REVISITING LONG-RUN DYNAMICS OF THE DETERMINANTS OF PUBLIC EDUCATION EXPENDITURE IN MALAYSIA

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ABSTRACT

The main purpose of this paper is to revisit the long-run dynamics on the Malaysia's public education expenditure determinants during the period of 1982 to 2016. This study will also attempt to discuss some of the relevant theories that are able to explain and characterized the pattern of the Malaysia's public education expenditure. A relatively recent developed estimation technique, ARDL bound testing was employed to estimate the long-run relationship between the public education expenditure and its determinants. The results based on the ARDL bound testing approach concluded that a stable, long run co-integrated relationship exists between public education expenditure and its determinants: real gross domestic product (GDP), unemployment rate (UNEM), inflation rate (INF) and working age population (POP2). Furthermore, the result highlighted the relevancy and suitability of Keynesian Counter Cyclical theory, Economic-Demography theory and Peacock-Wiseman in explaining the pattern of Malaysia's public education expenditure. In addition, bilateral causality was found between public education expenditure and real GDP. Similarly, a two-way causal relationship was also found between tax revenue and public education spending. Finally, this study suggests that policy makers should pay more attention to the economic situations and the demands from the society when formulating future policies or allocations.

Keywords: education expenditure, ARDL bound testing, determinants, long-run dynamics

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INTRODUCTION

Education is considered as a vital aspect of social development and economic growth for every society, providing beneficial impact on economic future and social well-being of all individuals. United Nations (2003) reported that education yielded enormous motivation to the development of countries of the world, by providing opportunities for individuals to achieve their potential and contribute meaningfully to the society. Through education, individuals can make better decisions and will be empowered to take on national development. Society will not be able to consider itself as truly developed without its citizens being educated.

Increase of education will make an important contribution to societies' economic growth and to the individuals' income. Malaysia government has sustained a high level of investment in its education sector since gaining independence in 1957. During the early of 1980, the investment by Malaysian government had reached the highest in East Asia as reported by education review. However, a closer inspection of the education allocation showed that there was a clear fluctuation of the public education spending with declining expenditure observed in 2011.

Our focus on education expenditure can be justified on the following number of grounds. First, the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) score during the year 2009 showed that Malaysia's performance was not quite satisfactory. The PISA score obtained in the year of 2009 were rather disappointing with Malaysia taking up the rank of the bottom third of the 74 participating countries (Ministry of Education Malaysia, 2013). As such, there is a need to examine the pattern of the public education expenditure and to determine its factors.

Secondly, the importance of education is globally recognized with many past studies encouraging the increase of education funding. It had been proven by many researches the presence of positive and beneficial effect of public education expenditure on the individual's social well-being and national economic growth. Hence, a heavier emphasize should be placed upon the allocation of government education expenditure. Furthermore, increased global competition has forced policymakers to pay more attention to funding for education in Malaysia (Govindaraju, Rao, & Anwar, 2011).

The study build upon a number of established economic theories will serve as basis to empirically investigate the determinants of public education expenditure. Analysis of the government spending on education will provide better knowledge and understanding of the concerning issue. Identification of the public education expenditure's determinants will generate profound findings that may be useful for the policy makers to develop an effective education policy in the future. In addition, the theories found that truly reflected the behaviours of the Malaysia government education expenditure policy will significantly add to the literature.

This paper will be organized in the following: Section 1 begins with a brief introduction on the study. Section 2 describes the literature review on the past researches that were related to this study. Meanwhile, Section 3 will discuss on the data that will be analysed in the study. Next, Section 4 explains on the theoretical model that is being employed in the study. Section 5 provides description and discussion on the methodology of the study. On the other hand, Section 6 reveals the result on the empirical study conducted. Finally, Section 7 will provide a conclusion on the study conducted.

LITERATURE REVIEW

In the first stage of the literature review, this paper will attempt to highlight the positive impacts of public education expenditure on economic growth and the overall social well-being. Numerous studies conducted over various countries had concluded unanimously that the a higher education expenditure will lead to enhance human capital productivity, increase of individual's income, reducing poverty rates and bringing to a better social well-being of all individuals.

