

Causal Relationship between Public and Private Education Expenditure and Thailand's Gross Domestic Product

Article History

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Abstract

This paper examined the relationship between public and private education spending and Gross Domestic Product (GDP) of Thailand. Using time-series data from 2009 to 2024, the study employed cointegration and Granger causality tests to explore the linkages between sectoral educational expenditures and economic output. This is complemented by an Error Correction Model (ECM) to capture short-run dynamics and determine the speed of adjustment toward long-run equilibrium. The findings revealed a significant bidirectional relationship between private spending on education and GDP, suggesting that private spending on education stimulated the economic output, which in turn provided the resources for further private educational expenditure. The Autoregressive Distributed Lag (ARDL) cointegration results confirmed a stable long-run equilibrium among the variables, while the ECM indicated a significant, albeit moderate, speed of adjustment following economic shocks, reflecting the time lag inherent in educational investments. However, no significant causal relationship between public spending on education and GDP was found. This non-causal link is attributed to the inefficient allocation of the fiscal budget as a disproportionately large share of spending was consumed by administrative and personnel costs rather than quality-enhancing initiatives. Consequently, government educational expenditure must be redirected toward improving human capital. To leverage the positive impact of the private sector, the government should implement policies such as tax incentives or matching grants, while establishing clear regulatory frameworks to ensure educational quality, thereby stimulating economic output in the long run.

Keywords: *Education, Public Spending, Private Spending, Gross Domestic Product, Thailand*

Introduction

Economic development and long-term prosperity are fundamentally linked to a nation's human capital. The accumulation of knowledge, skills, and health within a population is a core driver of innovation, productivity and economic growth (Mincer, 1974). Consequently, a country's spending on education is widely regarded as a critical policy for enhancing its long-term competitiveness. Despite Thailand consistently prioritizing education with significantly high proportion of government expenditure for education, the country has struggled to translate this spending into tangible improvements in human capital and sustained economic growth (Budsayaplakorn & Sompornserm, 2022). For policymakers, Thailand's current approach to human capital accumulation through education is characterized by high expenditure for education.

Spending on education is an important component not only for government budget allocation, but also for private sector consumption. Beyond consistent and substantial public sector education expenditure, private sector spending on education in Thailand has also indicated a commensurate rise. This trend reflects an increasing societal recognition of education as a key factor for improving individual opportunities and earnings (Chen, 2025; Gupta & Rani, 2024). For this reason, the analysis of correlation between spending on education and Thailand's Gross Domestic Product (GDP) is critical as it provides a robust metric for evaluating the effectiveness and contribution of private investment to the nation's human capital development.

This research aims to fill a critical gap by investigating the dynamic cointegration and causal effects of public and private education expenditures on Thailand's GDP. Specifically, this study investigates the dynamic cointegration and directional causality of each sector independently and employs an Error Correction Model (ECM) to capture the short-run dynamics and determine the speed of adjustment back to the long-run equilibrium. This approach reveals whether injecting funds into the education sector can effectively drive economic growth. The objectives of this research are addressed in the subsequent section, followed by a literature review covering public and private spending, human capital development, and endogenous growth theory. The empirical analysis utilizes time-series data, employing cointegration test, ECM for short-term fluctuations, and Granger causality tests to examine the directional relationships within the Thai economy. The paper concludes with a summary of findings, policy recommendations, and a discussion of limitations and future research.

Research objectives

1. To analyze dynamic cointegration, short-run dynamics, and causal relationship between public and private education spending and the GDP of Thailand.
2. To formulate policy recommendations for Thailand to enhance the efficiency of educational spending as a key driver of human capital and economic output.

Literature review

Education is defined as an input in production function, taking a crucial role in fostering innovation, accelerating productivity and even building resilient economies. In addition, education is also a key driver of long-term economic growth because it is a crucial way to improve skills and labor productivity, leading to stronger human capital. For this, education has been supported by both government and private funding for decades. According to empirical findings from the past, contributions of education to the economic growth of each country or economy are still varied.

