Effects of Government Expenditure on the Poverty Level: A Nonlinear ARDL Approach

Saharudin Yusoff[a]
Siong Hook Law[b]
Norashidah Mohamed Nor[c]
Normaz Wana Ismail[d]
Universiti Putra Malaysia

Abstract: The argument on the behaviour of government expenditure toward reducing the poverty level is still controversial among economists and policymakers. This study investigates the role of government development expenditure in alleviating poverty in Malaysia. The study employs a nonlinear autoregressive distributed lag (NARDL) model from 1970 to 2019 using annual time series data. The bounds test of the NARDL specification suggests the presence of cointegration among the variables, namely the poverty level, development expenditure, gross domestic product per capita, inflation rate, physical capital and human capital. The empirical findings demonstrate that an increase in development expenditure is an insignificant determinant of poverty, but the reductions in development expenditure significantly eradicate the poverty level in the long run. For robustness checks, the share of development expenditure on gross domestic product is used in the estimation. The findings show that all development expenditure has little to no impact on lowering poverty levels over the long and short runs. The Malaysian government should therefore consider how crucial it is to allocate public funds effectively and make sure that the emphasis on spreading development gains across all economic sectors must have an influence on the poverty level.

Keywords: Poverty, development expenditure, NARDL, Malaysia
JEL classification: A10, B41, D31

1. Introduction

This paper investigates one of the most severe social issues every country faces: poverty. Poverty, according to Ahmad et al. (2016), is defined as a lack of capacities and resources to meet one's basic needs. This unacceptable human condition could be due

[a] School of Business and Economics, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. E-mail: yusoffsaharudin@yahoo.com
[b] School of Business and Economics, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia and College of Business and Economics, University of Johannesburg, South Africa. E-mail: lawsh@upm.edu.my (Corresponding author)
[c] School of Business and Economics, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. E-mail: norashidah@upm.edu.my
[d] School of Business and Economics, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. E-mail: nwi@upm.edu.my

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to unequal wealth distribution. That means the advantages of development initiatives and programmes are not felt equally across society. Poverty will, in general, continue to be a global issue in this century. This field of research is especially important considering recent crises, such as the COVID-19 pandemic, which is predicted to increase unemployment and poverty in the country. As a result, it is critical to consider the impact of development expenditure in alleviating poverty in Malaysia. Furthermore, the poverty issue is one of the sustainable development goals (SDGs) that aims to end all forms of poverty and promote prosperity.

In 2019, the United Nations (UN) challenged Malaysia's claim that poverty had been practically eradicated. According to the UN, official estimates are inaccurate and do not reflect the reality on the ground. Malaysia's official poverty rate fell from 49.3% in 1970 to just 0.4% in 2016, which has since been revised to 5.4%, as shown in Figure 1. According to the UN, the official figures were based on antiquated criteria, with the poverty line remaining at the same level for decades despite rising living costs. Malaysia's poverty line was amended to more than double to RM2,208 in July 2020, up from RM980 previously. Since 2005, the government has not revised Malaysia's poverty line methodology. The World Bank applauded the decision, allowing the government to ensure that all Malaysians can reach a new primary standard of living that is more in line with today's Malaysia.

According to Majid et al. (2016), Malaysia has implemented many programmes and policies to steer its development and poverty reduction since its independence. Therefore, the main purpose of the development plan in Malaysia is poverty eradication and bridging the inequality gap in society. It was manifested in adopting the concept

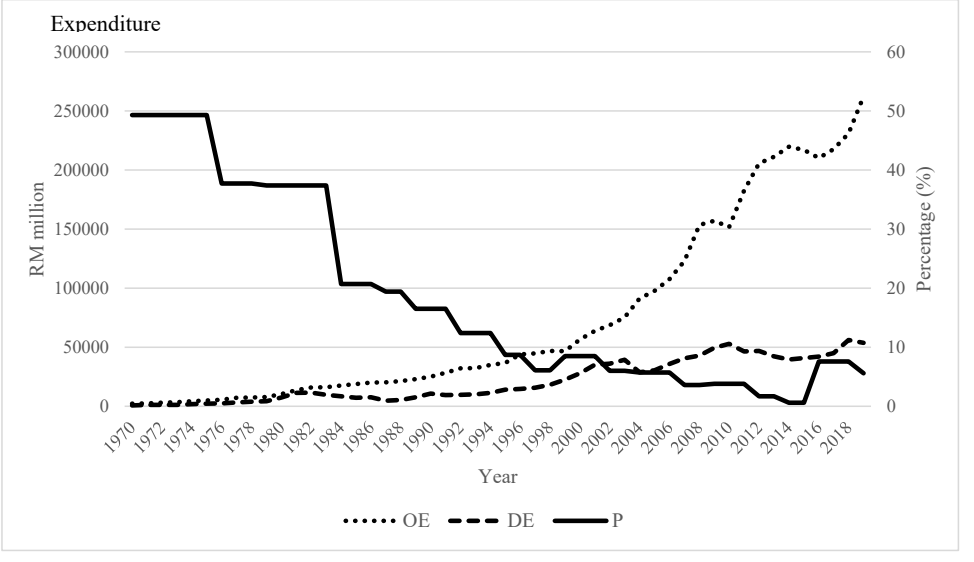

Figure 1. Operating expenditure (OE), development expenditure (DE) and poverty level (P) in Malaysia (1970–2019)
Source: Economic Planning Unit and Ministry of Finance.

