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Abstract

The purpose of this study is to reinvestigate the relationship between defence expenditure and economic growth in Malaysia, over the period from 1960 to 2006. The bounds testing procedure is used to examine the long-run equilibrium relationship between defence expenditure and economic growth. The bounds test suggests that the variables are co-movement in the long run, but defence expenditure and economic growth is negatively correlated in both the short and long run. Moreover, the MWALD test shows bilateral causality evidence.

Defence Expenditure and Economic Growth in Malaysia: A Reassessment Using Bounds and Modified Wald Tests

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Introduction

Over the past decades, we have witnessed voluminous research and a succession of papers relating to the role of defence expenditure on economic growth. In the past literature, a study on defence expenditure and economic growth in Malaysia is limited to Chowdhury (1991), Frederiksen (1991), Kusi (1994), and Frederiksen and McNab (2001). Unfortunately, no consensus causality evidence has emerged. For Malaysia, Chowdhury (1991) noted that defence expenditure and economic growth does not Granger cause each other. While on the one hand, Frederiksen (1991) suggested that the causality is running from economic growth to defence expenditure, on the other hand, Kusi (1994), and Frederiksen and McNab (2001) documented that defence expenditure fostered Malaysia's economic growth through research and development, utilization of capital stock, and higher labor employment. Reviewing the existing literature, three shortcomings have been detected. Firstly, the earlier research on Malaysia's defence expenditure does not take into consideration the structural break. The plotting of defence expenditure as percentage of Gross Domestic Product (GDP) in Figure 1 obviously reveals that there has been at least one structural break occurring in the 1980s. Moreover, there is one minor break in the late 1990s, which may be due to the Asian financial crisis and the terrorist attacks on September 11, 2001, on the US. Hartfiel and Job (2005) noted that Asian governments have been focusing on the

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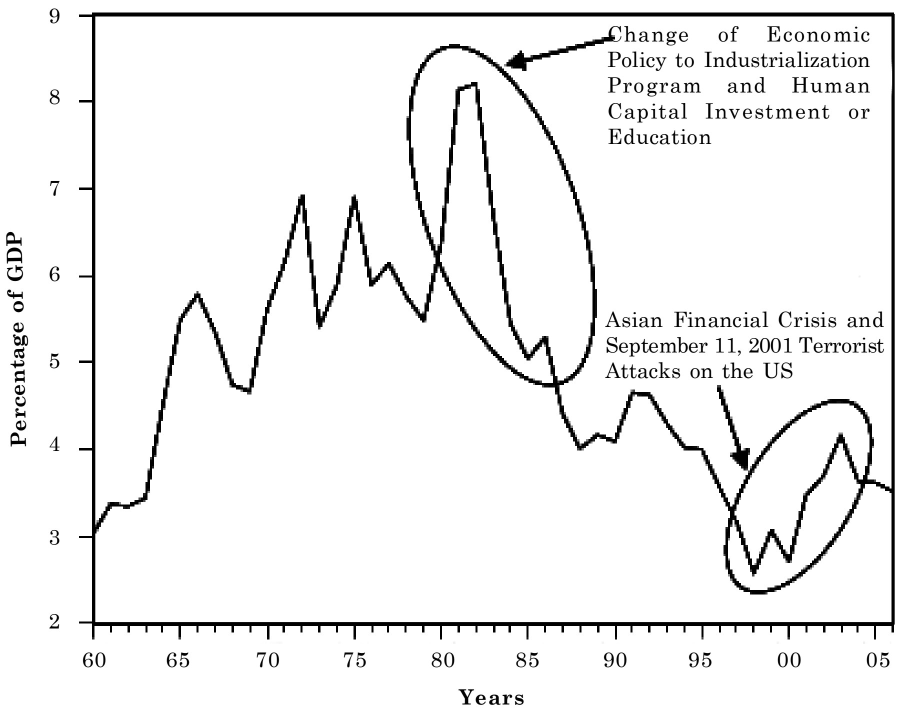
Figure 1: Defence Expenditure as Percentage of GDP



prevention against terrorist attack and hence have accelerated the defence expenditure.

