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ARDL approach: The determinants of government size in Malaysia

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Abstract

The government size is determined through the ratio between the government expenditure which including the operation and development with the Gross Domestic Product (GDP). This study with the intention to examine the long-run relationship between the determinants with the government size of Malaysia during the periods of year 1980 to year 2018. The determinants including the trade openness, country size, foreign direct investment openness, portfolio investment openness and the economic growth. The annual data are achieved from the World Bank and the Department Statistic of Malaysia (DOSM). Moreover, we adopted the Autoregressive Distributed Lag (ARDL) model, which proposed by Pesaran et al. (2001), to examine the long-run relationship. The result revealed that there are long-run negative relationship significantly between the determinants including the trade openness, country size, foreign direct investment openness and portfolio investment openness with the government size. On the other hands, the economic growth has a significant positive long-run relationship with the government size in Malaysia. Both trade openness and economic growth variables have the Granger Causality effects towards the government size variable. Therefore, it is essential for the government to maintain a balanced allocation of both operating and development expenditures, taking into account key influencing factors, to support sustainable long-term economic growth in Malaysia.

Keywords: ARDL, Country size, Economic growth, Foreign direct investment openness, Government size, Malaysia, Portfolio investment openness, Trade openness.
JEL Classification: C32; H11; H50; O47.

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Contents

Contribution of this paper to the literature:
This study gives a valuable insights regarding the determinants of government size of Malaysia, and it may serve as input for individuals (Malaysians) or policymakers in understanding which indicators give impact on the government size.

1. Introduction

In general, "government" can be interpreted as a group of people who has the authority to officially control a country. In other words, the term "government" can be referred as a set of institutions and concerns a body of actors, which defines how and to what extent the public affairs within society are shaped and directed (Keman, 2010). It is an undeniable fact that government plays a major role in the development of a country in all aspects, ranging from social, economics to politics. For example, the roles of government include utilizing the domestic resources efficiently, maintaining law and order by having an effective administrative system as well as stabilizing the economy.

From an economic perspective, government intervention takes several forms. One primary role is the direct production of goods and services for the public, including national defence, infrastructure, and education. Additionally, the government facilitates income redistribution—both horizontally among groups with similar income levels and vertically across different income strata. In essence, government spending contributes to enhancing a country's economic efficiency, particularly in the presence of market failures or externalities. Furthermore, government regulations influence economic activity, and although their effects are often difficult to quantify in terms of costs and benefits, they remain significant. These regulations can sometimes function as substitutes for taxation or public spending. While economics provides valuable tools for assessing the relative merits of government intervention in specific sectors, it does not offer a definitive answer to the broader question of how much government involvement is too much or too little (Labonte, 2010).

The most commonly used indicators of government size in researches are the government expenditure measures derived from national accounts, in which at the same time it is used to stimulate the economic growth and social welfare of a country. In other words, the Malaysian government expenditure can be rephrased as the amount spent by Malaysian government using the revenue collected from the country's residents based on its planning and budget in an annual manner. The Malaysian government expenditure can be classified into two major categories, which are the operating expenditure and development expenditure respectively as shown in Table 1.

Table 1. Federal government operating expenditure by object, 2015-2018.

Components	Total expenditure (RM million)			
	2015	**2016**	**2017**	**2018**
Emoluments	70,050	73,108	78,801	79,149
Retirement charges	18,872	21,029	23,648	24,550
Debt service charges	24,283	26,480	28,866	30,882
Grants and transfers to state governments	6,921	6,942	8,058	8,023
Supplies and services	36,373	30,070	32,642	33,621
Subsidies and social assistance	27,269	24,690	23,085	26,544
Asset acquisition	N/A	676	698	577
Refunds and write-offs	947	799	802	888
Grants to statutory bodies	15,487	13,557	13,449	13,099
Others	16,796	12,822	9,861	16,917
Total	216,998	210,173	219,910	234,250
Share of GDP (%)	18.8	17.1	16.4	16.2

Source: Ministry of Finance Malaysia (2018).