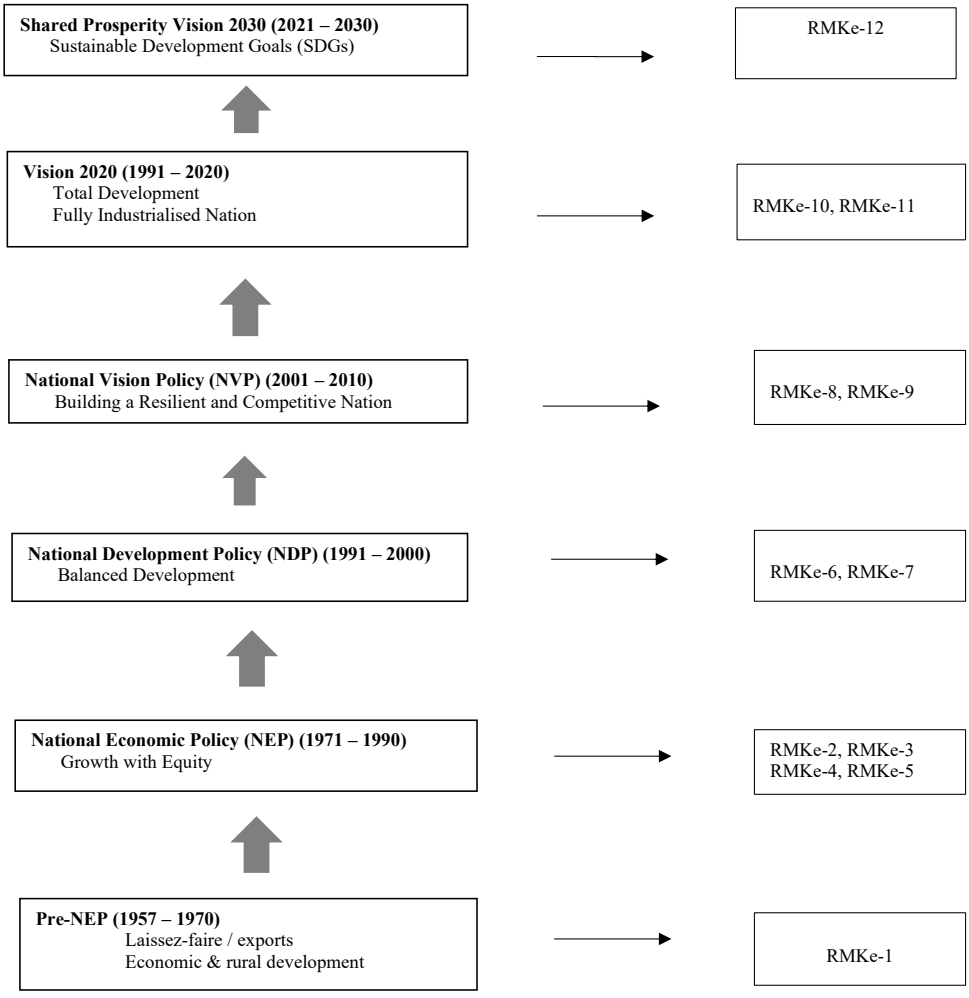

Figure 2. Major economic policies
Note: RM (Rancangan Malaysia) denotes various Malaysia Plans (from First to Twelfth).

of "growth with equity" in all development programmes and policies. Even though the country's poverty rate has dropped dramatically, poverty remains a serious problem. The government must address this issue and start working on it, particularly in raising the standard of living in society. The Shared Prosperity Vision 2030 was established to replace the New Economic Model (NEM) with the goal of developing a high-income economy and increasing purchasing power of the people. Major economic policies are shown in Figure 2. Even though many development programmes and policies have been implemented, none have been able to eradicate poverty. However, the efforts to overcome poverty are a continuous process. Therefore, the question is whether government development expenditure impacts Malaysian poverty reduction.

Combating poverty has been a primary priority for the government, even if it needs more stringent and comprehensive policies that include both urban and rural areas. The government must achieve inclusive growth by putting the "people economy" at the centre of its development strategy to become a high-income country. The multiplier effect on poverty reduction in the country is controversial, even though government expenditure increases every fiscal year. The World Bank (2019) claimed that Malaysia's poverty rate is significantly higher with rising living costs. Consequently, the research question to be addressed in this paper is: what are the relationships between government development expenditure towards the rate of poverty? This study aims to investigate the relationships between government expenditure and poverty levels in Malaysia, utilising time series data from 1970 to 2019.

The following are the study's contributions to the body of knowledge. First, the results of this study can assist policymakers in developing and implementing effective strategies for allocating government expenditure. As a result, the findings should assist the government in developing appropriate strategic policies and public resource allocation in government expenditure, affecting poverty levels in Malaysia. Second, from a research standpoint, utilising the nonlinear autoregressive distributed lags (ARDL) model by Shin et al. (2014) to investigate the long-run and short-run asymmetries in government development expenditure and poverty level nexus.

The remainder of the paper is organised as follows. Section 2 reviews the relevant literature, section 3 describes the empirical model, econometric approach and the data used. Section 4 discusses the empirical results and interprets the findings. Lastly, the conclusion wraps up the discussion.

2. Literature Review

2.1 Determinants of Poverty

Asymmetric effects of development expenditure on the poverty level are among the most important concerns in developing economies. According to Sasmal and Sasmal (2016), economic progress and income distribution, social capital growth and infrastructure development, and productivity levels all contribute to the prevalence and persistence of poverty. As a result, using the spillover effect of economic expansion to benefit the poor is an essential method of eliminating poverty. Then there's the direct poverty objective when the government helps the poor directly through measures and distribution. This opinion was supported by Manaf and Ibrahim (2017), saying that an emerging economy can be an excellent example of poverty reduction in Southeast Asian countries. The poverty rate has steadily decreased from 49.3% in 1970 to 5.6%. The Malaysia Plans, National Development Policy and the New Economic Model are only a few of the government's anti-poverty initiatives. Many initiatives, such as the eKasih system, FELDA and the 1AZAM programme, have aided in the eradication of poverty. The government is now executing the 2030 Agenda to prosper together. The policies and programmes are underpinned by strong political will and inclusiveness and attach to national unity. Poverty eradication will remain a primary focus for the country's long-term development.

In addition, Milasi et al. (2016) revealed that the relationship between economic growth and poverty reduction is significantly linked to implementing appropriate policies and programmes. Policies and initiatives must vigorously address changes in economic growth and diversification. Other than that, employment policies should also be drafted to increase the skill levels and increase labour market participation rate in the economy. Whereas Nair and Sagaran (2015) claimed that the term poverty is very dynamic that encompasses both absolute and relative poverty. Absolute poverty is a minimum standard of life based on a fixed income. Regarding relative poverty, those who earn less than the median national income is considered poor.

Hassan et al. (2020) examined the impact of globalisation, governance and competition on poverty in the case of 73 developing nations between 2005 and 2016. The results were estimated using a feasible generalized least squares approach, which confirmed that all governance indicators have a negative impact on poverty. In the same vein, globalisation, competitiveness and development expenditures help to reduce poverty. Poverty also refers to having less access to health care, education and opportunities for improving one's life. The Keynesian cross outlines the laws governing the relationship between government development expenditures and growth. State expenditures spur increased spending by firms and households, boosting growth. There are two ways to interpret the bidirectional impact of education on poverty. Firstly, public investment in human capital improves the skills and productivity of low-income families. Second, poverty may place a significant restriction on educational achievement.

Inegbedion and Obadiaru (2021) investigated Nigeria's perceived causes of poverty. It used a longitudinal survey of four perceived determinants of poverty for the years 1980 to 2019: unemployment rate, population, inflation rate and income disparity. Stationarity and cointegration were examined using Augmented Dickey-Fuller and Johansen's tests. Vector error correction model was used in testing for statistical significance of the explanatory variables. In the short term, the results showed that both the unemployment rate and the inflation rate are significant predictors of the level of poverty, but in the long run, only the unemployment rate is significant. On the other hand, Taufiq and Dartanto (2020) examined the impact of education on the dynamics of poverty in Indonesia as well as the employment mobility of informal to formal employees (informal turnover). The analysis of the *National Socio-Economic Survey* (2011–2013) found that those with higher levels of education tended to leave the informal economy, showing that education significantly influenced this trend (Central Bureau of Statistics of Indonesia, 2011–2013).

