Fiscal and demographic drivers of public education spending in Malaysia (1971–2017): ARDL evidence

Wong Sing Yun[1,2]
Saizal Pinjaman[1,2]
Jain Yassin[3]
RuiQi Zhang[4+]
Imamudin Yuliadi[5]

[1,2]*Faculty of Business, Economics and Accountancy, Universiti Malaysia Sabah, Malaysia.*
[1,2]*Centre for Economic Development and Policy, Universiti Malaysia Sabah, Malaysia.*
[1]*Email: wongsing.yun@ums.edu.my*
[2]*Email: saizal@ums.edu.my*
[3]*Faculty of Business and Management, Universiti Teknologi MARA, Sabah Branch, Malaysia.*
[3]*Email: jainyassin@uitm.edu.my*
[4]*Jilin University of Chemical Technology, Jilin, China.*
[4]*Email: zrqwangwang@gmail.com*
[5]*Universitas Muhammadiyah Yogyakarta, Indonesia.*
[5]*Email: imamudin@umy.ac.id*

(+ Corresponding author)

ABSTRACT

This study examines the fiscal factors influencing education expenditure in Malaysia, emphasizing the relationship between fiscal policies and demographic trends. Using the Autoregressive Distributed Lag (ARDL) bounds testing approach, the analysis identifies both short-term and long-term relationships affecting public education funding. Results indicate that public debt and tax revenue significantly impact education spending, suggesting that government budget adjustments respond to fiscal conditions. Additionally, demographic factors, including population growth, play a substantial role in shaping budgetary decisions related to education. These findings enhance existing theoretical models by integrating fiscal and demographic variables into the analysis of public education expenditure. The research contributes valuable empirical evidence from a developing country context and offers practical policy recommendations. It highlights the importance of adopting more flexible and demographically aware fiscal strategies to sustain investment in education. The insights gained aim to guide future policymaking, particularly in improving the effectiveness and responsiveness of public education financing.

Contribution/ Originality: This study empirically integrates fiscal and demographic factors into Malaysia's education expenditure analysis using ARDL. It demonstrates that public debt, tax revenue, and population dynamics significantly influence education spending, providing policy-relevant insights for adaptive, sustainable, and demographically responsive fiscal planning in developing countries.

1. INTRODUCTION

Education has played a crucial role in helping the country overcome various challenges on its path to becoming a developed nation. It is widely believed that education promotes social equality, economic growth, and national unity. As a result, the rapid expansion of the education sector is reflected in the increasing number of institutions and higher budget allocations. Governments worldwide recognize that investing in education is essential for sustainable economic development. Malaysia, in particular, has invested heavily in education, exemplified by the Malaysia Education Blueprint 2013-2015 (Chok, 2014). In 2011, the government introduced a free education policy, abolishing

school fees and benefiting approximately 5.3 million primary and secondary students (The Sun Daily, 2011). The government allocated RM100 in schooling aid per student and provided book vouchers to pre-university and higher education students. These changes in government education spending may align with broader education and economic policy objectives. Table 1 summarizes and compares the trends in government expenditure on education with Malaysia's development plans, highlighting the strategic focus on education as a driver of national progress.

Table 1. Public education allocations in Malaysia's development plans.

Malaysia Plan	Public Education Expenditure ($ Million)
First Malaysia Plan (Year 1966-1970)	440.8
Second Malaysia Plan (Year 1971-1975)	537.26
Third Malaysia Plan (Year 1976-1980)	1,450
Fourth Malaysia Plan (Year 1981-1985)	2,988.03
Fifth Malaysia Plan (Year 1986-1990)	5,566.06
Sixth Malaysia Plan (Year 1991-1995)	8,501
Seventh Malaysia Plan (Year 1996-2000)	10,098.80
Eighth Malaysia Plan (Year 2001-2005)	22,600
Ninth Malaysia Plan (Year 2006-2010)	41,114
Tenth Malaysia Plan (Year 2010-2015)	43,455

Source: Data extracted from Economic Planning Unit (2018).

