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The Real Effect of Government Debt: Evidence from the Malaysian Economy

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The results demonstrate that there is a long-run relationship between federal government debt and economic growth in Malaysia. In addition, our findings are of great interest since there is evidence of a non-linear relationship between the federal government debt and economic growth, which suggests the optimal level of debt that the government should hold. Hence, the accumulation of federal government debt is positively associated with Malaysia's economic growth up to an optimal level. While an additional increase in federal government debt beyond the optimal level has inversely contributed to the Malaysian economy.

1. Introduction

There are several lessons to be learnt from the recent sovereign debt crisis that has affected most of the European economies. A rise in public debt and country-specific problems are among the factors behind the European Financial Crisis. Ireland is facing a banking crisis while Spain is experiencing a housing bubble. In addition, Greece, Italy and Portugal are involved in fiscal mismanagement. Thus, they have drawn their economies into sovereign debt crises and are still in the process of recovery four years after the crisis erupted in 2008. On the other hand, current development shows that Japan, Greece, Italy, Portugal and Ireland are among the top-listed countries with very high levels of public debt (IMF 2012). As at the end of 2011, Japan held a public debt of about 229.77 per cent of gross domestic product (GDP) and this was expected to hit almost 240 per cent of its growth. In addition, Greece, Italy, Portugal and Ireland held public debts (as percentages of GDP) of about 160.81 per cent, 120.11 per cent, 106.79 per cent and 104.95 per cent respectively. Furthermore, in response to this issue, the Organisation for Economic Cooperation and Development (OECD) has

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called on countries to cut their public debts to prudent levels of around 50 per cent of GDP in order to cope with future challenges including health, long-term care and pensions.[2]

Looking at the roots of the problem, it can be seen that persistent large deficits, used primarily to finance public sector operating expenses, have resulted in high ratios of debt to GDP, thus driving Greece and other European countries into debt overhang problems. In the midst of this phenomenon, some developing countries are showing signs or symptoms of the debt overhang problem; this highlights the question of whether government debt has benefited economies (Cecchetti, Mohanty and Zampolli 2011; Baum, Checherita-Westphal and Rother 2012; Presbitero 2010; Caner, Grennes and Koehler-Geib 2010). Thus has underlined the urgency of investigating the issue of the heavy stock of public debt in developing economies, since neither developed nor developing countries are immune to the public debt sustainability issue.

Malaysia, a small open economy, has recorded a fiscal deficit position since its independence in 1957 except for the period 1993-1997. Furthermore, the country has recorded 13 consecutive years of fiscal deficits since the year 1997. This condition was leading Malaysia to accumulate a stock of indebtedness regardless of domestic or international capital markets since, by continuing to run budget deficits, the country would have a high stock of debt (as depicted in Appendix 1). In addition, the federal government debt was financed from domestic and foreign funding, which constituted approximately 96.2 per cent and 3.8 per cent of the gross borrowing respectively.[3] As at the end of 2011, total federal government debt was recorded at RM 455,745 million, which is equivalent to 53.8 per cent of Gross Domestic Product (GDP) (Malaysia Economic Planning Unit 2011). This position has already been reached and is slightly higher than the prudent cut-off point of public debt-holding that has been set for developed economies. However, no one size fits all. This highlighted the importance of

[2] Furthermore, the European Union has set a ceiling for public debt at 60 per cent of GDP. By the same token, OECD highlights the importance of macro prudential supervision on an individual-country basis.

[3] Meanwhile, the federal government financing came mainly from domestic sources through the issuance of Malaysian Government Securities (MGS) and Government Investment Issues (GIIs) where the major shareholders were Employee Provident Fund (EPF), foreign investors, banking institutions and insurance companies.

analysis on a country-by-country basis before it was too late and the country had already passed its optimal level, becoming trapped in a debt overhang situation, being in default and, to a lesser extent, witnessing the eruption of a sovereign debt crisis.

In principle, if borrowing has been allocated efficiently, a country will benefit from it since debt financing of public spending can make a positive contribution to productive investment and ultimately to economic growth (Miller and Foster 2012). In contrast, a country with high levels of debt will face the probability of a debt overhang problem, to a lesser extent, or default or bankruptcy. As such, the increasing level of government indebtedness raises the issue of the effectiveness of the fiscal policy formulated by the government. Furthermore, it leads to the issue of whether the borrowing is efficiently and productively allocated to the economy through development projects which in return will generate sustainable economic growth.[4]

A country that accumulates large stock of debt and could affect the ability to repay its debts is more likely involved in a debt overhang situation. There is limited study conducted to investigate the effect of debt overhang on various economies. Recent study conducted by Reinhart et al. 2012, identify 26 public debt overhang episodes in 22 advanced economies since the early 1800s. The study found that growth effects are significant even in the many episodes where debtor countries were able to secure continual access to capital markets at relatively low real interest rates. On the other spectrum, Brown and Lane (2011) conduct a study to assess the effect of debt overhang to economic activity in Emerging Europe countries. Debt overhang could be a threat to activity in the tradable sector in the more advanced economies of the region. In addition, the debt overhang emerge at different levels of indebtedness depending on the country characteristics namely institution, policies and

[4] The highest deficit was recorded in 2009 and was due to the global economic slowdown as the external sector collapsed and the business community remained cautious and risk-averse. Weak private investment, sluggish exports performance and higher expenditure incurred are due to the implementation of the stimulus packages, resulting in a weak financial position in the fiscal position (Malaysia Economic Planning Unit 2009).

access to private capital (Cordella et al. 2005). Sound institutions can probably affect the ability to service debt in times of crisis. As such, with limited but growing study, the effect of debt overhang situation might differ depending on the economies.

As a consequence, the increasing level of the stock of government debt has raised concerns and leads to the question of whether a country with high levels of government debt is still sustainable. Furthermore, this problem could threaten the developing economies, especially their banking sectors, in the event of sovereign debt crises. Thus, this situation has intensified interest and drawn attention to the long-lasting implications of policy action for the country's government debt position. A real picture of Malaysia's public debt position is important for policy formulation as well as for investors' ability to strategize their investment decisions. Considering the growth in the literature on developed countries, an attempt to investigate Malaysia's public debt position is feasible since, as a small open economy, Malaysia also faces a high risk of vulnerability and uncertainty in its economy. Focusing on a long-horizon return, the objective of this paper is to analyze the real effect of government debt on Malaysia's economy. This study is a contribution to the literature on the Malaysian government's debt position after a long episode of fiscal deficits. Thus, this study attempts to fill this gap in the literature. The paper is laid out as follows. Section II offers a brief overview of the literature on external debt. Section III outlines the data and methodology, while the empirical results are presented in section IV. Section V concludes the paper.