Dewitt (1965) highlighted the crucial role of education as an investment which brings to the improvement of productivity through skill of work force, professional competence, and organization human activities. According to Dewitt (1965), investment in people creates human capital which was an embodiment of resources devoted to produce, maintain, and increasing the capabilities of human beings as participants in the social mode of production. Human resources will be the key to economic development. Without human resources development, the society will not be able to develop technology, political or social institutions, cultural welfare or its economy.

Expenditure on education was widely recognized by economists as a method of investing in human capital that contributed to the future levels of income. Woodhall (1967) reviewed the economic returns of education produced positive effect on lifetime earnings and occupation. The investment of education is believed to generate economic growth making it necessary for governments to make detailed projections of the future scale of the education system.

A more educated individual will be able to earn well above the average earnings. Schooling will raise earnings and productivity by providing knowledge, skills and analytical thinking (Becker, 1992). The growth of per capita incomes in many countries during nineteenth and twentieth century is partly due to the expansion of scientific and technical knowledge that raises the productivity of labour and other inputs in production (Becker, 1992).

Gupta, Verhoeven, and Tiongsan (1999) supported the proposition that a greater public expenditure on education generate positive impacts on the education attainment measures. The overall education spending was statistically significant to the gross enrolments. They further suggest that policy makers would need to pay greater attention on the allocations if

education expenditure is to boost economic growth and promote the well-being of the poor. The allocations in terms of their size and efficiency are important drivers that need to be considered in order to promote equity.

Sylwester (2002) attempted to analyse whether higher devotion of resources to education sector may reduce the income inequality within a country. By conducting the least square regression test on a cross section data of countries, it was evident that the public education expenditures appear to cause a decline of the level of income inequality. In other words, the education expenditure will be able to close the income disparity exist in the society. Hence, it can be concluded from this study that the support on education expenditure is likely to enhance the human capital which in turn spur the economic growth.

A number of studies conducted within the context of Malaysia depicted that the government education spending had been producing desirable positive effects. Govindaraju et al. (2011) concluded in their study that the government spending in education will enhance Malaysia's GDP growth in the long run. Based on the bivariate model, they found that the aggregate government spending Granger causes the real GDP. In this study, the authors investigate the time series data in Malaysia over the period of 1970 to 2006. They used both the bivariate and multivariate models to study the relationship between the government spending on education and GDP.

Similarly, Mohd Yahya, Fidlizan, Mohd Fauzi, and Azila (2012) explored the long-run relationship and causality between government expenditure in education and economic growth in Malaysia over the period of 1970 to 2010. Their empirical results illustrated positive co-integration between economic growth and variable of capital fixed formation, labour force participation and government expenditure on education. Besides that, their study also showed that economic growth Granger cause the education expenditure variable and vice versa in the short-run. Thus, confirming the existence of a long-run relationship between education expenditure and economic growth.

Lai and Yussof (2014) examined the long-run relationship between human capital accumulation and economic growth in Malaysia from 1981 to 2010. The findings of their autoregressive distributed lag (ARDL) model revealed that there is significant long-run relationship between education level and economic growth. The result of their study indicated that labour with high level education had positive effect towards GDP, while labour with low level education attainment had insignificant positive impact on GDP. This implied that labour force with high education level attainment had positive contribution to economic growth. Hence, the study was concluded by suggesting a higher investment in education to boost the development of Malaysia as a high income country.

With a large number of studies generating positive results of the public education expenditure in creating high productive workforce, studies that investigate the determinants of public education expenditure becomes highly relevant and necessary. The studies on the determinants of public education expenditure will be able to provide an ideal framework that helps in determining the

indicators that should be incorporated when deciding on the education allocation. Thus, in the second stage of this literature review, exposition and review will be done on the papers that discussed on the variables that determine the public education spending.

Gu (2012) examined a multivariate spatial autoregressive model of public education expenditure determinants in China. The findings of the study revealed that economic level determines the education expenditure level significantly. Other determinants such as proportion of non-agricultural population, immigrant population from other provinces and children population does not had a linear relationship with the education expenditure.

Sagarik (2012) analysed the determinants of public education expenditure in Thailand within a multi-dimensional approach. A multidimensional framework was constructed on a number of established theories to determine the important determinants that influence public education expenditure in Thailand. Findings from this research indicated that inflation is negatively related to the total educational expenditure. Meanwhile, insignificant relationship was found to exist between unemployment and education expenditure.

