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The Determinants of Public Education Expenditure in Malaysia

(Penentu Perbelanjaan Pendidikan Awam di Malaysia)

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ABSTRACT

The aim of this paper is to investigate the determinants of the public education expenditure in Malaysia during the period of 35 years from 1982 to 2016. This study intends to address the existing research gaps within Malaysia context that failed to receive much attention in the past. The determinants of education expenditure will be modeled using time series data within the autoregressive distributed lag (ARDL) Bound Testing approach and Error Correction Model (ECM) method. The empirical findings from this study identified the real gross domestic product growth rate (GDP), unemployment rate (UNEM), inflation rate (INF) and working age population (POP2) as the long run determinants of public education expenditure. Findings from the ARDL Bound Testing result further supported the Keynesian Counter-Cyclical theory as implied by the negative relationship between economic growth and public education expenditure in the long run. The short run analysis through ECM demonstrated that fluctuations in education expenditure was sensitive to the real gross domestic product growth rate (D(GDP)), unemployment rate (D(UNEM)), population of age less than 15 (D(LNPOP1)), and population of age greater than 64 (D(LNPOP3)). This study further recommends that the policy makers to play the role in responding to the economic conditions and demands of the society in their decision-making of the future allocation.

Keywords: Determinants; education expenditure; ARDL bound testing; ECM; time series

ABSTRAK

Matlamat kajian ini adalah mengkaji faktor penentu perbelanjaan pendidikan awan di Malaysia untuk tempoh 35 tahun dari 1982 hingga 2016. Kajian ini bertujuan untuk menangani jurang penyelidikan yang wujud dalam konteks Malaysia yang gagal mendapat perhatian ramai.Penentu pendidikan awam ini akan dimodelkan melalui data siri masa dan menggunakan kaedah autoregressive distributed lag (ARDL) Bound Testing serta kaedah Error Correction Model (ECM). Penemuan empirical dari kajian ini telah mengenal pasti kadar pertumbuhan keluaran dalam negeri (KDNK), kadar pengangguran (UNEM), kadar inflasi (INF) dan populasi umur bekerja (POP2) sebagai penentu perbelanjaan pendidikan awam dalam jangka panjang. Hasil keputusan kaedah ARDL Bound Testing yang menunjukkan hubungan negatif jangka panjang antara pertumbuhan ekonomi dan perbelanjaan pendidikan awam memberi sokongan kepada teori Keynesian Counter-Cyclical. Analisis jangka pendek melalui ECM menunjukkan bahawa corak turun naik perbelanjaaan pendidikan adalah sensitif terhadap kadar pertumbuhan keluaran dalam negara kasar (D(GDP)), kadar pengangguran (D(UNEM)), populasi umur kurang daripada 15 (D(LNPOP1)) dan populasi umur melebihi 64 (D(LNPOP3)). Kajian ini seterusnya mencadangkan agar pembuat dasat memainkan peranan dalam menanggapi keadaan ekonomi dan tuntutan masyarakat dalam membuat keputusan mengenai peruntukan masa depan.

Kata kunci: Penentu; perbelanjaan pendidikan; ARDL bound testing; ECM; siri masa

INTRODUCTION

Education plays a fundamental role in any country's pursuit of economic growth and development. A well-developed human capital would increase its productivity and boost any nation's economic growth. For this very reason, the education system in Malaysia has been an ongoing effort to holistically develop an intellectual, spiritually, emotionally, physically balanced and harmonious community. The education system was designed with the hope of producing knowledgeable, highly-skilled and competent individuals who will uphold high moral values. According to Prof. Datuk Dr. Morshidi Sirat, there are three main objectives of education that all countries aimed to achieve: free access to quality education, wider coverage and adequate provision. These main aims are only achievable provided that there is sufficient public education expenditure allocated (Sirat 2018).

In line with the belief that education is able to propel any country's economic growth, the Malaysian government has extensively developed policies to

enhance the education sector. Other than that, a significantly high amount of investment has been injected into the education sector over the past years. This was as reflected in the Malaysia's public spending data which recorded a large amount of education expenditure spent since the independence in 1957. According to a report by the Ministry of Education Malaysia, the investment by Malaysian government had reached the highest in East Asia during the early 1980s. However, in the recent years it can be observed that the pattern of the allocation experienced a declining trend. In the year 2003 to 2005, a declining trend of the public education expenditure was observed. The data of the allocation illustrated a slowly increasing trend during the period of 2006 to 2010. Beginning in the year 2011, the government education expenditure dropped significantly. In the recent Budget 2016 and Budget 2017, the education sector further took a hard hit and suffered some massive cuts to its budgetary allocation. Data from the World Bank which calculated the government education expenditure on the basis of GDP percentage showed that there was lesser money set aside for education by the government beginning 2011. The substantial fluctuation of the public education expenditure pattern across time is therefore worth examined.

Furthermore, the benefits of government education investment was recognized to contribute in a better resource management, leading to more rapid technological innovation and boosting total productivity (United Nations 2003). Expansion of education opportunities through increase public education expenditure is therefore necessary. Increase of education will make an important contribution to societies' economic growth and to the economic fortunes of individuals. Recently, the Malaysian education system has come under fire by the increasing public scrutiny and debate, as parents' expectations rise and employers voicing out their concern of the education system's failure in producing young workforces who are capable of handling the 21st century challenges. Although Malaysian student performance had been improving over several decades, its performance now is at risk against the international standard. This was reflected in its score for the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). The PISA score obtained for the year of 2009 were very much disappointing with Malaysia taking up the rank of the bottom third of the 74 participating countries (Malaysia Education Blueprint 2013).

