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The Impact of Government Debt on Output, Private Investment and Human Capital Stock in Malaysia

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Abstract

This paper mainly aims to examine the effect of government debt on real output per capita in a successful developing economy of Malaysia during 1985-2014 period. Using Vector Error Correction modeling (VECM) and employing Generalized Impulse Response (GIR) tool, dynamic response of output per capita to a shock to government debt is obtained. Using the same model, the effect of government debt on economic growth factors, namely, private investment and human capital are also examined. The impulse response result based on VECM model shows that using this sample on average debt does not significantly influence output per capita and private investment although, the later shows negative response. However, human capital positively respond to a debt shock. Overall, this result did not find evidence for crowding out effect of government debt. In other words, the result provide some support for prudent debt management in Malaysia in the past. However, wisely use of government sources is always important. Moreover, excessive borrowing is not advised as it could negate positive effects and jeopardize debt sustainability.

Keywords: Government debt, GDP per capita, Malaysia, VECM, time series

1. INTRODUCTION

Malaysia has been a high performing developing economy during recent decades with government debt trend continuously rising. Its government had access to relatively cheap domestic capital market to finance its development projects. According to the law, Malaysian government can only borrow for developing purposes. Government reports claim that increasing debt is due to government impulses to stimulate economic growth and not due to locked in expenditure and inability to collect tax. However, some critiques say that the problem of Malaysia government debt is serious. In 2016 government default on interest payment. The debt ratio surpassed the self-imposed ceiling. In that year, Malaysia lost credit rating in international financial markets. Which could affect the cost of borrowing for Malaysia.

The prevalent use of expansionary fiscal policy suggest that policy makers believe in its positive effect. Malaysia had been running budget deficit since Asian financial crisis in 1997-8. Government has used expansionary fiscal policy to stimulate the economy that was facing several downturns since then. Given above background, it is the interest of present paper to investigate the macroeconomic effect of government debt in Malaysia. In addition, lack of empirical evidence on the macroeconomic effects of government debt in developing countries in general, and in Malaysia in particular, makes it timely to investigate this issue using rigorous econometrics methods.

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1.1 Economic Background

The preliminary correlation analysis using data from 1970-2014 is shown in figure 1.1. Based on this graph a slight negative correlation between debt and GDP growth can be observed. Regarding private investment correlation with government debt, it is nearly zero; but government investment has a positive correlation. That suggest government borrowing was invested in fixed physical capital (among other expenditures). And it is the government investment that makes total investment-debt correlation positive. Therefore, based on this correlation analysis no positive relation is evident between government debt and output growth (and private investment). This result adds more emphasis to the need for a more rigorous empirical examination of the issue in case of Malaysia.