2. Theoretical and empirical evidence

Over the past decades, academics and policy-makers have shown a consistent interest in investigating and developing the theory on the link between debt and economic growth. However, a limited but growing number of studies have been examining the role of public debt in a country's economic growth.[5] The discussion on the impact of public debt on a country's growth has produced a single conclusion on the adverse impact of public debt on growth (Modigliani 1961; Adam and Bevan 2005; Aizenman et al. 2007). Based on the aggregate model

[5] On the other hand, there is a vast amount of literature focusing on the impact of external debt in generating countries' economic growth.

developed by Modigliani (1961), the accumulation of government debt will have a positive impact on growth if the increase in debt is accompanied by government expenditure on productive public capital formation. In other words, the debt will benefit the economy if it is capable of generating a stream of real income for future generations and vice versa (Modigliani 1961). In addition, Modigliani stated that holding too much public debt will affect the country through the crowding-out effect, which will lead to the debt overhang problem, as explained by Krugman (1988). On the other hand, by setting up a simple overlapping generation (OLG) model of savings, Adam and Bevan (2005) found evidence of interactive effects between deficits and debt stock, with high debt stock exacerbating the adverse consequences of high deficits. Furthermore, the fiscal deficits would be growth-enhancing if financed by limited seigniorage, growth-inhibiting if financed by domestic debt, and have an opposite flow and stock effect if financed by external loans. In addition, Aizenman et al. (2007) examined the optimal public investment and fiscal policy for countries subject to binding on tax and debt capacities. They found that the public debt-to-GDP ratio should be held constant in the economy, adding that public sector borrowing to finance the accumulation of public capital goods may allow the economy to reach a long-run optimal growth path faster (Aizenman et al. 2007).

Several empirical works have focused on the impact of public debt on a country's economic growth, while proposing a non-linear analysis (Reinhart and Rogoff 2010; Pattillo 2004; Baum et al. 2012; Cecchetti et al. 2012; Presbitero 2010; Schclarek 2004). Most of the literature found that the tipping point of government debt should be held at around 64 per cent to 100 per cent of GDP depending on the size and the development stage of the economy. In particular, Reinhart and Rogoff (2010) conducted a study on 20 developed countries over the period 1790-2009 to investigate the relationship between public debt and long-term real GDP growth. The findings suggest that the relationship between public debt and economic growth is relatively weak below the threshold of 90 per cent of GDP; however, above the 90 per cent level the median growth rate falls by one per cent. By the same token, Checherita and Rother (2010) examined the impact of government debt on economic growth in twelve Euro-area countries for a period spanning about 40 years from 1970 and found a non-linear impact of debt with 90 to 100 per cent of GDP estimated as the optimal level. On the other

hand, recent studies conducted for almost the same sample, for the period 1990-2010, suggest that the short-run impact of debt on growth is positively and statistically significant up to 67 per cent debt to GDP (Baum et al. 2012). Meanwhile, according to Baum et al. (2012), beyond the limits the positive impact of government debt decreases to around zero and loses its significant impact on economic growth. However, no robust evidence on the relationship between government debt and economic growth has been found for 24 industrial countries (Schclarek 2004). In addition, results from a dataset of 18 OECD countries over the period 1980-2010 support the view that, beyond 85 per cent debt to GDP, debt is a drag on growth (Cecchetti et al. 2012). Meanwhile, Presbitero (2010) complemented the existing studies by focusing on the developing countries. Over the period 1990-2007, the results show that public debt has a negative impact on output growth up to a threshold of 90 per cent of GDP; beyond this level, its effect becomes irrelevant. An interesting study by Caner et al. (2010) estimates the threshold debt levels based on annual datasets of 101 developing and developing countries from 1980 to 2008. The results established a threshold of 77 per cent public debt-to-GDP ratio. Beyond the threshold level, each additional percentage point of debt costs 0.017 percentage points of annual real growth. In addition, results for a sample of emerging economies are even more pronounced with the estimated thresholds found to be at 64 per cent debt-to-GDP ratio; above the threshold level each additional percentage point of public debt amounts to 0.02 percentage points. Thus, inspired by the notion that no one size fits all, this paper will contribute to the literature by focusing on an individual developing country, namely Malaysia.

3. Model, Method and Data

A detailed analysis of the effect of federal government debt on Malaysia's economic growth will provide evidence on the real scenario of Malaysia's federal government debt position. In addition, with the application of several econometric procedures, the optimal level of public debt that the country should hold will be estimated. Thus, to investigate whether the federal government has contributed to economic growth, the basic growth model to be estimated is

$$Y_t = \beta_0 + X_t'\beta + \varepsilon_t \qquad (1)$$

where Y is the dependent variable, X is k-vector of regressors, and the subscripts t =1,….,T identify the time dimensions. Y represents the real GDP per capita and X includes investment rate, labour force rate and federal government debt, while ε_t represent the error term. The real GDP per capita (dependent variable) is a proxy of economic growth. In addition, the independent variables include investment rate, labour force rate and federal government debt to represent the rates of growth of factor inputs in the production function, and openness captures for government policy. This paper also estimates the direct link between federal government debt and investment rate to provide an additional insight into the effect of federal government debt on economic growth via capital accumulation. The estimated investment model is

$$I_t = \varphi_0 + X_t'\beta + \varepsilon_t \qquad (2)$$

I represents the investment rate while X is labour force, openness and federal government debt. The investment rate represents the growth of the economy, labour force rate and federal government debt represent the rates of growth of factor inputs in the production function, and openness represents the government policy. Since the observations are on a quarterly basis, for the maximum order of the lags in the ARDL model, a lag order of 4 is chosen.

The procedure starts with the Ordinary Least Squares estimation as a benchmark for the analysis. Next, the analysis proceeds with the cointegration tests. The Autoregressive Distributed Lag (ARDL) cointegration bound test developed by Pesaran et al. (2001) will be employed. The bound test developed by Pesaran et al. (2001) is the Wald test (F-statistic version of the bound testing approaches) for the lagged level variables in the right-hand side of an Unrestricted Error Correction Model (UECM). This procedure involved two stages before the long-run relationship could be established. In addition, the null hypothesis of a non-cointegrating relation (H_o: $\delta_1 = \delta_2 = \delta_3 = \ldots = \delta_n = 0$) is tested by performing a joint significance test on the lagged level variables. The first stage of the ARDL approach involved the F-test in which the asymptotic distribution of the F-statistic is non-standard under the null hypothesis of no cointegrating relationship between the examined variables, irrespective of whether the explanatory variables

are purely I(0) or I(1). Under the conventional levels of significance such as 10 per cent, 5 per cent and 1 per cent, if the statistic from a Wald test falls outside the critical bounds value (lower and upper values), a conclusive inference can be made without considering the order of integration of the explanatory variables. If the F-statistic exceeds the upper critical bound, the null hypothesis of no cointegrating relationship can be rejected. However, if the test statistic (F-statistic) falls below the lower critical bound, then the null of non-cointegration cannot be rejected. If the F-statistic falls between the upper and lower bounds, a conclusive inference cannot be made. Next, the second stage of the ARDL approach involves an estimation of the coefficients on the long-run cointegrating relationship and the corresponding error correction model. The lagged error correction term (e_{t-1}) derived from the error correction model is an important element in the dynamics of the cointegrated system as it allows for adjustment back to the long-term equilibrium relationship given a deviation from the last year.