These arising problems posed an imminent need to analyze the recent trend of the public education expenditure and to study the factors that are affecting the growth of the government education spending. As supported by Sagarik (2012), the determinants of public policy are crucial as they provide important information for a nation to achieve desirable outcomes. An analysis that determines the determinants of the public education expenditure will generate profound findings that may useful for the policy makers to develop an effective education policy in the future. In addition, such analysis will be crucial to address the existing gap in the literature of the determinants of public education expenditure. This paper will attempt to make theoretical contribution by integrating several theories to form a relevant model that explains the determinants of public education spending in Malaysia. The integration of the two opposing theories into the model of study would helps to determine which of the specific theory that best illustrate the behavior of the public education expenditure level. Differed from the past studies, this paper will distinguish between long run determinants and short run determinants of public education expenditure. Our paper will be organized into five sections consisting of Introduction, Literature Review, Methodology, Results and Discussions and Conclusion.

LITERATURE REVIEW

In the past, many studies had highlighted the contributions of education on economic growth. There were papers in the past that extensively discussed on the relationship between education expenditure and economic growth. Many of these papers successfully pointed out that the public education expenditure contributed significantly to the economic growth. During the first stage of the literature review, this paper will highlight these literatures that studied on the public education expenditure and its effect on economic growth.

Downes (2001) discussed the effect of education expenditure towards labour productivity by employing the Ordinary Least Square (OLS) estimation. Empirical findings portrayed that education enhanced both the cognitive and non-cognitive skills of labourers, hence, increasing their productivity. This result further suggested that the relationship between the productivity and government spending on education is significantly positive. Jung and Thorbecke (2003) investigated the positive effect of public education expenditure. The result of their study indicated that the increase of public education expenditure contribute to economic growth and poverty alleviation. However, such significant positive contribution is only possible if the public education expenditure is supported by suitable policy measures.

Conrad (2011) posited that government spending on education was identified as an important indicator of human capital formation that propels economic growth. An efficient allocation of resources for education will increase the human capital growth and stimulate economic growth. Govindaraju et al. (2011) concluded in their study that the government spending in education is an important determinant of the GDP growth in Malaysia over the years investigated 1970 to 2006. They proposed that promoting education will enhance the GDP growth.

In addition, their analysis revealed that the investment in education will only improve the economic growth in the long run. Both the bivariate and multivariate model was employed in their study of the relationship between the government spending on education and GDP. The result of their study produced a mixed finding with bivariate model supporting Wagner's law, while, multivariate model supported the Keynesian Theory.

Mohd Yahya et al. (2012) explored the long-run relationship and causality between government expenditure in education and economic growth in Malaysia. The Vector Auto -Regression (VAR) method, Granger causality test and Co-integration such as Johansen Multivariate Cointegration test were employed on the time series data from 1970 to 2010. The empirical results exhibited significant 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. Empirical evidence from the autoregressive distributed lag (ARDL) model revealed that there is significant long run relationship between education level and economic growth. This implied that labour force with high education level attainment had positive contribution to economic growth. Hence, suggesting a higher investment in education to boost the development of Malaysia as a high income country.

In the second stage of the literature review, we intend to explore the literatures which analyze public education expenditure and the education outcome nexus. The education expenditure provision is associated with notable improvements to the measured school inputs such as increases in teacher salaries, reduction in school-to-teacher ratios and longer school years (Jackson et al. 2016). Findings by Jackson et al. (2016) further proved that the increase in education spending will lead to higher education completion rate and reduction of poverty. Additionally, their findings showed the elimination of education attainment gaps between low-income families and higher income families. Hence, they suggested that an adequate provision of spending coupled with good system is necessary to generate productive inputs.

Dauda (2011) discovered the positive impacts of public education expenditure on education outcomes. He further recommended that adequate provision of the government expenditure is required to enhance education attainment. In a separate finding, Hildago and Ormaetxe (2018) highlighted that the public expenditure on education had a strong long run effect on reducing the incidence of poverty in adulthood. They further stressed the important role of government intervention through public education expenditure to equalize opportunities and reducing the long run effects of poverty. The public education expenditure had a strong effect of raising individuals above the poverty line. Al-Samarrai (2003) advocated that the improvement in the management of public education spending is significant in strengthening the relationship between public spending and education outcomes. These comprehensive literatures had provided support in explaining how the education allocation is able to provide desirable positive outcomes.

With a large number of studies that generate positive results of the public education expenditure in creating high productive workforce and producing positive desirable outcomes, studies that investigate the determinants of public education expenditure becomes crucial and necessary. The studies on the determinants of public education expenditure is necessary as it is able to provide an ideal framework that helps in determining what is the best allocation for education sector. Thus, in the next stage of this literature review, exposition and review will be done on the papers that discussed on some of the studies that attempt to determine the public education expenditure.

Sagarik (2012) analyzed the determinants of public education expenditure in Thailand within a multi-dimensional approach. A multidimensional framework was constructed with several 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 et al. (2014) studied the determinants of public education expenditure across Indian States from the year 2001 to 2010. Their study revealed that economic variables such as tax revenue and grants from central government exerted positive impact on education expenditure. However, political factors such as political ideology of the ruling party do not affect education spending. Meanwhile, 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 study had found out that education expenditure increases with a larger share of children. Finally, the ratio of the states revenues to total expenditures indicated that the local population is more reluctant to support shares of public funds being channeled to education sector. In a separate study by Kurban, Gallagher and Persky (2015), they refuted the idea that the elderly population hindered the growth of the per-pupil education expenditure. By conducting a re-examination on the U.S. data, the authors revealed that the increase of the elderly

population has in a way results in an improvement to the education expenditure.

In another study by Ukwueze (2015), the author draws attention into determining factors that affect the public expenditure, in particular the size of the expenditure. In this research, the short-run error correction model, long-run static equation and ordinary least square regression technique was performed on the Nigeria data from 1961 to 2012. Result of the tests conducted showed 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. The notion of increasing national income will raise the public expenditure size was in favor of the Wagner's theory. Factors such as external debts and domestic debts indicated significant influence on the size of government expenditure in the short run only. The authors asserted that factors such as revenue, private investment and income are able to enhanced public expenditure.