Figure 1 reveals a consistent increase in public education expenditure across Malaysia's development plans. This trend underscores the government's ongoing commitment to investing in education. As shown in Table 1 and Figure 1, expenditure rose from 440.8 million dollars during the First Malaysia Plan to approximately 43,455 million dollars in the Tenth Malaysia Plan. Notably, by 2001, the Eighth Malaysia Plan allocated 22,600 million dollars, nearly doubling the amount from the Seventh Plan. The Ninth Malaysia Plan further doubled expenditure to 41,114 million dollars. The trend of increasing education spending persisted into the Tenth Malaysia Plan, reflecting sustained prioritization of education funding.
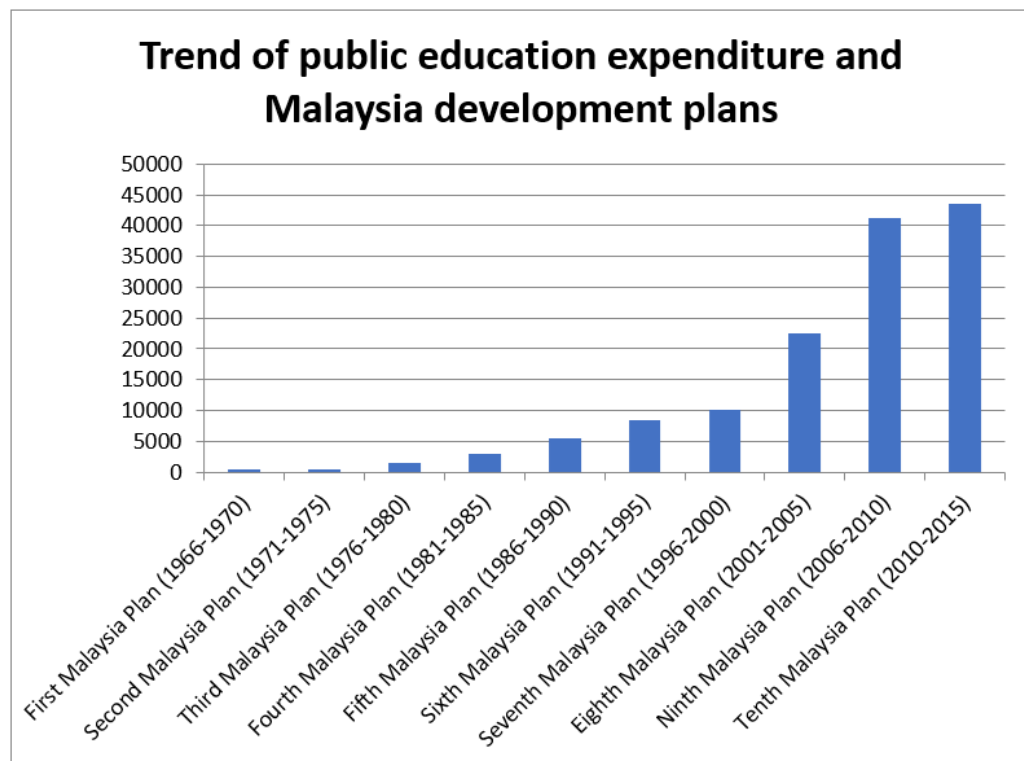
Figure 1. Public education allocations in Malaysia's development plans.
Source: Data extracted from Economic Planning Unit (2018).

The data on public education expenditures, as shown in Figure 1, provide evidence of government behavior in policy formulation. Data analysis clearly indicates that policymakers consider education a vital sector deserving full attention. Adequate public funding for education is essential and necessary. Therefore, studying the factors influencing public education spending is crucial for identifying key elements that can improve future allocation strategies (Yun & Yusoff, 2019). Additionally, the allocation and distribution of funds are affected by various factors that change over time. Exploring the complex interactions among economic conditions, demographic trends, and educational policies is vital to understanding how public education spending is shaped and how it can be optimized for better outcomes.

This paper is organized as follows: Section 2 reviews relevant literature on education expenditure, fiscal dynamics, and demographic influences. Section 3 describes data sources, variable definitions, and the ARDL methodology. Section 4 presents empirical results and findings. Finally, Section 5 offers a comprehensive discussion based on the findings, concluding with policy implications and recommendations for sustainable education financing in Malaysia.

2. LITERATURE REVIEW

2.1. Theoretical Literature Review

The inclusion of tax revenue as a variable in the model is based on the idea that public program funding largely depends on tax income. Several theories, such as the Friedman Hypothesis, Buchanan-Wagner Hypothesis, Barro Hypothesis, and Peacock-Wiseman Displacement Theory, explain the relationship between government spending and tax revenues. Reviewing these theories provides a comprehensive understanding of how government expenditure is financed through taxes. Fluctuations in tax revenue can impact funding for sectors like education. Higher tax revenues may enable increased investment in education, while budget constraints could lead to reduced spending. However, the extent to which education expenditure depends on tax revenue remains debatable. For example, during fiscal constraints, governments might prioritize education spending to ensure long-term benefits, such as developing a skilled and competitive workforce.