Chatterji, Mohan, and Dastidar (2014) studied the determinants of public education expenditure across Indian States from the year 2001 to 2010. Their study had revealed that the economic variables such as tax revenue and grants from central government exerted positive impact on education expenditure. On another note, a negative relationship is found between child population and education expenditure. Bischoff and Prasetyia (2015) carried out a study on the determinants of local public expenditures on education for the Indonesian districts between year 2005 and 2012. The result from their study had found out that education expenditure increases with a larger share of children as contradicted to Chatterji et al. (2014).

Meanwhile, Poterba (1997) postulated elderly population was found to be having negative relationship on the public education expenditure. Poterba (1997) argued that elderly population do not favour education expenditure, hence, resulting in a negative association. Ukwueze (2015) employed the short-run error correction model, long-run static equation and ordinary least square regression technique on the Nigeria data from 1961 to 2012 to determine factors that affect the public expenditure size. The results revealed that the size of revenue, national income rate of growth and private investment had significant impact on the size of the government expenditure both in the short run and long run. Factors such as external debts and domestic debts indicated significant influence on the size of government expenditure in the short run only.

Based on the literature review, it appears that the significant positive contribution of education expenditure on economic growth and the social well-being was well established. Hence, justifying the emphasis placed on the need to increase the public education expenditure. As such, there is a need to address the key determinants and theories that can explain the behavioural pattern of the Malaysia's education expenditure. The existing literature reviews on the determinants of education expenditure was still rather less, especially within the context of Malaysia. Hence, this paper will also attempt to address the research gaps of these existing literatures.

METHODOLOGY

This paper will focus on investigating the long run dynamics of the determinants of public education expenditure through Granger Causal analysis. In addition, this paper will be an extension of our past paper (Wong & Yusoff, 2018) by incorporating the Economic-Demography Theory and Peacoc-Wiseman Theory in the study of the determinants of Malaysian education expenditures from 1982 to 2016. As in Wong and Yusoff's(2018), a relatively new approach of ARDL bound testing has been employed to determine the key factors influencing the public education expenditures. By integrating the relevant theories from the literature, a suitable model with variables adjusted to the situation in Malaysia was developed. The variables identified for this study include the independent variables of real gross domestic product, unemployment rate, inflation rate, tax revenue, public debt, population sizes for different cohorts and dependent variable of public education expenditure. The secondary data of the variables were obtained from the Economic Planning Unit, Malaysia Statistical Department, and World Bank.

THEORETICAL MODEL

Before developing the empirical model of the study, the existing theories obtained from the literature was discussed. The discussion will justify the need to use these theories into developing a relevant empirical model.

Economic-Demographic Theory

The economic demographic theory focuses on the importance of the socioeconomic environment factors in shaping public expenditure. Under this theory, the public expenditure or public policy was considered as the political system that is expected to be responsive to the socioeconomic environment or demands of the society. This simply means that the environment or factors in a particular system are considered as the determinants of certain policies. The concept of system implies a set of institutions and activities in society that function to transform demands into authoritative decisions which required support of the whole society (Dye, 1973). The public education expenditure is modelled into the proposed concept of system theory. In accordance to the concept of system model, policy makers would need to pay careful attention to the forces or demands in its environment, as these factors would affect the public policy. Following the proposition by Sagarik (2012), any crucial factors in the system should be taken into account in the attempt to analyze the changes in public education expenditure.

Keynesian Counter-Cyclical Theory

According to the Keynesian Counter-Cyclical theory, any decision to increase or decrease the allocation of government expenditure will depend on the economic conditions of the society. Any changes to the society's economic situation will lead to another change of the public expenditure allocation. The Keynesian Counter-Cyclical theory further advocated that the government played a major role to enhance the economy by tax cut or increasing the public expenditure through expansionary fiscal policy. Under the expansionary fiscal policy, government expenditure programme was stimulated during economic recession in the hope of increasing the aggregate demand. Meanwhile, the public expenditure will be reduced when the economy is on the rise. The increased of government expenditure during economy recession was to inject more money into the economy to stimulate the aggregate demand expansion and economy growth. In another instance, a higher budgetary expenditure will be allocated when the country experienced high unemployment. However, it is still remain unclear if the following theory will applied directly to Malaysia's education expenditure. For example, an economic downturn may not directly lead to education institutions closure.

