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Research Articles

Governmental expenditure on education: Efficiency analysis in Asean countries, period 2015 – 2021

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ABSTRACT

Recently, the issue of public spending efficiency has garnered the attention of both policymakers and researchers worldwide. Therefore, this study aims to evaluate the effectiveness of public spending in the education sector in several ASEAN countries during the period from 2015 to 2021. Based on the DEA - Malmquist - Tobit method, the study utilizes 2 inputs and 2 outputs, along with 3 impact factors, to conduct an efficiency analysis and the impacts on the effectiveness of public spending on education**.** The results indicate that Singapore, Thailand, and Vietnam are the three countries that consistently achieved efficient public spending in education from 2015 to 2021. In contrast, countries such as Indonesia, Malaysia, and the Philippines have not maintained efficiency in public spending in the education sector during this period. Furthermore, the efficiency of educational spending in these countries mainly depends on technology; however, most countries have not achieved pure technical efficiency, indicating that investment in technology is one of the key factors contributing to enhancing public spending efficiency. Additionally, considering the impact factors, foreign aid (ODA) and GDP per capita (GDPC) negatively affect the efficiency of national public spending, whereas trade openness (TRADE) has the opposite effect. Based on these findings, the author will provide recommendations regarding the state of education spending in these countries. Specifically, the government can gather issues in the field of primary education to find ways to improve and implement the budgeting process and allocate spending appropriately. In addition, the potential for high technology to be applied in teaching and learning is the key to promoting a modern, fair, and highly effective education system. Moreover, education spending heavily depends on the specific macroeconomic situation of each country. Therefore, educational spending policies should consider in relation to factors such as GDP per capita, trade openness, and foreign aid.

Key words: Public expenditure on education, DEA, Malmquist, Tobit

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INTRODUCTION

Currently, education is a global concern because the quality of human resources is one of the factors contributing to the development of countries. According to information from the Ministry of Finance, in the second half of the twentieth century, countries' interest in education became a global phenomenon [1]. According the World Bank – WB data, since 1990, the proportion of government spending on education programs in many developing countries has been close to the average level in developed countries. Besides, education is also identified as a top priority of the ASEAN Community and is one of three goals recorded in the ASEAN Charter. In a rapidly changing world, countries have determined to put people at the center of the development process because, after all, economic growth and socio-economic development are human development [2]. After the COVID-19 pandemic, ASEAN member countries focused on discussing each country's education and training situation, sharing practical lessons and experiences, and finding cooperative solutions for development. sustainable education of each country, in which public spending efficiency is a top concern [3]. Effective education spending is an issue of concern to governments of countries because: (i) The government uses scarce resources from people's tax collection to spend on education; (ii) Improving the efficiency of public spending on education will benefit society and create positive socio-economic externalities. In addition, there are currently many viewpoints on whether public spending on education should be increased or decreased. At the same time, debates surrounding the increase or decrease in public spending are also associated with the emergence of models of autonomy for educational institutions to achieve their own educational goals and effectiveness. Faced with the issues within the education system, the Government is more concerned with the efficiency of spending in education as a basis for considering whether to continue ad-

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justing spending on education and what factors genuinely impact the effectiveness of a country's public spending on education?

The effectiveness of public spending has been studied in many stages and in many different countries. However, the research results only apply to the subject under consideration and cannot be used to infer other subjects. Just because a country is efficient in spending doesn't mean another country is also efficient. Therefore, to analyze and find out the level of effectiveness in educational spending on subjects of interest such as Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam, the author decided to carry out the topic: "Governmental Expenditure On Education: Efficiency And Influencing Factors Analysis In Some ASEAN Countries, Period 2015 - 2021".

LITERATURE REVIEW

Concept of the role of the state in public spending on education

Public spending on education includes direct spending on educational institutions and education-related public subsidies given to households and administered by educational institutions[4]. According to the steps for evaluating the effectiveness of public spending programs on education by Joseph E. Stiglitz[5], public spending on education aims to bring about social benefits and address issues of market inefficiency and social inequities.

The program is necessary for "circumstances" such as current spending on education that does not fully and adequately meet the needs of society, the allocation of government resources for education ineffectively, and social inequality. Therefore, the education spending program is needed for "beneficiaries" who are participating in the national education program, that is, studying at levels such as primary, primary to post-secondary, non-tertiary, and tertiary levels... An effective spending program on education will bring "benefits" to help improve training quality and enhance human capacity, contributing to improving labor productivity and developing the economy.