According to Milton Friedman's hypothesis, increasing taxes is unlikely to reduce budget deficits because it may lead to higher spending rather than savings (Darrat, 1998). In other words, taxes will increase as government spending expands, indicating a positive causal relationship between taxes and government expenditure. Therefore, reducing the budget deficit typically requires a tax cut. A tax reduction aimed at lowering the deficit may pressure the government to decrease allocations. However, the Buchanan-Wagner Hypothesis suggests otherwise. It posits that public deficits lower the perceived cost of public goods for current voters, leading to increased demand for social services. This hypothesis challenges the traditional view that tax cuts directly reduce deficits, highlighting the complex relationship between fiscal policy and public demand (Christopoulos & Tsionas, 2003). Contrary to Friedman's hypothesis, Buchanan-Wagner argued that a negative causal relationship exists from taxes to government spending. They claimed that tax reductions lower the cost of government projects, prompting voters to demand more spending, which increases government expenditure. This leads to higher budget deficits. Buchanan-Wagner suggested that tax increases, perceived by voters as reducing government expenditure, could decrease spending and lower budget deficits (Darrat, 1998).

Meanwhile, Barro Hypothesis and Peacock-Wiseman Displacement Theory offered a reverse causality effect that assumed government expenditure leads to higher taxes. Barro (1979) and Peacock and Wiseman (1979) argued that the government spends first and raises taxes later (Darrat, 1998). The arguments further suggested that a temporary increase in government expenditure during economic crises or social disturbances could lead to a permanent rise in taxes. Both theories imply a causal pattern from increased spending to higher taxation. An effective strategy proposed was to reduce public spending to control the budget deficit. Human Capital Theory emphasizes that education can develop highly productive human capital, enabling individuals to earn higher incomes. With increased income and

productivity, it is likely that larger tax revenues can be generated. Therefore, it is relevant to consider that a causal relationship may exist from public education expenditure to tax revenue.

Government debt is considered an independent variable because it directly influences government expenditure behavior. A heavily indebted country may spend less on goods and capital, but more on interest payments. Rising interest rates on public debt result from ongoing net borrowing, leading to increasing debt levels. Consequently, this causes higher public expenditure to service the debt, reducing funds available for essential public needs like education. This reduction can negatively impact economic growth. Kanano (2006) noted that excessive public debt could destabilize the domestic economy by potentially increasing inflation. Conversely, findings from Ukwueze (2016) suggest that, in the short term, public debt may positively influence government spending. However, evidence indicates that, in the long term, public debt negatively and insignificantly affects public expenditure.

2.2. Empirical Literature Review

Both the tax-spend theory and debt-spend theory emphasize the importance of studying how financing variables tax revenue and public debt, affect public education expenditure. It is argued that governments may need to increase taxes to meet rising demand for education funding. Conversely, excessive public debt could lead to financial crises and severe budget deficits. Consequently, many previous studies have identified taxes as a key variable influencing public expenditure. Understanding these relationships is crucial for effective fiscal policy, ensuring sustainable funding for public education without risking financial instability. For example, Von Furstenberg, Green, and Jeong (1985) tested the inter-temporal relations between taxes and government spending in the United States over the period of 1955 to 1982. The research question addressed whether taxes lead to increased spending or vice versa. According to Von Furstenberg et al. (1985), maximum likelihood techniques applied to U.S. data indicated a causal relationship where expenditure tends to lead taxes. However, tax changes did not result in changes in government spending. Empirical findings suggest that tax changes influence spending in the same direction, but not necessarily vice versa. Von Furstenberg et al. (1985) examined the inter-temporal relationship between taxes and expenditures from 1954 to 1982 using vector autoregressions (VAR). The impulse response functions indicated that government expenditure did not respond positively to past tax impulses. The results supported the concept of spend now and tax later. Overall, tax responses were consistently smaller than changes in total government spending, highlighting a tendency for government expenditure to outpace tax adjustments over the period.

