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MODELING MALAYSIA DEBT THRESHOLD: DEBT COMPOSITION PERSPECTIVE

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ABSTRACT

This study intends to examine the effect of the debt on economic growth of Malaysia from the perspective of domestic debt and external debt. Furthermore, the impact of different type of debts on growth upon either above or below certain threshold level of the debt also investigated using Threshold regression method for sample period 1980-2015. Empirical findings indicate that the threshold level for domestic debt is approximately 37% of GDP while 4% of GDP for external debt. Initial domestic debt accumulation contributes positively to the economic growth of Malaysia when the domestic debt level is below the threshold level but becomes detrimental to economic growth when the debt level exceeds the threshold level. On the other hand, external debt has negative impact on the economic growth when the debt is below the external debt threshold and become positive when exceed the threshold level. In terms of policy recommendation, government has an uphill task in managing the debt at optimal level as different type of debts and levels of debt may have different impact on the economic growth.

Keywords: Debt; Threshold; Economic Growth.

1. INTRODUCTION

Malaysia as one of the fast-growing economy in the Southeast Asia region experienced challenging tasks in managing the increasing level of debts. This is due to the accumulation of debt is unavoidable for the purpose of acquiring capital for overcome the negative implication of the external economic shocks such as global financial crisis, fluctuation of the currency and volatility in the oil price. Figure 1 depicts the debt level of Malaysia from 1990 to 2015 which are expressed as percentage of GDP. There was a drastic reduction in the level of debt from 75% of GDP to 30% of GDP in 1990 and 1997 respectively. This was due to the significant development in the Southeast Asia region where most of the countries in the region, including Malaysia, act as Foreign Direct Investment (FDI) preference destination. The spillover effects of the FDI contributed to the economic growth of Malaysia and eventually reduce the debt dependency. However, there was an upsurge of the debt level since 1998, which is post Asian Financial crisis, with 34% of GDP and further increased to 50% of GDP in 2010. The upward trend resumed until 55% of GDP in 2015. In terms of debt composition, the aggregate debt comprises of domestic debt and external debt.

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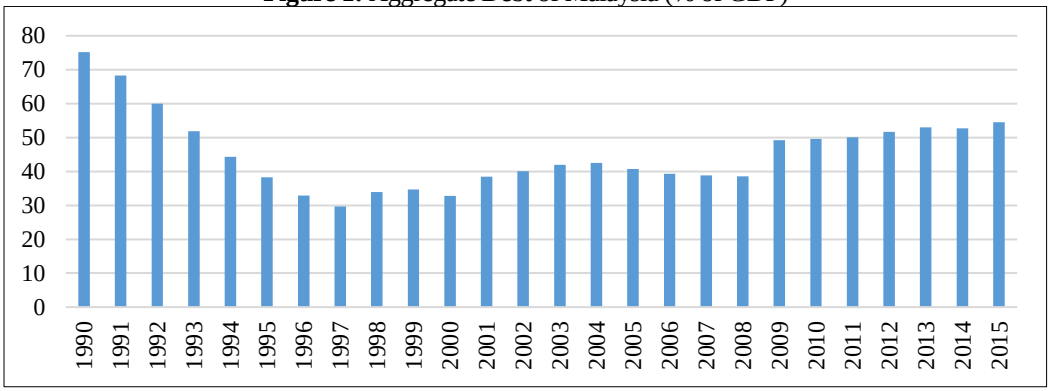
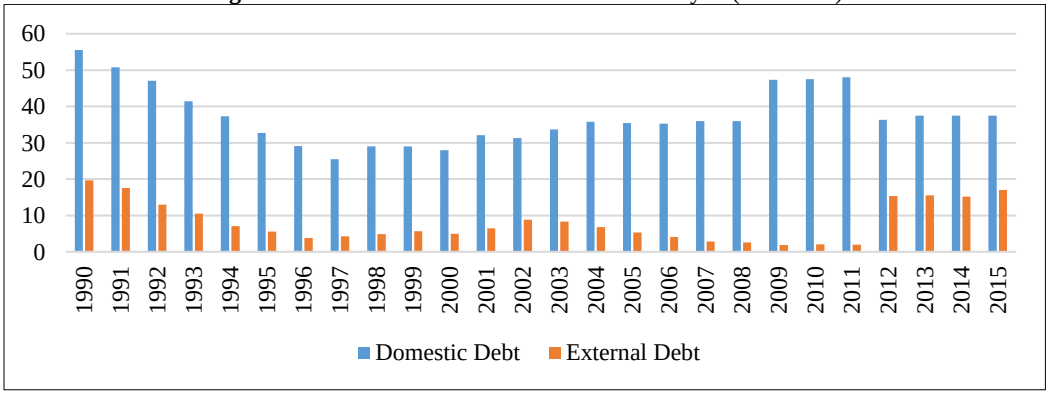
Malaysia aggregate debt composition is dominated by the domestic debt in relative to external debt. Figure 2 depicts the level of Malaysia domestic debt and external debt which are expressed as percentage of GDP. In 1990, Malaysia recorded domestic debt level of 55% of GDP and declined to 25% of GDP in 1997. Nevertheless, the domestic debt level began to increase since 1998 from 29% of GDP to 48% of GDP in 2011 and eventually recorded a slight reduction in 2015 with 37% of GDP. Meanwhile, the external debt level was at 19% of GDP in 1990 and showing downward trend and reached 4% of GDP in 1996. However, the external debt level portrayed increasing trend and reached 17% of GDP in 2015. This means that the external borrowing is rather low and most of the borrowing are domestic. This is a good indication as external debt may subject to unforeseen external factors and beyond the control of the government.