In addition, in order to gather as much as information as possible on the effect of the federal government debt on Malaysia's economic growth, this paper also employs a causality test which is an extension of the Granger causality test that applies the bootstrapping method with endogenous lag length proposed by Hacker and Hatemi-J (2010). The causal relationship between federal government debt and other economic variables will provide evidence on the impact of federal government debt on the economy. As such, this analysis should at least provide some indication of the impact of the current implemented policy. A standard Granger causality test on the first difference is performed to find the direction of causality. The Granger test is performed on

$$\Delta FGD = \sum_{i=1}^{n} \delta_i \Delta FGD_{t-1} + \sum \lambda_i \Delta GDP_{t-i} + \omega \tag{3}$$

$$\Delta GDP = \sum_{i=1}^{n} \alpha_i \Delta GDP_{t-1} + \sum \beta_i \Delta FGD_{t-i} + \varepsilon \tag{4}$$

$$\Delta DEF = \sum_{i=1}^{n} \delta_i \Delta DEF_{t-1} + \sum \lambda_i \Delta GDP_{t-i} + \omega \tag{5}$$

$$\Delta GDP = \sum_{i=1}^{n} \alpha_i \Delta GDP_{t-1} + \sum \beta_i \Delta DEF_{t-i} + \varepsilon \quad (6)$$

$$\Delta INV = \sum_{i=1}^{n} \alpha_i \Delta INV_{t-1} + \sum \beta_i \Delta FGD_{t-i} + \varepsilon \quad (7)$$

$$\Delta FGD = \sum_{i=1}^{n} \delta_i \Delta FGD_{t-1} + \sum \lambda_i \Delta INV_{t-i} + \omega \quad (8)$$

$$\Delta INV = \sum_{i=1}^{n} \delta_i \Delta INV_{t-1} + \sum \lambda_i \Delta DEF_{t-i} + \omega \quad (9)$$

$$\Delta DEF = \sum_{i=1}^{n} \alpha_i \Delta DEF_{t-1} + \sum \beta_i \Delta INV_{t-i} + \varepsilon \quad (10)$$

where GDP represents the real GDP per capita and FGD signifies the federal government debt. In addition, the INV and DEF represent the investment rate and federal government deficits respectively. In standard procedure when applying the Granger causality test, the lag length is assumed to be known beforehand where the preselection of the lag order may affect the distribution of the test statistics. Thus, Hacker and Hatemi-J (2010) suggests endogenously determining the lag length choice including the use of the bootstrapping method. Furthermore, the bootstrapping method appears to have better size properties, seems to be robust to the existence of autoregressive conditional heteroscedasticity (ARCH), and appears to have more power compared to the asymptotic test for the same actual size (Hacker and Hatemi-J 2010).[6]

Next, this paper employs the test proposed by Hansen (2000) which tests the null hypothesis of a linear regression against a threshold regression analysis. In the form of the thresholds model,

$$y_t = \beta_1' x_t + \mu_t \qquad q_t \leq \gamma \quad (11)$$

$$y_t = \beta_2' x_t + \mu_{ti} \qquad q_t > \gamma \quad (12)$$

[6] Thanks to Professor Abdulnasser Hatemi-J and Scott Hacker for the GAUSS routine.

where q_t is the threshold variable, which is federal government debt. In addition, the threshold variable could be part of the regressors and it is used to split the sample into two regimes. Meanwhile y_t is economic growth measured by real GDP per capita. x_t is $p \times 1$ vector of independent variables which include investment rate, openness and federal government debt, and μ_t is a regression error.

Hansen (2000) has developed a threshold model estimator that considers the least squares estimations. Furthermore, by providing an asymptotic simulation test of the null of linearity against the alternative of a threshold, this method also computed a confidence interval by inverting the likelihood ratio statistics. Hansen (2000) also proposes an F-test bootstrap (heteroscedasticity-consistent) procedure to test the null of linearity. Since the threshold value γ is not identified under the null, the p-values are computed by a fixed bootstrap method. The sample consists of economics data from the period 1996Q1-2011Q4. The data are collected from the IMF/IFS statistics and the Monthly Bulletin of the Central Bank of Malaysia. Details of the variables are attached in Appendix 5.

4. Results and discussion

4.1 Descriptive analysis

Table 1 provides descriptive statistics on the main variables employed in this study. The variables include real GDP per capita, labour force, investment, openness, federal government debt and federal government expenditure. The descriptive statistics consist of mean, standard deviation, maximum values and minimum values. Table 1 shows that there are substantial variations for all variables. The real GDP per capita ranges from RM2,785 to RM7,090 with a mean value of RM4,454. In addition, the labour force and investment show small variations with lower values of standard deviation, which indicates the dispersion from the mean. Meanwhile the openness variable ranges from RM95,889 to RM330,817, with a mean of RM206,075. By the same token, with a significant variation indicated by its standard deviation of RM108,776, the mean value of federal government debt is RM210,478.

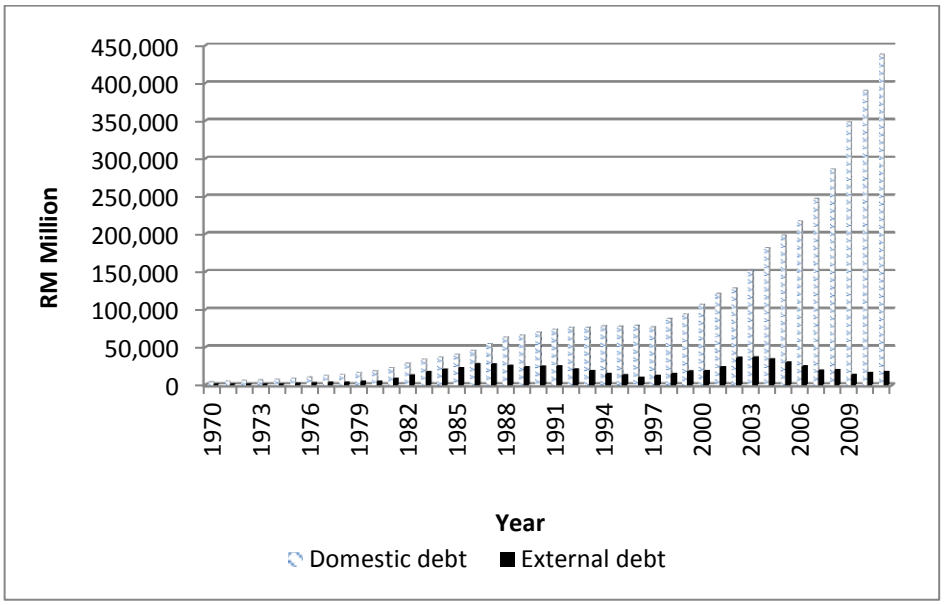
Table 1. Descriptive Statistics

	Mean	Standard Deviation	Min	Max
Real GDP per capita	4,454	1,110	2,785	7,090
Labour force	10,253	1,095	8,469	12,730
Investment	27,075	5,988	15,189	39,019
Openness	206,238	71,614	95,889	330,817
Federal government debt	210,478	108,776	83,533	456,127

Note: All figures are in RM Million.