Secondly, only Chowdhury's (1991) paper considered the presence of a long-run relationship between defence expenditure and economic growth. He employed the Engle and Granger (1987) two-step cointegration test. This procedure is biased in a finite sample. Furthermore, Gregory and Hansen (1996) noted that in the presence of a structural break, the Engle-Granger test is likely to accept the null of no cointegration. Thirdly, earlier papers used the Granger's test based on Vector Autoregressive (VAR) framework, to examine the causal link between defence expenditure and economic growth. However, the causality test based on VAR may have missed the long-run causality information (see Granger, 1988). Furthermore, causality test with Error-Correction Model (ECM) or Vector Error-Correction Model (VECM) is not reliable, especially in finite samples, because they are sensitive to the value of the disturbance terms (see Zapata and Rambaldi, 1997).

In this study, the detected gaps are filled by imposing dummy variables and the recently developed methodology is employed. In view of the cointegration test, the bounds testing procedure developed by Pesaran in 2001, is used. The advantage of using this test is that it has superior properties in small samples and is more robust than the conventional cointegration test, because it does not push the short-run dynamics into the residual terms, as in the Engle-Granger approach (see Pattichis, 1999). In contrast to the existing studies, the modified Wald (MWALD) test proposed by Toda and Yamamoto (1995) has been used, to investigate the causality direction between defence expenditure and economic growth. The major advantage of using MWALD test for this study is that it is applicable to the variables with different order of integration, 7(0) and 7(1).

The paper goes on to discuss the data, econometric techniques and results of this study, before presenting the conclusion.

Data, Econometric Techniques and Results

In this study, the annual data of defence expenditure as percentage of GDP (DEG) and the real GDP growth (EG) from 1960 to 2006 in Malaysia is used. The consumer price index (CPI, 2000 = 100) is used to derive the real term. The data was obtained from Asian Development Bank Key Development Indicators, International Financial Statistics (IPS) and Bank Negara Malaysia Monthly Statistical Bulletin.

The bounds testing approach to cointegration can be carried out by estimating the following Unrestricted Error-Correction Models (UECM) by Ordinary Least Squares (OLS).

Model 1: $$\Delta DEG_t = \alpha_0 + \pi_1 DEG_{t-1} + \pi_2 EG_{t-1} + \sum_{i=1}^{p} \delta_i \Delta DEG_{t-1} + \sum_{j=1}^{q} \lambda_j \Delta EG_{t-j} + \mu_t \qquad ...(1)$$

Model 2: $$\Delta DEG_t = \alpha_0 + \alpha_1 D84_t + \pi_1 DEG_{t-1} + \pi_2 EG_{t-1} + \sum_{i=1}^{p} \delta_i \Delta DEG_{t-i} + \sum_{j=1}^{q} \lambda_j \Delta EG_{t-j} + \mu_t \qquad ...(2)$$

Model 3: $$\Delta DEG_t = \alpha_0 + \alpha_1 D84_t + \alpha_2 D97_t + \pi_1 DEG_{t-1} + \pi_2 EG_{t-1} + \sum_{i=1}^{p} \delta_i \Delta DEG_{t-i} + \sum_{j=1}^{q} \lambda_j \Delta EG_{t-j} + \mu_t \qquad ...(3)$$

where, Δ is the first differenced operator, and $D84_t$ and $D97_t$ are dummy variables to capture the structural break(s) effect(s) around 1984 and 1997. These breakpoints are based on the visual inspection from the plotting of the *DEG* (see Figure 1). The optimal lag order of ΔDEG_t and ΔEG_t are represented by p and q respectively. Three models are set up in this study for the purpose of comparison. The F-statistic is used