Based on the literature review, it appears that significant contribution of education and its expenditure on economic growth was well established by substantial studies. In addition, past literatures had highlighted the positive desirable outcomes produced by the public education expenditure. Recognizing the significant positive contribution of public education expenditure, studies had emerged to address the issue in identifying factors that would help to explain the size of the education spending. Understanding of the instruments that affect public education expenditure patterns would assist in better decision making in relation to the spending (Verbina & Chowdhury 2004).

However, note that the existing literature reviews on the determinants of education expenditure was still rather less, especially within the context of Malaysia. Curiously it is found that many of the past studies that examined the determinants of public education expenditure had omitted the varying effects of these variables on the expenditure allocation across time. The knowledge of the short run and long run influence of the determinants will be essential to address the issue of effectiveness government's economic policy. Earlier discussion by Peacock and Wiseman (1961) clearly states that the behavior of public expenditures over any period depends on factors that can differ in influence and importance from one time to another. Effects from certain identified determinants drew temporal effect which disappeared during longer period. Assessment of the factors that draws transient influences or long run effects can best be used to explain the displacement pattern in the public education expenditure. Thereby, allowing policy makers not just to identify the determinants but to understand the time-variants effects which characterized the pattern of the public education allocation. In addition, multiple theories from literature was extracted and integrated in the development of a conceptual framework and model that was relevant to the study in Malaysia. The omission of the demography variable (working age population) in the past researches was also addressed through this study. Therefore, this paper will attempt to address the research gaps of the previous literatures such as the omission of the determinants' vary effects across time and failure to consider the demography effect particularly the working age population's effect to the public education expenditure.

METHODOLOGY

This paper will focus on finding out the determinants of Malaysian education expenditures by examining the time-series data from 1982 to 2016. By integrating the existing theories from literature, a relevant model with variables adjusted to the situation in Malaysia will be established. This paper will employ the ARDL Bound Testing approach and the Error Correction Model (ECM) for this study. The variables identified for this study includes the independent variables of real gross domestic product, unemployment rate, inflation rate, tax revenue, public debt, population 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 will be firstly discussed. The discussion of the theories was important as they contribute towards their integration and application in establishing a relevant empirical model. Economic circumstances tend to create pressure on policy makers in formulating policies that can respond well to the concerning economic fluctuations. It is therefore, worth discussing these theories that can explain how education allocation policy may respond well by taking account of the economic conditions when developing the policies. The discussions of the two opposing theories were in fact motivated by the study of Sagarik (2012). These two opposing theories would serve ideally for the building of the relevant empirical model that would explain how economic circumstances may affect the Malaysia's public education expenditures.

WAGNER'S LAW

The law of increasing state activity was developed by the German political economist Adolph Wagner (1835 – 1917). Wagner proposed through his law that the public expenditure will grow continuously as the output grows in developing countries. He further states that the growth of real income will lead to an increase to the share of public welfare expenditure. It stipulates a positive relationship between economic growth and government

expenditure. According to Wagner's Law, an increase on GDP increases the public expenditure (Bayrakdar et al. 2015). Wagner's law therefore seems to assume and expect that the government had a duty to expand its spending in respond to the increasing social progresses. According to Guandong and Muturi (2016), Wagner's law advanced and postulated the following: firstly, the extension of the functions of the states leads to an increase in public expenditure. Secondly, the development of modern industrial society would give rise to increasing pressure and call for increased expenditure. Thirdly, the rise in public expenditure is expected to grow at a faster rate and higher proportionally than the national income resulting relative expansion of public sector.

KEYNESIAN COUNTER-CYCLICAL THEORY

According to the Keynesian Counter-Cyclical theory, any decision to change the allocation of government expenditure will depend on the economic conditions of the society. This implied that changes of the society's economic situation will lead to the changes of the public expenditure allocation. The Keynesian Counter-Cyclical theory further emphasized 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 program 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. According to Sagarik (2012), the Keynesian Counter-Cyclical Effect can be illustrated as follow:

EMPIRICAL MODEL

Economic volatility was justified as the main cause to the current austerity measures of massive budgetary cuts to Malaysian education (Abdullah, 2017). This portrayed the important role of economic variables in influencing the public education expenditure allocation. The economic variables of real gross domestic product (GDP) growth rate, inflation rate (INF) and unemployment rate (UNEM) which corresponds to the Wagner and Keynesian Counter-Cyclical Theory were selected for the analysis. In addition, we will consider the demography variables effect as well. As there had been past studies that demonstrated the significant effects of child population and elderly population on the allocation of government expenditures, hence, it become imperative not to neglect the demography variables as determinants of public expenditure. Rather than just focusing on child population (age less than 15) and elderly population (age greater than 64) as the past studies had done, we decided to investigate the possible effects of working age population on public education expenditure as well. This particular age cohort of population (age 15 – 64) was introduced into our study because this group of population stood as the largest proportion of our total population. According to the Malaysia Department of Statistics, the population group of age 15 to 64 comprised about 70% of the total population. The introduction of this variable was in consistent with Lewis (1961) suggestion. In a paper by Lewis (1961), he pointed out that education system can produce educated individuals that would be easily absorbed into labour market. The quickest way to increase productivity in developing countries is through training the adults who were already on job (Lewis 1961). Lewis (1961) explained that the education for young children will pay a comparably smaller potential contribution compared to efforts devoted to improving working age population skills. Following this recommendation, it is justifiable to introduce the working age population (age 15 to 64) as this group will contribute directly to the human capital production. The demography concerns that arise from past researches highlighted the controversial results obtained. With some studies such as Bischoff and Prasetyia (2015) demonstrated positive results between the child population and expenditure allocation. Meanwhile, research paper by Chatterji et al. (2014) argued and showed a contradicted result instead. In a separate paper by Kurban et al. (2015), positive result was