Figure 1: Aggregate Debt of Malaysia (% of GDP)



***Source*:** Central Bank of Malaysia

Figure 2: Domestic Debt and External Debt of Malaysia (% of GDP)



***Source*:** Central Bank of Malaysia

Therefore, this study intends to investigate the implication of the debt (domestic debt and external debt) towards economic growth of Malaysia by adopting Threshold regression method for sample period from 1980 to 2015. Instead of estimating the long-run impact of debt on growth, this study further capture the heterogeneous impacts of the debt towards economic growth based on different debt threshold levels. The debt threshold levels are determined endogenously utilizing the Bai and Perron (2003) approach.

Understanding the threshold level is critical to the policy makers as it provide significant guideline regarding the optimal level of the debts that a country should manage.

2. LITERATURE REVIEW

The debt-growth relationship is based on the debt overhang hypothesis. This hypothesis indicates that there will be no incentive for the country to adopt policies to generate growth to the country if the country experience high level of debt. The argument is that most of the income will be used to finance the debt payment interest (Clements, Bhattacharya & Nguyen, 2003). There are a number of literatures discuss the implication of the debt on economic growth in the long-run and the empirical findings are mixed. Despite the long-run implication of debt on growth, the effect of different levels of debt on economic growth also become prominent. The non-linearity of the debt on growth is related to the study by Reinhart and Rogoff (2010) where they discovered that there is a positive impact of debt to economic growth for both advanced and emerging markets countries. This condition only holds when the public debt level is below 90% of GDP. This means that debt will be detrimental to economic growth when the debt exceeds 90% of GDP level. Other studies such as Kumar and Woo (2010) also concluded existence of non-linearity of the relationship between debt and economic growth for advanced and emerging economies from 1970-2007. This means that high public debt level will be harmful to economic growth and the debt threshold is 90% of GDP. Baum, Checherita-Westphal and Rother (2013) examined the relationship between public debt and economic growth for 12 Euro Area countries from 1990 to 2010. Empirical findings indicated that there is short-run positive impact of debt on growth and the effect will become negative in the long-run when the debt exceeds the 67% threshold level. Most of the studies as shown conclude existence of different impact of debt on growth and depend on the level of the debt. This means that initial debt may contribute to the growth of a country. If the debt level exceeds certain level threshold, there will be negative impact of debt on economic growth of a country. However, Lof and Malinen (2014) found insignificant impact of the debt on growth for 20 developed countries using panel Vector Autoregressive (VAR) approach for data span from 1954 to 2008.