Related to market problems and social problems, identify market failures related to public goods, externalities, incomplete markets, information failures, imperfect competition, individual perceptions, distribution of income and equity... and social problems related to merit goods, society equality… In particular, regarding the distribution of income and equity, not everyone has the financial ability to pay for education, leading to inequality in opportunities to access education among students. Or as a matter of public goods, education can be viewed as a public good, meaning that one person's receipt of education does not reduce the likelihood of another person receiving the same education. This can lead to an undersupply from the private sector as profits cannot be maximized. In addition, the problem of asymmetric information, when consumers (pupils, students, parents) do not have enough information about the quality of schools, training programs, or career opportunities after graduation, they may make sub-optimal decisions regarding their choice of educational institution, and countless other market failures exist in the education market.

Macro and Micro perspective on the efficiency of public expenditure on education

From a macro perspective, Teresa Balaguer-Coll & Prior[6] found some countries such as Luxembourg, Sweden, and Denmark to be inefficient in education spending despite having higher spending levels than other countries. On the other hand, this result coincides with the study of Afonso et al.[7]. Besides, based on the Free Disposable Hull (FDH) and Data Envelopment Analysis (DEA) method, the problem of ineffective spending on education is also witnessed in Croatia when Sopek[8] concluded that Croatia faces inefficiencies in public spending on education due to a surplus of teachers. Teacher salaries also need to be adjusted to compete with private sector salaries, as these salaries indirectly affect student learning outcomes and are critical in attracting, developing and retaining skilled and high-quality teachers. In addition, in Sonje et al.[9] study on the efficiency of Croatia's education spending compared to other countries in 2009, 2012, and 2015, the efficiency of this country's public spending was less effective. Unlike Sopek[8], Sonje et al.[9] study used the input factors of public spending on education per student and percentage of total education spending, while the output variables for secondary education are PISA results and the proportion of unemployed people with university degrees, however, the results for efficiency levels in Croatia are similar to those of Sopek[8]. In European countries, Mandl & Ebejer[10] also analyzed educational efficiency through the PISA output index and used the Envelopment Analysis (DEA) method to prove that the average educational spending efficiency of European countries is relatively high. With the same Envelopment Analysis (DEA) method, Mandl & Ebejer[11] studied education in Malta, the results showed that primary and secondary education spending was relatively effective. However, education spending on Higher education is ineffective. In another approach,

Afonso et al.[12] and Afonso et al. (6) used the Free Disposable Hull (FDH) method to review the efficiency of public spending in 23 EU member countries and concluded that the efficiency of public spending has gradually decreased over the years. For a broader study of 81 countries in the period 2006 - 2010, Prasetyo & Zuhdi[13] found that the average educational spending efficiency index in these countries remained relatively stable over the years, in which Singapore and Zambia are the two highest - rated countries.

From the micro perspective, Mohanty & Bhanumurthy[14] researched 27 central states in India on the effectiveness of public spending on education with two input factors: the ratio of public spending to GDP and the ratio of non-educational spending to GDP, and two output factors are the general enrollment rate for general education and higher education, especially the research is also placed in the context of comparison with the effectiveness of health spending. Research results show that the efficiency of spending on education is higher than the efficiency of spending on health. Besides, Sankar[15] also investigated the state of India and found that the efficiency of public spending has decreased over the years due to limited investment allocation. In addition, in China, the efficiency of education spending from 1998 - 2015 in 31 provinces improved significantly over the years[16]. However, the SBM - Malmquist model used by Cao et al.[17] to research 31 provinces in China during the period 2012 - 2021 brought results with the efficiency of educational investment gradually decreasing over time. Additionally, Prasetyo & Zuhdi[13] again approached 38 districts and cities in East Java during the period 2007 - 2014. The results showed that government spending on the education sector was relatively ineffective. In the period 2001 - 2011, Brazil also achieved efficiency in education spending in regions[18].

The relationship between ODA, GDPC, and TRADE on public spending

Regarding foreign aid (ODA), Shah[19] showed that the impact of foreign aid on education policy areas was negative in 77 developing countries during the period 2000 - 2020, the cause of this may come from the unreasonable allocation of spending in aid sources. However, research by Angelopoulos et al.[20] shows that foreign aid can have a positive impact on public sector management, education systems, and stability in recipient countries. This result is similar to some studies[21–23]. Regarding GDP per capita (GDPC), research by Tu et al.[16] has suggested that the more GDP increases, the more effective public spending becomes in China from 1998 to 2015. In addition, average GDP per capita has a positive and significant impact on the efficiency of public spending on education in the study of Shah[19]. According to Zhao[24], regions with the highest GDP per capita are the ones that benefit the most from public spending on education. This result is similar to some studies[25–27]. As for the trade openness factor, trade liberalization contributes to improving the efficiency of the public sector by promoting competition, and market access and achieving efficiency through specialization. Increased competition from foreign companies may push domestic companies to improve efficiency and productivity[28]. However, Shah[19] did not find significant and consistent results with stable performance.