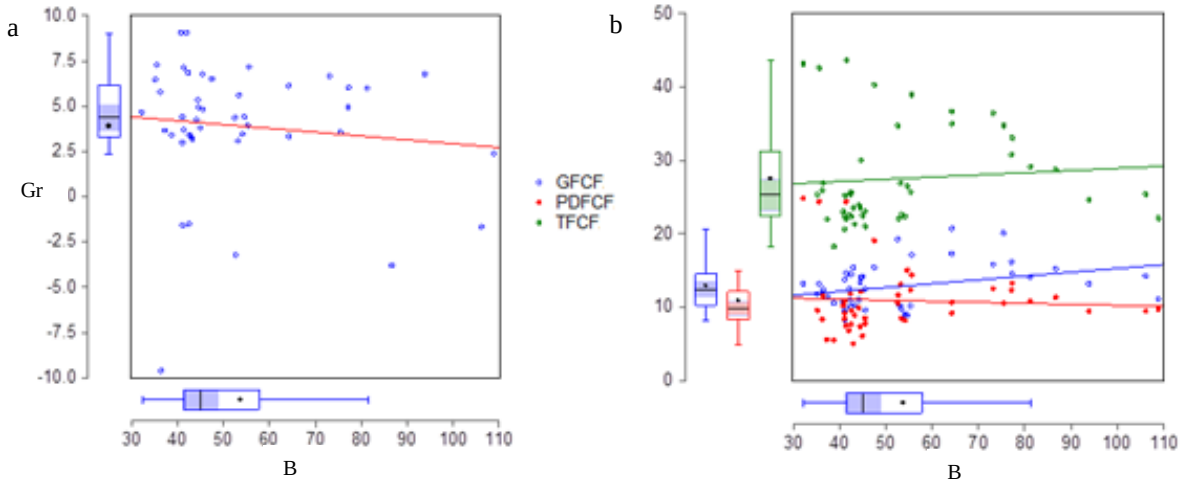

Figure 1 (a) Correlation of GDP growth - Government debt (% GDP); (b) correlation of government/ private/ total fixed capital formation-government debt (%GDP). Description of abbreviations: Gr: GDP growth; B: government debt as percent of GDP; GFCF: gross fixed capital formation; PDFCF: private domestic fixed capital formation; TFCF: total fixed capital formation.

2. LITERATURE REVIEW

Literature of theoretical studies contain miscellaneous views regarding the effect of government debt. This paper classifies these views into four categories. First, the Keynesian view suggest in short run government debt-financed fiscal expansion specially, in time of economic downturn can boost demand and therefore output. Second view, is the so-called Ricardians which is based on the work of Barro (1991) who states government borrowing which creates deficit in government saving will be compensated by private sector saving increase, therefore, government borrowing action cannot have any effect on the real sector. Third, is the conventional view of neoclassicals that hold negative effect for debt rise (Mankiw, 1999) as it reduce capital formation and thus output in long run. Forth, is some of the endogenous growth models that incorporate government debt in the supply side of production function and argue that government debt can contribute to GDP growth. These theories usually consider conditions for this outcome to happen. Such as when government spend borrowings into productive investment in the country. Furthermore, usually a certain limit for borrowing is considered above which negative consequences will dominate the positive impact (Greiner, 2007).

Empirical studies on the effect of government debt are a few. The effect of government debt in advanced economies especially U.S. has attracted most of the research. Especially regarding debt-interest rate relationship. More studies in developing countries have focused on external debt effect motivated by debt overhang hypothesis of Krugman (1988) and Sachs (1989). Pattillo, et. al (2002, 2004) reported a nonlinear effect of external debt on growth, as a negative and significant impact on growth at high debt levels (typically, over 60 percent GDP), but an insignificant impact at low debt levels. In contrast, Cordella, et. al. (2005) find evidence of debt overhang for intermediate debt levels, but an insignificant debt-growth relationship at very low and very high levels of debt.

A few recent panel studies found adverse effect of debt on growth and capital formation. Checherita and Rother (2012) found nonlinear relationship with threshold point of about 90% between government debt and growth and also four channels of transmission, namely private saving and investment, public investment, total factor productivity and sovereign long run interest rate for the sample of 12 Euro countries. They mentioned that the relationship bellow threshold of 90% remains a question.

Kumar and Woo (2010) using a sample of 38 advanced and emerging economies during 1970-2007, employing multiple panel estimators and accounting for several econometric issues found negative and significant relationship between government debt and GDP per capita growth both in advanced countries and emerging economies. Schclarek (2004) found linear negative and significant relationship among public external debt and GDP per capita growth and also capital growth for a panel of 59 developing countries during 1970-2002. Using exogenous threshold dummies of total external debt of 20% GDP and 30% GDP alternatively no evidence for nonlinear relationship was obtained. Paniza and Presbitero (2013) in a recent survey of debt-growth in advanced countries among other points mentions that future research should focus on cross-country heterogeneity.

Some evidence from the single country studies in developing countries include Bal and Rath (2014) examined the effect of public debt (divided into domestic and external debt) and debt service on GNP per capita. Other explanatory variables were total factor productivity and export. They found significant adverse effect for both public debt variables and recommended to reduce the debt. Prior to them Singh (2012) investigated domestic debt and growth effect using VECM models and concluded that Ricardian equivalence prevails.