2.2 Development Expenditure and Poverty

The theory of the vicious circle of poverty (TVCP) states that a country is poor because of the market's small size (Nurkse, 1952). According to this theory, the relationship between demand, incentives to invest and supply, which is the ability and willingness to save, exists in undeveloped and financially unstable countries. As a result, expanding the country's market is vital for stimulating and nurturing the economy's growth and development. Nurkse believes that for a country to thrive, it must adopt a balanced

development strategy that prioritises the industrialised sector above raw materials and basic manufacturing. As a result, establishing cooperation between the government and the private sector regarding savings and investments is crucial for the individual country. TVCP is projected to improve economic growth and, as a result, eliminate poverty, particularly in undeveloped regions. From 2008 to 2013, Khasanah et al. (2016) used panel data regression analysis to study the relationship between the government's spending on education, health, housing and public facilities in Indonesia. According to the findings, all the independent factors have a link with the dependent variable. According to the study, the allocation for health and education expenses should be increased by 10% and 20%, respectively. Furthermore, additional funding for home development should be made available, ultimately benefiting the poor.

From 2010 to 2014, Saad and Nor (2018) studied the impact of health spending on economic growth in 67 low-income and middle-income countries. The countries were divided into two groups which are low-income and middle-income, and each group was studied separately to determine the differing effects of health spending on economic development. The findings demonstrate a strong relationship between health spending and economic growth for both countries, with middle-income countries having a slightly stronger influence. As a result, for the nations to become developed countries, boosting the health sector through raising health expenditure should be a priority.

Subsequently, Sasmal and Sasmal (2016) investigated the effect of government spending on economic growth and poverty alleviation, focusing on emerging countries such as India. For example, the government can enact distributive measures during times of extreme poverty. Of course, these distributive measures will come at a cost in terms of long-term progress. However, they will fail if attempts to eliminate poverty are not executed with excellent governance and adequate targeting. Nonetheless, if public spending is aimed at boosting per capita income, it will reduce poverty. Sasmal and Sasmal employed both fixed and random effects approaches in this study. The results showed that per capita income grows when the government spends a higher percentage of its budget on infrastructure development, such as roads and transportation. As a result, poverty levels will be lowered. Therefore, the study suggested that spending on infrastructure development improved economic growth and, as a result, aided in poverty alleviation.

Mustapha et al. (2017) examined how public spending affects poverty reduction in the Organisation of Islamic Cooperation (OIC) and non-OIC nations. For them, all levels of government must share responsibility and should take the issue of poverty reduction as a priority. They used the ordinary least squares (OLS) approach to assess the impact of education and health spending on poverty reduction in the OIC and the rest of the globe for each of the 126 countries. It was assumed that the OIC countries were generally free of poverty. However, the truth was that numerous OIC countries were among the poorest in the world. Therefore, the study discovered that government expenditure positively impacted poverty eradication in both OIC and non-OIC countries, with gross national incomes (GNIs) essentially comparable in both. As a result, research in many countries showed that education, health and private investment expenditure, inward remittance, and secondary school enrolment contributed to alleviating the poverty level.

Musaiyaroh and Bawono (2017) extended the study of acceptable strategies to alleviate poverty challenges in the four Association of Southeast Asian Nations (ASEAN 4 – Malaysia, Indonesia, Thailand and the Philippines) through economic development. The construction of state infrastructure was thought to support economic growth by boosting human resource quality and implementing relevant technology. By eliminating poverty and unemployment, infrastructure improvements can help to boost growth. The research used the panel generalized method of moments (PGMM). The variables were poverty, education and health infrastructure expenditure, government expenditure, GDP per capita, the Gini index and the unemployment rate. The results reported statistically significant implications for health care infrastructure, GDP per capita and government expenditure in poverty reduction in the ASEAN 4. As a result, infrastructure investment was vital for any country to stimulate economic growth and eliminate poverty.

Using panel smooth transition regression models, Kuang et al. (2019) investigated how financial and fiscal policies affect poverty alleviation in China. The results show that fiscal and financial policies both have a favourable impact on reducing poverty, and their linkages are nonlinear. Therefore, the degree of poverty should be considered while selecting which programmes to prioritise for eliminating poverty. Specifically, when a portfolio of policies aimed at reducing poverty is put into place, fiscal measures should initially take precedence while the prevalence of poverty is high. Then, when the poverty rate declines, financial help should take centre stage, and when the poverty rate keeps down, fiscal support should be intensified.

The relationship between government spending, economic growth and poverty alleviation in Nigeria is examined by Oriakhi (2021). It demonstrated the causality of the bidirectional relationship between poverty reduction, total public spending, real gross domestic product as a measure of economic growth, and natural resource rent for 38 years. The results suggest that variables have a bidirectional relationship. Each variable contributed to distinct percentage levels and fluctuations in shocks within the variable and in other model variables throughout time. Nigeria generally has a bidirectional causal relationship between overall public spending and decreased poverty. The study concludes with recommendations for increased government spending to reduce poverty, adopting pro-growth and pro-poor policies, and a transparent and corrupt-free system of government.

2.3 Research Gaps

The perceived poverty rate in Malaysia and other countries has attracted the attention of researchers, thereby making empirical literature on the research problem appreciable. The aspects of the problem so far examined include determinants of poverty (Hassan et al., 2020; Islam et al., 2017; Majid et al., 2016; Manaf & Ibrahim, 2017; Siwar, 2016), the positive impact of public expenditure on poverty alleviation (Ahmad et al., 2016; Kuang et al., 2019; Mustapha et al., 2017; Saad & Nor, 2018), the negative impact of public expenditure on poverty alleviation (Khasanah et al., 2016), reducing poverty incidence in Nigeria (Inegbedion & Obadiaru, 2021; Oriakhi, 2021) and impact of infrastructure on poverty level (Musaiyaroh & Bawono, 2017; Sasmal & Sasmal,

2016). The results of the studies indicate a positive impact of public expenditure on poverty alleviation (Musaiyaroh & Bawono, 2017; Sasmal & Sasmal, 2016). However, some studies also revealed a negative impact of public expenditure on the poverty level (Khasanah et al., 2016). While development expenditure is perceived to have significant implications on the poverty rate, only few studies focused on development expenditure and poverty. In addition, not many studies appear to have included inflation, physical capital and human capital as control variables, even though they may influence the poverty level in a country and thus trigger poverty. This study sought to fill these gaps.

2.4 Development Expenditure and Poverty in the Malaysian Context

One of the biggest issues in developing nations like Malaysia is poverty. Poor health and malnutrition are associated with poverty, as well as a lack of control over resources and education. As a result, according to Ahmad et al. (2016), one of the main issues of the twentieth century is poverty. Poverty is an intolerable human condition characterised by a lack of necessary resources and capacities because of dynamic and complex individuals' basic needs. Malaysia, according to Nair and Sagaran (2015), has to revisit its previous methods for eliminating poverty and disparities across the country. They believe that Malaysia must address both absolute and relative poverty, as well as rising inequality. The government must adopt an urgent policy prescription, not only for rural poverty, but also for urban poor. Prioritising income distribution is also necessary. Income distribution improvements should occur in tandem with poverty reduction. Besides that, a paradigm shift is necessary in conceptualised and measured poverty in Malaysia.