As a key means of human capital improvement, education is a way for individuals in enhancing earnings and labor productivity (Mincer, 1974). A higher level of education implied longer time to acquire more skills, knowledge and labor productivity (Budsayaplakorn & Sompornserm, 2022). As empirically supported by the Cobb-Douglas production function, continuous investment in education drives labor productivity, which in turn accelerates technological advancement. Within the framework of the Cobb-Douglas production function, education is structuralized as the primary engine for human capital accumulation. Qualitative educational enhancements systematically upgrade labor productivity and foster knowledge spillovers. This transformation then accelerates total factor productivity (TFP), serving as a proxy for technological progress, and shifts the aggregate production frontier outward, driving long-term economic growth (Essien, 2016; Kintsurashvili, 2026; Onalan & Basegmez, 2018; Wulan, 2014). There were numerous research works studied on how education, as measured by expenditure for this purpose, was correlated to economic growth. Besides measuring impacts of human capital on economic directly, empirical research studies also established connections between human capital and key determinants of economic growth, such as investment, technology adoption, and invention. Other factors including university activities also played an important role in fostering growth (Valero, 2021). For this reason, education alone could not provide a substantial impact on the economy, a capable amount of investment and speed of technical modification of firm were crucial factors accelerating level of economic development (Sombat, 2021). This confirmed the role of education in the growth of the economy.

Empirical research studies also stated the crucial role of education in generating individual's earnings (e.g. Chivu & Pârgaru, 2012; Dhakal & Santosh, 2024; Jallow & Journal, 2023; Lesuisse, 2024; Mallick et al., 2016). In macroeconomic perspectives, public sector spending on education played a major role in driving GDP, primarily through its impact on human capital formation (Mekdad et al., 2014; Motkuri & Revathi, 2024). Government usually took the main responsibility in providing compulsory education, therefore, government spending, as well as other quantitative indices, student enrollment and pupil-teacher ratios, were employed to measure how these variables, as proxies of education, impacted economic growth (Jallow & Journal, 2023). This finding was supported by evidence that public expenditure on primary education significantly boosted the economy (Lesuisse, 2024). While public spending on tertiary education had a smaller impact on economic growth compared to spending on primary education, a significant positive influence was still observed (Najaf-zada & Huseynova, 2024). The quality of education also determined how much government spending on education influenced economic growth (Tran, 2023). Good quality of education positively impacted economic growth by boosting labor productivity and enhancing human capital. (Khan et al., 2023; Pal, 2023; Trabelsi, 2017). Chivu and Pârgaru (2012) found that education spending tended to yield in the long run. Public finance enhancement contributed to both economic and social progress. The impact of public spending on education on economic growth was influenced by knowledge and the level of technological advancement (Nazukova, 2020; Tang & Lai, 2022).

While empirical evidence highlights the vital role of government spending on education, the contributions of the private sector are also a significant driver of economic growth. Spending on education for both government and private sector yielded approximately 10 percent higher annual income, excluding other benefits and spillovers (Chen, 2025). Education has long been considered a private good because the benefits, such as increased wages and improved labor productivity, primarily go to the individual (Gupta & Rani, 2024). Private spending on education played a crucial role in stimulating enrollment, which consequently led to labor productivity improvement and consumption (Alani et al., 2022). In certain regions, there were noticeable differences in the quality-related signs found in publicly and privately run schools (Pal, 2023). Therefore, private sector's increased spending on education as a proportion of GDP was a catalyst for accelerated economic growth (Motkuri & Revathi, 2023). Even though, the role of public spending on education was considered preferably greater in boosting economic growth (Loaiza, 2024).