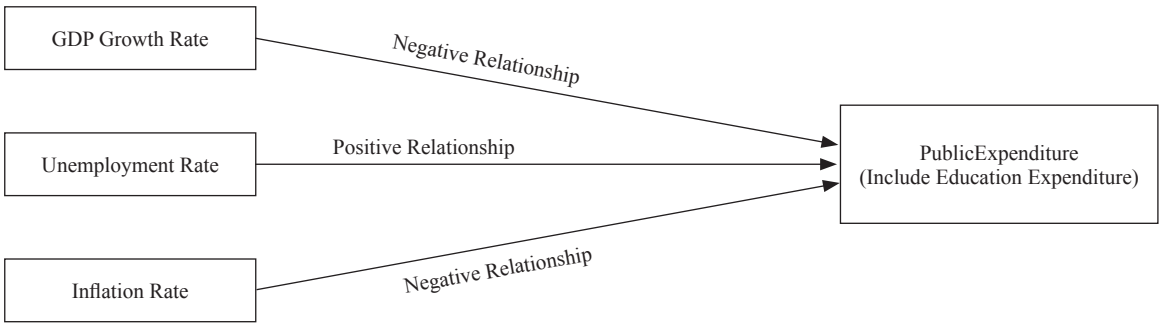

FIGURE 1. Keynesian Counter-Cyclical Theory
Source: Sagarik (2012)

found between elderly population and public education expenditure. However, Poterba (1997), Grob and Wolter (2005) refuted the findings. In light of the contradicted issues concerning the effect of the different age cohorts' effects on the public education expenditure, we decided to include the demography variables of different age cohorts in our study. According to Okafor and Eiya (2011), the public debt may impact the public budget to the extent of favoring government expenditure in certain sectors. In other words, the public debt may helps to increase the size of the public sector budgetary allocation. Similarly, it is suggested that the size of revenue may positively affect the size of the public sector. However, Ukwueze (2015) pointed out that the public debt may serve as a liability. Continual borrowing of money resulted in higher cost of servicing the debt. Following the studies by Okafor and Eiya (2011), Ukwueze (2015), the tax revenue and public debt was included into our model.

Our empirical model developed for this study will be similar to Okafor and Eiya (2011) and Sagarik (2012). This model will be employed to empirically analyze both the economic and demographic determinants of the public education expenditure.

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

Where;

EDU_t = Public Expenditure on Education at time t (RM Million)
GDP_t = Real Gross Domestic Product growth rate (%)
$UNEM_t$ = Unemployment Rate (%)
INF_t = Inflation Rate (%)
TAX_t = Tax Revenue at time t (RM Million)
$DEBT_t$ = Public Debt at time t (RM Million)
$POP1_t$ = Population ages 0 to 14
$POP2_t$ = Population ages 15 to 64
$POP3_t$ = Population ages 65 and above

For the purpose of regression and estimation, the variables of Public Education Expenditure (EDU), Tax Revenue (TAX), Public Debt (DEBT), Population ages 0 to 14 (POP1), Population ages 15 to 64 (POP2) and Population ages 65 and above (POP3) in this research will be modified into the log-linear form so that all variables in our model will be showing its impacts in terms of percentage change. Therefore, our model will be specified as follow:

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

Where,

EDU_t = Public Expenditure on Education at time t (RM Million)
GDP_t = Real Gross Domestic Product growth rate (%)
$UNEM_t$ = Unemployment Rate (%)
INF_t = Inflation Rate (%)
TAX_t = Tax Revenue at time t (RM Million)
$DEBT_t$ = Public Debt at time t (RM Million)
$POP1_t$ = Population ages 0 to 14
$POP2_t$ = Population ages 15 to 64
$POP3_t$ = Population ages 65 and above
ε_t = 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. Next, the lag length selection test is conducted to find out the appropriate lag length that can be used in ARDL Bound Testing approach. It is fundamental to choose the suitable lag length so that the analysis will be consistent with the real economy. 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. The ARDL Bound Testing procedure was based on the joint F-statistic for cointegration analysis. In the ARDL model, the null hypothesis of no cointegration as denoted by . The null hypothesis of no cointegration is tested against the alternative hypothesis, (there is cointegration among the variables). When the computed F-statistic is greater than the upper bound critical value, then the null hypothesis of no cointegration is rejected. If F-statistic is below the lower bound critical value, then the null hypothesis (no cointegration among variables) cannot be rejected. Should the F-statistic found to lies in between the lower and upper bounds, the inference will be inconclusive. With cointegration evidence found, the following ARDL framework is estimated for the long run relationship model:

$$\begin{aligned}\Delta LNEDU_t = {} & \delta_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta LNEDU_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta GDP_{t-1} \\ & + \sum_{i=1}^{n} \alpha_{3i} \Delta UNEM_{t-1} + \sum_{i=1}^{n} \alpha_{4i} INF_{t-1} \\ & + \sum_{i=1}^{n} \alpha_{5i} \Delta LNTAX_{t-1} + \sum_{i=1}^{n} \alpha_{6i} \Delta LNDEBT_{t-1} \\ & + \sum_{i=1}^{n} \alpha_{7i} \Delta LNPOP1_{t-1} + \sum_{i=1}^{n} \alpha_{8i} \Delta LNPOP2_{t-1} \\ & + \sum_{i=1}^{n} \alpha_{9i} \Delta LNPOP3_{t-1} + \beta_1 LNEDU_{t-1} \\ & + \beta_2 GDP_{t-1} + \beta_3 UNEM_{t-1} + \beta_4 INF_{t-1} \\ & + \beta_5 LNTAX_{t-1} + \beta_6 LNDEBT_{t-1} \\ & + \beta_7 LNPOP1_{t-1} + \beta_8 LNPOP2_{t-1} \\ & + \beta_9 LNPOP3_{t-1} + e_t \end{aligned} \quad (3)$$

Where;

a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, represent the short run dynamics of the model.
β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8, β_9, represent the long run elasticities.