The investigation starts by analyzing the composition of Malaysia's government debt. Figure 1 shows the composition of federal government debt over the period 1970-2012. The figure shows a stable pattern with the domestic debt accounting for about 85 per cent of total federal government debt in 1970, increasing to 96 per cent in 2011. In addition, the borrowing is funded from domestic financial institutions in Malaysia, including banks, financial institutions and social security institutions.

Figure 1. The composition of Malaysia Federal Government Debt



In addition, about 63 per cent and 25 per cent are in the form of government securities and government investment issues (GII's) respectively (as at the end of 2011). Furthermore, the maturity of the government debt is mainly seen over the maturity periods of 6 to 10 years and 4 to 5 years, covering 38 per cent and 29 per cent respectively of the total government securities debt.

4.2 Empirical analysis

The empirical analysis of this paper starts by estimating a standard ordinary least squares test on the standard baseline debt-growth model to establish a reference point. The results are shown in Table 2. By following the general-to-specific methodology, the results show an estimation of a model where the real GDP per capita and investment signify the economic growth. The estimated model of real GDP per capita as the dependent variable is shown in columns (1) to (5), while columns (6) to (10) show the results of the estimates where investment proxy is the dependent variable. The results in columns (1), (2) and (3) show an insignificant effect of federal government debt on the country's economic growth (which is proxied by the real GDP per capita as the dependent variable). However, estimates that only consider federal government debt as the independent variable reveal a positive and significant effect (at 5 per cent significance level) on the country's economic growth.

On the other hand, with the investment rate variable representing the country's growth, there are positive and significant (at 5 per cent significance level) effects of federal government debt on the country's growth, as depicted in columns (6), (7) and (10). Meanwhile, the results also reveal a positive and significant (at 5 per cent significance level) effect of trade openness in explaining Malaysia's economic growth, as shown in columns (1) to (3). In addition, we try to include the federal government debt squared in columns (3) and (8) to investigate the potential of the non-linear effect or debt-Laffer curve relationship. Columns (3) and (8) demonstrate that the federal government debt has a significant effect on the country's economic growth. In addition, the federal government debt ^2 variable is significant at 5 per cent significance level, with a negative effect on the growth rate of the country's income. This may implies evidence of an inverted-U-shaped relationship in the federal government debt-growth model. The inverted-

U relationship explains that an increase in debt stock has a positive effect on economic growth until it achieves its optimal level (up to a certain level). Beyond the threshold level, an increase in the stock of indebtedness is associated with a negative effect on economic growth. The negative effect could be related in cases where it has not been efficiently allocated to investment and if there is too much debt-holding that might squeeze the investment through debt repayment. In contrast, the results show that the federal government deficit plays an insignificant role in explaining the variability in economic growth. However, these results should be interpreted with caution since the diagnostic test shows a sign of bias where the results may be suffering from major econometrics problems including serial correlation, functional form and heteroscedasticity problems.

We proceed by estimating equations (1) and (2) with cointegration technique to examine the long-run cointegration relationship between economic growth and federal government debt with the inclusion of other explanatory variables.

Table 2. Results Of Ordinary Least Squares Estimation on the Impact of Federal Government Debt and Deficits to the Economy

	Real GDP Per Capita as the Dependent Variable					**Investment as the Dependent Variable**				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ln (Investment)	0.234 (0.059)*	0.279 (0.058)*	0.215 (0.060)*	0.3100 (0.057)*						
ln (Labour)	-1.321 (0.475)8	-1.318 (0.472)*	-0.850 (0.483)**	-0.674 (0.257)*		-1.189 (1.046)	-1.233 (1.049)	0.155 (1.051)	0.771 (0.573)	
ln (Trade Openness)	0.611 (0.080)*	0.610 (0.079)*	0.546 (0.079)*	0.668 (0.073)		0.010 (0.178)	0.017 (0.178)	-0.148 (0.172)	0.191 (0.163)	
ln (Federal government debt)	0.179 (0.111)	0.173 (0.111)	0.175 (0.105)		0.408 (0.035)*	0.527 (0.238)*	0.519 (0.239)*	0.413 (0.222)		0.286 (0.049)*
ln (Federal government debt ^2)			-0.004 (0.001)*					-0.010 (0.003)*		
Federal government deficits	-0.000 (0.000)			-0.000 (0.000)		0.000 (0.000)			0.000 (0.000)	
Intercept	8.062 (3.333)*	8.046 (3.313)*	5.312 (3.319)	3.310 (1.571)*	3.4217 (0.365)	14.618 (7.162)*	15.053 (7.179)*	5.671 (7.183)	0.721 (3.555)	6.711 (0.605)
No of observations	64	64	64	64	64	64	64	64	64	64
Adjusted R-Squared	0.895	0.896	0.905	0.892	0.744	0.408	0.404	0.492	0.370	0.409
	Diagnostic test									
Serial Correlation $\chi^2(4)$	41.647*	41.297*	40.066*	42.854*	46.908*	47.261*	46.140*	40.730*	48.647*	46.353*
Functional Form $\chi^2(1)$	0.306	0.368	0.745	0.102	17.204*	3.673**	6.437*	0.359	10.298*	4.033*
Heteroscedasticity $\chi^2(1)$	11.016*	11.127*	8.778*	9.115*	23.983*	12.474*	13.536*	6.299*	21.999*	16.029*

Notes: * and ** denote significant at 5 and 10 per cent significance levels. Numbers in brackets represent the robust standard error. The serial correlation test is based on Lagrange multiplier test of residual serial correlation, the functional form test is based on Ramsey's test, and the heteroscedasticity test is based on the regression of squared residuals on squared fitted value.