Table 2. Federal government development expenditure by sector, 2015-2018.

Components	Total expenditure (RM million)			
	2015	**2016**	**2017**	**2018**
Economic of which:	23,286	25,113	25,897	26,342
Agriculture and rural development	3,105	2,902	2,416	2,523
Trade and industry	5,638	4,841	4,830	4,149
Transport	6,693	7,827	10,749	10,479
Public utilities and energy	3,637	2,927	2,514	2,746
Environment	N/A	2,346	2,197	2,013
Social of which	11,161	10,429	12,119	11,720
Education and training	4,758	3,727	5,904	5,256
Health	1,442	1,495	1,532	1,910
Housing	2,008	2,238	870	1,167
Security	4,754	4,832	5,286	5,214
General administration	1,567	1,621	2,660	2,724
Total	40,768	41,995	45,962	46,000
Share of GDP (%)	3.5	3.4	3.4	3.2

Source: Ministry of Finance Malaysia (2018).

One of the key challenges faced by Malaysia is its reliance on debt to finance development expenditure. According to Yeap (2017), this has been a persistent issue, as 97.7 sen of every ringgit the government expects to earn is allocated to operational expenses, leaving only a small fraction for development. As a result, approximately 88% of the subsequent year's development spending must be financed through borrowings. Due to continuous budget deficits since 1998, Malaysia's debt service charges were projected to reach RM 30.88 billion in 2018, meaning nearly 13 sen of every ringgit in revenue would be used solely for debt repayment. Although there is a clear need for increased investment in economic and social development, the government faces limitations on how much it can borrow to fund these initiatives. This constraint has hindered the growth of development spending. Therefore, this research aims to identify the long-term determinants that influence government expenditure in Malaysia.

Hence, the objective of this paper is to examine the long run relationship between the determinants with the government size in Malaysia by utilizing the Autoregressive Distributed Lag (ARDL) model.

2. Literature Review

Developed by John Maynard Keynes during the 1930s, the Keynesian economics can be referred as an economic theory of total country spending and its effects on both output and inflation (Chappelow, 2019). In an attempt to understand the Great Depression, he has also suggested that the increase in government expenditure in conjunction with the lowering in taxes may help in stimulating demand and pulling the global economy out of depression. In conjunction with the government size which is commonly measured by using the government expenditure as a share of GDP, there are many previous studies that have been carried out with the aim to examine the factors affecting the government size and the researches have prioritized the demand or supply sides. Hence, taking into account the Keynesian theory and other non-budgetary measures of the government size, this study has put a huge emphasis on the demand size, which focuses more on the relationships between variables such as trade openness, population, capital openness and economic growth. Analysts have defined "government size" as the ratio of government expenditures to the total output of an economy, where the total output refers to the gross domestic product (GDP) (Berry & Lowery, 1984). To elaborate, the government expenditure reflects the involvement of public sector in the society, where its share of the total GDP acts as a proxy which represents the governmental activities scale relative to those of the private sector (Congleton, 2001; De Witte & Moesen, 2010).

Trade, where imports and exports are the major categories of it, is vital to a country's economy and therefore can be considered as one of the factors that may cause effects on the government size in Malaysia. The term "trade openness" can be defined as the ratio of the sum of exports and imports to the gross domestic product of a country. The relationship between trade openness and government size was firstly introduced by Cameron (1978) where there is an argument stating that trade openness increases an economy's international economy and its associated risks which may lead to a larger government expenditure in order to compensate for the external risk. Rodrik (1998) has further reintroduced the study and has proposed the compensation hypothesis, where government expenditure plays a risk-reducing role in open economies. However, based on the previous studies done by Liberati (2007) as well as Benarroch and Pandey (2012) the validity of the compensation hypothesis has been rejected which is also supported by Katumba (2013) who has found that there was a negative and significant relationship between trade openness and government size. Hence, an assumption of the negative long run association between the trade openness variable and government size variable has been made in this study.