The orders of the ARDL model are selected by using Akaike Info Criterion (AIC). Next, we will proceed with the ECM model estimation when the long run relationship between the variables was well established. ECM model is applied to evaluate the short run properties of the co-integrated series. The Error Correction Term (ECT) will indicate the speed of adjustment back to its long run equilibrium after a short disturbance. The short run equation for the ECM model estimation is as follow:

$$\begin{aligned}\Delta LNEDU = {} & \alpha_1 + \sum_{i=0}^{n} \beta_1 \Delta GDP + \sum_{i=0}^{n} \beta_2 \Delta UNEM \\ & + \sum_{i=0}^{n} \beta_3 \Delta INF + \sum_{i=0}^{n} \beta_4 \Delta LNTAX \\ & + \sum_{i=0}^{n} \beta_5 \Delta LNDEBT + \sum_{i=0}^{n} \beta_6 \Delta LNPOP1 \\ & + \sum_{i=0}^{n} \beta_7 \Delta LNPOP2 + \sum_{i=0}^{n} \beta_8 \Delta LNPOP3 \\ & + \beta_9 \, ECT_{t-1} \end{aligned} \quad (4)$$

EMPIRICAL RESULTS

The empirical findings from this research will be analyzed thoroughly and accordingly. The research will begin with unit root test later proceed with ARDL Bound Testing approach and ECM. Lastly, the dynamic interaction of the variables beyond the sample period was also considered in this study.

ESTIMATION RESULTS BASED ON ARDL BOUND TESTING APPROACH

The unit root test is used to examine the time series data on both at level 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 result showed that most of the variables were stationary after the first difference. The Augmented Dickey Fuller (ADF) test result implied that most of the variables are integrated of order I(1) except for Gross Domestic Product (GDP) growth rate, Unemployment Rate (UNEM), and Inflation Rate (INF). Phillips Perron (PP) test result, however, depicted that most variables are of integrated order I(1) except for Gross Domestic Product (GDP) growth rate and Inflation Rate (INF). Table 1 illustrated the Augmented Dickey Fuller (ADF) result. While, Table 2 showed the Philip-Perron (PP) result.

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

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**
LNPOP2	–0.850050	–2.390414	–9.430008*	–9.990579*
LNPOP3	–1.439379	–3.832019**	–7.740894*	–7.622849*

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

the optimal lag length that should be used in the ARDL Bound Testing approach. The following Table 3 showed the VAR lag order selection criteria.

According to the VAR lag order selection criteria as shown in Table 4.3, 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.

The computed F-statistic of 10.12218 was higher than the upper bound critical value at 1 per cent level of significance. Thus, the null hypothesis of no cointegration 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.

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

$$\begin{aligned} LNEDU_t = &-0.128573\ GDP_{t-1} + 0.174543\ UNEM_{t-1} \\ &+ 0.177549\ INF_{t-1} + 0.304742\ LNTAX_{t-1} \\ &+ 0.995010\ LNDEBT_{t-1} - 8.592410\ LNPOP1_{t-1} \\ &+ 189.2219\ LNPOP2_{t-1} + 14.96697\ LNPOP3_{t-1} \end{aligned} \quad (5)$$

The 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. These four variables were taken into consideration

TABLE 3. VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	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

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

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

by policy makers as factors that determine the public education expenditure. Real gross domestic product growth rate (GDP) was found to have negative long run relationship with the public education expenditure. This indicates that the decline of real gross domestic product leads to a higher government spending in education. Additionally, unemployment rate was found to be positively significant in the long run. Higher unemployment rate will leads to higher education expenditure in the long run. These findings for real gross domestic product (GDP) and unemployment rate (UNEM) was consistent with the Keynesian Counter Cyclical theory. Robust support to the Keynesian Counter-Cyclical theory implied that the government would spend more when the economic shrinks. In contrast, a rise of the economy will be followed by a decline of the allocation. This implied that the decision made by policy makers was directly determined by the economic conditions. Any changes to the economic situations may lead to changes in the allocation of the public education expenditure and will significantly influence the education policy making. On the other hand, the result reported that inflation rate (INF) was positively significant in the long run. Our result supported finding by Imana (2017) that inflation rate had a positive effect on education expenditure. High inflation rate causes prices hike of commodities and services, thus making parents unable to afford high school fees and other education costs. As such, government needs to intervene by allocating more funds to education system so that no citizens will be left out from education access.

Empirical result for the demography variables indicated that the population growth of age 15 – 64 has a positive significant long run relationship with the public education expenditure. The present result signified the working age population which is also the highest proportion of the overall population had a positive effect on the allocation of public education expenditure. In the long run, the government would prioritize on creating large quantity of workers. This explains the increase of human capital investment which focused on the working age population. 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. Malaysia's Development Plans showed expanded growth of every year revenues that was increased together with the raise of development expenditures. There is tendency to increase government spending when government managed to effectively collect tax revenue (Taha 2008). It is further well-recognized that debt acted as a critical instrument for a government to fund the development of a nation. Debt is used for public expenditures that will eventually generate productivity and stimulate economy (Burhanuddin et al. 2017). Contrary to the expectation that the increase of tax revenue and public debt would bring similar increase to the public sector allocation may have applied for other sectors expenditure but not to the education sector spending. According to Kelley (1976) economic-demography model specified how population-induced demands for higher financing of public services. The population-induced demands should results in increases of public spending. In other words, the upsurge of population should lead to increase of demands for higher expenditure allocation. However, insignificant result of the concerning demography factors showed that the pattern of the education allocation failed to respond to the change of the children population and elderly population sizes. These could suggest the possibility that the policy makers had failed to take account of the demography factors especially the schooling age population in the public education allocation. An increasing schooling