From studies on macro, micro perspective on the efficiency of public expenditure on education, and the relationship between ODA, GDPC, and TRADE on public spending. We can look back at the overview of previous studies, most of the research primarily focuses on large-scale studies in regions such as Europe or major cities in large countries like China, India, etc. There appears to be very little research focused on the effectiveness of public spending on education within the scope of the six ASEAN countries of current interest, including Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. Moreover, most studies have only concentrated on the effectiveness of public spending on education without extending their analysis to consider the impact of other factors such as Net ODA received (% of GNI), GDP per capita (GDPC), and Trade Openness (Trade (% of GDP)) on the effectiveness of public spending on education. For example, studies by Teresa Balaguer-Coll & Prior[6], Sopek[8], Sonje et al.[9] have only provided in-depth research related to the effectiveness of public spending on education without further discussion on the external factors impacting this effectiveness. Therefore, this study aims to fill this gap by focusing on the six ASEAN countries during the 2015-2021 period and applying the Data Envelopment Analysis Methodology (DEA methodology) – Malmquist – Tobit to evaluate the effectiveness of public spending on education, while also examining the effectiveness of public spending on education over time and analyzing the impact of other factors on the effectiveness of public spending on education.

METHOD

Data Envelopment Analysis Methodology (DEA methodology)

Data Envelopment Analysis Methodology (DEA) is considered a non-parametric statistical technique that

was researched and developed by Coelli[29]. This method constructs an envelopment frontier over data points such that all observed points lie above or below the production frontier[30], and is applied primarily to measure whether Decision Making Units (DMU) of multiple inputs and outputs of the same type are technically efficient[31]. Coelli[29] assumed that production efficiency is constant with scale (CRS), so it is not highly general in evaluating efficiency. Banker et al.[32] developed the variable efficiency of scale (VRS) model and overcame the disadvantages of CRS in Charnes's study. Data Envelopment Analysis Methodology is used to assess the efficiency of public investment in education across countries.

The CRS model used to evaluate DEA effectiveness in the education sector is estimated through the following model:

$$
\begin{aligned}
&Max \in 0 = u_1 SLE + u_2 PLE \\
&With\, v_1 TPE + v_2 TPG = 1 \\
&u_1 SLE_i + u_2 PLE_i - v_1 TPE_i - v_2 TPG_i \leq 0 \\
&u_{1,2}, v_{1,2} \geq 0
\end{aligned}
$$

The VRS model used to evaluate DEA effectiveness in the education sector is estimated through the following model:

$$
\begin{aligned}
&Max \in 0 = u_1 SLE + u_2 PLE + u_0 \\
&With\, v_1 TPE + v_2 TPG = 1 \\
&u_1 SLE_i + u_2 PLE_i - v_1 TPE_i - v_2 TPG_i \leq 0 \\
&u_{1,2}, v_{1,2} \geq 0
\end{aligned}
$$

Which, TPE = Public expenditure on education % GDP; TPG = Government expenditure on education, total (% of government expenditure); SLE = Secondary level enrollment: School enrollment, secondary (% gross); PLE = Primary level/net enrollment (% gross); $u_{1,2}$ = The weight for the output SLE, PLE; $v_{1,2}$ = The weight for the input SLE, PLE; i = Individual unit (district); and u_0 = Coefficient that can be valuable positive or negative (Figure 1).

Malmquist Index

In 1953, Malmquist[33] worked to measure the change in TFP between two time periods. The distance functions are specified relative to a set of inputs or outputs to compare technical efficiency at t+1 and t. The original analytical method was presented by Coelli[30], to estimate the change in TFP (Malmquist index) and decompose it into change components – technical efficiency change and technological efficiency change. For the Malmquist Index with efficiency change to scale (VRS), EFFCH (Technical efficiency change index) is the product of two components including pure technical efficiency change index (PECH) and scale efficiency change index (SECH). Besides, the TECH index is the technological progress change index. In general, the Malmquist index measures the productivity of the production point (x+1, y+1) relative to the production point (x,y). An index value greater than one indicates a positive improvement in efficiency. Fare et al.[34] specify the Malmquist index as:

$$
\begin{aligned}
&m_0(y_{t+1}, x_{t+1}, y_t, x_t) = \\
&\left[\frac{d_0^t(x_{t+1}, y_{t+1})}{d_0^t(x_t, y_t)} \times \frac{d_0^{t+1}(x_{t+1}, y_{t+1})}{d_0^{t+1}(x_t, y_t)}\right] \\
&Where: \left[d_0^t(x_t, y_t)\right]^{-1} = max_{\phi,\lambda}\, \phi, \\
&S.t \begin{cases} -\phi y_{it+1} + Y_{t+1}\lambda \geq 0 \\ x_{it+1} - X_{t+1}\lambda \geq 0 \\ \lambda \geq 0 \end{cases} \\
&\left[d_0^t(x_{t+1}, y_{t+1})\right]^{-1} = max_{\phi,\lambda}\, \phi, \\
&S.t \begin{cases} -\phi y_{it+1} + Y_t\lambda \geq 0 \\ x_{it+1} - X_t\lambda \geq 0 \\ \lambda \geq 0 \end{cases} \\
&\left[d_0^{t+1}(x_t, y_t)\right]^{-1} = max_{\phi,\lambda}\, \phi, \\
&S.t \begin{cases} -\phi y_{it} + Y_{t+1}\lambda \geq 0 \\ x_{it} - X_{t+1}\lambda \geq 0 \\ \lambda \geq 0 \end{cases}
\end{aligned}
$$