A maximum lag of 4 (since our data involved a quarterly series) is imposed for both specifications with real GDP per capita and investment as the dependent variables. Results of the F-test are presented in Table 3, where the real GDP per capita is the dependent variable, and the computed F-statistics exceed the critical bound (at the 5 per cent significance level) described by Pesaran et al. (2001) at a lag length of 3 for both estimated models (Model 1 only includes federal government debt as the independent variable and model 2 includes other explanatory variables). However, with the critical values provided by Narayan (2004), which are robust for a small sample size, the computed F-statistics exceed the critical bound (at the 5 per cent significance level) at lag lengths of 3 and 4, implying a rejection of the null hypothesis of no cointegration on the two estimated models.

Table 3. Long- Run Cointegration Test

	Real GDP per capita as dependent variable		**Investment as dependent variable**	
	Model 1	Model 2	Model 3	Model 4
Independent variable (s)	Federal government debt	investment, labour force, trade penness and federal government debt	federal government	labour force, trade penness and federal government debt
F-statistic of bound test Lag 1 Lag 2 Lag 3 Lag 4	3.581 5.640 7.609* 4.342*	1.926 3.288 4.184* 2.721*	1.172 1.482 2.783 2.429	4.192* 6.064* 5.236* 6.421*
Pesaran et al. (2001) critical values 5 per cent 10 per cent	(4.934,5.764) (4.042,4.788)	(2.850,4.049) (2.425,3.574)	(4.934,5.764) (4.042,4.788)	(2.850,4.049) (2.425,3.574)
Narayan (2004) critical values 5 percent 10 percent	(3.803,4.363) (3.127,3.650)	(2.743,3.792) (2.323, 3.273)	(3.803,4.363) (3.127,3.650)	(2.962,3.910) (2.496,3.346)

Notes: * and ** denote significant at 5 and 10 per cent significance levels.

On the other hand, the computed F-statistics exceed the critical bounds of Pesaran et al. (2001) and Narayan (2004) at the 5 per cent significance level for model 4 where investment is the dependent

variable with the inclusion of labour force, trade openness and federal government debt as the independent variables. This suggests a rejection of the null hypothesis of no cointegration on the estimated model. Once a long-run cointegration relationship has been established, we proceed to the coefficients of the estimated model, which are revealed in Table 4. In model 1, the federal government debt is found to have a positive and significant (at 5 per cent significance level) effect in explaining the variation in the country's economic growth. However, the robustness test indicates that the estimated model would be able to reject the null of no serial correlation and heteroscedasticity, thus suggesting that the estimation is biased and inefficient.

Table 4. Results of Cointegration Tests Between Gowth and Federal Government Debt

***ln*(Real GDP per capita) as dependent variable**	**Model 1 ARDL (1,0)**	**Model 2 ARDL (1,1,0,4,0)**
ln (Investment)		0.312 (0.136)*
ln (Labour)		-0.847 (1.179)
ln (Trade Openness)		1.279 (0.330)*
ln (Federal government debt)	0.316 (0.147)*	-0.424 (0.377)
Intercept	4.597 (1.805)*	2.650 (8.676)
Error correction term	-0.122 (0.070)**	-0.232 (0.078)*
	Diagnostic test	
Serial Correlation $\chi^2(4)$	15.247*	5.577
Functional Form $\chi^2(1)$	1.500	0.030
Heteroscedasticity $\chi^2(1)$	3.589**	0.066
No of observations	64	64
Adjusted R-Squared	0.922	0.658

Notes: * and ** denote significant at 5 and 10 per cent significance levels. Numbers in brackets represent the robust standard error. The critical values are provided by Pesaran et al. (2001), unrestricted intercept and no trend. All models include intercept in the estimation. The null hypothesis of F-test is no long-run relationship. Numbers in brackets represent the standard error. The ARDL model is selected based on Schwarz Bayesian Criterion (SBC). The serial correlation test is based on Lagrange multiplier test of residual serial correlation, the functional form test is based on Ramsey's test, and the heteroscedasticity test is based on the regression of squared residuals on squared fitted value.

Meanwhile, despite the significant role of investment and trade openness in explaining the country's economic growth in model 2, there is no evidence to support the role of federal government debt in the country's economic growth. In addition, this model best represents the real scenario of Malaysia since none of the test statistics could reject the null of no serial correlation, functional form and heteroscedasticity in the model, hence suggesting that the estimation analysis is unbiased and efficient. The error correction term coefficient is estimated at -0.122 and -0.232 for model 1 and model 2 respectively, is statistically significant, and has the correct sign, ensuring that the long-run equilibrium is attainable. This suggests that economic growth is adjusting in a slow phase, ranging from about 12.2 per cent to 23.2 per cent changes in the explanatory variables before reaching its equilibrium.

To provide an in-depth investigation of the role of federal government debt in the country's economic growth, this paper tries to estimate from different perspectives where the growth is measured by the investment variable. Following the results of F-statistics that lie above the critical upper bound and lower bound of Pesaran et al. (2001) and Narayan (2004), the estimation of model 4 is presented in Table 5. In line with the previous estimate, the federal government debt variable is found to be insignificant in explaining Malaysia's economic growth. Even though none of the test statistics could reject the null of no serial correlation, functional form and heteroscedasticity in the model, which implies that the estimation analysis is unbiased and efficient, there is no evidence of the role played by federal government debt in the country's economic growth.

Table 5. Results of cointegration tests between growth and federal government debt

***ln*(Investment) as dependent variable**	**Model 4 ARDL (1,0,2,2)**
ln (Labour)	1.094 (2.448)
ln (Trade Openness)	0.660 (0.099)*
ln (Federal government debt)	-0.155 (0.619)
Intercept	-5.934 (17.646)
Error correction term	-0.196 (0.057)*
	Diagnostic test
Serial Correlation $\chi^2(4)$	2.034
Functional Form $\chi^2(1)$	0.007
Heteroscedasticity $\chi^2(1)$	1.106
No of observations	64
Adjusted R-Squared	0.474

Notes: * and ** denote significant at 5 and 10 per cent significance levels. Numbers in brackets represent the robust standard error. The critical values are provided by Pesaran et al. (2001), unrestricted intercept and no trend. All models include intercept in the estimation. The null hypothesis of F-test is no long-run relationship. Numbers in brackets represent the standard error. The ARDL model is selected based on Schwarz Bayesian Criterion (SBC). The serial correlation test is based on Lagrange multiplier test of residual serial correlation, the functional form test is based on Ramsey's test, and the heteroscedasticity test is based on the regression of squared residuals on squared fitted values.