TABLE 6. ECM Model Estimation

Error Correction Model (ECM)				
Dependent Variable: D(LNEDU) D(LNEDU)=f(D(GDP), D(UNEM), D(INF), D(LNTAX), D(DEBT), D(LNPOP1), D(LNPOP2), D(LNPOP3))				
Variable	Coefficient	Standard Error	t-statistic	P-Value
Error Correction Term (-1)	–0.414049*	(0.116687)	[–3.548371]	0.0018
D(LNEDU(-1))	0.052480	(0.142412)	[0.368509]	0.7160
D(GDP(-1))	0.017564**	(0.006835)	[2.569795]	0.0175
D(UNEM(-1))	–0.083864**	(0.035327)	[–2.373909]	0.0268
D(INF(-1))	–0.000779	(0.013258)	[–0.058776]	0.9537
D(LNTAX(-1))	0.485278	(0.392231)	[1.237223]	0.2290
D(LNDEBT(-1))	0.668723	(0.523250)	[1.278019]	0.2146
D(LNPOP1(-1))	59.82025*	(19.86195)	[3.011801]	0.0064
D(LNPOP2(-1))	–17.32269	(16.57741)	[–1.044957]	0.3074
D(LNPOP3(-1))	–34.77925*	(9.479213)	[–3.669001]	0.0013
C	0.016779	(0.019882)	[0.843924]	0.4078

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

age population failed to be followed by a corresponding increase to the public education expenditure.

ESTIMATION RESULT BASED ON ERROR CORRECTION MODEL (ECM)

Examination of the ARDL bound testing model revealed a robust finding of long run relationship between the variables. Hence, we will proceed to estimate the ECM model. The following Table 6 illustrated the ECM model estimation result.

The error correction term coefficient indicated the speed of adjustment towards the long run equilibrium. A negative and significant coefficient of the error correction term implied that any short term fluctuations between the dependent variable and independent variables will give rise to a stable long run relationship between the variables. The negative sign demonstrated that the dependent variable will fall (a negative change) to adjust towards long run equilibrium. In other words, the series cannot drift too far and convergence is achieved in the long run. The coefficient of error correction term (ECM) of 0.414049 simply means that 41.40% of the disequilibrium in the public education expenditure of the previous year's shocks adjusts back to the long run equilibrium in the current year.

The findings from Error Correction Model (ECM) identified the real gross domestic product growth rate (D(GDP)), unemployment rate (D(UNEM)), population of age less than 15 (D(LNPOP1)), and population of age greater than 64 (D(LNPOP3)) as determinants that produced significant effect on education expenditure in the short run. The significant lagged values of real gross domestic product growth rate (D(GDP)) indicated positive impact on the education expenditure in the short run. The improvement in the economic development will lead to the increase of public education spending in the short run. This finding supported the Wagner's law in the short run. The support to Wagner's law implied that the government responds to the increasing demand in society. Following the rising economic more skilled labour will be required, thus, necessitate a higher budgetary allocation to education sector. However, government would tend to spend lesser when the demand in the economy shrinks under the Wagner's law proposition.

When considering the population size of age 0 – 14, the education expenditure was seen to be determined positively by the younger age population. That is, the increase of the size of young children population tends to increase the education expenditure. Our finding reaffirmed the findings by Bischoff and Prasetyia (2015) which suggested positive relationship between children population and expenditure allocation. Increasing child population will required higher education expenditure to be allocated. The variable of unemployment rate (D(UNEM)) has a significant but negative coefficient in the short run. This implied that the government tends to allocate less expenditure on education sector when unemployment increases in the short run. Meanwhile, the elderly population coefficient was negatively significant in the short run. This estimation confirmed the findings by Poterba (1997), Grob and Walter (2005) that the increase of elderly demographic group may place substantial demands on public sector, assigning priority on other sectors such as health care sector.

The insignificant coefficients of (D(LNTAX)), (D(LNDEBT)), (D(INF)), D(LNPOP2) showed that these variables were not taken account by the policy makers when deciding on the allocation of education expenditure in the short term. The lagged value of (D(LNTAX)) and D(LNDEBT) was found to be insignificant and positive. The increase of tax revenue and public debt can positively influenced the government expenditure. Coefficients of (D(INF)) and (D(LNPOP2)) is insignificantly negative in the short run. Inflation rate and population of age 15 – 64 appears to exhibit a negative impact on the education expenditure. A high inflation rate will lead to lesser education expenditure in the short run. Negative coefficient of population of age 15 – 64 suggested that this group of population could cause a decline of education expenditure in the short run. Possibly, a rising of working age population trigger reallocation of the expenditure to other sectors in the short run, hence leading to less spending allocated to education sector.

In summary, four determinants were identified as the key factors that cause the changes to the trend of public education expenditure in the short run. These factors were real gross domestic product growth rate (D(GDP)), unemployment rate (D(UNEM)), population of age less than 15 (D(LNPOP1)), and population of age greater than 64 (D(LNPOP3)). In the long run, real gross domestic product growth rate (GDP), unemployment rate (UNEM), inflation rate (INF) and population growth of age 15 – 64 (LNPOP2) significantly affected the allocation of public education expenditure. The different results observed for both short run and long run model estimation reflected that the determinants of public education expenditure changes over time. For example, the demography factors of population had varied between short and long run. This variation could imply that in the long run, we will expect more demographic transition such as mortality changes, fertility changes, social mobility, change of labour supply and changes in age cohort distribution. These changes will project variation effects on our education expenditure allocation across time. The significant positive effect for working age population group observed in the long run was not recorded in our short run result. One could explain that the insignificant result showed in the short run may be due to the frequent career change in the short run. As such, there is lesser expenditure invested in providing training for the workers in the short run. Hence, we strongly suggest the need to distinguish between long run and short run determinants of public education expenditure.