Majid et al. (2016) supported Nair and Sagaran's assertions. For them, the problem of poverty has been greatly lessened in Malaysia. However, there is still a lot of efforts needed to be embarked on the existence of poverty, particularly in rural communities in some states and in the urban areas. Certainly, today's poverty reduction policy development and policy designation must place a greater emphasis on effective implementation. Furthermore, Siwar (2016) examined the role of good governance in Malaysia's poverty alleviation. Over the years, Malaysia has recorded a sustainable economic growth with remarkable poverty alleviation. Good governance, pro-growth policies and poverty-reduction programmes that have been implemented since the NEP and which will now be carried over to the Shared Prosperity Vision 2030 have all played a role in poverty reduction. Particularly, in the economic sector, good governance has resulted in considerable improvements in the delivery of public services as well as enhanced accountability and efficiency. Nevertheless, based on certain research that support the "grease the wheel" theory, corruption, particularly in nations with poor governance systems, can reduce inefficiency and make it easier for enterprises to be established.

Poverty was among the key factors that have hampered Malaysia's economic progress, according to Islam et al. (2017). Since the 1970s, the government has adopted a range of measures to reduce poverty and income gaps, particularly in rural areas. As a result, their research focused on the magnitude of poverty and income inequality in Ipoh, Perak. The study also investigates the government's interventions and goals for reducing poverty and income disparity, as well as economic growth programmes. The

study offers a few suggestions and recommendations, mainly in terms of government financial aid and education policy to the lower income group.

3. Methodology and Data

This study investigates the association between government development expenditure and the poverty level by using the nonlinear ARDL method. The nonlinear ARDL model is an extension of the autoregressive distributed lags (ARDL) model by Shin et al. (2014). The model captures short and long-run asymmetry through positive and negative partial sum decompositions of changes in the independent variable. There are four reasons to choose nonlinear ARDL; according to Lee and Masih (2018):

(a) It enables the simulation of a cointegration relationship between the poverty level and the development expenditure.
(b) The concept can be applied to linear and nonlinear cointegration problems.
(c) It calculates all the independent variables' short- and long-run effects on the dependent variable.
(d) The concept allows for alternative integration orders for data series.

The nonlinear ARDL method appears to be adequate for detecting potential asymmetries in poverty levels, which development expenditure factors could cause. The study adopts an alternative econometric framework, namely the nonlinear ARDL model, because the framework is most appropriate since it allows potential long-run and short-run asymmetries in the development expenditure and poverty level relations and indirectly hints at the importance of fiscal policy in the country. Theoretically, it should be anticipated that increased government expenditure will have an asymmetric impact on the poverty rate. More economic spillover effects will encourage a greater standard of life and eventually lower people's poverty levels.

This technique examines long- and short-run nonlinearities by using positive and negative partial sum decompositions of the regressors. It also quantifies the regressors' responses to asymmetric dynamic multiplier shocks, both positive and negative. The nonlinear ARDL technique is an asymmetric extension of Pesaran et al. (2001) well-known linear ARDL bounds testing technique. After that, the cumulative dynamic multipliers are graphed. As a result, the nonlinear ARDL model can capture the nonlinear or asymmetric relationship between the variables in both the short and long terms in this study. This is how the long-run model is defined.

$$P_t = \alpha_0 + \alpha_1 GDPPC_t + \alpha_2 INF_t + \alpha_3 K_t + \alpha_4 \mathrm{HC}_t + \alpha_5 DE_t + e_t \quad (1)$$

where *P* is poverty level, *DE* is government development expenditure, *GDPPC* is gross domestic product per capita, *INF* is rate of inflation, *K* is physical capital, *HC* is human capital, *e* is error term and *t* is time series subscript. *GDPPC*, *K* and *HC* are expected to record a negative sign, and *INF* is a positive sign. That means the poverty level is expected to be reduced with an increase in *GDPPC*, *K* and *HC*, but higher *INF* will increase the poverty level. The nonlinear ARDL model allows us to determine whether positive and negative development expenditure shocks have any impacts on short and

long run poverty. Equation (1) augmented with asymmetric coefficients of nonlinear ARDL is as follows:

$$P_t = \alpha_0 + \alpha_1 GDPPC_t + \alpha_2 INF_t + \alpha_3 K_t + \alpha_4 HC_t + \alpha_5 DE_t^+ + \alpha_6 DE_t^- + e_t \quad (2)$$

where $\alpha(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6)$ is a cointegrating vector or a vector of long run parameters to be estimated. The asymmetric effect of development expenditure is accounted for by including the positive changes DE_t^+ and the negative changes DE_t^- in Equation (2). DE_t^+ and DE_t^- constitute the partial sums of positive and negative changes in the development expenditure, respectively. They are specified as follows:

$$DE_t^+ = \sum_{i=1}^{t} \Delta DE_t^+ = \sum_{i=1}^{t} \max(DE_i, 0)$$

$$DE_t^- = \sum_{i=1}^{t} \Delta DE_t^- = \sum_{i=1}^{t} \min(DE_i, 0)$$

Based on the above formulation, the long-run relationship between the poverty level and increases in development expenditure is α_5, which is expected to be negative. Meanwhile, α_6 is expected to have a positive sign between the poverty level and development expenditure, because both are expected to move in the opposite direction. The study further posits that development expenditure increases will result in lower long-run changes in the level of poverty as compared to the impact of development expenditure reduction of different magnitude, i.e. $\alpha_5 > \alpha_6$. As a result, the long-run relationship, as represented by (2), reflects asymmetric long-run development expenditure passes through to the poverty level. Therefore, the nonlinear ARDL equation will take the following error-correction form to estimate the short-term coefficients:

$$\Delta P_t = \alpha + \beta_0 P_{t-1} + \beta_1 GDPPC_{t-1} + \beta_2 INF_{t-1} + \beta_3 K_{t-1} + \beta_4 HC_{t-1} + \beta_5 DE_{t-1}^+ + \beta_6 DE_{t-1}^- + \sum_{i=1}^{p} \phi_i \Delta P_{t-1} + \sum_{i=0}^{q} \vartheta_i \Delta GDPPC_{t-i} + \sum_{i=0}^{r} \vartheta_i \Delta INF_{t-i} + \sum_{i=0}^{s} \vartheta_i \Delta K_{t-i} + \sum_{i=0}^{u} \vartheta_i \Delta HC_{t-i} + \sum_{i=0}^{v} (\theta_i^+ \Delta DE_{t-i}^+ + \theta_i^- \Delta DE_{t-i}^-) + \mu_t \quad (3)$$

where all variables are as defined above, p, q, r, s, u and v are lag orders and $\alpha_5 = -\beta_5/\beta_0$, $\alpha_6 = -\beta_6/\beta_0$, the aforementioned long run impacts of respective development expenditure increases and development expenditure reduction on the level of poverty. $\sum_{i=0}^{u} \theta_i^+$ measures the short-run influences of development expenditure increases on the reduction of the poverty level and the short-run influences of development expenditure reduction on the hike of the poverty level. Hence, in this setting, in addition to the asymmetric long-run relation, the asymmetric short-run influences on development expenditure changes on the poverty level are also captured. Both the long run and short run asymmetry tests of the variables are conducted using the asymmetric statistics of nonlinear ARDL.