Tobit regression

According to McDonald[35] and Novignon[36], the Tobit model is used to estimate the relationship between the dependent variable *yi* (efficiency score) and the determinant of educational spending efficiency). The Tobit model for panel data can be defined as follows:

$$
\begin{aligned}
&y_{it}^* = x_{it}\beta + e_{it} \\
&Where:\ y_{it} = 0\ if\ y^* \leq 0 \\
&y_{it} = 1\ if\ y^* \leq 1 \\
&y_{it} = y_{it}^*\ if\ 0 < y < 1
\end{aligned}
$$

y_{it} is the dependent variable; x_{it} is the vector of independent variables; β is the unknown coefficient and e_{it} is the independently distributed error assumed to be normally distributed with a mean of 0.

$EFF_{it} = v_i + \beta_1 OCD_{it} + \beta_2 LGDP_{it} + \beta_3 TRADE_{it} + \varepsilon_{it}$

Where i and t represent country and time respectively, while vi is the individual fixed effect and ε_{it} is the error. Tobit regression is used to assess the impact of various other factors on the efficiency of public investment in education.

DATA AND SAMPLE

The study collects data from 6 countries in ASEAN: Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam from 2015 to 2021. The study identifies input indicators, including Public expenditure

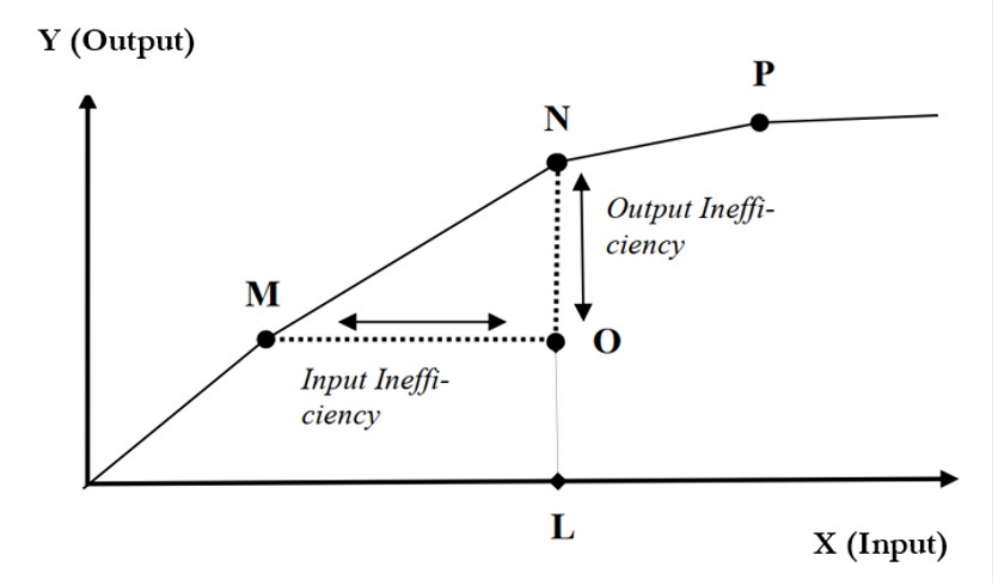

Figure 1: Efficiency Frontier

on education (% GDP) and Government expenditure on education, total (% of government expenditure). Public expenditure on education (% GDP) reflects the percentage of government spending on education as a share of the total gross domestic product[37]. Additionally, Government expenditure on education, total (% of government expenditure) reflects the extent of government spending on education compared to all other sectors[38]. For output indicators, Primary level/net enrollment (% gross) and Secondary level enrollment (% gross) are factors that reflect the enrollment rates of students at the primary and secondary levels, respectively[39], both of which contribute to reflecting the educational attainment of the population in a country. Table 1 summarizes input and output indicators and statistical descriptors for each indicator.

The study uses data from 6 ASEAN countries over 7 years, equivalent to 42 observations. Descriptive statistics results show that the lowest rate of Public expenditure on education (% of GDP) is about 2.7%, and the highest is about 4.704%, demonstrating the difference in public expenditure on education % of countries' GDP significantly (2% difference). In addition, the ratio of spending on education compared to the total spending of countries also has a large difference, proving that some countries still prioritize invest in education. Apart from those, the output index of countries is related to Primary level/net enrollment (% gross) and Secondary level enrollment, secondary (% gross) at a relative level. Regarding the dependent variables, the ODA variable with the smallest value is negative due to the presence of Singapore, which is a country that does not receive foreign aid because Singapore belongs to a group of developed countries. In particular, GDPC and TRADE variables have a significant difference between min and max due to differences in the economic situation and the level of trade openness between countries.