VARIANCE DECOMPOSITION ANALYSIS

We will then proceed with variance decomposition analysis to consider the dynamic interaction of the variables when the system is exposes to shock. Variance decomposition analysis will provide information on the percentage of variation in the forecast error variance which is attributed to its own shock and percentage of variation which is attributed to other variables shock in the system. A truly exogenous variable forecast error variance will be explained by its own shock only. Table 7 illustrated the variance decomposition analysis.

The variance decomposition analysis result revealed that about 64.23% shocks in education expenditure were explained by itself in the short run (2 years period). However, it seems that the percentage of the shocks in education expenditure being explained by its own shock gradually declined to 42.23% in the long run (10 years period). This means that the public education expenditure tend to be endogenous in the long run. Empirical evidence indicated that inflation rate (INF) is the most important factor that explains the highest proportion of the shocks to education spending.

TABLE 7. Variance Decomposition Analysis

Period	S.E.	LNEDU	GDP	UNEM	INF	LNTAX	LNDEBT	LNPOP1	LNPOP2	LNPOP3
1	0.107874	100.0000	0.00000	0.000000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.177287	64.23062	3.14976	0.131680	5.66493	5.06326	10.8600	5.06596	0.07994	5.75387
3	0.226672	50.62465	1.96145	3.123913	18.6155	4.90941	9.61723	6.91552	0.40913	3.82323
4	0.247306	49.66138	1.72961	3.225996	19.1140	5.00975	10.2606	7.39459	0.34433	3.25981
5	0.273031	47.77226	2.35968	2.973398	20.1539	5.16784	10.8109	7.66666	0.28966	2.80573
6	0.295738	45.76348	2.56043	2.887064	21.1187	5.21161	11.5681	8.15154	0.26244	2.47667
7	0.315195	44.64890	2.48489	2.892047	21.7578	5.25645	12.0064	8.47677	0.23161	2.24519
8	0.334625	43.75495	2.58270	2.841766	22.2357	5.31888	12.3319	8.67093	0.21029	2.05292
9	0.353007	42.85771	2.70149	2.803629	22.7277	5.35085	12.6123	8.85912	0.19511	1.89205
10	0.369813	42.23334	2.72514	2.775123	23.0328	5.37024	12.8888	9.02737	0.17969	1.76749

TABLE 8. Diagnostic Tests Results for ARDL Model

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.669593	Prob. F(1,11)	0.4306
Obs*R-squared	1.893516	Prob. Chi-Square(1)	0.1688
F-statistic	0.336256	Prob. F(2,20)	0.7222
Obs*R-squared	2.079444	Prob. Chi-Square(2)	0.3536
Breusch-Pagan-Godfrey Heteroskedasticity Test			
F-statistic	0.599528	Prob. F(20,12)	0.8495
Obs*R-squared	16.49350	Prob. Chi-Square(20)	0.6856
Jarque-Bera Test			
Jarque-Bera	1.622130	Prob.	0.444385

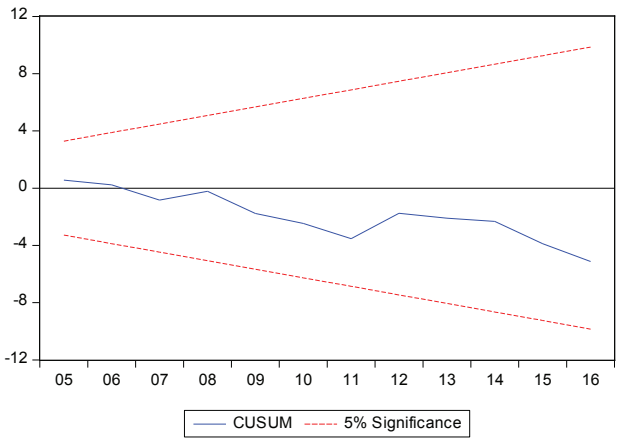

FIGURE 2. CUSUM Stability Test for ARDL Model
Source: Generated from EViews10

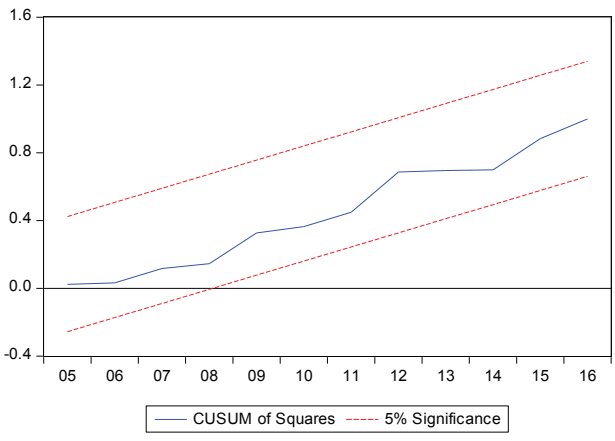

FIGURE 3. CUSUM of Squares for ARDL Model
Source: Generated from EViews10

TABLE 9. Diagnostic Tests Results for ECM Model

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.161956	Prob. F(1,21)	0.6914
Obs*R-squared	0.252555	Prob. Chi-Square(1)	0.6153
F-statistic	0.077488	Prob. F(2,20)	0.9257
Obs*R-squared	0.253743	Prob. Chi-Square(2)	0.8808
Breusch-Pagan-Godfrey Heteroskedasticity Test			
F-statistic	0.474527	Prob. F(20,12)	0.9310
Obs*R-squared	12.50446	Prob. Chi-Square(20)	0.8201
Jarque-Bera Test			
Jarque-Bera	0.037470	Prob.	0.981440