Before embarking on the model's stages, like the ARDL model, the unit root test is required to investigate the stationarity condition of the required variables. To this end, the study applies the widely used augmented Dickey-Fuller (ADF) and Phillips-

Perron (PP) unit root tests for establishing the variables' orders of integration. It is crucial to ensure the variables are only stationary at I(0) and I(1). That is, no variables of order two or above will integrate to avoid an erroneous F-statistic result at a later stage. Generally, the nonlinear ARDL model involves carrying out long-run cointegration utilising bounds testing. This approach is used to test for cointegration among the variables based on the estimated nonlinear ARDL. At this stage, the F-statistics will be compared to the critical values proposed by Pesaran et al. (2001) or Narayan (2005). Then, if the estimated F-statistics are above the higher critical value, reject the null hypothesis of no cointegration. The null hypothesis is maintained and cannot be rejected if the F-statistic is at the lower critical value. When the F-statistics value falls between the lower and higher critical value, the result is inconclusive. Then, there is the matter of testing for short-run and long-run asymmetries. As a result, the null hypothesis is H_0: focused variables are symmetric, while the alternative hypothesis is H_1: focused variables are asymmetric.

In the next step, equation (3) is estimated using the standard OLS estimation method. The general-to-specific procedure was adopted to arrive at the final specification of the nonlinear ARDL model by trimming insignificant lags. Based on the estimated nonlinear ARDL, a test was performed for the presence of cointegration among the variables using a bound testing approach of Pesaran et al. (2001) and Shin et al. (2014). This involves the Wald F test of the null hypothesis, $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$. In the final step, with the presence of cointegration, an examination of long-run and short-run asymmetries in the relations between development expenditure and poverty level is made, and inferences are drawn.

3.1 Data

The sample period of this study is from 1970 to 2019, based on the annual datasets. Poverty rate (P) – measured in terms of percentage over population – is obtained from the Prime Minister's Office's Economic Planning Unit. Development expenditure (DE), gross domestic product per capita (GDPPC) and inflation rate (INF) are collected from Malaysia's Ministry of Finance. The physical capital (K) and human capital (HC) variables are obtained from the Penn World Table version 10 (Feenstra et al., 2015).

4. Empirical Results

Table 1 shows the descriptive statistics of all variables, namely poverty rate (P), development expenditure (DE), human capital (HC), gross domestic product per capita (GDPPC), inflation rate (INF) and physical capital (K). The standard deviation is lower than the mean, reflecting that the datasets are not highly varied from the year 1970 to 2019. The average of DE, P and INF during the same period were RM21,421 million (P: 18.39% and INF: 3.43%), a maximum of RM56,095 million (P: 49.30% and INF: 17.33%) and a minimum of RM725 million (P: 0.60% and INF: 0.29%), respectively. Whereas the average of GDPPC, HC and K were RM13,330 (HC: 2.34 and K: 27.38%), a maximum of RM43,708 (HC: 3.08 and K: 43.59%) and a minimum of RM1,087 (HC: 1.50 and K: 17.51%), respectively.

Table 1. Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis
P (%)	18.39	10.55	49.30	0.60	16.38	0.81	2.15
DE (RM million)	21420.80	12768.00	56095.00	725.00	17869.84	0.48	1.69
HC (Index)	2.34	2.42	3.08	1.50	0.50	-0.17	1.65
GDPPC (RM)	13,329.80	7,794.50	43,708.00	1,087.00	12,552.28	0.9136	2.5349
INF (%)	3.43	2.90	17.33	0.29	2.88	2.71	12.72
K (% to GDP)	27.38	25.21	43.59	17.51	6.65	1.07	3.03

Note: P = poverty rate, DE = development expenditure, HC = human capital, GDPPC = gross domestic product per capita, INF = inflation rate and K = physical capital.
Source: Authors' calculation.

Table 2. Correlations

	P	DE	HC	GDPPC	INF	K
P (%)	1.00					
DE (RM million)	-0.78	1.00				
HC (Index)	-0.94	0.92	1.00			
GDPPC (RM)	-0.72	0.94	0.86	1.00		
INF (%)	0.49	-0.38	-0.43	-0.36	1.00	
K (% to GDP)	-0.05	-0.31	-0.24	-0.29	0.18	1.00

Note: P = poverty rate, DE = development expenditure, HC = human capital, GDPPC = gross domestic product per capita, INF = inflation rate and K = physical capital.

In Table 2, the correlation matrix among the selected macroeconomic variables stated that P decreased with higher DE at degrees of correlation of -78%, HC -94%, GDPPC -72% and K -5%, respectively. However, poverty increased with higher INF at correlation coefficient of 49%.

The unit root tests are based on the results of the augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. The dependent variable was stationary at first difference. The majority of regressors namely DE, HC, GDPPC and K were stationary at first difference, while INF was stationary at level, as shown in Table 3. Thus, the research can proceed with the nonlinear ARDL bounds test to investigate the relationships between the level of poverty and government development expenditure. This paper focuses on DE in asymmetry relationships to the level of poverty in Malaysia.

The Brock, Dechert and Scheinkman (BDS) independent test of non-linearity is shown in Table 4. The BDS test is a non-parametric test designed to look at identical and independent distributions (IID). When residuals from fitted models are employed, the BDS test is a general test used to assess the model specification. The results show that the selected variables have a nonlinear trend in all dimensions at a 1% significance level, except INF, which has a nonlinear trend at a 10% significance level for m=2 and m=5; and a 5% level of significance for m=6. The null hypothesis of linearity is rejected, but the alternative hypothesis is accepted, implying that the variables are nonlinear.

It is worth noting that the defined model of development expenditure and poverty is suitable for policymaking in Malaysia. In addition, the nonlinear ARDL asymmetry test reported in Table 5 indicates that the development expenditure variable has an asymmetric relationship in the long run and short run, where the p-values are less than 0.05. Therefore, the nonlinear ARDL approach is appropriate to analyse the effect of development expenditure on poverty.