Country size emerges from the trade-off between the economies of scale in public good supplies of large countries, including the cultural and ethnic heterogeneity costs, which may lead to the increase in country sizes given the assumption that the costs of partially or completely non-rival public goods can be shared over large populations that may lower the per capita expenditure on the goods, which means that the government share in GDP will be lower (Alesina & Spolaore, 1997). For instance, as the country size increases which also represents that the population of the country increases, it is an undeniable fact that the number of taxpayers in the country will also rise as well. This will in return lead to the decline in the per capita costs of the public goods such as monetary and financial system, public health, police and juridical system and national parks. In this case, the government expenditure to GDP ratio will decrease with GDP, which states that smaller countries tend to have larger governments and vice versa (Alesina, 2003; Alesina & Wacziarg, 1998). Therefore, this study assumes that there will be a long run association between the country size and government size variables in Malaysia. Economists have been questioning whether the capital openness may play an autonomous role in shaping government size and may cause an effect on the validity of the compensation hypothesis. There is an argument that the capital openness would further rise the external economy exposure risk as well as the demand for public expenditure compensations (Rodrik, 1998). However, the efficiency hypothesis can be said to occur when the increase in degrees of capital openness may cause higher mobility of tax factors and governments will have a declined ability to maintain greater public sectors.

Aregbeyen and Ibrahim (2014) examined the relationship between trade openness and government size in Nigeria using the bounds testing approach to cointegration within an ARDL framework. Their empirical findings indicated a significant long-run association between trade openness and government size, measured by the share of total government expenditure and recurrent expenditure in GDP. However, when government size was proxied by the share of capital expenditure in GDP, no significant long-run effect on trade openness was observed. These findings were further supported by the empirical results of Nwaka and Onifade (2015).

3. Research Methodology

This study utilizes annual time series data for Malaysia covering a 39-year period from 1980 to 2018. All variable data, except for the country size, were obtained from the World Bank (2020). Due to limited availability of direct data on portfolio investment openness, this variable was calculated manually by dividing portfolio investment figures by GDP, both sourced from the World Bank. Meanwhile, data for country size, represented by population, were gathered from the Department of Statistics Malaysia (2020) for the corresponding period.

The research model is take account the previous research models which developed by Liberati (2007) and Sabra (2016) as follows.

$$GOVSIZE = \alpha + \beta_1 lnTRADE + \beta_2 lnPOP + \beta_3 FDI + \beta_4 PI + \beta_5 GROWTH + e \quad (1)$$

Where,

GOVSIZE = Government size.

TRADE = Trade openness.

POP = Population as proxy to the country size.

FDI = Foreign direct investment openness.

PI = Portfolio investment openness.
Growth = Economic growth.
e = Random error.

3.1. Empirical Methodology
3.1.1. Unit Root Test

The unit root is run to verify the stationary of the model. This is very important to ensure that the model is stationary because the data will unstable in the long run and the spurious regressions will be exist. Hence, the Augmented Dickey-Fuller (ADF) test will be used for this study to test the existence of the 'unit root' problem in the model.

3.1.2. Autoregressive Distributed Lag (ARDL) Bounds Test Approach

To examine the existence of a long-run relationship among the study variables, an Autoregressive Distributed Lag (ARDL) model is employed using the Bounds testing approach. This method is based on the ordinary least squares (OLS) estimation of a conditional Unrestricted Error Correction Model (UECM) for cointegration analysis. As demonstrated by Banerjee, Dolado, Galbraith, and Hendry (1993), the ARDL model allows for the derivation of a dynamic Error Correction Model (ECM) through a simple linear transformation. The ECM effectively incorporates short-run dynamics with the long-run equilibrium relationship, without losing long-run information (Chowdhury & Shrestha, 2005). The government size equation can thus be expressed using the UECM form of the ARDL model as follows:

$$D(GOVSIZE) = \alpha + \sum_{i=1}^{n} \beta_1 D(GOVSIZE)_{t-i} + \sum_{i=0}^{n} \beta_2 D(lnTRADE)_{t-i} + \sum_{i=1}^{n} \beta_3 D(lnPOP)_{t-i} + \sum_{i=0}^{n} \beta_4 D(FDI)_{t-i} + \sum_{i=0}^{n} \beta_1 D(PI)_{t-i} + \sum_{i=0}^{n} \beta_6 D(GROWTH)_{t-i} + \beta_7 GOVSIZE_{t-1} + \beta_8 lnTRADE_{t-1} + \beta_9 lnPOP_{t-1} + \beta_{10} FDI_{t-1} + \beta_{11} PI_{t-1} + \beta_{12} GROWTH_{t-1} + e \quad (2)$$