Peacock-Wiseman Theory

Peacock and Wiseman (1961) explained that the behaviour of public expenditures over any period depends on factors that can differ in influence and importance from one time to another. Their study anchored on the Displacement Theory explained that the public expenditure does not increase in a straight and continuous manner, but rather in a step-like pattern to accommodate social upheavals. The unanticipated social disturbance brings to the need of increasing public expenditure which now would require higher taxation. The movement of the government expenditure from low level to higher level spending resulted in the displacement effect. The tolerance of the citizens on the higher taxation imposed during times of crisis will still persist even after the crisis ended. This would results in a permanent shift of the trend following the social disturbance. Following Peacock and Wiseman analysis of the time pattern of public expenditures, it will be interesting to investigate whether the education expenditure is affected by the time of economic crisis. Factors such as population upsurge or that of the increasing price level may tend to increase the cost of public activities raising the public expenditure.

EMPIRICAL MODEL

The empirical model developed for this study was motivated by Okafor and Eiya (2011) and Sagarik (2012). This model was employed to empirically analyze the economic and demographic determinants of the public education expenditure as in our previous paper (Wong & Yusoff, 2018).

$$EDU_t = f(GDP_t, UNEM_t, INF_t, TAX_t, DEBT_t, POP1_t, POP2_t, POP3_t) \tag{1}$$

Where:

= Public Expenditure on Education at time t (RM Million)
= Real Gross Domestic Product growth rate (%)
= Unemployment Rate (%)
= Inflation Rate (%)
= Tax Revenue at time t (RM Million)
= Public Debt at time t (RM Million)
= Population ages 0 to 14
= Population ages 15 to 64
= Population ages 65 and above

For the purpose of regression and estimation, the model in this research will developed into the log-linear form and is specified as follow:

$$\ln EDU_t = \beta_0 + \beta_1 GDP_t + \beta_2 UNEM_t + \beta_3 INF_t + \beta_4 \ln TAX_t + \beta_5 \ln DEBT_t$$
$$+ \beta_6 \ln POP1_t + \beta_7 \ln POP2_t + \beta_8 \ln POP3_t + \varepsilon_t \tag{2}$$

Where:

= Public Expenditure on Education at time t (RM Million)
= Real Gross Domestic Product growth rate (%)
= Unemployment Rate (%)
= Inflation Rate (%)
= Tax Revenue at time t (RM Million)
= Public Debt at time t (RM Million)
= Population ages 0 to 14
= Population ages 15 to 64
= Population ages 65 and above
= Error Term at time t

RESEARCH METHODS

Unit root test will be first conducted to investigate whether the data is stationary or not. The test is conducted to avoid spurious regression. Lag length selection test is followed next to find out the appropriate lag length that can be used in ARDL Bound Testing approach. As in Wong and Yusoff (2018), this paper adopted the relatively recent developed ARDL bound testing approach to examine the long run relationship for public education expenditure and its determinants. Unlike the Engle-Granger and Johansen-Juselius Cointegration tests, ARDL Bound Testing approach can be implemented even when the variables in the model are of mixed order of integration I(0) and I(1). In addition, ARDL Bound Testing approach was considered to be more robust when applied on small sample data.

RESULTS

Estimation Results Based on ARDL Bound Testing Approach

The unit root test is used to examine the time series data on both levels and first differences by carrying out the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) test. The Augmented Dickey Fuller (ADF) and Philip-Perron (PP) test results showed that the variables were of mixed order of integration I(0) and I(1). Table 1 illustrated the Augmented Dickey Fuller (ADF) result. Meanwhile, Table 2 showed the Philip-Perron (PP) result.