In contrast, some empirical work found that private education in developed countries was typically driven by a desire for alternatives to the public school system (Grant, 2017). Large amounts of private education expenditures, when lacking supportive external conditions, could result in subpar educational outcomes and thus hinder economic growth. Debts, arrears, and government

regulations contributed to inefficient private education spending, leading to underperforming educational outcomes (Zabad, 2023). During an economic downturn, private expenditure on education likewise declined, a phenomenon attributable to the challenging financial circumstances (Deng, 2024). Previous empirical studies have yielded varied and inconclusive findings. This makes the impact of private education spending on Thailand's economic growth a particularly interesting issue to explore.

Empirical research works also revealed a reciprocal impact between education and economic growth. Economic growth, driven by investment, positively influenced educational advancement, especially in tertiary education. This link likely played a crucial role in fostering technological progress, labor productivity improvement, and increasing income (Jackson, 2021). GDP positively impacted educational attainment, which accelerated human capital (Mai, 2022). Economic growth significantly boosted education spending, which in turn led to a stronger human resource capacity (Jackson, 2021). The results were aligned with several empirical evidence, revealing a two-way causal relationship between education expenditure and GDP (For example, Chandra, 2010; Rambeli et al., 2021; Sunde, 2017).

Also, some empirical findings also declared that the relationship between these two variables was found indeterminate (for example, Maitra & Mukhopadhyay, 2012; Frank, 2017). The indetermination of the relationship could be attributed to several factors. First, the effectiveness of education expenditure was not uniform across all contexts. Spending on education only positively influences growth when the existing quality of education was already high (Goczek et al., 2021). Second, the relationship was complicated by the bidirectional causality between education spending and economic growth, which made it challenging to isolate the specific impact of one factor on the other. Third, the misallocation or ineffective use of the education budget was also a key reason for the ambiguous link between spending and economic growth. In systems with low educational quality, increased spending might be ineffective if resources were misallocated or wasted (Trinh, 2025).

Empirical evidence shows a complex and sometimes inconclusive relationship between education spending and economic growth, with its effectiveness often depending on a variety of factors. Understanding this complex, two-way relationship between education spending and economic growth is critical for effective policymaking. In this study, economic output (GDP) is employed as the primary indicator rather than growth rates, as GDP levels better preserve the long-term information required for cointegration analysis. While growth rates often capture short-term volatility, GDP levels reflect the cumulative impact of human capital development. However, a significant research gap remains in the Thai context, as existing studies often overlook the distinct

long-term dynamics and causal directions between public versus private educational expenditures. This investigation is particularly vital for Thailand, which continues to face systemic challenges in its education sector despite substantial budgetary allocations.

Spending on education, economy and growth of Thailand: Deconstructing the relationship between high spending and performance

Thailand consistently prioritizes education by allocating a substantial portion of its national budget to the sector in recognition of its foundational role in national development. The country has provided several policies to support education, for instance, 15-Year free basic education, from kindergarten to Grade 12; Education Sandbox Act to encourage collaboration between government, local organizations, and the private sector to develop innovative and localized learning programs; competency-based curriculum development for critical 21st-century skills, e.g., self-management, critical thinking, and collaboration. There has been also a rising awareness of importance of education among people in private sector because of better opportunities and higher income. Nevertheless, current efficiency in budgeting for education in Thailand is questionable due to a misallocation of resources.

Both government and private sector have allocated substantial amounts of annual budget for education. Thai government demonstrated a commitment to improving education through the enactment of new education laws. In 2009, with the aim of providing more comprehensive educational opportunities, the government extended the period of free education from 12 to 15 years for citizens from pre-school to upper secondary level. Reflecting the perception of education as a prerequisite for higher income, Thai households demonstrate a stable trend of prioritize educational spending within their annual consumption patterns.