In the context of Malaysia, a few studies examine the impact of the debt (either public debt or external debt) on economic growth. Most of the studies focus on the long-run perspective and rather less study emphasize on the non-linearity perspective. For example, Choong, Lau, Liew and Puah (2010) investigated the association between the debts and economic growth of Malaysia from 1970 to 2006 using cointegration test and Granger causality test. In their study, various debt burden proxies are adopted such as long-term debt, short-term debt, external debt, public and publicly guaranteed debt and total debt service. Their empirical findings show that there is a negative association between the debt burden and economic growth in Malaysia. Meanwhile, Mohd Daud et al. (2013) investigated the implications of the external debt towards economic growth of Malaysia via Autoregressive Distributed Lag (ARDL) based on quarterly sample period from 1991 to 2009. Findings show that external debt has long-run impact on the economic growth. Furthermore, the effect of the external debt on growth initially contribute to the economic growth. However, there is a negative impact of the external debt on growth when the external debt exceeds certain threshold level. Recent study by Lee and Ng (2015) investigated the association between the public debt and economic growth of Malaysia for the sample period of 1991-2013. They concluded that the public debt has negative impact on the economic growth. Although there a several studies investigating the impact of the debt on growth of Malaysia, however, their focus mainly on the long-run impact and less on the threshold effects.

3. METHODOLOGY

This study utilizes annually data from the period of 1980-2015. The data used includes Gross Domestic Product, domestic debt and external debt as the main variables of the study. In addition, export and nominal exchange rate are included into the model as control variables. All the variables are obtained from World Economic Outlook, International Monetary Fund and Central Bank of Malaysia. Prior to estimation, the Augmented Dickey-Fuller (ADF) (1979) unit root test is employed to test the time series properties to evade spurious regression. Equation (1) indicates the equation for the ADF test.

$$\Delta Y_t = \beta_0 + \beta_1 t + \gamma_1 Y_{t-1} + \sum \gamma_{2j} \Delta Y_{t-j} + \varepsilon_t \,, \qquad (1)$$

where Y_t is variable of interest, Δ is to differencing operator, t is to time trend and ε is to the error term. The parameters to be estimated are β_0, β_1, γ_1 and γ_{2j} where the null and alternative hypotheses are as followed:

$$H_0: \gamma_1 \geq 0$$
$$H_A: \gamma_1 < 0$$

The decision rule of the stationarity is when the null hypothesis cannot be rejected, Y_t has unit root or non-stationary. Instead, when the null hypothesis can be rejected, Y_t is stationary.

Subsequently, Cointegration test can be performed if the time series variables are stationary after first-differencing, or *I*(1) with the aim to test for the existence of long-run equilibrium. The Johansen and Juselius (1990) cointegration test is shown 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 refers to the column vector of stationary *I*(1) variables, Γ and Π refers to the 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. Subsequently, Π can be separated into two matrices, α and β where $\Pi = \alpha\beta'$. In detail, β consists of the r cointegration relationship and α represents the necessary adjustment coefficient matrix.

Furthermore, there are two types of test statistics, specifically trace statistics and maximum eigenvalue in the Johansen and Juselius (1990). 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 null hypothesis of r cointegrating vector while the alternative hypothesis of k cointegrating vector for $r = 0, 1, \ldots, k-1$.

Meanwhile The maximum eigenvalue statistic test is shown in Equation (4):

$$\lambda_{max} = -Tln(1 - \lambda_{r+1}) \,, \qquad (4)$$

where T refers the number of observation and 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.

In terms of the threshold regression, the equations are shown in Equation (5) and (6):

$$Y_t = \alpha_1 + \beta_{11} X_t + \beta_{12} Z_t + \varepsilon_{1t} \qquad if\ X_t \leq \gamma \qquad (5)$$

$$Y_t = \alpha_2 + \beta_{21} X_t + \beta_{22} Z_t + \varepsilon_{2t} \qquad if\ \ X_t > \gamma \qquad (6)$$

where Y_t refers to the Gross Domestic Product, X_t refers to the Debt as % of GDP (domestic debt/external debt), Z_t refers to the control variables and γ is the threshold value. The threshold values are determined based on the minimization of the sum of squared errors across the estimated models (Bai and Perron, 2003).