Table 1 Augmented Dickey-Fuller (ADF) test result

Augmented Dickey-Fuller (ADF) Test				
Variable	**Level**		**First Difference**	
	Intercept	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
LNEDU	−1.665734	−1.878210	−4.019243*	−4.077466**
GDP	−4.662843*	−4.718834*	−7.479796*	−7.349714*
UNEM	−4.104694*	−4.081727**	−4.631867*	−4.553312*
INF	−4.687023*	−4.589514*	−5.275477*	−5.192888*
LNTAX	−0.634133	−4.162475**	−4.204515*	−4.129920**
LNDEBT	0.190717	−1.414864	−4.636494*	−4.663650*
LNPOP1	−0.614135	−3.283629***	−4.038305*	−3.992080**
LNPOP2	0.842240	−0.002555	−8.640937*	−3.972737**
LNPOP3	−1.580103	−3.832019**	−4.241152*	−4.407884*

*Significant at 1% significance level, **Significant at 5% significance level, *** Significant at 10% significance level

Table 2 Phillips Perron (PP) test result

Phillips Perron (PP) Test				
Variable	Level		First Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
LNEDU	−1.387722	−1.419961	−3.789019*	−3.820630**
GDP	−4.679070*	−4.718834*	−17.76575*	−17.84715*
UNEM	−1.782147	−2.651450	−4.631867*	−4.553312*
INF	−4.711439*	−4.625832*	−9.074482*	−8.937915*
LNTAX	−0.628564	−2.403621	−4.301160*	−4.211465**
LNDEBT	0.116207	−1.414864	−4.570787*	−4.913593*
LNPOP1	−0.555813	−1.948861	−4.102117*	−4.069134**
LNEDU	−1.387722	−1.419961	−3.789019*	−3.820630**
GDP	−4.679070*	−4.718834*	−17.76575*	−17.84715*

*Significant at 1% significance level, **Significant at 5% significance level, *** Significant at 10% significance level

Next, the lag length selection estimated based on the unrestricted Vector Autoregressive (VAR) model is carried out. It is crucial to be carried out to determine the optimal lag length that should be used in the Co-integration test. The following Table 3 showed the VAR lag order selection criteria.

Table 3 VAR lag order selection criteria

VAR Lag Order Selection Criteria						
Lag	Log L	LR	FPE	AIC	SC	HQ
0	15.75130	NA	0.038047	−0.450087	−0.029728	−0.315610
1	22.78009	9.371720*	0.025645	−0.852006	−0.384940	−0.702588
2	25.12126	2.965481	0.023671*	−0.941417*	−0.427645*	−0.777057*
3	25.47570	0.425330	0.024998	−0.898380	−0.337901	−0.719078
4	25.47570	1.66e-07	0.027099	−0.831713	−0.224528	−0.637470
5	25.62543	0.159714	0.029169	−0.775029	−0.121137	−0.565843

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

According to the VAR lag order selection criteria as shown in Table 4, the lag length $p = 2$ was selected for the model. The minimum Akaike's Information Criterion (AIC) suggested the lag order 2 for the model.

Table 4 ARDL Bounds Test for cointegration

Test statistic	Value	Significance level	Bound critical values	
			I(0)	I(1)
F-Statistic	10.12218*	10%	1.85	2.85
		5%	2.11	3.15
		2.5%	2.33	3.42
		1%	2.62	3.77

*Significant at 1% significance level

The computed *F*-statistic of 10.12218 was greater than the upper bound critical value at 1 per cent level of significance. Thus, the null hypothesis of no co-integration is rejected at 1 per cent level of significance. The existence of long-run relationship among the variables was confirmed. The empirical results of the long-run model are presented in the following Table 5.

Table 5 Long-Run Coefficients Estimates of ARDL (1, 2, 2, 2, 2, 0, 1, 2, 0) model
Dependent Variable: LNEDU

Independent Variables	Coefficient	T-Statistic	Probability
GDP	−0.128573*	−5.053811	0.0003
UNEM	0.174543***	1.946343	0.0754
INF	0.177549**	2.382193	0.0346
LNTAX	0.304742	0.353236	0.7300
LNDEBT	0.995010	1.374961	0.1943
LNPOP1	−8.592410	−0.536184	0.6016
LNPOP2	189.2219*	3.157208	0.0083
LNPOP3	14.96697	0.972278	0.3501
C	−8.378472	−1.489292	0.1622

*Significant at 1% significance level, **Significant at 5% significance level, *** Significant at 10% significance level

