines, Thailand, and Indonesia were countries with medium human development with HDI between 0.500 and 0.699 in 2000. In 2019, the Philippines and Indonesia were classified as having high human development with HDI between 0.700 and 0.799, while Thailand had very high human development ranging equal to or greater than 0.800. Malaysia was classified as having high human development in 2000 and improved its living standard to very high in 2019. Lastly, Singapore maintained its very high human development between 2000 and 2019. This signifies that the countries continuously improve the citizens' quality of living.

Government spending on education secures the accessibility and quality of education for its citizens. The general trend for all countries is a decreasing percentage of GDP for spending on education. In the Philippines, the decline started in 2001, while Singapore's decrease in government spending on education began in 2005. Additionally, Malaysia had a massive decrease in 2004. These reductions in government spending on education were likely to be a cause of financial crises and economic slowdown in ASEAN countries. The financial crises caused government spending in the countries to tighten. Although studies have not yet confirmed the lower productivity in education and health during the economic slowdown, the evidence of the financial crisis in the years 1997 and 1998 proved the negative impacts of the crisis on education and health (ASEAN, 2010).

Government spending on health encompasses the health services of its citizens, including the funds for public hospitals and health centers, family planning, and other health-related activities. Generally, the trend for the five countries is increasing. Conversely, the Philippines had a massive decrease in government spending on health in 2001 and 2002. The percentage of GDP of the social services during the presidency of Arroyo declined from 6.4 to 5.4 percent. This affected the country's education, health, labor welfare, land distribution, and other services (Diokno, 2010). This caused a massive decline in the government spending on health in the Philippines.

In evaluating the viability of the data, stationarity and cointegration of the data were observed using Levin, Lin & Chu t-statistic, Im, Pesaran, and Shin W-Statistic, Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Pedroni Residual Cointegration Test. The results are presented in the tables below.

Table 1. Summary of Panel Unit Root Test of First Difference of HDI

Panel unit root test: Summary
Series: D(HDI)
Sample: 2000 2019
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on AIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections
Null: Unit root (assumes common unit root process)			
Levin, Lin & Chu t*	-6.60902	0.0000	5
Null: Unit root (assumes individual unit root process)			
Im, Pesaran and Shin W-stat	-4.59838	0.0000	5
ADF - Fisher Chi-square	41.0451	0.0000	5
PP - Fisher Chi-square	70.6255	0.0000	5

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root tests were conducted using the first difference in HDI from 2000 to 2019. The analysis considered individual effects and utilized automatic lag length selection based on the Akaike Information Criterion (AIC), with lag length ranging from 0 to 3. Newey-West automatic bandwidth selection and the Bartlett kernel were employed to account for autocorrelation and heteroskedasticity.

The Levin, Lin & Chu t-statistic, which assumes a common unit root process across cross-sections, yielded a t-statistic of approximately -6.60902 with a p-value of 0.0000. This result provided compelling evidence against the presence of a unit root, indicating that the data for HDI is stationary.

Im, Pesaran, and Shin W-Statistics were used to consider individual unit root processes. It produced a W-statistic of approximately -4.59838 with a p-value of 0.0000. This outcome further reinforced the conclusion that the data for HDI is stationary, even when assessing individual processes. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were also applied. These tests are consistent with the prior findings, as both returned extremely low p-values, close to 0.0000, offering strong evidence against a unit root. Thus, the data is confirmed to be stationary according to these tests as well.

In summary, the panel unit root tests consistently demonstrate that the first difference of HDI panel data from 2000 to 2019 does not exhibit unit root properties and is likely stationary since the probability of the three tests is less than the alpha level of 0.01. This signified that the data is suitable for further stationary panel data analysis.

Table 2. Summary of Panel Unit Root Test of First Difference of GSH

Panel unit root test: Summary
Series: D(GSH OF GDP)
Sample: 2000 2019
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on AIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections
Null: Unit root (assumes common unit root process)			
Levin, Lin & Chu t*	-5.66291	0.0000	5
Null: Unit root (assumes individual unit root process)			
Im, Pesaran and Shin W-stat	-4.97603	0.0000	5
ADF - Fisher Chi-square	44.3679	0.0000	5
PP - Fisher Chi-square	169.142	0.0000	5

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Further, panel unit root tests were conducted using the first difference of Government Spending on Health (GSH) as a percentage of Gross Domestic Product (GDP) from 2000 to 2019.