Where,
D = The first difference operator.
i = The parameters which it explains the short run dynamic coefficients when i = 1-5 while i = 6-10 explain the long run multipliers of the equation.
t = Trend.
e = Error term.

The ARDL model acts as a tool in determining the short run and long run relationships between the series by performing the model estimation through conducting the F test of the hypothesis that all the coefficients of the lagged series are equal to zero, where $H_{0:}$ m0 = m_1 = 0 null hypothesis claims that there is no long run relationship, or in other words cointegration, between the series, and vice versa. In this test, the F statistics values will be compared with the lower and upper bounds' critical values as proposed by Pesaran, Shin, and Smith (2001). Based on the theory, if the F statistics value is greater than the upper limit of boundary value, the alternative hypothesis which claims that there is a long-term relationship between the series will be accepted. On the contrary, if the F statistic value is lower than the lower limit of boundary value, the null hypothesis will be accepted. Otherwise, if the F statistic value falls in between the lower and upper limits, the results will remain inconclusive. Consecutively, an error correction model will be estimated by using the determined optimum lag lengths. The error correction model is constructed as follows:

$$D(GOVSIZE) = \alpha + \sum_{i=1}^{n} \beta_1 D(GOVSIZE)_{t-i} + \sum_{i=0}^{n} \beta_2 D(lnTRADE)_{t-i} + \sum_{i=1}^{n} \beta_3 D(lnPOP)_{t-i} + \sum_{i=0}^{n} \beta_4 D(FDI)_{t-i} + \sum_{i=0}^{n} \beta_1 D(PI)_{t-i} + \sum_{i=0}^{n} \beta_6 D(GROWTH)_{t-i} + \beta_7 GOVSIZE_{t-1} + \beta_8 lnTRADE_{t-1} + \beta_9 lnPOP_{t-1} + \beta_{10} FDI_{t-1} + \beta_{11} PI_{t-1} + \beta_{12} GROWTH_{t-1} + \varphi ECM_{t-1} + e \quad (3)$$

Where,
ECM = Error correction term.
φ = The adjustment speed at which the model turns back to long-term model.

3.1.3. Granger Causality

There is a causal effect occur between the variable. The null hypothesis is formed which the GOVSIZE, TRADE, POP, FDI, PI and GROWTH do not Granger cause to each other (Granger, 1988). The null hypothesis will be rejected when the p-value is larger than 0.05. If the null hypothesis is rejected due to the significant of the p-value, the variables will have the granger cause between each other.

Table 3. The results of augmented Dickey-Fuller test.

Variables	Level	First difference
GOVSIZE	-1.9246	-6.2781***
lnTRADE	-3.9721**	-6.0147***
lnPOP	1.6247	-5.3413***
FDI	-2.9209	-6.6587***
PI	-3.9889**	-5.0086***
GROWTH	-5.1449**	-7.5949***

Note: (***) and (**), show the significance level at 1% and 5%.

4. Result
4.1. Unit Root Test

From the Table 3, the unit root test in the intercept form either the data of the level or the first difference is examined. The results show that the GOVSIZE, lnTRADE, lnPOP, FDI, PI and GROWTH are significant at the 1% level for the first difference. Hence, the study will take the data in the first difference.