3. ANALYTICAL FRAMEWORK AND DATA

The standard neoclassical growth model has been the workhorse for examining the effect of government debt on output (growth). Our model is based on derivation of Mankiw, Romer, Weil (1992) of the Solow growth model, in that:

$$\ln y_t = lnA_0 + g_t + \frac{\alpha}{1-\alpha}\ln(s_k) - \frac{\alpha}{1-\alpha}\ln(n+g+\delta) + \frac{\beta}{1-\alpha}\ln(h^*) \quad (1)$$

or

$y_t = F(A, sk, n, h)$

Where:

A_0 is level of technology

y_t is the output per capita (labor).

h^* is the level of human capital.

s_k the share of output that is allocated for capital accumulation (which could be indexed by investment as percent of GDP).

$(n + g + \delta)$ is population growth, technological growth and rate of depreciation respectively.

This paper extends above production function, to include government debt (Cunningham, 1993). Investigating the effect of debt (government or external) by including it in the neoclassical growth model has been the procedure followed by several recent relevant empirical studies to name a few examples that took this approach in panel framework are: Pattillo, et. al. (2011), Sen et al (2007), Clement et al (2003), Checherita-Westphal and Rother (2012), Schclarek (2004) and in time-series framework: Bal and Rath (2014), Mohd Daud et. al. (2013), Asmaddy and Mohammad (2015). Present study employs above growth model augmented with government debt as bellow:

$ly_t = F(pinv, H, D)$

Where:

ly_t is the logarithm form of real per capita GDP

$pinv$ (as sk shown in above model) indexed by ratio of fixed capital formation in private sector as percent of GDP.

H is the capital stock indexed by average years of schooling of population above 25 years.

B is the ratio of government debt stock as percent of GDP.

Moreover, some control variables are included in the model as exogenous variables, namely, banking crisis dummy to capture financial instability, budget balance to capture general economic instability, volatility of real exchange rate to capture external shocks and finally, real interest rate that captures monetary policy in the model.

3.1 VECM Model Specification

This paper employs Vector Error Correction model and the Generalized impulse response (GIR) function of Pesaran and Shin (1998) to investigate the scenario of what has been the average impact of government debt increase on private investment, output per capita and human capital. The use of VECM model is because of four reasons. First, in VAR/VECM model all variables are treated as endogenous in the first place. Second, using VECM model allows to use the information of the variables at level so that, it combines long run and short run information. Third, more than one cointegration relation is allowed, if specified. Forth, the impulse response tools implemented in VEC model provides a framework in that the effect of government debt on itself, private investment, output and human capital can be traced out using the same model.

In order to use VECM the endogenous variables need to be integrated of order one. To check unit root of the variables ADF unit root test is carried out for all variables. Deterministic terms in ADF test are chosen following Elder and Kennedy (2001) guideline. Next, to determine the rank of the system Johansen (1991) multiple cointegration test is performed. According to the results obtained from the cointegration test and lag length selection followed by Akaike information criterion (AIC), VECM model is specified.

Order of variables in the system follows economic intuition and helps to address the question of this paper. Government debt variable placed first, followed by private investment, output per capita and finally human capital. The Generalized impulse response function (Pesaran and Shin, 1998) is invariant to the order of variables and trace out the response of other variables when the shock to first variable leads. To deal with criticisms about the extreme identifying assumptions of GIR, Cholesky impulse response with two alternative orders is performed for robustness check. The first order is as mentioned earlier. The second order is private investment, output, government debt and human capital.

4. RESULTS

This section, first, deals with unit root and cointegration analysis, second, estimation of VECM and finally impulse response analysis. Employing standard augmented Dickey-Fuller (ADF) test, (non)stationarity condition of the endogenous and exogenous variables of the model is tested as reported in Table 1. In order to select the optimal lag for the VECM, AIC criterion is used. Table 1 shows that government debt (B), private investment (pinv), output per capita (ly) and human capital stock (H) are I(1), which are set as the endogenous variables in the VECM model and the exogenous variables of this model, namely, budget balance (BB), volatility of real exchange rate (vex) and real interest rate (r) are stationary or I(0). Table 2 shows the optimal lags chosen by various information criterion for a VAR model of maximum lag two. All criterion chose two lags for VAR model. Thus, one lag would be suitable in the respective VECM model. However, the model with one lag shows first order serial correlation. To rectify this problem one lag was added to the VECM model.