Under the linear assumption, this paper also examines the possible existence of a short-run causality relationship between the interest variables. The results are presented in Table 6. There is no evidence of causality between the GDP and federal government debt or vice versa. In addition there is no evidence of causal direction between investment rate and federal government debt. On the other hand, the reported Wald statistics are significant at 5 per cent and 10 per cent significance levels, implying a rejection of the null hypothesis that real GDP per capita does

not cause the primary deficits. In other words, it can be argued that past values of the real GDP per capita contribute to the prediction of the fiscal position. In addition, the results also reveal a causal effect of investment rate on the primary deficit at 5 per cent significance level. These results would imply that any changes in the investment rate cause the changes in the primary deficit position. Thus, growth is a requirement for fiscal restraint in Malaysia.

Table 6. Results of bootstrap test for causality with endogenous lag length choice

	W-statistics	**Critical values**		**Lag length**
		5 percent	10 percent	
GDP => Federal government debt	0.713	4.016	2.835	1
Federal government debt => GDP	0.265	4.044	2.769	1
GDP => Fiscal position	6.238*	4.047	2.890	1
Fiscal position => GDP	1.213	4.140	2.853	1
Federal government debt => Investment	0.289	3.998	2.769	1
Investment => Federal government debt	0.107	4.030	2.847	1
Fiscal position => Investment	2.203	6.594	4.818	1
Investment => Fiscal position	7.946*	6.292	4.703	1

Notes: * and ** denote significant at 5 per cent and 10 per cent significance levels respectively. The lag length selection is based on *Schwarz's Bayesian criterion (SBC).*

On the other spectrum, this paper uses an econometrics tool to investigate the descriptive findings on the possible existence of a non-linear effect of federal government debt. By employing the threshold method of Hansen (2000), with 10,000 bootstrap replications, the results for F-statistics and the p-value for the threshold model are reported in Table 7. The F-statistics and the bootstrap p-value suggest a rejection of the null of no thresholds effect, at 5 per cent significance level, of federal government debt on economic growth. This shows the existence of an inverted-U-shaped relationship between the federal government debt stock and growth. The inverted-U relationship explains that an increase in debt stock has a positive effect on economic growth until it

achieves the optimal level (up to a certain level). Beyond the threshold level, an increase in the stock of indebtedness is associated with negative federal government debt of RM362, 386 million for the overall period of estimation.[6]

In other words, the result reveals that an increase of federal government debt below RM362, 386 million is associated with an increase in Malaysia's economic growth. As the stock of federal government debt increases, it is associated with a negative effect on the economy. The empirical results obtained in this study suggest that Malaysia should hold the federal government debt within the limit of RM362, 386 million. Intuitively, it can be seen that, with the current stock of federal government indebtedness of RM456,128 (as at the end of 2011), Malaysia has accumulated debt at about 25.92 per cent higher than the optimal debt level. Furthermore, Malaysia has held the debt higher than the optimal amount for the last eight quarters and is positioned in the 'bad' section of the "Laffer Curve", which implies that accumulating more borrowings would raise the risk of being trapped in the debt-overhang situation.

[6] The estimation has also been conducted with the variable transformed into natural logarithmic terms. The results do not vary sensibly and are attached in Appendix 3.

Table 7. Results of threshold regression: Federal government debt as a threshold variable between growth and federal government debt

Real GDP per capita as dependent variable		
F-test statistics	368.50	443.91
Bootstrap p-value	0.000	0.000
	$q_i \leq 260{,}113$	$q_i \leq 362{,}386.17$
Investment		0.033 0.005)*
Labour force		-0.005 0.0740)
Openness		0.010 0.001)*
Federal government debt	0.014 (0.000)*	0.005 (0.001)*
Intercept	1818.3 (82.70)*	745.221 (641.321)
No of observations	46	56
R-Squared	0.949	0.982
	$q_i \geq 260{,}113$	$q_i \geq 362{,}386.17$
Investment		0.001 (0.009)
Labour force		-0.117 (0.111)
Openness		0.013 (0.003)*
Federal government debt	-0.010 (0.001)*	-0.002 (0.003)
Intercept	9340.98 (501.06)*	3190.87 (671.84)*
No of observations	18	8
R-Squared	0.685	0.963

Notes: * and ** denote significant at 5 and 10 per cent significance levels. The null hypothesis is no threshold relationship. Numbers in brackets represent the standard error.

To check the stability of the estimated parameters, this paper also performs a Cumulative Sum of Recursive Residual test and a Recursive Coefficient test, as depicted in Figure 2 and Figure 3 respectively. The graphs show that none of the lines exceed the critical lines of 5 per cent

significance level, implying a non-rejection of the null hypothesis of stability. In other words, the estimated equation is stable over the period of study with a 5 per cent significance level.

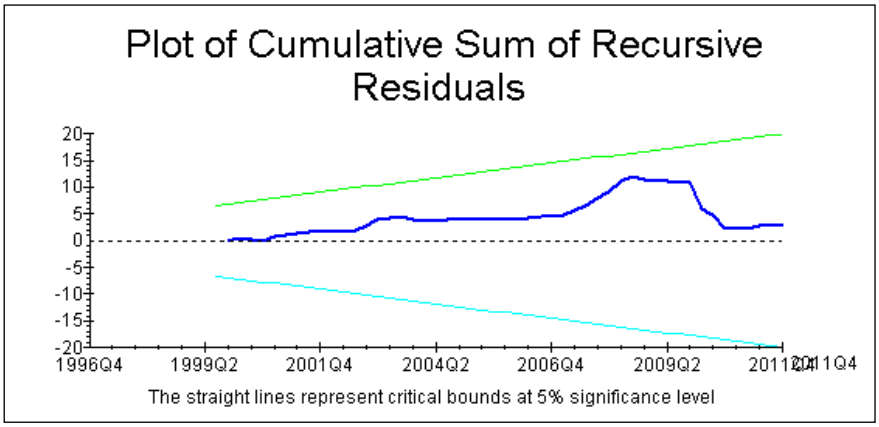
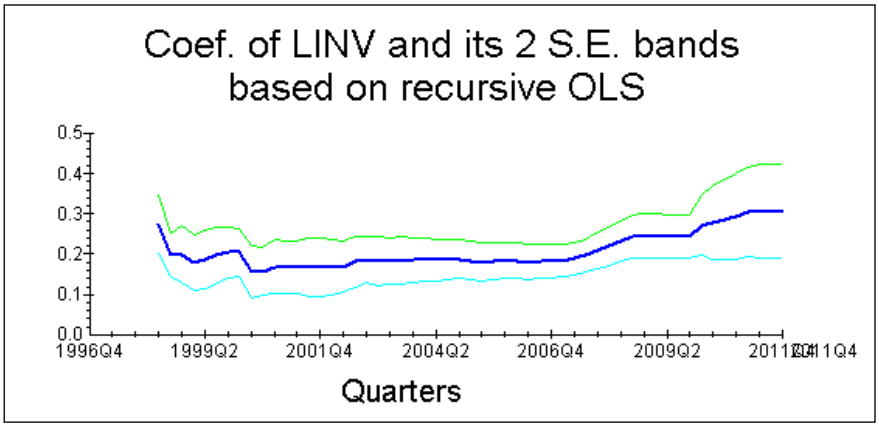