Table 3. Results of unit root tests

Variable	Augmented Dickey Fuller (ADF)		Phillips-Perron (PP)	
	Constant without trend	Constant with trend	Constant without trend	Constant with trend
Level				
P	-0.2208 (0.9281)	-3.3209* (0.0768)	-1.4560 (0.5472)	-3.3014* (0.0780)
DE	-1.8747 (0.3411)	-2.3418 (0.4042)	-2.4925 (0.1234)	-2.4329 (0.3589)
GDPPC	-1.0460 (0.7291)	-3.3658* (0.0680)	-1.6581 (0.4458)	-3.3370* 0.0723
INF	-3.8370*** (0.0048)	-4.3478*** (0.0060)	-3.8662*** (0.0044)	-4.3478*** 0.0060
K	-2.5375 (0.1132)	-2.6630 (0.2559)	-2.5191 (0.1172)	-2.5901 (0.2864)
HC	-2.1267 (0.2354)	-3.1373 (0.1094)	-2.1267 (0.2354)	-3.1373 (0.1094)
First Difference				
P	-7.7998*** (0.0000)	–	-7.6483*** (0.0000)	–
DE	-5.4936*** (0.0000)	–	-5.4871*** (0.0000)	–
GDPPC	-6.0968*** (0.0000)	–	-10.2445*** (0.0000)	–
INF	-9.1477*** (0.0000)	–	-9.3716*** (0.0000)	–
K	-5.0398*** (0.0001)	–	-4.9797*** (0.0002)	–
HC	-6.6113*** (0.0000)	–	-6.6104*** (0.0000)	–

Notes: P = poverty rate, DE = development expenditure, GDPPC = gross domestic product per capita, INF = inflation rate, K = physical capital and HC = human capital. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively. Figures in parentheses are p-values.

Table 4. BDS independent test of nonlinearity

Variables	m = 2	m = 3	m = 4	m = 5	m = 6
P	0.1580***	0.2645***	0.3289***	0.3719***	0.3856***
DE	0.1811***	0.3024***	0.3838***	0.4366***	0.4741***
GDPPC	0.1976***	0.3310***	0.4250***	0.4917***	0.5400***
INF	0.0247*	0.0265	0.0401	0.0483*	0.0538**
K	0.1422***	0.2260***	0.2651***	0.2808***	0.2790***
HC	0.1711***	0.2997***	0.3760***	0.4242***	0.4561***

Notes: P = poverty rate, DE = development expenditure, GDPPC = gross domestic product per capita, INF = inflation rate, K = physical capital and HC = human capital. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

Table 5. Nonlinear ARDL asymmetry statistics

	Long-run asymmetry		Short-run asymmetry	
	F-stat	(p-value)	F-stat	(p-value)
Development expenditure	5.594	(0.028)**	6.297	(0.020)**
GDP per capita	0.1614	(0.692)	0.0081	(0.929)
Inflation rate	0.8211	(0.375)	3.944	(0.060)*
Physical capital	3.074	(0.094)*	7.205	(0.014)**
Human capital	0.7224	(0.405)	0.7591	(0.393)

Note: ** and * denote significance at 5% and 10% levels, respectively.

4.1 Cointegration Test

Table 6 gives a summary of the cointegration test. In the model, the focal variable DE has an F-statistic of 6.00. When compared to the critical values provided by Narayan (2005) in the table below, it is evident that the F-statistic is more than the 1% upper bound critical value (i.e., 4.88). This means there is a long run cointegration relationship between the level of poverty and its determinants, namely DE, GDPPC, INF, K and HC, across the sample period of 1970 to 2019. This conclusion emphasises the necessity of accounting for asymmetry when investigating the relationship between these factors.

Table 6. Bound cointegration test

Critical value	Lower bound value	Upper bound value	Computed F-statistics
k = 6, n = 50			
1%	3.42	4.88	6.00***
5%	2.55	3.71	
10%	2.17	3.22	

Notes: *, ** and *** denote significance at 10%, 5% and 1% levels, respectively. Critical values are taken from Narayan (2005), Table in the Appendix, Case III, p. 1988. K and n are the number of regressors and observations, respectively.

4.2 Results of Long-run Coefficients

Following the establishment of the cointegration relationship, the next step is to examine the variables for long-run and short-run asymmetries. Table 7 presents the long-run coefficients for the nonlinear ARDL model.

Based on the findings for development expenditure, negative development expenditure shock has a positive coefficient and is a statistically significant determinant of poverty in the long run. This means that the poverty level tends to drop when development expenditure decreases. However, positive development expenditure is an insignificant determinant of poverty. The findings reflect inefficiency in government expenditure. The results reflect that not everyone receives aid from the government, and the allocation does not reach the people on the ground. The results contradicted the studies on the effectiveness of government expenditure in reducing poverty, such as Ahmad and Masih (2017), Khasanah et al. (2016) and Sasmal and Sasmal (2016) which showed that government expenditure recorded a negative and significant impact on the number of poor people. Ineffective government expenditure in reducing the poverty level in Malaysia is most probably due to too many regulations in executing the allocation which deters the impact on the growth of the poverty level. However, some researchers, such as Kimaro (2018), supported these findings by proving that increasing government expenditure slows economic growth, resulting in a rise in Tanzanian

Table 7. Estimated long-run coefficients

Dependent variable: *Rate of poverty* (*P*)

Regressors	Coefficient	T-ratio (p-value)
Intercept	28.344***	15.995 (0.0000)
DE_POS	0.048	0.476 (0.6391)
DE_NEG	0.786***	3.965 (0.0007)
GDPPC	0.0003	0.002 (0.9987)
INF	-0.113*	-1.981 (0.0608)
HC	-6.594***	5.673 (0.0000)
K	-2.280***	-9.386 (0.0000)

Notes: P = poverty rate, DE = development expenditure, GDPPC = gross domestic product per capita, INF = inflation rate, HC = human capital and K = physical capital. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

poverty. Tanzania's economic status as a low-income country means it performs less efficiently than countries with higher incomes. Inflation is negatively associated with poverty; this indicates that the higher the inflation, poverty tends to increase. Better human capital and physical investment are significant in reducing poverty. All control variables have expected signs except inflation.

The model was confirmed and passed by two diagnostic tests, namely the serial correlation and cumulative sum control (CUSUM) tests. Figure 3 presents the serial