Historically, numerous studies, such as those by Von Furstenberg et al. (1985), have examined the influence of tax revenue on government expenditure growth. The relationship between taxes and public expenditure has been questioned, prompting research into whether a Granger causal relationship exists between government taxes and budgetary allocations. Understanding this causality offers valuable insights into how policies can control government growth (Hondroyiannis & Papapetrou, 1996). For example, Hondroyiannis and Papapetrou (1996) empirically analyzed the causal relationship between government expenditure and revenue in Greece from 1957 to 1993. The study employed co-integration and Granger causality tests to analyze the data. Results indicated a long-term relationship between government revenue and expenditure. Additionally, the findings revealed a unidirectional causality running from government expenditure to revenue, supporting the spend-tax hypothesis.

Undoubtedly, socio-economic conditions significantly influence public spending decisions. Equally, government policies play a crucial role in shaping the environment in which these decisions are made. External events causing upheaval can drastically alter the socio-economic landscape. For instance, Afexentiou (1988) conducted an empirical test of the displacement effect theory on Cyprus's government expenditure from 1960 to 1982. The displacement effect, proposed by Peacock and Wiseman (1979), suggests that such effects occur following a structural fiscal break. After the Turkish invasion in 1974, Cyprus experienced a structural break; however, this was not followed by an increase in taxes. Instead, the government increased spending on refugee housing programs. The study demonstrated that the displacement effect was present in Cyprus. Nonetheless, this conclusion primarily considers government

expenditure rather than the tax revenue hypothesis. This empirical evidence offers valuable insights into fiscal history and provides guidance for budget decision-making processes, emphasizing the importance of understanding structural breaks and their impact on fiscal policy.

The extensive empirical literature has examined the intertemporal relationship between government expenditure and taxation. For instance, Von Furstenberg et al. (1985); Hondroyiannis and Papapetrou (1996) contributed to this research area. Similarly, Darrat (1998) investigated the relationship in Turkey, noting the scarcity of studies on developing countries. Darrat (1998) highlighted mixed findings regarding the impact of tax changes on expenditure. A long-term stable relationship between government spending and tax revenues was found to be significant in Turkey. Multivariate error correction models indicated that taxes unidirectionally and significantly Granger cause government spending, both in the short and long term, supporting the tax-spend hypothesis. Additionally, tax revenues had a negative impact on government expenditure, aligning with Buchanan-Wagner's hypothesis. This suggests that increasing taxes in Turkey could help address budget deficits. Buchanan-Wagner proposed that reducing taxes lowers the perceived cost of government programs, leading voters to demand more spending. Conversely, higher taxes increase the perceived cost, potentially reducing government expenditure.

Payne (1998) conducted a study analyzing the relationship between revenues and expenditures across forty-eight contiguous states from 1942 to 1992. The empirical results, derived from error correction model estimation, supported the tax-spend hypothesis in twenty-four states. This hypothesis suggests that efforts to reduce budget deficits through increased revenues are unlikely to succeed. Conversely, data from eight states supported the spend-tax hypothesis, which posits that government revenue adjusts to expenditure changes with a lag. The study also indicated that revenue and expenditure decisions are jointly determined under the fiscal synchronization hypothesis. Overall, findings were mixed, aligning with previous research. Payne (1998) emphasized the importance of integrating various factors influencing expenditure growth to better understand the long-term relationship between revenues and expenditures, highlighting the complexity of fiscal policy interactions over time.

The intervention of the government sector over the years has become a significant means of promoting economic growth, equitable resource distribution, enhancing production, and stabilizing the economy. Consequently, the relationship between public expenditure and its budgetary resources has become a critical economic issue, especially in developing countries. There is a need to understand the factors contributing to high government expenditure and budget deficits. Kanano (2006) examined the determinants of public expenditure using time-series data from Kenya spanning 1980 to 2004. The study focused on two fiscal variables involved in financing public education expenditure. Employing the Ordinary Least Squares (OLS) method, the research estimated a growth model. The empirical evidence indicated that public expenditure was strongly influenced by internal debt. Conversely, an inverse relationship was observed between external debt and public expenditure. The government tends to avoid over-reliance on internal debt, as excessive borrowing may harm economic development. The study also found a strong positive correlation between government revenue and public expenditure. Additionally, factors such as a high population growth rate may contribute to increased public expenditure and budget deficits, likely due to Kenya's government commitments to meet rising social service demands.