4.2. Autoregressive Distribution Lag (ARDL) Bounds Test

The ARDL boundary test approach can be applied to test the existence of cointegration between the series since the series are not integrated at two or more level. The Schwarz Bayesian Criteria (SBC) is being taken into consideration to identify the most suitable ARDL model as Pesaran and Smith (1998) have discovered the fact that SBC is more preferable to Akaike Information Criterion (AIC) because it is a parsimonious model that selects the smallest possible lag length, whereas AIC selects the maximum relevant lag length. Therefore, according to the results obtained from Figure 1 as illustrated below, the optimal model for ARDL is (3,4,4,4,2) among the top 20 models with the lowest SBC value. Hence, the ARDL (3,4,4,4,2) model has been chosen.

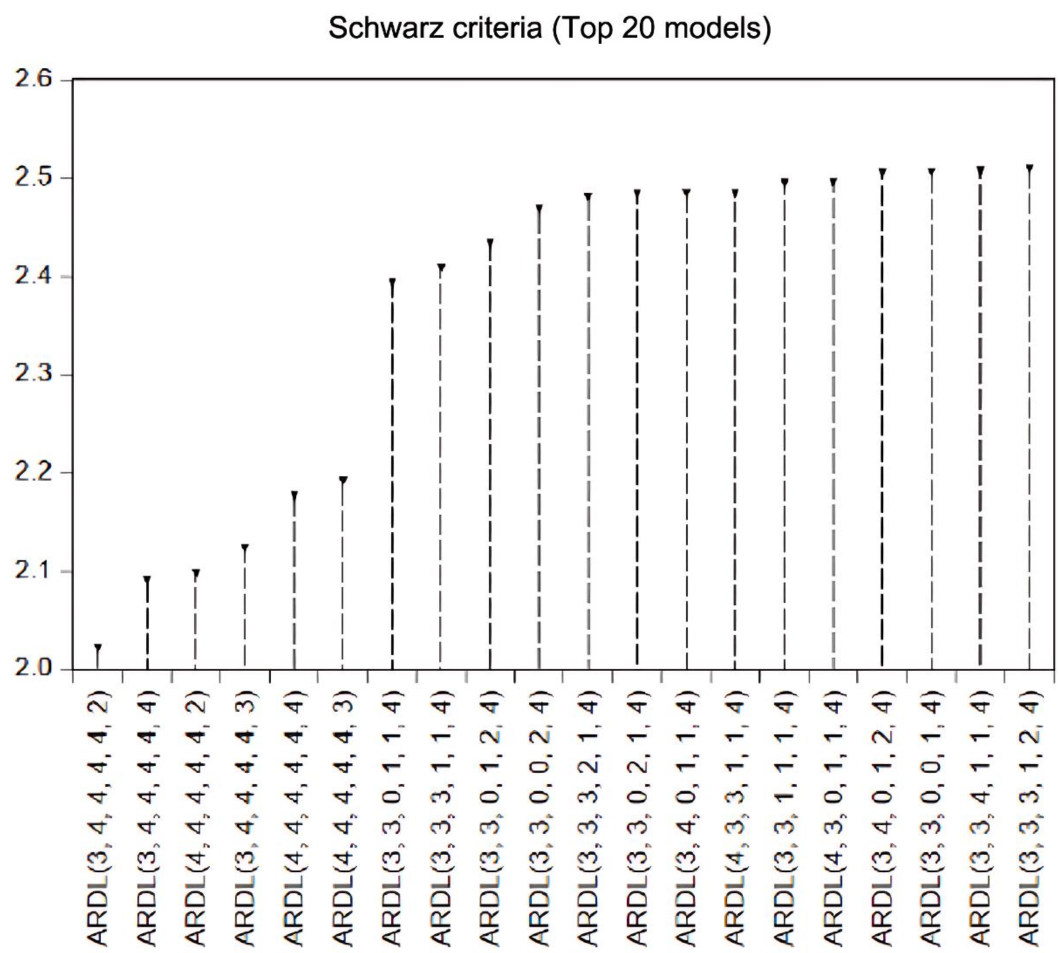

Figure 1. Model selection based on Schwarz Bayesian criteria (Top 20 models).

Table 4. Model selection (3,4,4,4,4,2) by using ARDF method.

