Estimation of Malaysia Public Debt Threshold

Jerome Kueh[1], Venus Khim-Sen Liew[1], Sze-Wei Yong[2], Muhammad Asraf Abdullah[1]

[1]Faculty of Economics and Business, Universiti Malaysia Sarawak, Sarawak, Malaysia

[2]Faculty of Business & Management, Universiti Teknologi MARA Sarawak, Sarawak, Malaysia

Abstract

The objective of this study is to examine the implication of the public debt on the economic growth of Malaysia from the perspective of different public debt levels threshold. Threshold Regression method is utilized to identify the public debt threshold from 1991:Q1-2014:Q4 and examine the heterogeneous impacts of the public debt on growth based on certain threshold levels. Empirical results indicate that there is a positive association between the public debt and economic growth when the public debt is below 41% of GDP threshold level. Furthermore, there is a marginal positive impact when the public debt level falls between 41%-53% of GDP threshold levels. However, there is a harmful impact on growth when public debt is above 53% of GDP threshold level. As a result, managing the public debt position and the quality of the debt are important to ensure sustainable economic growth.

Keywords: Public debt; threshold; growth

JEL Classification*: H63, C24, O10*

1. Introduction

Debt is unavoidable and is viewed as a tool to curtail the adverse impacts of economic shock. In the inter-temporal perspective, a country may run into deficit and leads to accumulation of debt in the circumstances of economic shock with the purpose to mitigate the negative impacts of the shock. This is with the assumption that the country will experience surplus in the future due to the recovering of the economy. Nevertheless, the debt level of most of the countries are showing rising trend and can be harmful to the economic growth of the countries. For instance, Reinhart and Rogoff (2010) indicate that the threshold of the public debt is 90% of GDP where countries may experience positive economic growth when the public debt level is below 90% of GDP threshold level. However, economic growth of the countries may worsen when the public debt of the countries is beyond the 90% of GDP threshold level. Therefore, this indicates that the implication of the debt on the economic growth may diverge depending on the threshold levels.

Malaysia recorded remarkable gross domestic product (GDP) growth in the 1990s with average 9.2% from 1990 until 1997 (World Economic Outlook, IMF). However, the economic growth deteriorated drastically due to the Asian Financial crisis in 1997. The economic growth of Malaysia preserves at the range 4-5% from 2011 to 2014 and recorded around 4.9% in 2015 (World Economic Outlook, IMF) due to the prudent fiscal and monetary policies in safeguarding rapid recovery of the economy.

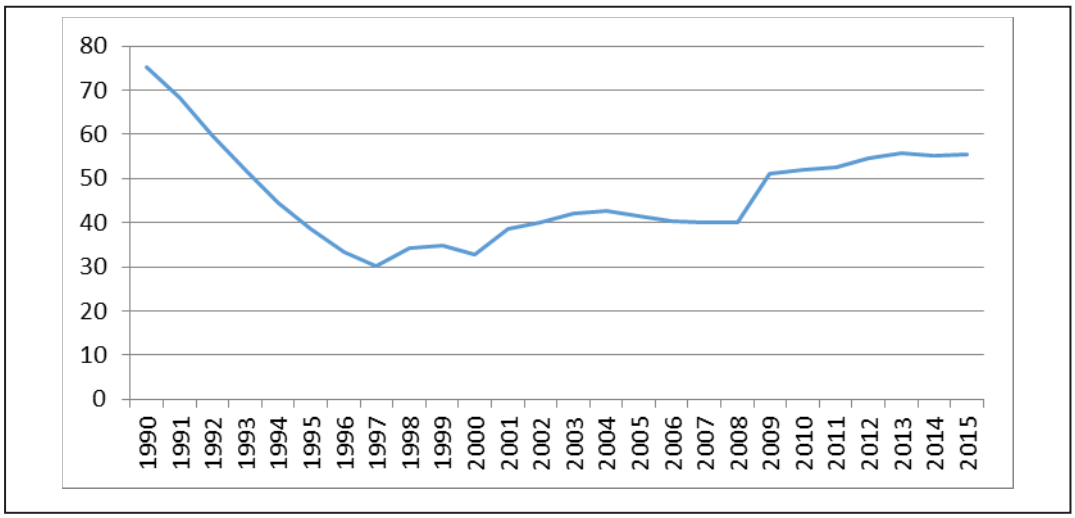

Figure 1: Malaysia Gross Government Debt (% of GDP) from 1990-2015
Source: World Economic Outlook, International Monetary Fund.