The findings from these studies emphasize the significance of fiscal policy variables, specifically tax revenue and public debt, in explaining public education expenditure. Researchers such as Von Furstenberg et al. (1985), Hondroyiannis and Papapetrou (1996), Afexentiou (1988), Darrat (1998), Payne (1998), and Kanano (2006) have consistently examined the impact of these variables on education spending. Typically, total education expenditure depends heavily on resource availability for financing. Education programs are usually funded through either tax revenue or public debt. Therefore, any increase in financial resources is likely to lead to higher public education spending.

Opposing ideas and hypotheses challenge the notion that increasing tax revenue necessarily boosts public education expenditure. One such hypothesis, Buchanan-Wagner's, argues that higher tax revenue may not directly

lead to increased spending. Instead, it could raise the costs associated with public expenditures. As voter demand grows, this might result in reduced public education spending, implying a negative correlation between tax revenue and expenditure. Additionally, rising public debt can further burden a government economically. An increase in public debt strains the national budget, potentially leading to fiscal contraction. This contraction could cause a decline in public expenditure, including education. Overall, these hypotheses suggest that higher tax revenue and public debt do not automatically translate into increased public spending, highlighting the complex relationship between fiscal policy and government expenditure.

3. METHODOLOGY

Annual time series data from 1971 to 2017 are utilized in this study. The logarithmic transformation was applied to all series to reduce heteroscedasticity. Table 2 provides descriptions of the variables used in this research.

Table 2. Description of variables.

Variable	Measurement of variable	Source	Expected finding
Public education expenditure (EDU)	Ratio to GDP	Economic planning unit (EPU)	Dependent variable
Real gross domestic product (GDP)	Real GDP (Constant LCU)	World Bank	Positive
Tax revenue (TAX)	Ratio to GDP	Economic planning unit (EPU)	Positive
Public debt (DEBT)	Ratio to GDP	Economic planning unit (EPU)	Negative
Total population (TPOP)	Growth Rate	Economic planning unit (EPU)	Positive

The model for this study is built based on underlying theories such as the tax-spend and debt-spend theories. The demographic variable, total population, is included to examine its impact on education allocation. The logarithmic equation for this study is structured as follows.

$$\ln EDU_t = \beta_1 + \beta_2 \ln GDP_t + \beta_3 \ln TAX_t + \beta_4 \ln DEBT_t + \beta_5 \ln TPOP_t + e_t \tag{1}$$

4. EMPIRICAL RESULTS AND FINDINGS

This section discusses the outcomes and conclusions derived from the empirical model's estimation. As shown in Tables 3 and 4, the Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests confirmed that none of the variables are integrated at second differences, or I(2). Consequently, ARDL bounds testing is appropriate for this analysis. The ARDL cointegration approach is invalid if an I(2) stochastic trend exists and does not require pre-testing for unit roots, unlike other methods. Additionally, ARDL performs optimally with small sample sizes, making it suitable for this study.

Table 3. Augmented Dickey-Fuller (ADF) test results.

Variable	Level		First difference	
	Intercept	Trend and intercept	Intercept	Trend and intercept
LNEDU	-2.576	-2.976	-4.748***	-4.754***
LNGDP	-2.083	-1.634	-5.686***	-5.958***
LNTAX	-3.499**	-2.454	-5.678***	-6.394***
LNDEBT	-1.518	-2.576	-4.226***	-4.278***
LNTPOP	1.018	-2.991	-5.186***	-5.893***