The Levin, Lin & Chu test yielded a strong result with a statistic of approximately -5.66291 and a p-value of 0.0000. This test assumes a common underlying process across the data and strongly indicates that the GSH data is stationary, following a consistent pattern. Likewise, the Im, Pesaran, and Shin tests provided a similar outcome with a statistic of around -4.97603 and a p-value of 0.0000. This test examines if each data point has an individual process and, like the first test, suggests that the GSH data is stationary. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests further confirm stationarity. The ADF test resulted in a statistic of 44.3679 and a p-value of 0.0000, while the PP test yielded a statistic of 169.142 with a p-value of 0.0000.

In summary, these results reiterate that the GSH data is stationary and does not possess unit root properties. This signified that the data is suitable for further stationary time series analysis.

Table 3. Summary of Panel Unit Root Test of First Difference of GSE

Panel unit root test: Summary
Series: D(GSE OF GDP)
Sample: 2000 2019
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on AIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.50222	0.0000	5	80
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-8.67058	0.0000	5	80
ADF - Fisher Chi-square	72.1673	0.0000	5	80

PP - Fisher Chi-square	77.4839	0.0000	5	83

To assess whether the data exhibits a stable pattern over time, the panel unit root tests were conducted using the first difference of Government Spending on Education (GSE) as a percentage of Gross Domestic Product (GDP) from 2000 to 2019.

The results of the tests of Levin, Lin & Chu t-Statistic showed a strong statistical result (approximately -8.50222) with a very low p-value of 0.0000, indicating that the GSE data is stationary and maintains a stable pattern. Additionally, Im, Pesaran and Shin W-Statistic presented a similarly compelling result (approximately -8.67058) with a p-value of 0.0000, reinforcing the idea of stationarity for the GSE data, even when accounting for individual processes. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests consistently supported the stationary nature of the data, with extremely low p-values close to 0.0000.

In summary, all panel unit root tests affirm that the GSE data is stationary. This signifies that the data was reliable for further interpretation of panel data analysis.

Table 4. Pedroni Residual Cointegration of First Differences of GSE, GSH, and HDI

Pedroni Residual Cointegration Test
Series: D(GSE OF GDP) D(GSH OF GDP) D(HDI)
Sample: 2000 2019
Included observations: 100
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with lags from 2 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.434992	0.3318	-0.552234	0.7096
Panel rho-Statistic	-2.822958	0.0024	-3.512433	0.0002
Panel PP-Statistic	-6.131638	0.0000	-8.974443	0.0000
Panel ADF-Statistic	-5.952466	0.0000	-8.063058	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-2.061433	0.0196
Group PP-Statistic	-8.623934	0.0000
Group ADF-Statistic	-7.365786	0.0000

The Pedroni Residual Cointegration Test was applied to a dataset encompassing the three variables, the first differences of GSE of GDP, GSH of GDP, and HDI, spanning from 2000 to 2019. The objective was to ascertain if there is evidence of long-term relationships, or cointegration, among these variables.

The null hypothesis assumed no cointegration, conveying that the variables did not exhibit a long-term interconnected relationship. Additionally, the analysis proceeded under the assumption of no deterministic trend.

The alternative hypothesis for Common AR Coefficients within the same dimension, the Panel v-statistic, provided weak, non-significant evidence (p = 0.3318), while the Panel rho-statistic offered stronger, significant evidence (p = 0.0024), supported by highly significant p-values from Panel PP-Statistic and Panel ADF-Statistic (both p = 0.0000).

While the alternative hypothesis for Individual AR Coefficients between dimensions, the Group rho-statistic hinted at evidence (p = 0.0196), strongly supported by highly significant p-values from Group PP-Statistic and Group ADF-Statistic (both p = 0.0000).

In summary, the Pedroni Residual Cointegration Test reveals evidence of cointegration among the variables at a 10% significance level. This suggests that there is a long-term relationship among the variables GSE, GSH, and HDI. This supports the findings of Ruzima and Veerachamy (2023) and Das et al. (2019), affirming that there is a long-run relationship between social spending and HDI. The nature and strength of this cointegration may vary, with some tests suggesting common AR coefficients within the same dimension and others pointing to individual AR coefficients between different dimensions.

Table 5. Causality Tests of First Differences of GSH, GDP, and HDI

Pairwise Granger Causality Tests
Sample: 2000 2019
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
D(GSH OF GDP) does not Granger Cause D(GSE OF GDP)	69	1.53850	0.2134
D(GSE OF GDP) does not Granger Cause D(GSH OF GDP)		1.08932	0.3603
D(HDI) does not Granger Cause D(GSE OF GDP)	69	0.44803	0.7196
D(GSE OF GDP) does not Granger Cause D(HDI)		2.22906	0.0937
D(HDI) does not Granger Cause D(GSH OF GDP)	80	0.52980	0.6632
D(GSH OF GDP) does not Granger Cause D(HDI)		1.65766	0.1836

Pairwise Granger Causality Tests were applied to assess potential causal relationships among variables over 2000-2019. These tests determine if one variable Granger causes another.