The long-run model of the corresponding ARDL (1, 2, 2, 2, 2, 0, 1, 2, 0) can be written as follow:

$$LNEDU_t = -0.128573 \ GDP_{t-1} + 0.174543 \ UNEM_{t-1} + 0.177549 \ INF_{t-1} + 0.304742$$
$$\ln TAX_{t-1} + 0.995010 \ \ln DEBT_{t-1} - 8.592410 \ \ln POP1_{t-1} + 189.2219 \ \ln POP2_{t-1}$$
$$+ 14.96697 \ \ln POP3_{t-1} \tag{3}$$

Estimation of the ARDL long-run model revealed that real gross domestic product growth rate (GDP), unemployment rate (UNEM), inflation rate (INF) and population growth of ages 15 – 64 (LNPOP2) significantly affect the public education expenditure in the long run. Real gross domestic product growth rate (GDP) has negative significant effect on the public education expenditure. This indicates that the decline of real gross domestic product leads to a higher government spending in education. At times of economic downturn, policy makers will formulate policies and increase government spending to re-stimulate the economy. The responsiveness of public education expenditure to the time of economic crises was consistent with Peacock-Wiseman theory. Meanwhile, unemployment rate has a positively significant impact on the public education expenditure. Increase of unemployment rate leads to higher education expenditure in the long run. These findings showed that Keynesian Counter Cyclical theory clearly characterized and explain the pattern of the Malaysia's public education expenditure in the long run.

The result from this study further reported that inflation rate (INF) was positively significant to the government education spending. Our result was consistent with Imana (2017) that demonstrated inflation rate with a positive effect on public education expenditure. High inflation rate causes prices hike of commodities and services, thus making parents unable to afford tertiary education fees and other education costs. As such, government needs to intervene by apportioning more funds to education framework to prevent Malaysia citizens left behind from education access. The significant effects of the economic variables on the public education expenditure provided support to the Economic-Demographic Theory. The Economic-Demographic Theory which had placed the importance of economic environment factors in shaping public expenditure. The only demography variable that showed significant result in the long run was the population cohort of age 15 – 64. This specific working age cohort showed a statistically significant and positive effect on the public education expenditure. This result highlighted that the working age population which stood as the highest proportion of the overall population had a positive effect on the allocation of public education expenditure. In the long run, the government tends to focus on developing a massive productive human capital resource. This working age population will contribute directly to the human capital production as they can easily enter the labour market upon graduation.

Meanwhile, other variables such as tax revenue, public debt, child population (age 0 – 14) and elderly population growth (age greater than 64) failed to deliver significant results. Changes to these variables did not show any significant long run impact on the allocation of public education expenditure. This implied that these variables were not incorporated into consideration by policy makers when deciding allocation. The insignificant result of the children

population and elderly population also showed that education allocation failed to respond to the change of these particular age cohorts. Hence, suggesting that policy makers had failed to take account of the schooling age population when planning public education expenditure. An increasing schooling age population failed to be matched with a corresponding increase to the public education expenditure. Elderly population did not negatively affect the public education expenditure as suggested by Poterba (1997). The changes of elderly population did not directly caused the expected re-allocation of expenditure from education sector to the health care sector.

The Dynamics of Long Run Causality

Granger causality test based on VECM was estimated to determine the long run causality between public education expenditure and its determinants. The following Table 6 illustrated the nature and direction of the long run dynamics of the specific variables.

Table 6 Long run causality dynamics

Direction of Causality	Chi-Square Statistics	p-value	Long Run (ECT-1)
GDP causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes GDP	13.65342***	0.0913	Significant at 10% significance level
UNEM causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes UNEM	9.168659	0.3283	Insignificant
INF causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes INF	9.215033	0.3245	Insignificant
TAX causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes TAX	15.71263**	0.0467	Significant at 5% significance level
DEBT causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes DEBT	3.212833	0.9203	Insignificant
LNPOP1 causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes LNPOP1	11.82500	0.1592	Insignificant
LNPOP2 causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes LNPOP2	2.448259	0.9641	Insignificant
LNPOP3 causes LNEDU	34.03729*	0.0000	Significant at 1% significance level
LNEDU causes LNPOP3	4.800685	0.7787	Insignificant