Johansen-Jusilius multiple cointegration test is performed including all endogenous and exogenous variables in a VAR model with optimal lag equal to two (P*=2) as found in table 2. Constant and trend terms were allowed as the deterministic terms in the underlying VAR model. The result of the test -shown in table 3- indicate existence of one cointegrating relation at 1%.

In the next step, VECM is estimated and the results are reported in Table 4. The result shows that ECT is significant in all equations except for output growth equation. This result can be interpreted as evidence for the existence of long run bidirectional causality among debt and private investment and also debt and human capital. Budget balance is positive and significant in private investment and output equations. Exchange rate volatility also, is negative and significant in both equations. Banking crisis dummy is significantly negative in output equation whereas interest rate is significantly negative in private investment equation. All of the signs are according to theoretical expectation. Finally, diagnostic test of serial correlation and non-normality test are favorable. Thus, GIR can be obtained based on this model. Figure 2 shows the GIR based on VECM model.

According to Figure 2 result, a one standard-deviation-positive shock to government debt will cause itself to rise continuously with only little decline from eight year. This relates to the actual increasing trend of government debt in Malaysia. Same shock induce a negative response in private investment while the negative effect gradually declines. Per capita output, however, mostly fluctuates around zero-line. Finally, human capital is positively affected by the government debt shock.

Another set of GIR, based on the VAR version of the above model, is presented in figure 3. So that, the IR could be provided along with confidence interval bands. This result confirms increasing debt due to a shock to itself but only significant until sixth year. Similar to the result in Figure 2, private investment shows some crowding out although it is not shown to be significant. Output per capita is almost irresponsive to the debt shock and finally human capital show positive effect.

Overall, from the impulse response analysis it can be inferred that a shock to government debt in Malaysia does not seem to have significant effect on per capita output and private investment, but some positive effect to human capital is obtained. Knowing that, government debt is spent on development project such as human capital, it can be inferred that government debt has a positive effect on output through increasing human capital stock that itself positively contribute to output (growth). The adverse impact on private investment obtained by this study makes a reason to impede economic growth.

Table 1. ADF-Unit root tests for sample period 1985-2014

Variables	Level		First difference	
	Deterministic term	Test-statistics	Deterministic term	Test-statistics
ly	C,T	-1.526	C	-4.861***
pinv	C,T	-2.625	C	-4.190***
B	C,T	-0.708	C	-4.383***
H	C,T	-1.461	C	-8.075***
BB	C	-2.266**	C	-4.042***
VEX	C	-2.755***	C	-5.149***
r	C,T	-6.940**	C	-5.770**

*, **and *** indicate that the null hypothesis of nonstationary variables can be rejected at 10, 5 and 1 percent significant level respectively. C denotes constant deterministic term and T denotes trend term.

Table 2. Lag order selection by different criteria

Lag	LR	FPE	AIC	SC	HQ
1	207.6477	0.0088	6.6108	7.5449	6.9096
2	42.5333*	0.0036*	5.6521*	7.3335*	6.1900*

* Indicate the number of lags selected by the respective information criterion (significance at 5% level).

LR: Sequential modified LR test statistics

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 3. Cointegration tests for sample period 1985-2014

Hypothesized no of CE	Trace Statistic	Critical Value	Probability	Max-Eigen Statistic	Critical value	Probability
None***	76.25157	47.85613	0.0000	54.32038	27.58434	0.0000
At most 1	21.93119	29.79707	0.3023	16.29869	21.13162	0.2079
At most 2	5.632502	15.49471	0.7385	5.353683	14.26460	0.6967
At most 3	0.278819	3.841466	0.5975	0.278819	3.841466	0.5975