The test reveals a significant unidirectional causal link between the first difference in GSE and the first difference in HDI, with a p-value of 0.0937, falling below the 0.1 significance level. This suggests that changes in GSE (% of GDP) may influence changes in the HDI. However, no other tested variables show similar causal relationships.

In conclusion, the Granger causality tests suggest a specific causal association between GSE and HDI during the 2000-2019 period. The test result further validates the studies of Patel and Annapoorna (2019) and Razmi and Abbasian (2012), wherein public spending on education, relative to the total government budget, significantly influences changes in the Human Development Index (HDI).

Table 6. Hausman Test of First Differences of GSH, GDP, and HDI

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

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	2	1.0000

To determine the model used in the regression analysis, the Hausman Test was used to specify the suitable model in the study. The null hypothesis presumed that the random effect model is accepted as the technique in regression. The probability result of the Hausman Test was 1.00, which signified the acceptance of the null hypothesis. This specified that the model to be used in this study is the random effect model.

The regression was conducted using the random effects model. The explanatory variables, the first differences between GSH and GSE, and the dependent variable, the first difference of HDI, were utilized in the model. The result is shown in the table below.

Table 7. Panel Least Squares Method of First Differences of GSH, GDP, and HDI

Dependent Variable: D(HDI)
Method: Panel Least Squares
Sample (adjusted): 2001 2019
Periods included: 19
Cross-sections included: 5
Total panel (unbalanced) observations: 90
White period standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006113	0.000238	25.69926	0.0000
D(GSH OF GDP)	-0.002807	0.005243	-0.535329	0.5942
D(GSE OF GDP)	0.000696	0.000382	1.821697	0.0731

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.323240	Mean dependent var	0.005967
Adjusted R-squared	0.073359	S.D. dependent var	0.004631
S.E. of regression	0.004458	Akaike info criterion	-7.758043

Sum squared resid	0.001292	Schwarz criterion	-7.063651
Log likelihood	374.1119	Hannan-Quinn criter.	-7.478024
F-statistic	1.293575	Durbin-Watson stat	2.336928
Prob(F-statistic)	0.205059		

The findings reveal a significant and positive relationship between the first differences of GSE and GSH at a 0.1 significance level, with a constant value of 0.006113. A unit increase in government expenditure on education corresponds to a 0.000696 increase in HDI. This further proves the consistent evidence across multiple studies (Ho, 2022; Maharda & Aulia, 2020; Herianingrum et al., 2019; Haque & Khan, 2019; Pahlevi, 2017; Fattah & Muji, 2012; Fatria, 2020; Asghar et al., 2012) supporting the significant and positive impact of government expenditure on education on HDI.

Contrastingly, the analysis reveals a positive yet insignificant effect of government expenditure on health on HDI. This aligns with Maharda and Aulia's (2020) findings, suggesting that government spending on health lacks influence on HDI due to inefficiencies within the public health sector across the 12 provinces of Indonesia.

V. CONCLUSION

In this study, the effects of government expenditure on health and education on HDI were aimed to be evaluated. From the collection of data in the United Nations Development Program's Human Development Reports and World Bank, the data were analyzed for validity through various statistical tests. The statistical tests showed that the government expenditure on health and education and HDI were stationary even when processed and gauged the individual data processes. Additionally, the variables have contributed to a relationship in the long run. However, only the GSE is assumed to influence the HDI.

The panel data regression analysis provided a substantial and positive impact of government expenditure on education on the Human Development Index (HDI), in line with several prior research studies. However, while positive, government spending on health was found to be statistically insignificant.

The authors recommend several policy considerations. Firstly, given the substantial and positive impact of government expenditure on education on the Human Development Index (HDI), it is encouraged to prioritize and reinforce investments in education. This could encompass initiatives aimed at improving educational infrastructure, enhancing the quality of education, and ensuring equitable access across diverse regions. Simultaneously, there is a need for a thorough evaluation of the efficiency and effectiveness of health expenditures despite their positive but statistically insignificant impact on HDI. This policy should focus on optimizing healthcare delivery systems, strengthening public health initiatives, and addressing potential inefficiencies in resource allocation within the health sector.

To refine health expenditure interventions, policymakers can explore targeted approaches to address specific inefficiencies or areas of improvement. This may involve directing resources toward key health initiatives or regions with identified gaps. Additionally, fostering collaboration between relevant government agencies, international organizations, and research institutions can facilitate knowledge sharing and the implementation of best practices. This collective effort is essential for informed policymaking and the development of effective strategies to improve the Human Development Index sustainably.

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