Selected model: ARDL (3,4,4,4,4,2)	
R-squared	0.9862
Adjusted R-squared	0.9412
F-statistic	21.9371
Prob (F-statistic)	0.0001

Table 4 stated to support the model selection (3,4,4,4,4,2). Both R-squared and adjusted R-squared values obtained from the model have exceeded 90%, which means that the goodness of fit of the dependent and independent variables in this study are relatively high. In addition, the F-statistical probability of less than 5% indicates that this model is significant. Hence, this model has been selected due to its suitability for this study.

4.3. ARDL Long Run Form and Bounds Test

Table 5 portrayed the ARDL Long Run Form and Bounds Test of the Model, where the levels equation of the model has been formed, given the case that there are an unrestricted constant and no trend. According to the results obtained, the probabilities of the variables are significant and therefore it can be said that there are long run cointegration associations between the dependent variable and the independent variables. Hence, the null research hypothesis can be rejected, and the research objectives have been achieved. Furthermore, the coefficients of the independent variables have played a part in determining the direction of relationship with the dependent variable of the study as well. In this case, all the variables except the economic growth variable share negative relationships with the government size variable in the long run. In short, the relationships between all variables which are trade openness, country size, foreign direct investment openness, portfolio investment openness as well as economic growth variables and government size variable have been proven to be consistent with the results obtained from the previous studies. In other words, if interpreting the numerical values of coefficients, a 1% increase in the government size variable will lead to approximately 17.16%, 3.28%, 0.34% and 47.60% declines in the variables of trade openness, country size, foreign direct investment openness as well as portfolio investment openness respectively. On the other hand, around 0.19% increase in the economic growth will be incurred in conjunction with a 1% increase in the government size. To conclude, all independent variables involved in the study possess either positive or negative long run relationships with the dependent variable.

Table 5. ARDL long run form and bounds test.

Level equation (Unrestricted constant and no trend)				
Variable	**Coefficient**	**Std. error**	**T-statistic**	**Prob.**
lnTRADE	-17.1563	2.3310	-7.3602	0.0001
lnPOP	-3.2800	0.4769	-6.8780	0.0001
FDI	-0.3411	0.0642	-5.3152	0.0007
PI	-47.6011	10.4168	-4.5696	0.0018
GROWTH	0.1875	0.0363	5.1591	0.0009
		Null hypothesis: No level relationship		
Test statistic	Value	Sig.	I (0)	I(1)
			Asymptotic: n=100	
F-statistic	11.0186	10%	2.26	3.35
K	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68
Actual sample size	35	Finite sample: n=35		
		10%	2.508	3.763
		5%	3.037	4.443
		1%	4.257	6.04
t-bounds test		Null hypothesis: No level relationship		
Test statistic	Value	Sig.	I(0)	I(1)
t-statistic	-6.9775	10%	-2.57	-3.86
		5%	-2.86	-4.19
		2.5%	-3.13	-4.46
		1%	-3.43	-4.79

The model is further tested with F-Bounds Test and t-Bounds Test to indicate if the null hypothesis of absence of levels relationship will be accepted or rejected for this study. Based on the same table, the F-statistic value and t-statistic value obtained from both tests are greater than the lower bound I(0) and upper bound I(1) probabilities, which has strongly rejected the null hypothesis at all significance levels from 1% to 10%. Hence, it can be concluded that the variables of this model possess levels relationship in the long run as the results are significant.

4.4. ARDL Error Correction Regression

From Table 6, the ARDL Error Correction Regression has shown a negative coefficient for the lagged one cointegration equation. This means that the model is statistically stable and there is an absence of serial correlation. Moreover, the zero per cent probability has proven that the lagged equation is significant for the long run model. Therefore, the selected model can be said to be favourable for the study.

Table 6. ARDL error correction regression.

Variable	Coefficient	Std. error	t-statistic	Prob.
CointEq(-1)	-1.3712	0.1323	-10.3649	0.0000

Table 7. Adjusted error correction model using (3,4,4,4,4,2) approach.