Meanwhile, the trend of the government debt of Malaysia depicts a declining pattern from around 75% of GDP in 1990 to 30% of GDP in 1997. The dependency on the public debt was reducing due to the fact that Malaysia was one of the favorite destinations of foreign direct investment in the 1990s. Nonetheless, the size of the public debt level began to expand in 1998 onwards and recorded a new level of 43% of GDP in 2004. The accumulation of the public debt was due to the needs to minimize the severe economic turbulence during the Asian Financial crisis in 1997. Subsequently, the recovery of the economy was linked with the decline in the debt level from 2004 until 2008. There was a severe rise in the debt level in 2009 due to the 2008 global financial crisis. The debt level recorded around 51% of GDP in 2009 and exhibited increasing trend since then and reached around 55% of GDP in 2015. Therefore, it is crucial to identify the threshold level of Malaysia public debt and further understand the effect of the public debt on economic growth when the public debt is above or below certain threshold levels.

The main objective of this study is to investigate the diverse impacts of the public debt on economic growth of Malaysia considering different threshold levels. This study varies from other studies in the following features: Firstly, the public debt threshold is determined endogenously based on the threshold regression approach, instead of predetermined threshold levels. This is dissimilar from the public debt threshold stated by Reinhart and Rogoff (2010), which is based on descriptive statistical analysis. In addition, the extreme critical threshold level such as 90% of GDP of debt threshold where debt will have negative impact of growth is based on large sample countries used in their study, which covers developed and developing countries. This threshold level may not be applicable in the case of individual country specific. Secondly, there are limited studies investigating the implications of the public debt on economic growth of Malaysia from the perspective of threshold levels. For instance, Lee and Ng (2015) examined the long-run impact of public debt on growth without identifying the level of threshold. Besides, most of those studies investigated on either external debt, such as Mohd Daud et al. (2013) or debt composition such as Choong et al. (2010).

The remainder of the paper is organized as follows: section two provides literature review on public debt and growth, followed by section three discussing the methodology, section four provides empirical findings and discussion and last section is conclusion.

2. Literature Review

The impact of the debt on economic growth can be associated to debt overhang hypothesis. This hypothesis states that there is no incentive for the government to implement macroeconomic policies to stimulate the economy if a country has high level of debt. This is due to the yields of successful policies will shift to finance the high level of debt, in terms of debt interest payment (Clements et al., 2003). Subsequently, the empirical findings provide mixed conclusion on the effect of debt on growth.

Choong et al. (2010) investigated the impact of various type of debt on economic growth of Malaysia from 1970 to 2006 using cointegration test and Granger causality test. Empirical findings indicated that existence of negative impact of the external debt on growth in the long-run. Meanwhile, Mohd Daud et al. (2013) examined the association between external debt and economic growth of Malaysia from 1991:Q1 to 2009:Q4 using Autoregressive Distributed Lag (ARDL). They further estimate the threshold effect via Hansen (2000) threshold method. The findings indicated that accumulation of external debt is link to expansion in economic growth of Malaysia until level of RM170,757. This means that there will be opposite association between external debt and growth when the external debt is above the threshold level. Lee and Ng (2015) examined the effect of the public debt towards economic growth of Malaysia for the sample period of 1991-2013. Their findings showed that public debt has negative impact on the economic growth with coefficient of 1.17%.

In terms of non-linearity perspective, there are several studies emphasize on the turning point of the debt effect on growth, particularly external debt. For instance, Pattilio et al. (2004) examined 93 developing countries for a sample period of 1969-1998. Their findings indicated that the impact of debt on growth become negative when debt level exceed 160-170% of export and 35-40% of GDP. Meanwhile, Kumar and Woo (2010) investigated the debt effect on growth for advanced and emerging economies from 1970-2007. Empirical results indicated that there is an inverse between initial debts on growth with 0.2% point for advanced countries and 0.15% point for emerging countries upon 10% point increase in initial debts. Furthermore, there is also evidence of non-linearity where negative effect of debt on growth when the public debt level is beyond 90% of GDP threshold level. Baum et al. (2013) investigated the implication of the public debt and economic growth based on sample countries of 12 Euro area countries from 1990 to 2010. Their empirical findings indicated that debt contributed positively to the economic growth when the debt is below 67% of GDP threshold level. Spilioti and Vamvoukus (2015) examined the relationship between debt and economic growth for Greece from 1970 to 2010. They discovered that debt becomes detrimental to economic growth when the debt is above 110% of GDP threshold level.