Thailand's educational expenditure is fundamentally categorized into public and private spending, representing the combined financial contributions from government and private sector respectively. Public education spending comprises direct institutional funding and government-subsidized household support, both are facilitated by educational institutions whereas private spending on education represents household and private-sector contributions to educational institutions, excluding auxiliary expenses such as private tutoring, textbooks bought by families, and general living costs. Table 1 illustrates amounts of expenditure for education by government and private sector, and GDP growth of Thailand. For government, substantial amounts of budget allocated to education throughout the years. Despite a decreasing proportion of the total government budget, the actual amount of education spending has risen every year. Private sector's education expenditure growth was more consistent and less volatile. However, the growth of GDP

in recent years, particularly in the five-year period since the COVID-19 outbreak, has moved in the opposite direction.

Table 1 Spending on education and GDP growth in Thailand from 2009–2024

Year	Government spending on education (Million Baht)	Percentage of education spending to total government spending (%)	Private sector spending on education (Million Baht)	Percentage of education spending to total private consumption (%)	GDP growth (%)
2009	387,630	20.96	81,859	2.00	-0.69
2010	396,454	21.72	84,629	1.96	7.48
2011	412,913	21.40	85,545	1.95	0.84
2012	495,396	19.90	85,185	1.81	7.20
2013	504,115	20.79	90,090	1.89	2.65
2014	536,370	22.61	90,239	1.89	0.99
2015	559,434	21.97	94,086	1.92	3.15
2016	522,597	19.06	95,519	1.89	3.44
2017	528,408	18.90	98,076	1.88	4.18
2018	506,592	17.76	103,083	1.89	4.20
2019	493,136	17.49	107,573	1.90	2.14
2020	483,042	15.16	106,254	1.89	-6.15
2021	478,402	15.17	107,939	1.88	1.64
2022	455,877	14.87	109,443	1.77	2.63
2023	464,009	14.76	113,073	1.66	2.01
2024	491,486	13.87	117,219	1.75	2.54

Sources: Bank of Thailand (2025) National Economic and Social Development Council (2025)

Thai government has allocated a top-tier budget to education-related purposes, compared to all other government sectors. The proportion of Thailand's education budget to its total fiscal budget is substantially higher than most countries in the world (Punyasavatsut et al., n.d.). However, most of the budget is not allocated to quality improvements or innovation; instead, it is absorbed

by personnel-related expenditures and other purposes that do not directly enhance education quality (Eiowphan, 2024). Table 2 portrays the allocation of government's education budget for fiscal year 2026. With over 0.61 of the budget dedicated to personnel-related expenses, the primary focus is on maintaining the existing workforce. The high proportion of these fixed costs results in restricted fiscal space for fostering innovation or implementing significant performance-based incentives. Moreover, the restrictive share of capital investment constrains the capacity for educational advancement and long-term human capital development. Therefore, the issue of the huge amounts of spending on education, but only a small proportion directed to students and quality improvement, highlights the question of whether spending on education is significantly correlated with the economy and growth.

Table 2 Education budget allocation, FY 2026

Expenditure Category	Budget Components	Share (%)
Personnel-related expenses	Teacher salaries, instructional management, and per-capita student subsidies (including school lunches).	61.47
Education subsidies	School uniforms, textbooks, educational supplies, and financial aid for underprivileged students.	27.27
Operating expenses	Utilities, transportation rentals, and general administrative maintenance.	3.87
Capital investment	Procurement of durable goods, land acquisition, and construction/renovation projects.	3.83
Other spending	Miscellaneous educational activities and supplemental programs.	3.56
Total		100.00

Source: Budget Bureau (2025)

Data source and empirical findings

This paper employed data collected quarterly on education spending for both government and private sector as well as GDP of Thailand from 2009 to 2024. This set of secondary data was sourced from the Office of the National Economic and Social Development Council (NESDC), one of the government departments responsible for creating an economic intelligence database, and the Bank of Thailand. This time series data would be applied to study how spending on education would affect Thai economic growth, as measured by GDP.