Dependent variables: D(GOVSIZE)			
Variable	**Coefficient**	**t-statistic**	**Prob.**
D(GOVSIZE(-3))	-0.4152	-3.1691	0.0157
D(lnTRADE(-3))	0.8609	3.9072	0.0058
D(lnPOP(-4))	-94.7118	-2.9511	0.0214
D(FDI(-4))	-0.3865	-5.1390	0.0013
D(PT(-4))	-13.2269	-2.7459	0.0287
D(GROWTH(-2))	0.1025	3.2782	0.0135
ECT(-1)	-5.2259	-2.7277	0.0294

4.5. Adjusted Error Correction Model using (3,4,4,4,4,2) Approach

Table 7 displays the short-run results in the model. After adjusting the lagged variables, the error correction coefficient as shown in Table 7 remains negative, but the probability has become statistically significant with the value of 0.029 at five per cent level. This not only has ensured that the adjustment process of the model from the short-run deviation is relatively fast, but also indicates that there is a long run causality between the variables. To be more precise, it indicates a 522.59 per cent of the disequilibrium in the government size from the previous period shock will be converged back to the long-run equilibrium in the current period. In other words, the speed of adjustment towards long run equilibrium is at 522.59 per cent. The estimated coefficients of all variables are statistically significant at five per cent level in the short run. However, the trade openness variable has shown an opposite sign in relation to the government size if compared with the association of both variables in the long run. In other words, the trade openness is positively related with the government size. Otherwise, the other independent variables share the same direction of relationship with the government size in both short run and long run. Besides, even though the trade openness variable has an optimal lag length of four in the long run, the short run analysis results show that the variable is more significant with the lag length of three. Hence, the trade openness variable is analysed by taking the third lag length values into consideration.

Table 8. Granger causality result.

Null hypothesis	Obs.	F-statistic	Prob.
lnTRADE does not granger cause GOVSIZE	36	6.6637	0.0015
GOVSIZE does not granger cause lnTRADE		2.2367	0.1051
lnPOP does not granger cause GOVSIZE	36	0.2409	0.8671
GOVSIZE does not granger cause lnPOP		1.1102	0.3609
FDI does not granger cause GOVSIZE	36	0.9870	0.4126
GOVSIZE does not granger cause FDI		0.4377	0.7277
PI does not granger cause GOVSIZE	36	0.2059	0.8915
GOVSIZE does not granger cause PI		0.5131	0.6765
GOVSIZE does not granger cause GROWTH	36	4.1284	0.0149
GROWTH does not granger cause GOVSIZE		0.5574	0.6474

4.6. Granger Causality

Based on the Table 8, it is observable that there are significant causal relationships between the independent variables, knowingly the trade openness as well as economic growth and the dependent variable, government size. Both trade openness and economic growth variables have the Granger Causality effects towards the government size variable, while the other independent variables such as country size, foreign direct investment openness and portfolio investment openness do not Granger cause the government size variable. Hence, in conjunction with the existence of Granger Causality effects of trade openness and economic growth towards the government size, thus these two variables can be taken into consideration when making future predictions.

5. Conclusion

In conclusion, this paper is to investigate the long run relationship between the determinants with the government size in Malaysia. The determinants including the trade openness, population, foreign direct investment, portfolio investment openness and the economic growth. The annual data which from year 1980 to year 2018 is achieved from the World Bank website and the Department Statistic of Malaysia (DOSM). The Autoregressive Distributed Lag model is applied to this study. Meanwhile, the empirical results have shown significant and negative long-run relationships between the dependent variable, government size, and four independent variables, knowingly trade openness, country size, foreign direct investment openness as well as portfolio investment openness. On the contrary, the economic growth variable has portrayed a significantly positive long-run association with the government size in Malaysia. Moreover, the trade openness and economic growth variables have been discovered to have the most significant Granger causality effects on the government size in Malaysia as well. Hence, it is crucial for the government to achieve stability in allocating both the operating and development expenditures towards a sustainable long-term economic growth in Malaysia by taking the potential determinants into consideration.

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