RESULT & DISCUSSION OF EFFICIENCY

Data Envelopment Analysis Results

Regarding the technical efficiency and the cost of using the assumption of the constant return to scale installation design (CRS), the results in Table 2 show that within 7 years, Singapore is the country with the best efficiency in education spending and maintains the level of efficiency and maintain the level of efficiency is 1 over the years. In addition, Thailand and Vietnam are also two countries that are assessed to have effective investments in education every year. Only in 2020 is the level of investment in education of these two countries ineffective. In addition, Indonesia, Malaysia, and the Philippines are three countries that are considered ineffective in investing in education during this period. In particular, until 2021, Malaysia and the Philippines will still be ineffective investing in education.

Table 1: The measurements and data sources

Indicators	Measurement metrics		Mean	Max	Min	Std. dev	Source
Input indicators	TPE	Public expenditure on education (% GDP)	3.417	4.704	2.70	0.549	World Bank
	TPG	Government expenditure on education, total (% of government expenditure)	16.927	21.6479	11.215	2.62214	World Bank
Output indicators	SLE	Secondary level enrollment, secondary (% gross)	96.1616	134.442	78.583	13.4191	World Bank
	PLE	Primary level/net enrollment (% gross)	103.515	120.023	90.61	6.034	World Bank
Dependent variable	EFF	The efficiency of public spending on education (DEA)					
Independent variable	ODA	Net ODA received (% of GNI)	0.1557	1.39461	-0.087	0.32063	World Bank
	GDPC	GDP per capita (GDPC)	15166.4	77710.1	2595.2	22286.6	World Bank
	TRADE	Trade Openness (Trade (% of GDP)	138.674	333.34	32.972	93.3448	World Bank

Source: Compiled by Author.

Table 2: The efficiency scores based on DEA results with CRS assumption

Nation	2015	2016	2017	2018	2019	2020	2021
Indonesia	0.950	0.857	1.000	1.000	0.966	0.784	0.916
Malaysia	0.664	0.676	0.681	0.709	0.703	0.602	0.606
Philippines	0.900	1.000	0.760	0.752	0.773	0.661	0.658
Singapore	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Thailand	1.000	1.000	1.000	1.000	1.000	0.982	1.000
Viet Nam	1.000	1.000	1.000	1.000	1.000	0.989	1.000

Source: Author's caculation.

In addition, the results also show that Malaysia is the least effective country in investing in education among the six countries and there has been no improvement in the country's educational investment. However, Charnes et.al[29] showed that using the assumption of the constant return to scale installation design (CRS) is still not very comprehensive, so the results in analysis with VRS assumptions in Table 3 are given to consider the changing efficiency of scale to have a more comprehensive perspective on how to evaluate efficiency. The VRS model assumes that each DMU does not operate at an optimal scale, that is, when the input increases by n units, the output does not always increase by (n) units, it can increase by more or less than n units. Technology is one factor influencing VRS, suggesting the possibility that production scale affects efficiency.

Regarding technical efficiency, which is the cost of using the assumption of the variable return to scale installation design (VRS), the results in Table 3 show that Singapore, Thailand, and Vietnam are the three countries that achieve efficiency in spending on continuing education in the period 2015 - 2021. In addition, Indonesia, Malaysia, and the Philippines have not yet been effective in investing in sustainable education over the years. In 2015, 2017, and 2018, Indonesia still achieved efficiency in education investment, however, from 2019-2021 the efficiency level decreased. Compared to using the CRS assumption, the VRS assumption can produce more efficient areas over 7 years. Differences in the effectiveness of educational investment across countries show the possibility that production scale affects efficiency.

The results show that countries such as Indonesia, Malaysia, and the Philippines are still incorrect in identifying problems with the budgeting process and allocation of government spending on the education sector. The government has not yet performed optimally in identifying and analyzing problems in public services in the education sector in planning budget expenditures to solve market problems and social problems occurring in the education sector. Singapore, Thailand, and Vietnam are three countries that have achieved efficiency in spending on education, proving that countries have achieved reasonable levels of public spending to solve education problems and contribute to the development of the education sector.