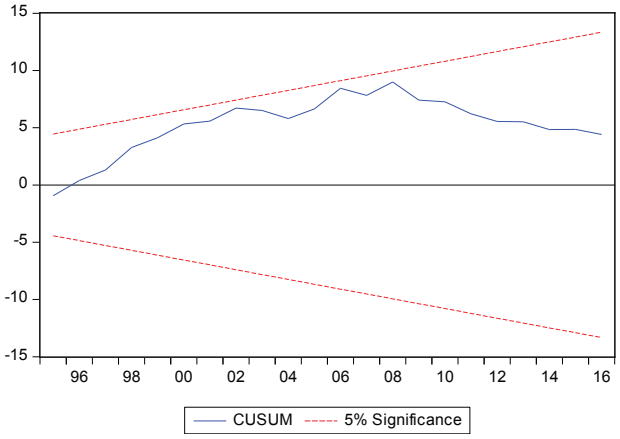

FIGURE 4. CUSUM Stability Test for ECM Model
Source: Generated from EViews 10

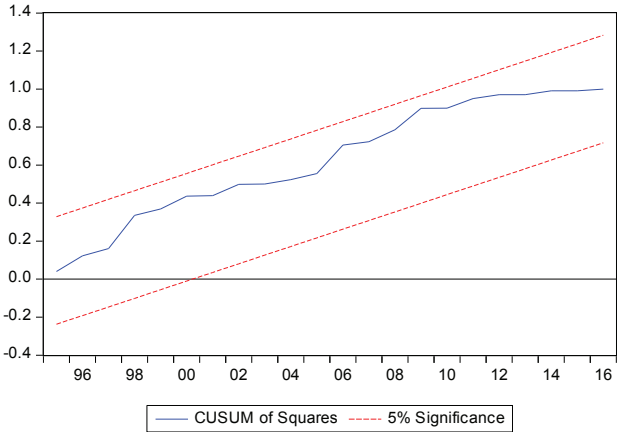

FIGURE 5. CUSUM of Squares for ECM Model
Source: Generated from EViews10

DIAGNOSTIC TESTS

Diagnostic testing was carried out on both of our ARDL model and ECM model for Serial Correlation, Heteroskedasticity, Normality and Stability. Both the model passes the diagnostic testing of Breusch-Godfrey Serial Correlation LM test with no serial correlation. The models are also free from heteroskedasticity problem as indicated by the result from Beusch-Pagan-Godfrey Heteroskedasticiy test. Both the plots of CUSUM and CUSUM square are within five percent of the critical bands. Hence, reflecting that both the ARDL model and ECM model are structurally stable. The Jarque-Bera Normality test suggested further that the errors are normally distributed.

CONCLUSION

In summary, our analysis differed from the previous studies by allowing us to distinguish between long run and short run determinants of public education expenditure. The economic and demographic variables concerned were found co-integrated with the public education expenditure in the long run. In light of our study, 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. The ARDL bound testing revealed significant negative relationship between real gross domestic product growth rate (GDP) and public education expenditure (EDU). In 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. The evidence of support to the Keynesian Counter Cyclical theory simply implied that the public education expenditure was increased to stimulate the economy in the time of a recession. The allocation of the education sector was prepared in a counter-cyclical way in response to the deteriorating economic conditions. The Keynesian Counter-Cyclical Theory proved to illustrate well the behavior of public education expenditure in Malaysia by explaining how the economic conditions affect the decision of the government in allocating the education expenditure level. The positive relationship was established between public education expenditure and inflation rate in the long run. Higher inflation caused price hike for all goods and services which includes the cost for education. The increase in the cost for education will now require the government to intervene

by allocating more expenditure to the 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 coefficient of error correction model (ECM) showed the speed of adjustment towards long run equilibrium. The negative and significant sign of the ECM coefficient validates the existence of long run relationship between the variables. The short run fluctuations in the public education expenditure, however, are expected to be caused by the real gross domestic product growth rate (D(GDP)), unemployment rate (D(UNEM)), population of age less than 15 (D(LNPOP1)), and population of age greater than 64 (D(LNPOP3)). The variables that were found to affect the level of public education expenditure differed both in the short run and in the long run. Our study therefore provided a new insight that the respond of the government education expenditure to its determinants varied across time.

The following policy implications could be drawn based on the findings from our study. 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. With the finding of the education allocation conforming to the Keynesian Counter-Cylical theory in the long run, researches can make use of this expectation to predict and develop education policy that meets the changing economic situations. In the short term, however, relevant policy should be formed by incorporating the significant indicators of real GDP, unemployment rate, children population and elderly population. Our study demonstrated that the demographic variable which is the working age population (POP2) had a significant impact on the Malaysia's education expenditure in the long run. This finding provide support to Lewis (1961) that suggested the quickest way to increase productivity in developing countries is through training the adults who were already on job. This clearly explains the reason why emphasis was placed by policy makers on the size of the working age populations as shown by its positive significant result. Although the implication showed that the policy makers had increase the investment to public education expenditure as the working age population increases, however, the education expenditure allocation was not sensitive to the increase of children population (POP1). As such, we highlighted the weakness of our education policymaker that seems to have overlooked the children population (POP1) in their policymaking. Lastly, our policy implications pointed out the need for government to increase the sensitiveness and responsiveness of their public education expenditure in respond to the needs and demands of the society in particular the children population (POP1). As stressed by Isaacs (2009), the education expenditures during childhood are considered as prime example of a human capital investment that has significant payoffs in adult years, for both the individual and society. United Nations (2003) highlighted studies which demonstrated primary education as a potent means of reducing poverty and inequality. The investment to early child education contributes to better natural resources management, and more rapid technological adaption and innovation; and boosting future productivity. A more responsive public education allocation policymaking will lead to a more efficient and effective policies, thus producing satisfactory outcome. Moreover, the government can consider implementing fiscal reform that involved a more responsive education expenditure policy and with participation from the public to improve on the efficiency of the education allocation. The policy makers can further make use of the time-varying effects of the determinants to formulate their future strategy in accordance with changes in these variables.

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