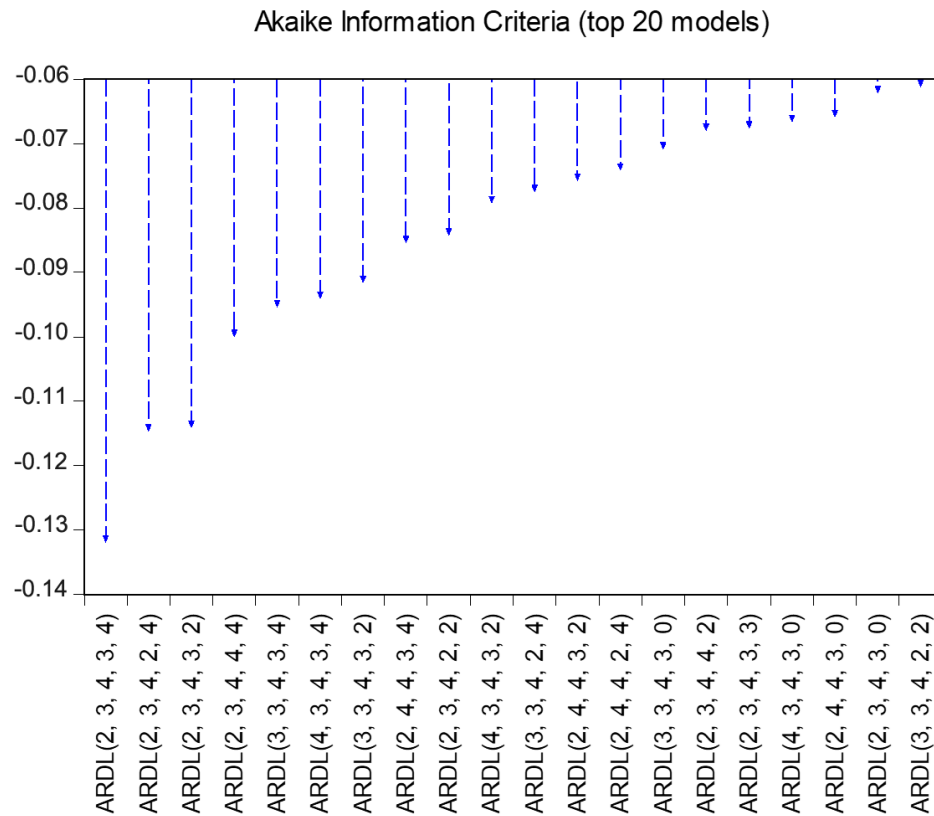**Note:** ***Significant at 1% significance level, **Significant at 5% significance level.

Table 4. Phillips-Perron (PP) test result.

Variable	Level		First Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
LNEDU	-2.409	-2.253	-4.374***	-4.309***
LNGDP	-2.012	-1.703	-5.647***	-5.959***
LNTAX	-3.499**	-2.457	-5.681***	-6.395***
LNDEBT	-1.589	-1.907	-4.175***	-4.211***
LNTPOP	-1.384	-2.784	-12.006***	-28.781***

Note: ***Significant at 1% significance level, **Significant at 5% significance level.

Figure 2. Top 20 ARDL models based on AIC.

The ARDL (2,3,4,3,4) model was identified as the most suitable based on the Akaike Information Criterion (AIC) for selecting the optimal lag length, as shown in Figure 2. At a 5% significance level, the calculated F-statistic (5.178716) exceeds the upper bound critical value (see Table 5), leading to the rejection of the null hypothesis. This indicates a long-term relationship among public education spending, economic growth, tax revenue, national debt, and population. The long-run equation estimation of the ARDL model is presented in Table 6, confirming the existence of these long-term associations.

Table 5. ARDL bounds test for cointegration.

Test Statistic	Value	Significance Level	Bound Critical Values	
			I(0)	I(1)
F-Statistic	5.178716**	10%	2.402	3.345
		5%	2.850	3.905
		1%	3.892	5.173

Note: **Significant at 5% significance level.

Table 6. Long-run coefficients estimates of ARDL (2,3,4,3,4) model.

Dependent variable: LNEDU			
Independent variables	Coefficient	T-Statistic	Probability
LNGDP	0.512997*	1.827400	0.0812
LNTAX	1.211602*	1.768034	0.0909
LNDEBT	−0.225541	−0.545251	0.5911
LNTPOP	2.567295***	4.519037	0.0002
C	−19.53287***	−3.023602	0.0062

Note: ***Significant at 1% significance level, *Significant at 10% significance level

The result presented findings in answering the question as to whether the government financing method through tax revenue and public debt may had any significant explanation on the public education expenditure as claimed by several researches in the past such as Falch and Rattsø (1997); Okafor and Eiya (2011); Chatterji, Mohan, and Dastidar (2015); Chatterji et al. (2015) and Ukwueze (2016). The long-run ARDL model (2,3,4,3,4) can be formed as follows:

$$LNEDU_t = 0.512997 LNGDP_t + 1.211602 LNTAX_t - 0.225541 LNDEBT_t + 2.567295 LNTPOP_t - 19.53287 \quad (2)$$

The long-run model demonstrated the significance of fiscal policy variables in explaining public education expenditure. Tax revenue was positively significant, with a coefficient indicating that a 1 percent increase in tax revenue could lead to a 1.21-point rise in education spending. This suggests that higher tax revenue enables increased funding for education.