Malmquist index and decomposition-dynamic analysis

In general, Table 4 and Figure 2 results show that the total productivity factor index (TFP index) in countries: Indonesia, Malaysia, Singapore, Thailand, and Vietnam is greater than 1 and increases compared to the efficiency level by 1.8%, 1.6%, 1.3%, 1.7%, and 2.7%, which shows that the efficiency of education spending has also increased, while in the Philippines this index is less than 1, only reaching 0.979, meaning the efficiency of education spending has decreased. Vietnam has the highest TFP index increase among countries in the period 2015 - 2021. The level of change in aggregate productivity is mainly based on technological factors (1.027), proving that during this period, Vietnam promoted technology investment in education and significantly improved educational efficiency. In addition, the Philippines' underperformance in the TFP index is due to the lack of improvement in pure technical efficiency, which is the most ineffective among the three factors (TECH, PECH, SECH).

Table 3: The efficiency Scores of the DEA Analysis with VRS Assumptions

Nation	2015	2016	2017	2018	2019	2020	2021
Indonesia	1.000	0.888	1.000	1.000	0.975	0.785	0.934
Malaysia	0.712	0.717	0.729	0.738	0.764	0.603	0.665
Philippines	1.000	1.000	0.799	0.801	0.861	0.693	0.748
Singapore	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Thailand	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Viet Nam	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Author's caculation.

Table 4: Malmquist and decomposition index result from 2015-2021

Nation	Year	TECH	PECH	SECH	EFFCH	Malmquist index
Indonesia	2015 - 2016	1.002	0.888	1.016	0.902	0.903
	2016 - 2017	1.120	1.127	1.036	1.167	1.307
	2017 - 2018	0.965	1.000	1.000	1.000	0.965
	2018 - 2019	0.994	0.975	0.991	0.966	0.959
	2019 - 2020	1.021	0.806	1.008	0.812	0.829
	2020 - 2021	0.981	1.189	0.983	1.168	1.146
Average	2015 - 2021	1.014	0.997	1.006	1.003	1.018
Malaysia	2015 - 2016	1.013	1.006	1.013	1.019	1.032
	2016 - 2017	1.004	1.018	0.989	1.007	1.010
	2017 - 2018	0.994	1.012	1.029	1.041	1.035
	2018 - 2019	1.088	1.035	0.958	0.992	1.079
	2019 - 2020	1.036	0.789	1.086	0.857	0.888
	2020 - 2021	1.042	1.103	0.913	1.007	1.050
Average	2015 - 2021	1.030	0.994	0.998	0.987	1.016
Philippines	2015 - 2016	1.035	1.000	1.111	1.111	1.150
	2016 - 2017	0.993	0.799	0.951	0.760	0.754
	2017 - 2018	1.002	1.002	0.988	0.990	0.992
	2018 - 2019	1.061	1.075	0.956	1.028	1.091
	2019 - 2020	1.092	0.805	1.061	0.855	0.933
	2020 - 2021	0.958	1.080	0.922	0.996	0.953
Average	2015 - 2021	1.023	0.960	0.998	0.956	0.979
Singapore	2015 - 2016	0.975	1.000	1.000	1.000	0.975
	2016 -2017	1.034	1.000	1.000	1.000	1.034
	2017 - 2018	0.984	1.000	1.000	1.000	0.984
	2018 - 2019	1.031	1.000	1.000	1.000	1.031
	2019 - 2020	1.127	1.000	1.000	1.000	1.127
	2020 - 2021	0.929	1.000	1.000	1.000	0.929
Average	2015 - 2021	1.013	1.000	1.000	1.000	1.013
Thailand	2015 - 2016	0.989	1.000	1.000	1.000	0.989
	2016 - 2017	0.979	1.000	1.000	1.000	0.979
	2017 - 2018	1.078	1.000	1.000	1.000	1.078
	2018 - 2019	1.005	1.000	1.000	1.000	1.005
	2019 - 2020	1.108	1.000	0.982	0.982	1.088
	2020 - 2021	0.945	1.000	1.019	1.019	0.963
Average	2015 - 2021	1.017	1.000	1.000	1.000	1.017
Viet Nam	2015 - 2016	0.996	1.000	1.000	1.000	0.996
	2016 - 2017	1.007	1.000	1.000	1.000	1.007
	2017 - 2018	0.993	1.000	1.000	1.000	0.993
	2018 - 2019	1.088	1.000	1.000	1.000	1.088
	2019 - 2020	1.041	1.000	0.989	0.989	1.030
	2020 - 2021	1.038	1.000	1.011	1.011	1.049
Average	2015 - 2021	1.027	1.000	1.000	1.000	1.027

Source: Author's caculation.

Regarding technological efficiency, almost 6 countries have an increase in the period 2015 - 2021, with the lowest increase being Singapore (1.3%) and the highest increase being Malaysia (3%). Besides, in terms of pure technical efficiency, only Singapore, Thailand, and Vietnam maintained a level of 1.000, on the contrary, Indonesia, Malaysia, and the Philippines had a slight decrease compared to the efficiency level. In addition, Indonesia is the country with the highest efficiency of scale, exceeding 0.6%.