Figure 2. Plot of cumulative sum of recursive residuals



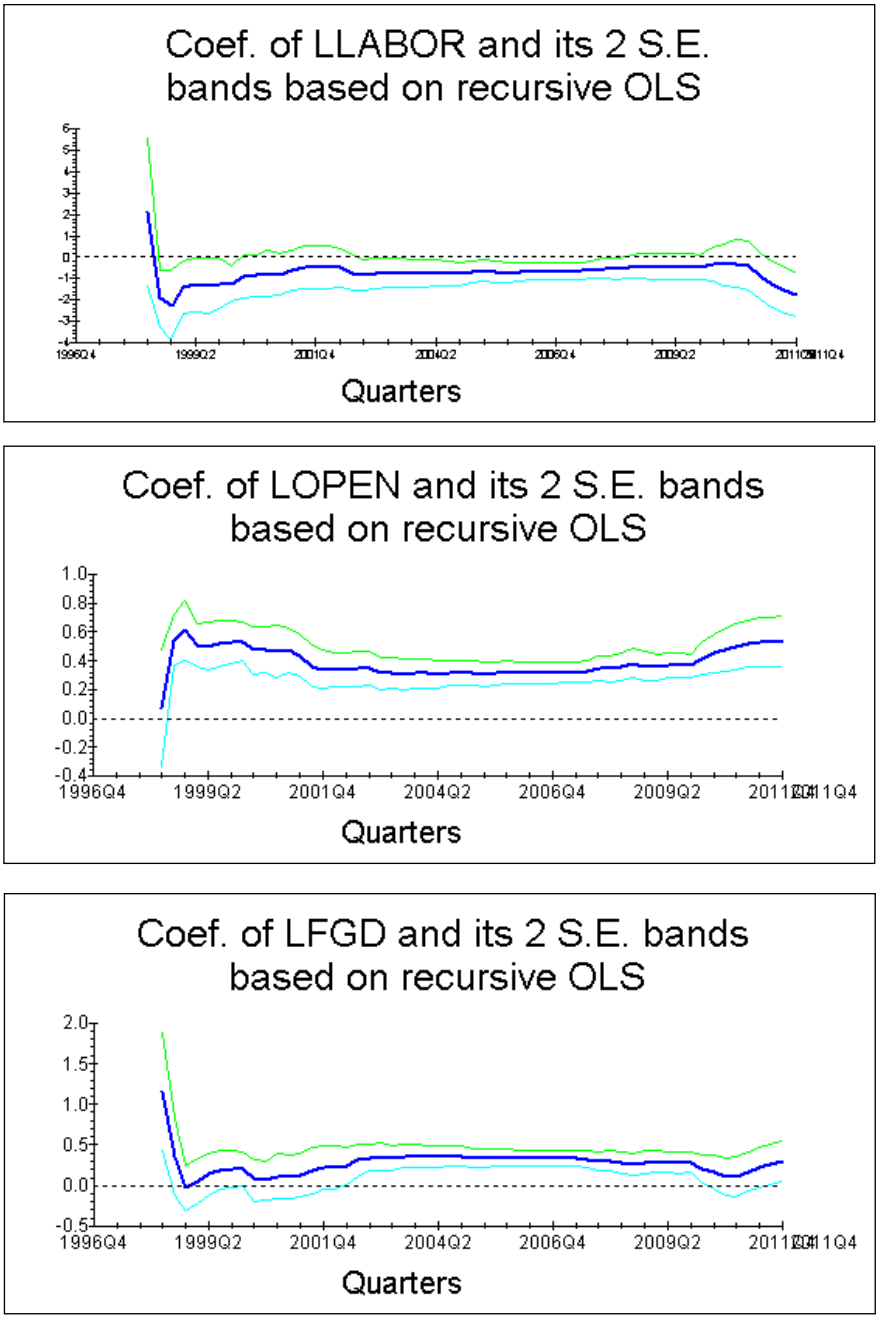


Figure 3. Plot of recursive coefficient and the standard errors

Notes: the LINV, LLABOR, LOPEN, LFGDP represent investment, labour, trade openness and federal government debt respectively.

5. Conclusion and policy implication

In this paper, the continuous increase in Malaysia's federal government debt as a result of a long episode of fiscal deficits (since 1957, with the exception of the period 1993-1997) has underlined the urgency of analyzing this issue. Countries with too much public debt may potentially be trapped in a debt overhang situation, which could lead to a default condition. Even worse, this would be associated with sovereign debt for a series of countries in default. Thus, the objective of this paper is to investigate the role of federal government debt in Malaysia's economic growth. Preliminary analysis shows that no role is played by the federal government debt in Malaysia's economic growth. However, further analysis shows that there are non-linear relationships between public and economic growth, thus suggesting an inverted-U-shaped relationship. In other words, the accumulation of federal government debt is positively associated with Malaysia's economic growth up to an optimal level. A novel aspect of this article is its recommendation of an optimal level of federal government debt that the Malaysian government should hold with respect to its economic growth rate. Furthermore, an additional increase in federal government debt beyond the optimal level has inversely contributed to the Malaysian economy. Moreover, the findings also demonstrate that growth is a requirement for fiscal restraint in Malaysia even though the analysis involves short-run causal effect. The policy should consider a growth-driven approach to narrow the deficit (or to reach a surplus fiscal position), thus reducing the stock of federal government debt. This is important since, at this point of analysis, the Malaysian federal government debt is in the 'bad' section of the Laffer Curve where additional debt has an adverse effect on growth.