Exploring the relationship between expenditure of public and private sector on education is crucial for measuring impact of spending for education on economic growth of Thailand. Spending on education is considered as a category of long-term investment on human capital development, which potentially determines long-term growth for the economy.

For model estimation to investigate how spending on education is correlated to economic growth, this paper employed unit root tests for stationary of the data. Then the paper applied cointegration analysis and Granger causality test. Steps of the analysis were as follows:

1. Unit root test for stationarity

To determine the stationarity of the time series data and the lag difference, which is a prerequisite for cointegration and causality analysis, Augmented Dicky-Fuller Test (ADF Test) was applied to the variables in this research work. The ADF test involves estimating regression equations which include a constant and a time trend. The model of the ADF Test is as follows,

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^p \delta_i \Delta Y_{t-i} + \epsilon_t \quad (1)$$

where Δ is the first difference operator, Y_t is the variable under consideration. In this research work, we assessed the stationarity of GDP, private spending on education, and public spending on education. The t is the time trend, p is the optimal lag length determined by Akaike information criteria (AIC), and ϵ_t is the white noise error term. The test will be applied with and without a trend, and with an intercept only.

Unit root tests were applied for the variables GDP, government spending and private spending on education to ensure the absence of unit roots and to prevent spurious regression. Then lag selection was then conducted before using Johansen cointegration.

Table 3 Augmented Dickey-Fuller unit root test

Variable	Lags	With a time trend		Without a time trend	
		Test statistic	Critical value	Test statistic	Critical value
GDP	1	-5.591	-3.447	-5.517	-2.885
Government spending on Education	1	-9.612	-3.489	-8.946	-2.913
Private Spending on Education	1	-2.881	-3.449	-6.686	-2.885

Note: Critical values at the 0.05 level

After employing ADF test, the finding indicated that all the variables, GDP, Government Spending on Education and Private Spending on Education were stationary at first difference level. Table 3 provided the ADF test results analyzed with a time trend and without time trend respectively. All the test results fell below the critical value. When stationarity of these variables enabled us to conduct a cointegration analysis and investigate any long-term relationships among these factors.

2. Cointegration analysis

After unit root test for stationarity, an optimal number of lags for the VAR model was specified before conducting the Johansen cointegration test, which helped avoid spurious regressions and identify long-run relationships. To determine whether there existed a long-run relationship between GDP and the two types of expenditure on education, Trace statistics and maximum Eigenvalue statistics were used for determining the cointegrating rank for Johansen cointegration analysis. The procedure included optimal lag selection and deterministic components by VECM model estimation. The optimum lags suggested from using AIC was five. The Johansen cointegration test results were as presented in Table 4.

Table 4 Johansen cointegration results

Trace Statistic				
<i>Variables, GDP, Government spending on education, Private spending on education</i>				
Cointegration rank (r)	With a time trend		Without a time trend	
	Test statistic	Critical value	Test statistic	Critical value
$r = 0$	36.476	29.797	27.074	24.276
$r \leq 1$	15.457	15.495	8.511	12.321
Eigenvalue				
Cointegration rank (r)	With a time trend		Without a time trend	
	Test Statistic	Critical value	Test statistic	Critical value
$r \leq 0$	21.018	21.131	18.563	17.797
$r \leq 1$	15.310	14.265	7.575	11.225

Table 4 showed the results from running trace statistics and maximum eigenvalue statistics for different cointegration ranks. Values from trace test when $r = 0$ were greater than the critical value, which implied the existence of cointegrating relationships. However, the maximum eigenvalue test value when analyzing with a time trend was less than the critical value. This suggested insufficient evidence to reject the null hypothesis of no cointegrating relationship. When testing for cointegration at $r \leq 1$, trace statistic values were slightly less than the critical value, indicating that the null hypothesis of no cointegrating relationship could not be rejected. Conversely, the maximum eigenvalue analysis confirmed existing cointegrating relationships. As the trace test had more power, comparing to the maximum eigenvalue, especially with a small sample size (Lütkepohl et al., 2001), the cointegration relationships for GDP and expenditure in education were not confirmed.