In general, for the increase in total factor productivity, countries are strongly influenced by the development factor of technology, which proves that technology is one of the key factors contributing to improving the efficiency of public spending. In addition, most countries with the TFP index are less affected by pure technical efficiency (a factor not influenced by technology) the reason may come from the fact that countries are promoting investment and development. Technology is entering the education industry to improve the effectiveness of teaching and training, so pure techniques are gradually replaced by high-tech equipment.

RESULT & DISCUSSION OF INFLUENCING FACTORS

In the tobit panel model, the likelihood ratio chi-square test of the model was performed first and Table 5 results showed that the P value of the model for this test was 0.0417.

Tobit regression results show that when ODA increases by 1 unit, the efficiency of education spending decreases by 0.291 units, ceteris paribus. The reason may come from the fact that the effectiveness of educational activities can be influenced by many other factors in society (not just the cost factor). In addition, foreign aid has a negative impact on the efficiency of public spending due to the way foreign aid is used and managed under conditions of limited institutional capacity. This result also coincides with the research of Shah [19] when this author also determined that ODA has a negative impact on the efficiency of education spending. In addition, when GPDC increases by 1 unit, the efficiency of public spending decreases by 0.384 units, ceteris paribus. This is because as people's income increases, they are more able to spend money on education, so the efficiency of government spending becomes less effective. In addition, as the average income of people increases with economic development and many new needs arise in education, government spending is not enough and not properly met. On the contrary, the TRADE variable positively impacts on the efficiency of public spending in the education sector. Promoting trade can promote increasing national income, importing modern educational equipment and learning new technology, creating other positive impacts that contribute to improving the efficiency of education spending.

CONCLUSION AND IMPLICATION

Overall, only three countries, Singapore, Thailand, and Vietnam, achieved efficiency in educational investment in the period 2015 - 2021. Meanwhile, Indonesia, Malaysia, and the Philippines did not achieve educational efficiency during this period. Almost all countries saw an increase in the efficiency of education spending thanks to efficiency in technology investments with the average efficiency in the period 2015 - 2021 exceeding 1.00. This shows that countries are paying attention to promoting the application of technology in the educational investment process. Governments can bring together the problems in the primary education sector to find ways to improve and implement budgeting processes and appropriate expenditure allocations so that the latter spending could improve educational quality in each country.

Regarding other decomposition indexes, Indonesia, Malaysia, and the Philippines do not achieve pure technical efficiency, which shows that countries do not effectively manage capital resources and do not allocate spending appropriately in the investment process for the public sector. Therefore, these countries must tighten management and make reasonable plans for public spending on education. Countries should also focus on investing in technology in education because technology is one of the critical factors in the period of industrialization and modernization to improve the quality of resources. In addition, other countries should learn from Thailand to exploit the efficiency of scale when investing in education to consider appropriately expanding or shrinking spending. Besides, pure technical efficiency is also a factor that countries should pay attention to, from which they can improve the application of technology on input factors to achieve better output efficiency. In general, exploiting the potential of high technology to apply to teaching and learning is the key to promoting a modern, fair, and highly effective education system. This will help improve labor quality, positively impacting socio-economic development.

Regarding the impact of factors, with aid from foreign countries (except Singapore, which does not receive aid), countries should invest and consider managing aid sources appropriately in public investments. Proper aid management in the process of allocating

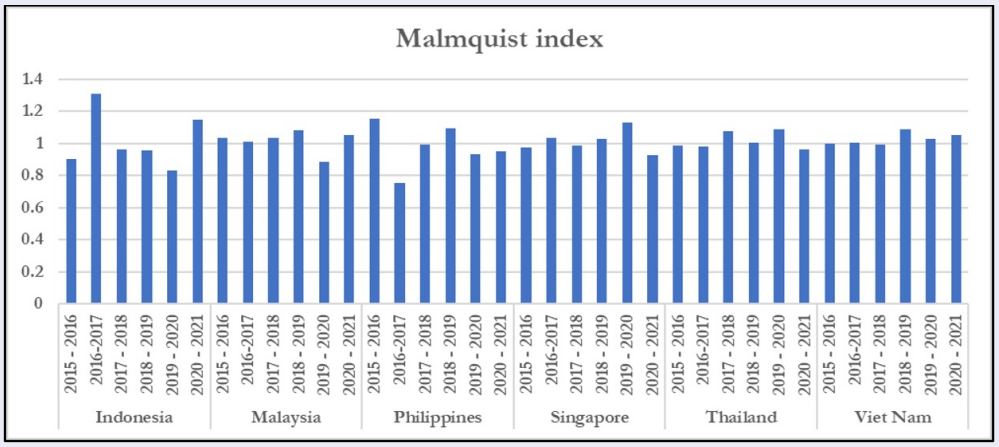

Figure 2: Malmquist and decomposition index result from 2015-2021[a]

[a]Source: Author's caculation.