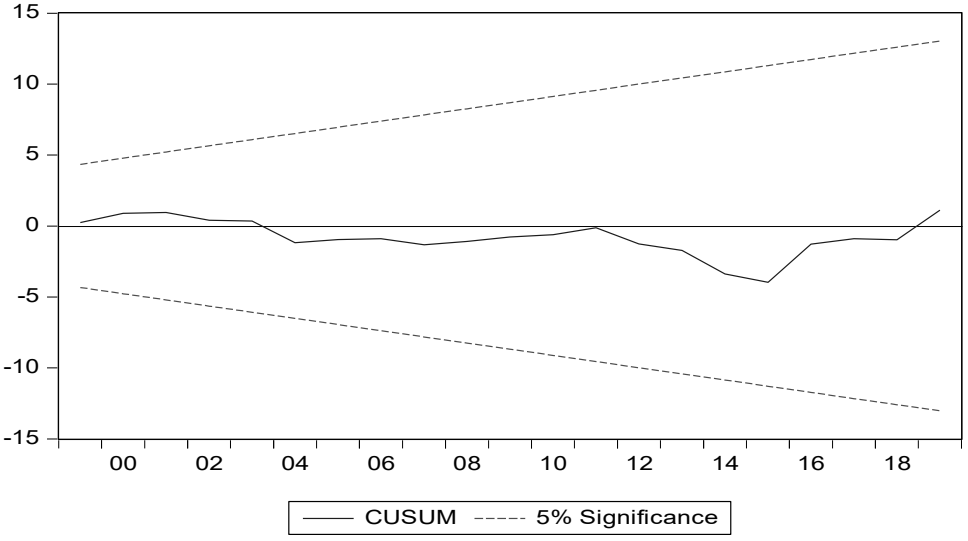

Figure 3. Development expenditure: CUSUM

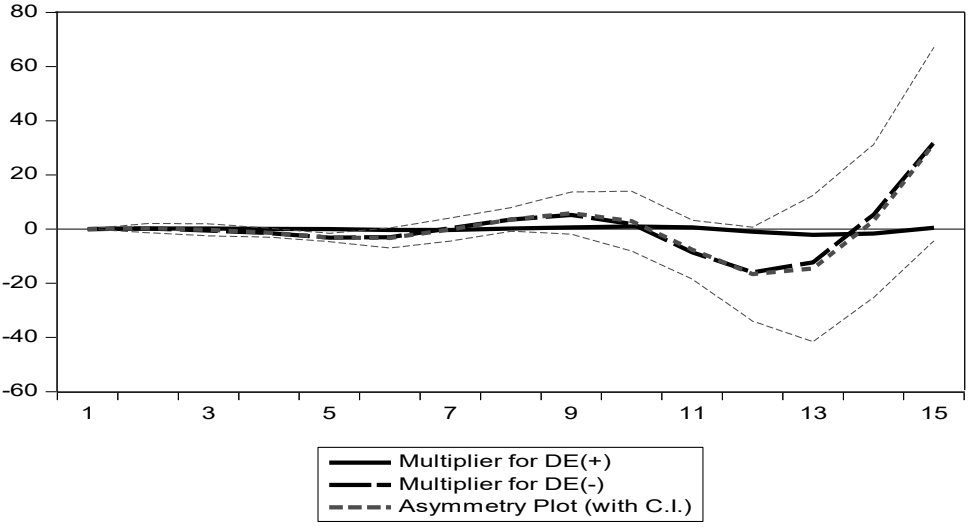

Figure 4. NARDL multiplier graphs

correlation test of the level relation model of long-run estimation for lags 2 and 4, respectively. The p-values of chi-square statistics are greater than 0.05, which indicate that there is no serial correlation problem. Additionally, the CUSUM statistics stability test is plotted to ascertain the significance of trajectory at the 95% confidence bounds. This is supported by the figure's rejection of the null hypothesis, which leads to the conclusion that all the regression parameters are stable. Figure 4 depicts the dynamic multiplier plot that indicates the positive or negative effect of development expenditure at a particular time. The negative shock has more effect on poverty as compared to positive shock.

4.3 Result of Short Run Error Correction Model

In terms of the short run, the earlier three years' poverty affects the current poverty, as indicated in Table 8. Increases or decreases in development expenditure did not

Table 8. Short run error correction model

Dependent variable: Δ*Rate of poverty* (*P*)

Regressors	Coefficient	T-ratio (Probability)
Error correction term$_{t-1}$	-0.294***	-2.913 (0.0000)
ΔP_{t-1}	2.361***	8.275 (0.0000)
ΔP_{t-2}	1.679***	6.895 (0.0000)
ΔP_{t-3}	1.592***	7.401 (0.0000)
ΔDE_POS_t	0.409	0.985 (0.3338)
ΔDE_NEG_t	0.062	0.102 (0.9194)
$\Delta GDPPC_t$	0.656*	1.752 (0.0915)
ΔINF_t	-0.087	-1.341 (0.1917)
ΔK_t	-13.311***	-3.625 (0.0012)
ΔHC_t	6.456***	2.833 (0.0000)

Notes: P = poverty rate, DE = development expenditure, GDPPC = gross domestic product per capita, INF = inflation rate, K = physical capital and HC = human capital. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

significantly impact on the poverty level. One potential explanation is that development expenditure needs some time for it to efficiently produce spillover effects in the economy in the long run. The short-run result is possibly due to the displacement cost theory in which increased government expenditures displace or crowd out private sector activities, dampening growth that does not significantly impact the level of poverty. The current physical investment is a negative and significant determinant of changes in poverty. However, changes in human capital are a positive and significant determinant of poverty, where the higher the human capital index, the higher the poverty. The short-run results are always dynamic processes and therefore, inconsistent with expected signs. The error-correction term (ECT) has a negative sign, and the coefficient is less than one and is statistically significant. This implies that any short-run deviation will adjust to the long-run equilibrium path. The full adjustment will occur at 100%. Therefore, 29.4% convert to 100% is 3.4, or it will take about 3.4 years to move back to the long-run equilibrium if there is any short-run deviation.

4.4 Robustness Check

Furthermore, robustness checks are also conducted using the variable share of development expenditure on gross domestic product. The nonlinear ARDL results confirmed that the model passed two diagnostic tests, namely the serial correlation and CUSUM tests. Table 9 presents the long-run cointegration result which reveals that there is cointegration among the variables even though the government expenditure variable is replaced by government expenditure over GDP. In the long-run estimation reported in Table 10, the negative government development expenditure coefficient is statistically significant at 5% level, which is similar with the findings presented in Table 7. The other four variables are insignificant determinants of the level of poverty, as reported in Table 10. Figure 5 shows the CUSUM statistics stability test while Figure 6 depicts the dynamic multiplier plot that indicates the positive or negative effect of development expenditure at a particular time. In the short run, it was reported that all variables are also insignificant determinants of the level of poverty, and earlier poverty affects current poverty, as presented in Table 11. Moreover, the error correction term (ECT) is significant and this finding is consistent with the bound cointegration test.

Table 9. Bound cointegration test

Critical value	Lower bound value	Upper bound value	Computed F-statistics
k = 6, n = 50			
1%	3.42	4.88	4.05**
5%	2.55	3.71	
10%	2.17	3.22	

Notes: *, ** and *** denote significance at 10%, 5% and 1% levels, respectively. Critical values are taken from Narayan (2005), Table in the Appendix, Case III, p. 1988. k and n are the number of regressors and observations, respectively.