Table 5 ARDL cointegration and estimation results

Variable	Coefficient	t-statistic	Probability (p-value)
<i>Long-run coefficients</i>			
Government spending on education	36.037 (7.621)	4.729	0.000***
Private spending on education	141.989 (9.855)	14.408	0.000***
Constant	-1610838 (344537.100)	-4.675	0.000***
<i>Short-run dynamics (ECM)</i>			
Δ Private spending on education	16.898 (10.277)	1.644	0.026**
Δ Private spending on education (-1)	25.694 (11.239)	2.286	0.000***
CointEq (-1)	-0.342	0.063	-5.459
<i>Bounds test for cointegration</i>			
F-statistic	16.290***	k = 2	
Critical values (Finite n=63)	1% level	5% level	10% level
I (0) Lower bound	4.538	3.285	2.738
I (1) Upper bound	5.475	4.070	

Note: The optimal lag structure ARDL (1, 0, 2) was selected based on AIC. * indicates significance level at the 0.10 level, ** indicates significance level at the 0.05 level, and *** indicates significance level at the 0.01 level. Standard deviations are in parentheses. D denotes the first-difference operator.

To address this ambiguity and ensure the robustness of the empirical findings, the research further employed the ARDL (Autoregressive Distributed Lag) bounds testing approach (Pesaran et al., 2001). Based on the AIC, the ARDL (1, 0, 2) specification was identified. ARDL bounds testing approach was chosen for its robustness in small-sample settings and its flexibility regarding the integration properties of the variables I (0) or I (1). Table 5 presents ARDL cointegration and estimation results. The ARDL bounds test declared a result with an F-statistic of 16.290, significantly exceeding the upper bound critical value at the 1% level. This robust evidence confirmed a stable long-run equilibrium among GDP, government education spending, and private education spending. Furthermore, the result obtained from

Error Correction Model (ECM) estimation portrayed a moderate speed of adjustment, suggesting that approximately 0.16 of the disequilibrium from the previous year's shock was corrected within the current year. It validated the existence of a stable, long-run cointegrated relationship among the variables, confirming that any short-term deviations would eventually converge back to the steady-state growth path as predicted by endogenous growth theory.

3. Granger causality test

To investigate whether causal relationships existed between GDP, government spending on education, and private spending on education, this paper employed Granger causality test. The number of lags as suggested by AIC was five. The result from the analysis was illustrated in Table 6.

Table 6 Granger causality test results

Null hypothesis	F-statistic	Probability (p-value)	Granger causality*
Government spending on education does not Granger cause GDP	1.180	0.333	No
GDP does not Granger cause government spending on education	1.339	0.265	No
Private spending on education does not Granger cause GDP	2.715	0.024*	Yes
GDP does not Granger cause private spending on education	2.628	0.028*	Yes
Government spending on education does not Granger cause private spending on education	2.258	0.092	No
Private spending on education does not Granger cause government spending on education	2.277	0.062	No

Note: * indicates significance level at the 0.05 level.

The result obtained from Granger causality test determined whether past values of GDP influenced values of government and private spending on education and vice versa. The findings revealed a significant bidirectional causal relationship between private spending on education and GDP. Private

sector education expenditure was primarily driven by income levels. On the other hand, GDP significantly influenced private spending on education. It implies that private sector's decision to spend on education contributes to human capital formation, leading to higher earnings and opportunities.

Besides, the results indicated a lack of causal interaction between private and government expenditure on education. This suggests that private and public education spending in Thailand operate as independent dynamics rather than complementary or substitutable forces. The influence of GDP on private education spending implies that the decision-making process for private education spending appears to be driven by market-based factors and household income levels, whereas government spending is constrained by fixed budgetary frameworks and administrative obligations.