*** Denotes rejection of the hypothesis at the 1% level.

** MacKinnon-Haug-Michelis (1999) p-values.

Table 4. VECM model estimated for impulse response analysis

$$\Delta B = 0.174\,\lambda^{*} + 0.233\,\Delta B_{-1} - 0.171\,\Delta B_{-2} + 0.656\,\Delta pinv_{-1}^{***} + +0.007\,\Delta pinv_{-2} - 150.825\,\Delta ly_{-1}^{***} + -30.193\,\Delta ly_{-2} + 9.164\,\Delta H_{-1} + +9.598\,\Delta H_{-2}^{***} + 0.198\,BB + 0.665\,BKD - 8.020\,vex^{***} - 2.151\,r^{***} - 2.132$$

$$\Delta pinv = 0.298\,\lambda^{***} - 0.252\,\Delta B_{-1} - -0.035\,\Delta B_{-2} - 0.240\,\Delta pinv_{-1} - 0.466\,\Delta pinv_{-1}^{***} - 25.154\,\Delta ly_{-1} - 23.720\,\Delta ly_{-2} + 17.183\,\Delta H_{-1}^{***} + 8.605\,\Delta H_{-2}^{*} + 0.208\,BB^{***} + 1.887\,BKD - 7.243\,vex^{***} - 1.321\,r^{***} + 13.711^{***}$$

$$\Delta ly = -0.000\,\lambda - 0.002\,\Delta B_{-1} - 0.000\,\Delta B_{-2} + 0.000\,\Delta pinv_{-1} - 0.001\,\Delta pinv_{-2} - 0.399\,\Delta ly_{-1} - 0.628\,\Delta ly_{-2}^{***} + 0.043\,\Delta H_{-1} + 0.057\,\Delta H_{-2} + 0.007\,BB^{***} - 0.037\,BKD^{***} - 0.060\,vex^{***} + 0.001\,r + 0.095^{***}$$

$$\Delta H = 0.012\,\lambda^{***} - 0.002\,\Delta B_{-1} - 0.008\,\Delta B_{-2} + 0.016\,\Delta pinv_{-1}^{*} + 0.003\,\Delta pinv_{-2} - 3.959\,\Delta ly_{-1}^{***} - 2.482\,\Delta ly_{-2}^{**} + 0.041\,\Delta H_{-1} + 0.003\,\Delta H_{-2} + 0.001\,BB - 0.064\,BKD + 0.016\,vex - 0.027\,r + 0.598^{***}$$

Diagnostic tests		Tests of:	
$R^2_{\Delta B}$	= 0.89	LM serial correlation (lag 1)	22.895
$R^2_{\Delta pinv}$	= 0.63	LM serial correlation (lag 2)	14.062
$R^2_{\Delta ly}$	= 0.63	LM serial correlation (lag 3)	19.400
$R^2_{\Delta H}$	= 0.32	Jarq-Bera nonnormality	3.535