The analysis indicates that a significant finding related to public debt was not reported, suggesting that public education expenditure primarily relies on tax revenue rather than borrowing. This implies that government spending on education was not heavily financed through debt. Consequently, the long-run ARDL estimation reflected an insignificant positive relationship with public debt. This finding supports earlier assertions by Okafor and Eiya (2011), who argued that public debt does not significantly constrain the government's ability to finance education. Additionally, real GDP showed a positive and significant influence on public education spending in the long term. Similarly, population growth also demonstrated a positive and significant effect on education allocation over the long run. These results highlight the importance of economic growth and demographic factors in shaping public education expenditure, while debt levels appear to have a limited impact in this context.

Table 7. ARDL-ECM model estimation.

Variable	Coefficient	T-statistic	P-Value
ECT (-1)	−0.780006*	−6.175288	0.0000
ΔLNEDU(-1)	0.322717**	2.794369	0.0106
ΔLNGDP	−0.597972	−0.624113	0.5390
ΔLNGDP(-1)	−3.764491*	−3.389754	0.0026
ΔLNGDP(-2)	−5.896136*	−3.957919	0.0007
ΔLNTAX	3.136283*	6.224152	0.0000
ΔLNTAX(-1)	1.581537**	2.638350	0.0150
ΔLNTAX(-2)	0.086640	0.195108	0.8471
ΔLNTAX(-3)	−1.247316	−2.804835	0.0103
ΔLNDEBT	0.198045	0.472837	0.6410
ΔLNDEBT(-1)	1.238056*	2.897777	0.0083
ΔLNDEBT(-2)	−0.598259	−1.611892	0.1212
ΔLNTPOP	0.394867	1.419295	0.1698
ΔLNTPOP(-1)	−1.284393*	−3.289582	0.0033
ΔLNTPOP(-2)	−0.586667***	−1.739792	0.0959
ΔLNTPOP(-3)	−0.592692**	−2.157868	0.0421

Note: ***Significant at 1% significance level, **Significant at 5% significance level, * Significant at 10% significance level.

Table 7 presented the ECM model estimation re-parameterized from the ARDL model that explains the short-run dynamics. The short-run coefficients of the model indicate that real GDP, tax revenue, public debt, and total

population significantly influence public education allocation. The estimated error correction term (ECT) was statistically significant and negative, at -0.78006, suggesting that deviations from the long-term relationship are corrected rapidly, approximately 78% within the period. The coefficients for lag-one and lag-two of real GDP were significantly negative, implying that education expenditure tends to increase when real GDP declines. This finding aligns with the Keynesian Counter-Cyclical Theory, which advocates for increased government spending during economic downturns.

The short-term coefficient estimates for the lag-three of tax revenue were significant and negative, indicating that a 1 percent increase in tax revenue led to a decrease in public education expenditure. This unexpected result suggests that increased tax revenue in the short run may have been allocated to other sectors rather than education. Consequently, public education spending did not rise with increased tax revenue in this period. This negative relationship aligns with Buchanan and Wagner's hypothesis, which posits that higher taxes increase the cost of government spending. As voter demand for expanded government programs persists, this can result in reduced allocations to public education.

The short-term coefficient of public debt was significantly positive, indicating that a 1% increase in public debt leads to a 1.24% rise in public education expenditure. This suggests that public debt may be used to finance education costs in the short run. However, the long-term coefficient was not significant, as shown in the ARDL model's long-term estimation. These findings imply that while public debt can temporarily boost education spending, its long-term impact remains uncertain. The results highlight the importance of considering both short- and long-term effects when evaluating fiscal policies related to public debt and education funding.

The analysis indicates that public debt primarily has a short-term impact on public education expenditure, with limited long-term effects. The model also shows that past education spending significantly influences current expenditure, aligning with Sagarik (2014), which emphasizes the importance of previous year's education expenditure in government decision-making regarding public education allocation. This suggests that historical spending patterns play a crucial role in shaping current fiscal policies for education funding.

The short-term model estimates reveal significant coefficients for total population. The lag-one, lag-two, and lag-three variables all show negative signs, indicating that a 1 percent increase in population leads to decreased public education expenditure. These results highlight the substantial impact of demographic factors on education spending, underscoring the importance of considering population dynamics in policy development and resource distribution. Accurate analysis of these factors is essential for effective planning.