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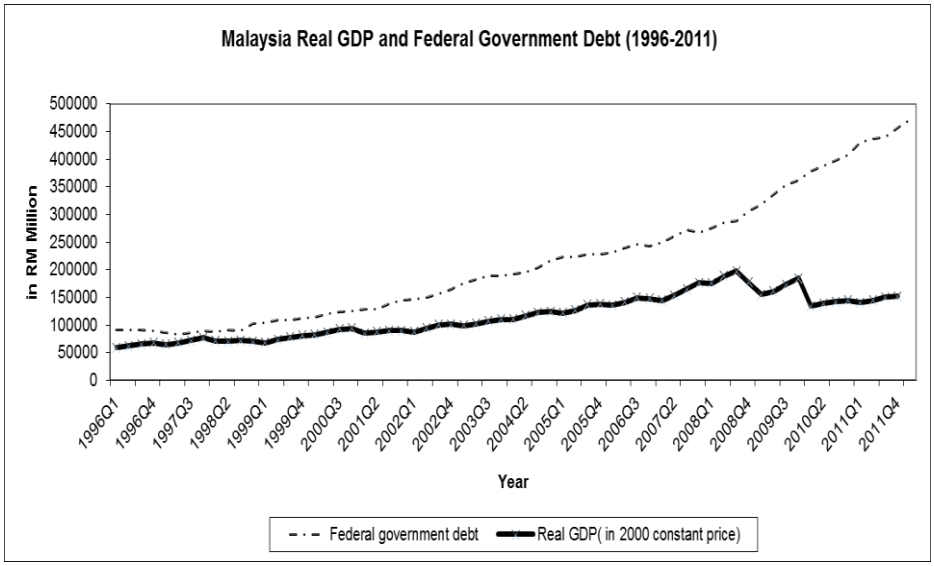
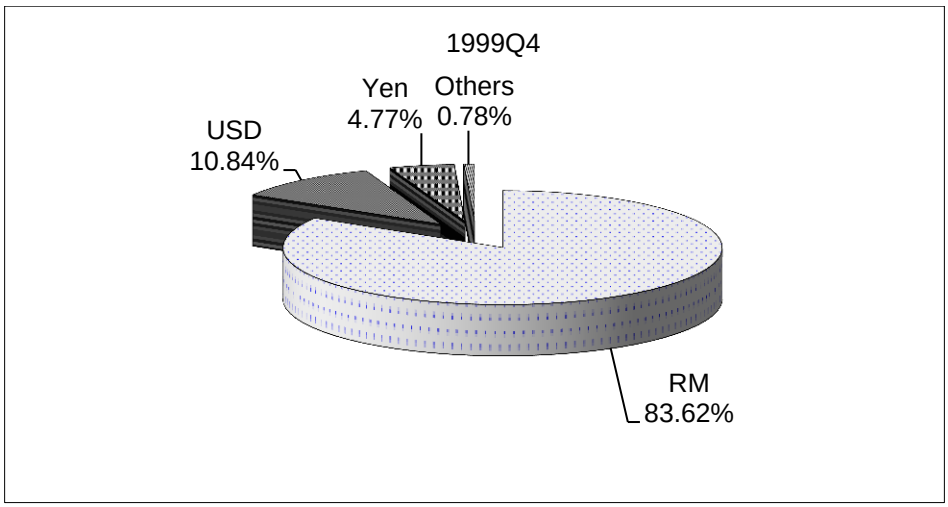
APPENDIX

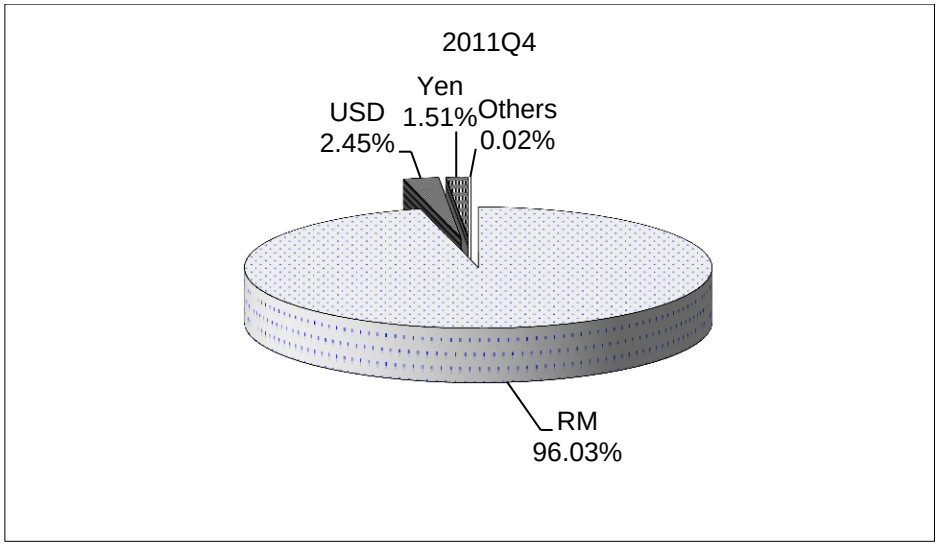
Appendix 1. The pattern of economic growth and federal government debt



Source: Monthly Bulletin, Central Bank of Malaysia.

Appendix 2: Currency composition of federal government debt





Appendix 3. Results of threshold regression: Federal government debt as a threshold variable (in natural logarithmic term)

ln(Real GDP per capita) as dependent variable		
F-test statistics	184.43	304.66
Bootstrap p-value	0.000	0.000
	$q_i \leq 12.469$	$q_i \leq 12.800$
ln(Investment)		0.235 (0.024)*
ln(Labour force)		-0.175 (0.239)
ln(Openness)		0.392 (0.037)*
ln(Federal government debt)	0.516 (0.023)*	0.226 (0.054)*
Intercept	2.148 (0.023)*	0.111 (1.756)
No of observations	46	56
R-Squared	0.92	0.983
	$q_i \geq 12.469$	$q_i \geq 12.800$
ln(Investment)		0.000 (0.053)*
ln(Labour force)		-0.333 (0.268)
ln(Openness)		0.834 (0.210)*
ln(Federal government debt)	-0.647 (0.078)*	-0.174 (0.282)
Intercept	16.898 (1.000)*	3.345 (0.853)*
No of observations	18	18
R-Squared	0.70	0.966

Notes: * and ** denote significant at 5 and 10 per cent significance levels. The null hypothesis is no threshold relationship. Numbers in brackets represent the standard error.

Appendix 4. Breitung (2001) non-linear cointegration test

	Real GDP per capita as dependent variable	**Investment as dependent variable**
Rank test	0.020*	0.019*
Score test	7.495*	1.240

Notes: * and ** denote significant at 5 and 10 per cent significance levels. Critical values for the rank test statistics are from Breitung (2001) and the null hypothesis of no non-linear cointegration is rejected for a test statistic value smaller than the critical value.

Appendix 5: List of variables

Variables	**Descriptions**	**Sources**
Real GDP per capita	Real Gross Domestic product per capita (2000 constant prices)	Monthly Bulletin, Central Bank of Malaysia
Investment	Gross fixed capital formation (in RM Million)	Monthly Bulletin, Central Bank of Malaysia
Labour force	Total labour force	International Monetary Fund/International Financial Statistics
Openness	Trade openness (exports plus imports)	Monthly Bulletin, Central Bank of Malaysia
XX	Exports of goods and services	Monthly Bulletin, Central Bank of Malaysia
MM	Imports of goods and services	Monthly Bulletin, Central Bank of Malaysia
Federal government debt	Total Federal Government external debt (in RM Million)	Monthly Bulletin, Central Bank of Malaysia
Fiscal surplus/ deficit	(in RM Million)	Monthly Bulletin, Central Bank of Malaysia