In contrast, the lack of causal link between spending on education of government sector and GDP is possibly attributed to the structural composition of public expenditure in Thailand. The largest share of Thai government education spending was dedicated towards administrative costs and personnel salaries, which limited the funds available for capital investment in education quality, human capital and labor productivity improvements. Consequently, while private education spending acts as a stimulus for economic development, public expenditure appears to lack the necessary alignment with productivity-driven growth.

To ensure the validity of the causal inferences, a series of robustness checks were performed. First, the optimal lag length for the Vector Autoregression (VAR) model was determined using several information criteria. The Schwarz Criterion (SC) suggested a structure of 4 lags, while the Akaike Information Criterion (AIC) and Hannan-Quinn Criterion (HQ) both identified 5 lags as the optimal length to capture the quarterly dynamics of the variables. Furthermore, the VAR stability condition was evaluated. For the selected model of 5 lags, all inverse roots were found to lie strictly within the unit circle. This indicates that the estimated VAR system is stationary and stable, providing a statistically sound foundation for the analysis. Consequently, the findings presented in Table 6 are not sensitive to specific lag choices and remain robust under alternative specifications.

Conclusion and recommendations

The empirical results from both the ARDL bounds test for cointegration and Granger causality analysis revealed a critical distinction in how Thailand's public and private education expenditures interact with GDP. The findings demonstrated a bidirectional causal relationship between private spending on education and GDP. This suggested a virtuous cycle where private sector spending in education effectively induced GDP, while rising GDP, in turn, provided households and firms with the financial capacity to further invest in human capital. The findings also underlined importance of private education expenditure as a dominant engine of long-term economic growth.

In contrast, no significant causal relationship was found between public expenditure on education and GDP. Despite the existence of a long-run equilibrium as shown in the ARDL results, the absence of causality and the smaller magnitude of the public spending coefficient were attributed to inefficient fiscal budget allocation. A disproportionate share of public education expenditure was consumed by recurrent expenses, such as administrative costs and personnel salaries, rather than being directed toward improving educational quality. Moreover, limited capital budgets are frequently diverted toward infrastructure maintenance rather than instructional innovation. While the economic system, characterized by the dynamic nexus between education spending and GDP, eventually converged to a long-run balance, the inefficiency of public spending acted as an impediment to rapid human capital improvement and economic development in both the short and long run.

To address these challenges, the government must strategically reallocate expenditure from administrative overhead toward initiatives that directly support education quality and teacher proficiency. Given the private sector's crucial role, the government should implement incentive-based policies, such as tax deductions or matching grants, to encourage private spending, investment in educational programs and scholarships. Furthermore, it is crucial for the government to establish regulatory frameworks for private educational institutions to ensure quality of education which potentially induces spending and growth of the GDP.

Limitations of the study and future research

While this research establishes a statistically significant cointegrating relationship and reveals the bidirectional causal linkages between private education spending and GDP, the findings are subject to limitations that present opportunities for future research. First, the study relies on aggregate time-series data, from 2009 to 2024, which may not fully capture long-term structural shifts within Thailand's education system. Second, the study focuses on quantitative expenditures, excluding qualitative indicators such as teacher competency and regional inequality, which directly influence educational outcomes and human capital quality. Finally, lacking disaggregated data by educational level prevents identifying which level generates the highest economic returns, as emphasized by endogenous growth theory regarding human capital improvement.

To address these limitations, future research should focus on several key areas. First, to better capture the long-term structural shifts in the education system, future studies should employ longitudinal data that tracks educational outcomes across extended periods. This would provide deeper insights into the transmission mechanism between educational reforms and long-run economic output. Second, future studies should supplement quantitative data with qualitative indicators such as the Human Capital

Development Index and teacher-to-student ratios, to gain a deeper understanding of the impact of education on human capital development and GDP. Finally, future research should disaggregate educational data by level and region, thereby enabling more targeted policy initiatives and implications.

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