Table 8. Diagnostic tests results.

Autoregressive Conditional Heteroscedasticity (ARCH) Test			
F-statistic	1.614498	Prob. F (1,40)	0.2112
Obs*R-squared	1.629454	Prob. Chi-Square (1)	0.2018
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.861279	Prob. F (2,20)	0.4377
Obs*R-squared	3.409820	Prob. Chi-Square (2)	0.1818
Normality Test			
Jarque-Bera	0.912101	Probability	0.633782

Diagnostic testing was conducted to evaluate the model's robustness and check for autocorrelation and heteroscedasticity issues.

Table 8 displays the results of these diagnostic tests. The ARCH tests confirmed that the models do not exhibit heteroscedasticity. The Breusch-Godfrey test indicated no serial correlation, and the Jarque-Bera test showed that the residuals are normally distributed.

5. DISCUSSION AND CONCLUSION

Empirical findings from the ARDL model indicate a positive coefficient for real gross domestic product (GDP), suggesting that GDP significantly influences public education expenditure in the long run. This positive relationship supports Wagner's law, which posits that economic growth leads to increased government welfare spending. As the economy expands, driven by growth and industrialization, there is a corresponding rise in demand for human resources. This necessitates greater government investment in education to develop a skilled workforce. The findings imply that higher economic activity, reflected by GDP growth, results in increased public expenditure on education, aligning with Wagner's theory that economic development is accompanied by expanded government services. Consequently, as countries grow economically, they tend to allocate more resources to education to meet the rising demand for trained labor, ensuring sustainable development and workforce readiness.

Analysis of the text reveals that the estimated coefficient of lagged real gross domestic product (GDP) indicates a negative impact on public education expenditure in the short term. This empirical finding aligns with Keynesian counter-cyclical theory, which suggests that a decline in real GDP prompts increased government spending. A decrease in GDP growth rate is likely to lead the government to boost expenditure in social sectors, affecting allocation decisions. These economic shifts demonstrate the counter-cyclical nature of public education spending over the long term. Essentially, real GDP serves as a significant determinant of public education expenditure in both the short and long run, reflecting the government's responsive behavior to economic fluctuations (Yun & Yusoff, 2018).

In the long term, it was found that tax revenue significantly impacted public education spending positively. The evidence indicated that public education expenditure was primarily financed through taxes over time. Consequently, an increase in tax revenue generally led to higher education spending. This finding aligns with studies by Jabbar and Selvaratnam (2017), Buchanan (1975), and Hanushek and Rivkin (1997). Buchanan (1975) argued that higher taxes are necessary to meet increased public spending demands. In contrast, the coefficient of lagged tax revenue was significantly negative in the short run, indicating that public education expenditure decreased when tax revenue increased. This suggests that, in the short term, the education sector is less financed by tax increases.

Instead, investment in public education may have been financed short-term through public debt. The government's borrowing likely had a significant short-term impact on education spending, as indicated by the negative coefficient of public debt. However, public debt was insignificant in the long run, suggesting its effect on education spending was temporary. This aligns with findings by Ukwueze (2016).

The analysis of demographic effects on public education expenditure revealed significant findings regarding the influence of changes in population structure. The total population size was also found to have a positive and significant impact in the long term. This indicates that demographic factors should be considered in future policy decisions related to public education funding. Over the long run, population growth is likely to pressure the government to increase education allocations. Conversely, in the short term, education spending tends to decrease significantly because current expenditures are insufficient to meet the needs of a growing population. These insights highlight the importance of adjusting education budgets to accommodate demographic shifts effectively.

In conclusion, this finding offers three key contributions. First, it provides new theoretical insights into how demographic variables influence public education expenditure patterns and behaviors. Specifically, changes in population size exert pressure and significantly impact public education allocations. Second, the study highlights the importance of tax-revenue and public debt theories, demonstrating their substantial effects on the distribution of education spending. This reinforces the idea that public debt and tax revenue are major determinants of government expenditure on education. Third, regarding policy implications, the analysis advocates for a more flexible approach to public education allocation. Such flexibility could lead to more effective and efficient policies in the future. Additionally, to enhance the effectiveness of public education spending, the government should consider implementing fiscal reforms that allow for adaptable spending policies and encourage greater public involvement.

These reforms could improve resource allocation and ensure that education funding aligns better with societal needs, ultimately fostering a more equitable and sustainable educational system.

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