4. RESULTS DISCUSSION

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. However, the null hypothesis can be rejected after first difference. This shows that all the time series variables are stationary after first difference. Since the variables are integrated with the same order and stationary after first difference, cointegration test can be implemented to examine the existence of the long-run equilibrium relationship between the economic growth and different type of debts. Table 2a and 2b show the result of the Johansen and Juselius Cointegration test for domestic debt with growth and external debt with growth, respectively. Both the trace statistic and max-eigenvalue exceed their critical value at three cointegrated vetors for domestic debt with growth model and single cointegrated vector for external debt with growth model. These mean that we have evidence to conclude that there are long-run equilibrium between the variables of interests.

Subsequently, we can proceed to estimate the effect of the domestic debt and external debt on economic growth via Threshold Regression method as shown in Table 3a and 3b. Since the main interest of this study is on the debt perspective, the result discussion will focus on the effect of domestic debt and external debt on economic growth of Malaysia. Table 3a portrays the results of the domestic debt on growth under two conditions; without and with threshold. There is a negative relationship between domestic debt and economic growth in the long-run. Under the threshold condition, we can observe that domestic debt has positive impact on economic growth when the debt level is below 37% of GDP. However, the impact become negative when the debt level is above 37% of GDP. Meanwhile, Table 3b shows the results of the external debt on growth under two conditions as well; without and with threshold. There is a negative relationship between external debt and economic growth in the long-run but is statistically insignificant. Under the threshold condition, the external debt has negative impact on growth when the debt level is below 4% of GDP, but is statistically insignificant. The impact become positive when the debt level is above 4% of GDP. This non-linearity results are consistent with previous studies such as Reinhart and Rogoff (2010), Kumar and Woo (2010), Baum et al. (2013), and specifically for Malaysia case such as Choong et al. (2010), Mohd Daud et al. (2013) and Lee and Ng (2015).

Table 1: ADF Unit Root Test Results

	Level		1st Difference	
	Trend & Intercept	**Intercept**	**Trend & Intercept**	**Intercept**
$LGDP$	-2.3753	-0.5086	-4.7172***	-4.8222***
$LDOMD$	-1.7960	-1.4384	-4.3317***	-4.4066***
$LEXTD$	-1.3668	-1.3367	-4.89057***	-4.8973***
$LEXP$	-3.0029	-4.2478***	-6.5062***	-6.6360***
EXC	-2.0876	-1.1204	-5.1969***	-5.3131***

Notes: Asterisks *, ** and *** denote significance levels: 10%, 5% and 1%. $LGDP$ = logarithm GDP, $LDOMD$ = logarithm domestic debt as % of GDP, $LEXTD$ = logarithm external debt as % of GDP, $LEXP$ = logarithm export debt as % of GDP and EXC = nominal exchange rate. Optimal lag is selected based on Schwarz Info Criterion (SIC).

Table 2a: Johansen and Juselius Cointegration Test Result: Domestic Debt View

Null	**Alternative**	**Trace Statistic**	**Critical Value**	**Max-Eigen Value**	**Critical Value**
r = 0	r = 1	93.5689**	47.8561	52.3047**	27.5843
r ≤ 1	r = 2	41.2643**	29.7971	22.0393**	21.1316
r ≤ 2	r = 3	19.2250**	15.49472	17.6213**	14.2646
r ≤ 3	r = 4	1.6038	3.8415	1.6038	3.8415

Note: Asterisk ** denotes rejection of the null hypothesis at 0.05 significance level.

Table 2b: Johansen and Juselius Cointegration Test Result: External Debt View

Null	**Alternative**	**Trace Statistic**	**Critical Value**	**Max-Eigen Value**	**Critical Value**
r = 0	r = 1	56.8010**	47.8561	28.0602**	27.5843
r ≤ 1	r = 2	28.7408	29.7971	15.2599	21.1316
r ≤ 2	r = 3	13.4809	15.4947	11.3482	14.2646
r ≤ 3	r = 4	2.1328	3.8415	2.1328	3.8415

Note: Asterisk ** denotes rejection of the null hypothesis at 0.05 significance level.