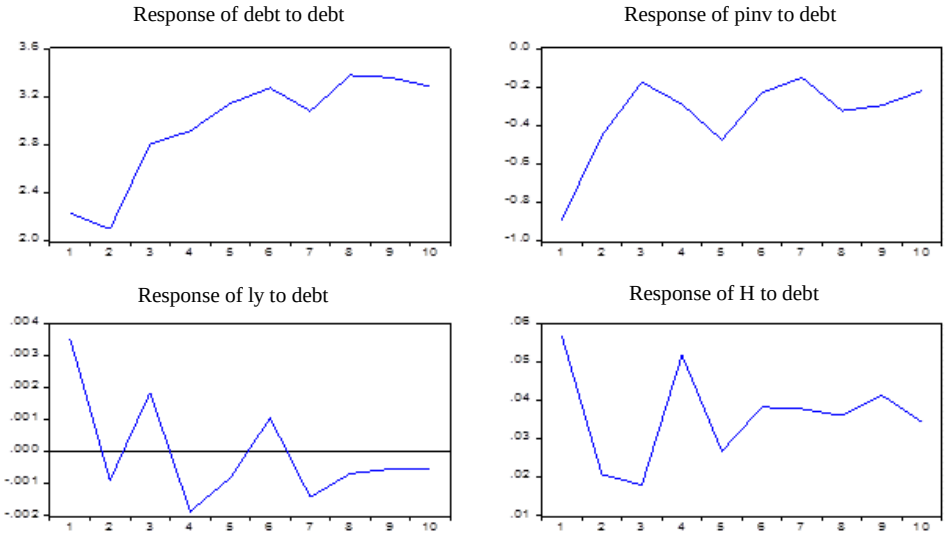

Figure 42. Generalized impulse response analysis, VECM model, period 1985-2014

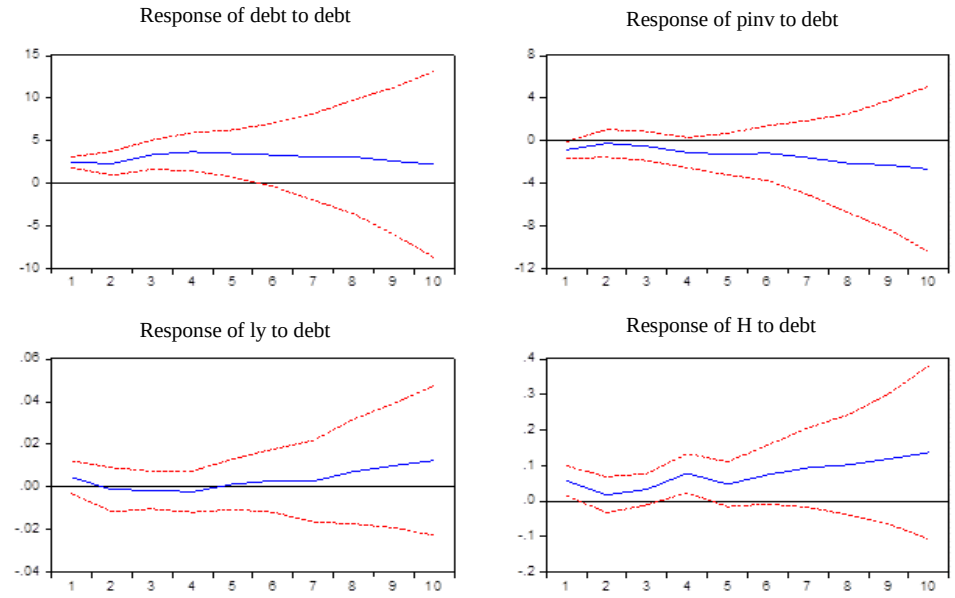

Figure 3. Generalized impulse response analysis, VECM model, period 1985-2014

The insignificant response of output and private investment to government debt shock (Figure 3) could be referred to the average level of government debt during the period of study. During 1985-2014, government debt was on average 56.03 % GDP. That is very close to the self-imposed 55% debt ceiling by Malaysia authorities. That means government had been using debt-leverage about the optimal level (self-imposed debt-ceiling). As the nonlinear theories suggest at the optimal level debt effect on real sector economy would be zero. However, exceeding this level could be the start of negative outcomes for the economy.

In contrast to the findings of Woo and Kumar (2010), and Bende-Nabende and Slater (2003), this paper does not support significant negative nexus between government debt and output/private investment. Woo and Kumar (2010) found adverse effect of government debt on output growth and private investment in emerging economies. Bende-Nabende and Slater (2003) found significant negative long run effect of external debt on private investment for a pool data of four emerging ASEAN economies (including Malaysia). Other related empirical findings had examined the effect of government investment on private investment in Malaysia. For instance, the finding of Guimaraes and Unteroberdoerster (2006) is more similar to that of present paper which is insignificant effect of government investment on private investment; while Ang (2009) found crowding-in relationship.

5. CONCLUSION

Using VECM timeseries model and Generalized Impulse Response analysis, this study found that government debt did not have significant impact on output per capita and private investment in the sample period of 19852014. Nonetheless, some positive effect was found with respect to human capital. The insignificant result of output and private investment to government debt shock, in one hand, could be thought to be the result of optimum level use of debt leverage. In the other hand, it could emphasize the critical status for debt management. Policymakers need to stabilize the debt trend and effectively allocate government funds. Well debt management is always relevant to avoid adverse effect of government borrowing in the economy. Moreover, debt sustainability impose limit on the amount of debt a government can borrow. Therefore, the result of this paper cannot be interpreted as a green light for further and further debt increase. Provided that, the insignificant debt-output relationship was because debt was already around optimal level, government should be cautious about any debt increase.

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