*Significant at 1% significance level, **Significant at 5% significance level, *** Significant at 10%

The Granger Causality test result implied the existence of long run Granger causality that runs from the real gross domestic product, unemployment rate, inflation rate, tax revenue, public debt, population (age 0 – 14), population (age 15 – 64), and population (age $\geq$ 65) to the dependent variable of education expenditure. The chi-square value statistic was found to be statistically significant when public education expenditure act as the dependent variable. This significant value of the Chi-Square statistic = 34.05729 exhibited long run causality that runs from real GDP growth rate, unemployment rate, inflation rate, tax revenue, public debt, and population of different cohorts to public education expenditure. Therefore, we can conclude that long run causality between public education expenditure and its determinants holds in Malaysia. Our Granger causality test result was in line the proven existence of long run co-integration between variables found by ARDL bound testing approach.

A significant long-run causality relationship was also observed from public education expenditure to real GDP growth rate at 10% significance level. In addition, significant long-run causality was also found from public education expenditure to tax revenue at 5% significance level. This suggested that there is bidirectional Granger causality between real GDP growth rate and public education expenditure in the long run. It means that the any changes to the public education expenditure will lead to change in real GDP growth rate and vice versa. The long run causality empirical result also showed that there was feedback effect between public education expenditure and tax revenue. As such, indicated that bidirectional causal relationship was established between tax revenue and public education expenditure. This causality evidence pointed out that any change to the tax revenue produce significant effect on the public education expenditure and reverse causation applies as well.

CONCLUSION

The real gross domestic product growth rate (GDP), unemployment rate (UNEM), inflation rate (INF) and working age population (POP2) were identified as the long run determinants of public education expenditure in Malaysia (Wong & Yusoff, 2018). The ARDL bound testing revealed significant negative relationship between real gross domestic product growth rate (GDP) and public education expenditure (EDU). On another note, a positive result was also recorded between unemployment rate (UNEM) and public education expenditure (EDU). These findings reflected that the Keynesian Counter Cyclical theory holds for the public education expenditure in Malaysia. In times of economic boom or economic crisis, public expenditure will respond by increasing the size of the allocation. In other words, economic situation or fluctuation will determine the level of public spending. The adjustment of government expenditure made by policy makers at times of economic crisis showed the suitability of Peacock-Wiseman used in explaining the pattern of Malaysia's education allocation Inflation rate has positive significant effect on the public education expenditure. Increase inflation caused a relatively higher cost for education. This will necessitate the government to intervene by allocating more expenditure to the now higher cost education sector. Meanwhile, the working age population (age 15 – 64) (LNPOP2) was the only demography variable that was found to be significantly

positive in the long run. This advocated that the increase of the working age population (age 15 – 64) (LNPOP2) encourage a greater investment from the government to create more productive human capital. The establishment of the economic and demography factors as the determinants of public education expenditure followed the proposition of Economic-Demography Theory.

Granger Causality test in our study clearly established a bidirectional causal relationship between government education spending and economic growth. This suggests that the growth of public education spending will likely lead to the growth of real GDP. Vice versa, the growth of real GDP Granger causes and leads changes to the growth of public education expenditure. Similarly, a two-way causal that runs between public education expenditure and tax revenue was proven. The bidirectional causal relationship signified that the changes in public education expenditure will lead to changes in tax revenue and vice versa. This means that the higher tax revenue collected by the government, the higher will be the tendency of the government to raise the public education expenditure. Likewise, increase in public education expenditure will project future positive income growth for the individuals. In return, Government would be able to collect more taxes from the now highly-income earning citizens.

Based on the findings from our study, the following policy implications are recommended. Firstly, the empirical findings showed that the public education expenditure was sensitive to the economic variables of gross domestic product growth rate (GDP), unemployment rate (UNEM), and inflation rate (INF) in the long run. Hence, government will be able to regulate their budgetary allocation by controlling these economic variables in the country. Secondly, government would need to increase the responsiveness of their public education expenditure to the demands of the society. Public policy making with regards to public education expenditure will also need to be more responsive to the economic conditions or any economic fluctuations so as to produce positive outcomes.

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