Table 5: Tobit regression results

Variable	Coefficient	Standard error	[z]
ODA	-0.291*	0.1842087	-1.58
LGDPC	-0.384***	0.1758131	-2.18
TRADE	0.006****	0.0020517	2.72
Notes: (1) ****p<0.01, ***p<0.05, **p<0.1, *p<0.15			

Source: Author's caculation.

public spending is one of the critical issues for countries other than Singapore. In addition, countries should consider adjusting education spending appropriately when GDP per capita increases, and when economic development increases, the spending needs of households and individuals on education increase daily. The higher it is, the government's public spending on education can be entirely adjusted to ensure efficiency and social equity. Similar to the factor of trade openness, countries should promote trade exchanges to have opportunities to trade modern equipment from other countries to invest in education and international economic development. In general, spending on education depends significantly on the specific macro situation of each country, so education spending policies should be correlated with factors such as GDP per capita, trade openness, and foreign aid.

ABBREVIATIONS

ASEAN: Association of South East Asian Nations
WB: World Bank
FDH: Free Disposable Hull
DEA: Data Envelopment Analysis
SBM: Slacks-Based Measure
DMU: Decision Making Units
CRS: The efficiency is constant with scale
VRS: The variable efficiency of scale
EFFCH: Technical efficiency change index
PECH: The pure technical efficiency change index
SECH: The scale efficiency change index
TECH: The technological progress change index

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest

AUTHORS' CONTRIBUTION

Nguyen Thi Thu Trang – The University of Economics and Law: Content and data analysis

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Bài nghiên cứu

Chi tiêu của chính phủ cho giáo dục: Phân tích hiệu quả ở một số quốc gia Asean, giai đoạn 2015 – 2021

Nguyễn Thị Thu Trang, Đỗ Thị Thủy Tiên*

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TÓM TẮT

Gần đây, vấn đề hiệu quả chi tiêu công đã thu hút sự quan tâm của cả các nhà hoạch định chính sách và các nhà nghiên cứu trên toàn thế giới. Vì vậy, nghiên cứu này nhằm mục đích đánh giá hiệu quả của chi tiêu công trong lĩnh vực giáo dục tại một số quốc gia ASEAN trong giai đoạn 2015–2021. Dựa trên phương pháp DEA - Malmquist - Tobit, nghiên cứu sử dụng 2 yếu tố đầu vào và 2 yếu tố đầu ra, cùng với 3 yếu tố tác động, để tiến hành phân tích hiệu quả và sự tác động của các yếu tố đến hiệu quả của chi tiêu công cho giáo dục. Kết quả cho thấy Singapore, Thái Lan và Việt Nam là ba quốc gia liên tục đạt hiệu quả chi tiêu công trong lĩnh vực giáo dục từ năm 2015 đến năm 2021. Ngược lại, các quốc gia như Indonesia, Malaysia và Philippines chưa duy trì được hiệu quả chi tiêu công trong giáo dục trong giai đoạn này. Hơn nữa, hiệu quả chi tiêu giáo dục ở các quốc gia này chủ yếu phụ thuộc vào yếu tố công nghệ; tuy nhiên, hầu hết các quốc gia chưa đạt được hiệu quả kỹ thuật thuần túy, điều này cho thấy rằng đầu tư vào công nghệ là một trong những yếu tố then chốt góp phần nâng cao hiệu quả chi tiêu công. Ngoài ra, xét về các yếu tố tác động, viện trợ nước ngoài (ODA) và GDP bình quân đầu người (GDPC) có ảnh hưởng tiêu cực đến hiệu quả chi tiêu công quốc gia, trong khi độ mở thương mại (TRADE) lại có tác động tích cực. Dựa trên những phát hiện này, tác giả sẽ đưa ra các khuyến nghị liên quan đến tình hình chi tiêu cho giáo dục tại các quốc gia này. Cụ thể, chính phủ có thể tập trung giải quyết các vấn đề trong lĩnh vực giáo dục tiểu học để tìm cách cải thiện và thực hiện quy trình lập ngân sách cũng như phân bổ chi tiêu một cách hợp lý. Bên cạnh đó, tiềm năng áp dụng công nghệ cao trong giảng dạy và học tập là chìa khóa để thúc đẩy một hệ thống giáo dục hiện đại, công bằng và hiệu quả cao. Hơn nữa, chi tiêu giáo dục phụ thuộc rất nhiều vào tình hình kinh tế cụ thể của từng quốc gia. Do đó, các chính sách chi tiêu giáo dục cần được xem xét trong mối quan hệ với các yếu tố như GDP bình quân đầu người, độ mở thương mại và viện trợ nước ngoài.

Từ khoá: Chi tiêu công cho giáo dục, Phân tích màn bao dữ liệu (DEA), Chỉ số Malmquist, Hồi quy Tobit

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