Table 10. Estimated long-run coefficients

Dependent variable: *Rate of poverty* (*P*)

Regressors	Coefficient	T-ratio (p-value)
Intercept	7.6449	0.7096 (0.4822)
DEGDP_POS	0.4015	0.5229 (0.6040)
DEGDP_NEG	0.1976	2.3334** (0.0306)
GDPPC	-0.3310	-0.4774 (0.6357)
INF	-0.0940	-0.6803 (0.5003)
HC	-3.9122	-0.6222 (0.5374)
K	0.0429	0.0349 (0.9723)

Notes: P = poverty rate, DE = development expenditure, GDPPC = gross domestic product per capita, INF = inflation rate, HC = human capital and K = physical capital. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

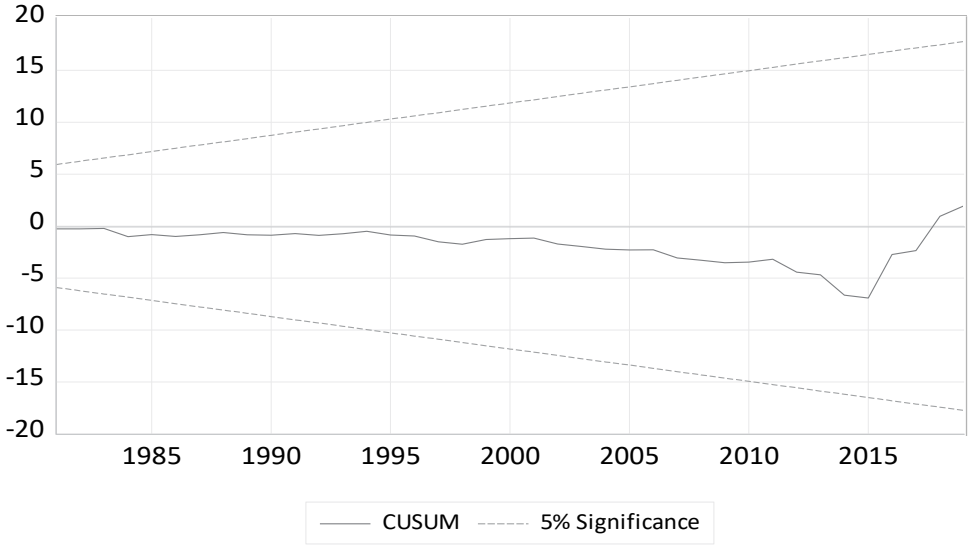

Figure 5. CUSUM plot for development expenditure/GDP

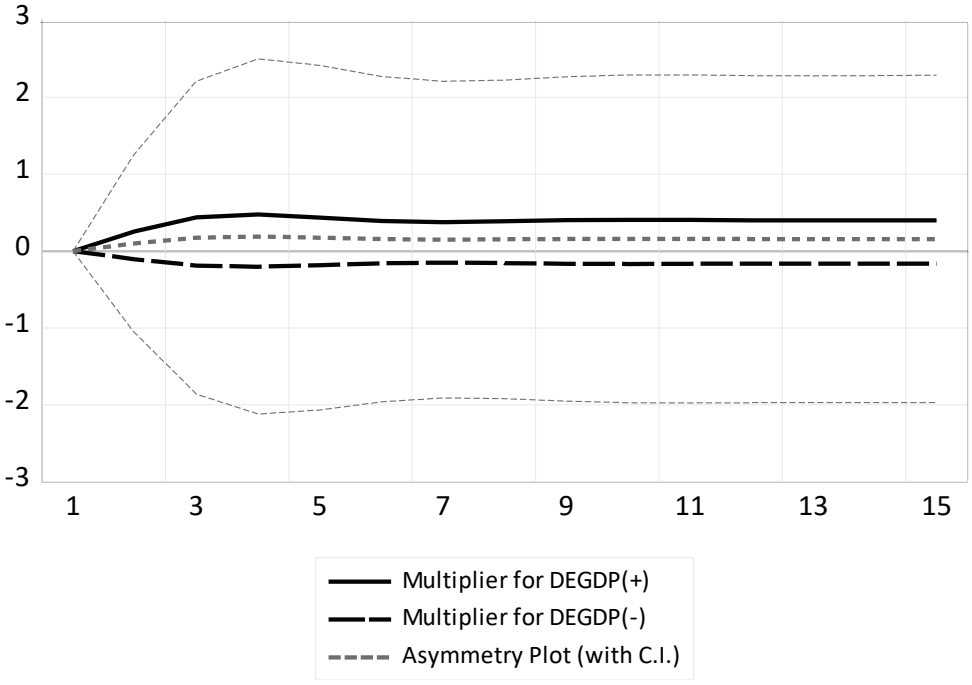

Figure 6. Nonlinear ARDL multiplier graphs

Table 11. Short run error correction model

Dependent variable: Δ*Rate of poverty* (*P*)

Regressors	Coefficient	T-ratio (Probability)
Error correction term$_{t-1}$	-0.6179***	-4.0338 (0.0002)
ΔP_{t-1}	0.3394*	2.0859 (0.0434)
$\Delta DEGDP\_POS_t$	0.4205	0.6726 (0.5051)
$\Delta DEGDP\_NEG_t$	0.3941	0.7401 (0.4635)
$\Delta GDPPC_t$	-0.0301	-0.0637 (0.9495)
ΔINF_t	-0.0591	-0.7855 (0.4368)
ΔK_t	-1.0738	-0.5115 (0.6118)
ΔHC_t	2.3290	0.2172 (0.8292)

Notes: P = poverty rate, DE = development expenditure, GDPPC = gross domestic product per capita, INF = inflation rate, K = physical capital and HC = human capital. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

5. Conclusion

This study investigates the relationship between government development expenditure and the level of poverty in Malaysia using the nonlinear ARDL approach and time series data from 1970 to 2019. The empirical results of nonlinear ARDL revealed that increase in government development expenditure has no significant effect on poverty in the long run. In the long run, development expenditure has a positive coefficient and is a statistically significant determinant of poverty. This indicates that higher development expenditure increases poverty. Therefore, based on this finding, government development expenditure should not misuse the resources and should examine the importance of focusing on proper allocation of fund resources in alleviating poverty. Therefore, this research recommends that government expenditure should minimise the resources when producing public goods and services to improve performance and reduce the poverty level. Some of the federal government expenditures tend to weaken the private sector and thus reduce economic growth and increase poverty level.

The government's significant emphasis on dispersing development benefits throughout all economic sectors must ensure that it impacts on the poverty level. Government policies should also try to ensure that the benefits of development are equally distributed among all the groups to ensure social harmony in a plural society. Every project and program implemented by the government must ensure that it is conducted in an effective manner, and any leakages must be eliminated. The government must pursue a policy of competitiveness and development to help achieve poverty alleviation targets. To circumvent these economic hazards, this research recommends that the government should embark on a public-private-partnership (PPP) to substitute for possible negative fiscal multiplier effects. The government should explore the opportunities of having a stable private sector by establishing and implementing PPP to enhance strong corporation between the two sectors. The public and private sectors should coordinate their planning approaches based on how to best use the resources at hand for the mutual benefit of the two sectors and the entire country. The reduction of poverty is significantly aided by improved physical and human capital investments. Theoretically, expenditure on development will boost labour's capacity and productivity in curtailing poverty. This is vital, especially in achieving the Shared Prosperity Vision 2030. For future studies, the research can use state-level datasets to examine the effect of government expenditure on the poverty level.

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