3. Methodology

The data used in this study comprises of gross domestic product per capita expressed in US dollar and public debt expressed as % of GDP covering the sample period of 1991:Q1 to 2014:Q4. All the variables are obtained from World Economic Outlook, International Monetary Fund. Initially, this study performs stationarity test on the variables to examine the order of integration in order to avoid spurious regression. The Augmented Dickey-Fuller (ADF) unit root test is applied to test the time series properties. Equation (1) shows the equation for the ADF test.

$$\Delta Y_t = \beta_0 + \beta_1 t + \theta_1 Y_{t-1} + \sum \theta_2 \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

where Y_t refers to variable of interest, Δ refers to differencing operator, t refers to time trend and ε refers to the error term. The non-rejection of the null hypothesis indicates that Y_t has unit root or non-stationary. On the other hand, the rejection of the null hypothesis indicates that Y_t is stationary.

Cointegration test can be performed if the time series variables are stationary and integrated in the same order or $I(1)$. The purpose of the cointegration test is to determine the existence of the long-run equilibrium between the parameters of interest. The Johansen and Juselius (1990) cointegration test is represented in Equation (2).

$$\Delta Z_t = \gamma + \Pi \Delta Z_{t-k} + \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \varepsilon_t \qquad (2)$$

where Z_t is column vector of stationary $I(1)$ variables, Γ and Π denote coefficients matrices, γ is constant, ε_t is error term and Δ is difference operator and k is the optimal lag length. If Π has zero rank, there is no stationary linear combination and this indicates that Z_t are not cointegrated. In contrast, if the rank r of Π is greater than zero, there is possible r stationary linear combinations. Π can be divided into two matrices, α and β where $\Pi = \alpha\beta'$. In detail, β consists of the r cointegration relationship and α denotes the necessary adjustment coefficient matrix.

Johansen and Juselius (1990) introduced two types of test statistics, which are trace statistics and maximum eigenvalue. In terms of trace statistic, the null hypothesis of r cointegrating vector while the alternative hypothesis of k cointegrating vector for $r = 0, 1, \ldots, k - 1$. The trace statistic test is computed as in Equation (3).

$$T_{trace} = -T \sum_{i}^{k} log(1 - \lambda_i) \qquad (3)$$

where T denotes the number of observation, k denotes the number of variables, λ_i is the i^{th} largest estimated eigenvalue.

The maximum eigenvalue statistic examines the null hypothesis of r cointegrating vector against alternative hypothesis of $r + 1$ cointegrating vector. The maximum eigenvalue statistic test is computed as in Equation (4).

$$\lambda_{max} = -T ln(1 - \lambda_{r+1}) \qquad (4)$$

where T refers the number of observation and λ_i is the i^{th} largest estimated eigenvalue.

The threshold regression model includes non-linear regression estimation and regime switching with the aim to capture the interaction between parameters of interest when the variables exceed certain unknown threshold level.

Following is the equation on the threshold regression approach:

$$Y_t = \beta X_t + \partial_1 X_t(\gamma) + \varepsilon_t \qquad if \ -\infty < \theta_t < \gamma_1 \qquad (5)$$

$$Y_t = \beta X_t + \partial_2 X_t(\gamma) + \varepsilon_t \qquad if \ \ \gamma_1 < \theta_t < \infty \qquad (6)$$

where Y_t = Gross Domestic Product per capita, X_t = Public debt as % of GDP, θ_t = Threshold variable

The coefficients of ∂_1 and ∂_2 reflect the interaction of the public debt on economic growth when the public debt is below and above the threshold level, respectively. In addition, budget balance expressed as percentage of GDP will be included in the model as control variable. The threshold level is determined by selecting the minimized sum of squared errors:

$$S_t(\beta, \partial, \gamma) = (Y - \beta X - \partial X_\gamma)'(Y - \beta X - \partial X_\gamma) \qquad (7)$$

where the least squares estimators, $\hat{\beta}, \hat{\partial}, \hat{\gamma}$ minimized the function $S_t(\beta, \partial, \gamma)$ and thus γ is restricted to a bounded set $[\underline{\gamma}, \overline{\gamma}]$. The interaction of the parameters of interest can be estimated based on different threshold levels as either above or below the respective levels.

4. Empirical Findings

It is important to confirm the stationarity of the time-series variables in the same order in the time-series analysis. Table 1 shows the unit root test results based on Augmented Dickey-Fuller (ADF) test. All the times series variables are non-stationary at the level since the null hypothesis of variable contain unit root cannot be rejected. This is due to the *t*-statistic values are negative and greater than the critical values. However, the null hypothesis can be rejected at first difference as the *t*-statistic values are negative and less than the critical values. This indicates that they are stationary at first difference. Since the variables are integrated with the same order and stationary at first difference, cointegration test can be performed in order to determine the existence of the long-run association between the GDP per capita and public debt. Table 3 depicts the result for the Johansen and Juselius Cointegration Test. Both the trace statistic and max-eigenvalue exceed their critical value at none cointegrated vector. This means that the null hypothesis of none cointegrated vector can be rejected. In contrast, both the trace statistic and max-eigenvalue are less than their critical value at most 1 and 2 cointegrated vectors. This shows that the null hypothesis of at most 1 and 2 cointegrated vectors cannot be rejected. Thus, we can conclude that there is a long-run association between parameter of interests.