Table 3a: Threshold Regression Results: Domestic Debt and Growth Model

Independent Variable	**Coefficients**	**Standard Error**	**Domestic Debt Threshold**
Non-threshold:			
$LDOMD$	-3.6058**	1.5841	-
$LEXP$	-3.6353***	0.4167	
EXC	-2.0862***	0.6616	
# Observations		36	
With Threshold: Debt <37.41			**37.41%**
$LDOMD$	0.8293***	0.2963	
$LEXP$	-0.0395***	0.2211	
EXC	0.5712***	0.2057	
# Observations		19	
With Threshold: Debt ≥37.41			**37.41%**
$LDOMD$	-0.7479***	0.197629	
$LEXP$	0.1239**	0.066142	
EXC	2.4603***	0.230568	
# Observations		17	

Notes: Asterisks *, ** and *** denote significance levels: 10%, 5% and 1%, respectively. $LGDP$ = logarithm GDP as dependent variable, $LDOMD$ = logarithm domestic debt as % of GDP, $LEXTD$ = logarithm external debt as % of GDP, $LEXP$ = logarithm export debt as % of GDP and EXC = nominal exchange rate.

Table 3b: Threshold Regression Results: External Debt and Growth Model

Independent Variable	Coefficients	Standard Error	External Debt Threshold
Non-threshold:			
$LEXTD$	-4.2209	0.9826	-
$LEXP$	4.4498***	1.0888	
EXC	- 4.6208***	1.1619	
# Observations		36	
With Threshold: Debt <4%			**4%**
$LEXTD$	-0.2614	0.2345	
$LEXP$	0.2641	0.0527	
EXC	1.6019	0.0599	
# Observations		6	
With Threshold: Debt ≥4%			**4%**
$LEXTD$	0.2667*	0.1409	
$LEXP$	0.0017	0.2030	
EXC	1.1910***	0.1209	
# Observations		30	

Notes: Asterisks *, ** and *** denote significance levels: 10%, 5% and 1%, respectively. $LGDP$ = logarithm GDP as dependent variable, $LEXTD$ = logarithm domestic debt as % of GDP, $LEXTD$ = logarithm external debt as % of GDP, $LEXP$ = logarithm export debt as % of GDP and EXC = nominal exchange rate.

5. CONCLUSION

This study intends to investigate the implication of the debt on economic growth of Malaysia based on domestic debt and external debt. Despite the long-run implication, effect of the different type of debt on growth also important as the effect may differ upon either above or below certain threshold level of the debt. Threshold regression method is adopted to capture the effect of the debt on growth based on threshold level. Empirical results indicate that debt has significant impact on the economic growth. Specifically, under the debt threshold condition of 37% of GDP, there is a positive impact of domestic debt on growth when the domestic debt level is below the threshold level. The impact becomes negative when the domestic debt is above the threshold level. This means that initial accumulation of domestic debt will contribute positively to the economic growth of Malaysia when the debt level is below 37% of GDP. However, the domestic debt may be detrimental to the growth when the debt level is above the 37% of GDP level. This is due to the needs of the domestic debt in temporary stimulating the economic growth as capital for development purpose. If the accumulation of the domestic debt is becoming larger, then the country will be burdened by the obligation to finance the debt interest repayment. In terms of the external debt, the threshold level is 4% of GDP. Initial external debt or when it is below the threshold level, there is a negative impact of debt on growth. The implication become positive when the debt is above the 4% of GDP level. In this case, the accumulation of external debt can contribute to the economic growth but the external debt level of Malaysia is considered at low level compared to domestic debt. Therefore, the effect of external debt is at marginal level.

In terms of policy recommendation, government has an uphill task in managing the debt at optimal level. This is due to the different type of debts and different levels of debt may have different impact on the economic growth. Understanding the threshold level enable the policy makers to be cautious regarding the level of debt as either can be considered high level or low level. If the debt level is considered high level, the government will take necessary strategies to reduce the growth rate of the debt accumulation.

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