Due to the existence of the long-run relationship between GDP per capita and public debt, we can proceed to estimate the implication of the public debt on economic growth based on Threshold Regression approach. This is important in terms of providing additional information regarding the heterogeneous impact of the public debt on economic growth when the public debt is above or below the certain threshold level. Table 3 indicates the results of the relationship between public debt and budget balance towards GDP per capita of Malaysia based on without threshold and with threshold perspectives. Public debt has a positive relationship with economic growth in the long-run. This result is inconsistent with the finding from Lee and Ng (2005) and may due to the frequencies of the data used where they used annually data while quarterly data are used in this study. However, the impact of the public debt becomes diverse when considering the different threshold levels. There is a positive impact of the public debt towards economic growth when the public debt is below around 41% of GDP threshold level. This means that the accumulation of the debt initially contributes positively to the growth via the need in financing the development projects. The effect of the public debt on growth reduces when the public debt is between around 41% and 53% of GDP threshold level. Nevertheless, there is an inverse relationship between public debt and economic growth when the public debt is above the 53% of GDP threshold level. This indicates that accumulation of the public debt beyond 53% of GDP threshold level may be harmful to economic growth.

Table 1: Unit Root Test Results

	Level		1st Difference	
	Trend & Intercept	Intercept	Trend & Intercept	Intercept
GDPPC	-2.435	-0.898	-4.024**	-4.047***
DEBT	-3.055	-2.032	-3.705**	-3.289**
BB	-2.337	-1.873	-2.795	2.807*

Notes: Asterisks *, ** and *** denote significance levels: 10%, 5% and 1%. GDPPC = logarithm GDP per capita, DEBT = logarithm gross government debt as % of GDP and BB = budget balance as % of GDP. Automatic lag selection by Schwarz Info Criterion (SIC).

Table 2: Johansen and Juselius Cointegration Test Result

Null	Alternative	Trace Statistic	Critical Value	Max-Eigen Value	Critical Value
r = 0	r = 1	35.344**	29.797	22.969**	21.132
r ≤ 1	r = 2	12.375	15.495	11.539	14.265
r ≤ 2	r = 3	0.836	3.8415	0.836	3.841

Notes: Asterisks *, ** and *** denote significance levels: 10%, 5% and 1%.

Table 3: Threshold Regression Results Based on Two Threshold Levels

Dependent Variable	Coefficients	Standard Error	Public Debt Threshold
Non-threshold:			
Debt	0.085*	0.045	-
Budget Balance	-0.057***	0.014	
Constant	1.919***	0.108	
With Threshold:			
Debt <40.74			**40.74**
Debt	0.392***	0.094	
Budget Balance	0.027***	0.012	
Constant	1.276***	0.204	
40.74<= Debt <53.16			**40.74; 53.16**
Debt	0.364***	0.089	
Budget Balance	-0.062***	0.011	
Constant	1.237***	0.216	
Debt =>53.16			**53.16**
Debt	-0.647***	0.164	
Budget Balance	-0.266***	0.034	
Constant	3.760***	0.454	

Notes: Gross Domestic Product per Capita as dependent variable. Asterisks *, ** and *** denote significance levels: 10%, 5% and 1%.

5. Conclusion

Although public debt is important to sustain economic growth, however, the association between the public debt and growth deserve attention due to the heterogeneous impact

depending on the different public debt threshold levels. In the case of Malaysia, there is positive relationship between public debt and economic growth when the public debt is below around 41% of GDP threshold level. In addition, the effects weaken when the public debt level is around 41% to 53% of GDP threshold levels. In contrast, there is an inverse association between public debt and economic growth when the public debt level exceeds around 53% of GDP threshold level. This means that the preliminary accumulation of the public debt leads to the growth of the economy. Nevertheless, additional debt will be harmful to the economic growth when the debt reaches the optimum level. This is essential to the policy maker in developing strategies as the impact of public debt on growth differ when the public debt is above or below certain threshold level.

In terms of policy perspective, managing optimal debt position is crucial for Malaysia in order to overcome the external economic uncertainties such as oil price fluctuation and fluctuation in the exchange rate. Besides, the quality of the debt deserve serious attention as the accumulation of the debt must be compensated with favorable yield in the future. Therefore, policy developed should monitor closely the public debt level in order to ensure optimal debt position and the quality of the debt.

Acknowledgement
Financial support from UNIMAS F01/SpGS/1415/16/16 is gratefully acknowledged. All remaining flaws are the responsibility of the authors.

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