Table 1: The Results of the Bounds Test			
Dependent Variable: ΔDEG_t **Method: Ordinary Least Squares (OLS)**			
Variable	**Model 1**	**Model 2**	**Models**
Constant	0.298	1.618*	1.958*
$D84_t$	–	–0.718*	–0.696*
$D97_t$	–	–	–0.221
DEG_{t-1}	–0.071	–0.247*	–0.301*
EG_{t-1}	0.005*	–0.004	–0.009
ΔDEG_{t-1}	0.426*	0.303**	0.320**
ΔDEG_{t-2}	–0.120	–0.141	–0.106
ΔDEG_{t-3}	–0.261**	–0.271**	–0.244**
ΔEG_t	–0.053	–0.050*	–0.051*
Diagnostic Tests:			
R^2	0.53	0.64	0.65
Adjusted – R^2	0.44	0.57	0.57
LM(2) ($n \times R^2$)	0.774	2.737	1.392
ARCH (1)	3.408***	0.569	0.420
Ramsey RESET (1)	0.125	0.440	0.536
Bounds Test:			
F-Statistics	1.185	9.658*	8.910*
# Adjusted Upper Bounds Critical Values:			
1%	8.690		
5%	6.105		
10%	4.986		

Note: LM(2) is a test of the 2nd order of serial correlation. The Ramsey RESET(l) is a test of the 1st order of specification error, and ARCH(l) is the heteroskedasticity test in time series; # unrestricted intercept and no trend (k = 2, T = 47), from Turner (2006) response surface procedure; *, ** and *** denote significance at the 1%, 5% and 10% levels respectively.

to test the joint significance of the lagged level variables, DEG_{t-1} and EG_{t-1}. The Akaike's Information Criterion (AIC) is used to determine the optimal lag structure, and the bounds test results are reported in Table 1.

The estimated UECM without break (Model 1) indicates that the variables are not cointegrated. However, considering the structural break(s) effect(s) (Model 2 and Model 3), the results support the presence of a long-run relationship between defence expenditure and economic growth in Malaysia. As a result, Bardsen's (1989) method is used to derive the short and long-run coefficients from Model 2, rather than from Model 3, because the dummy variable $D97_t$ is highly insignificant. Thus, the estimated short and long-run coefficients for economic growth are –0.050 and –0.016 respectively. While this result sharply contradicts the findings of Benoit (1978) in less developed countries, the current finding supports the presence of the crowding-out effect. Therefore, the allocation of resources for defence will reduce the resources available for investment, and eventually retard Malaysia's economic development.

However, the presence of cointegration does not imply causation. Thus, the MWALD test is performed by estimating Equation 4.

$$\begin{bmatrix} DEG_t \\ EG_t \end{bmatrix} = \begin{bmatrix} \beta_1 \\ \beta_2 \end{bmatrix} + \begin{bmatrix} A_{11,1} & A_{12,1} \\ A_{21,1} & A_{22,1} \end{bmatrix} \times \begin{bmatrix} DEG_{t-1} \\ EG_{t-1} \end{bmatrix} + \begin{bmatrix} A_{11,k} & A_{12,k} \\ A_{21,k} & A_{22,k} \end{bmatrix} \times \begin{bmatrix} DEG_{t-k} \\ EG_{t-k} \end{bmatrix}$$

$$+ \begin{bmatrix} A_{11,p} & A_{12,p} \\ A_{21,p} & A_{22,p} \end{bmatrix} \times \begin{bmatrix} DEG_{t-p} \\ EG_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{1t} \end{bmatrix} \qquad \text{...(4)}$$

where, k is the optimal lag order determined by AIC and p represents (k+d_{max}). In this study, d_{max} = 1 is used, because most of the macroeconomic series are integrated between 0 and 1. Moreover, Dolado and Lütkepohl (1996) noted that d_{max} = 1 is ideal. Usually, the MWALD test employs the uniform lag structure for all the variables, but there is no prior understanding that the lag order must be uniform. The uniform lag structure may have either over-specified or under-specified problems, which will lead to bias causality results. In order to avoid this problem, the nonuniform lag structure is used here. From Equation 4, $A_{12,k} \neq 0 \,\forall_k$ implies that economic growth Granger causes defence expenditure, whereas if $A_{21,k} \neq 0 \,\forall_k$, it means defence expenditure leads growth. However, it should be pointed out here that the parameters for the extra lag, $d_{max} = 1$, in Equation 4 are unrestricted, because the inclusion of this extra lag is to confirm that the asymptotic theory can be applied.

The causality evidence is reported in Table 2. The χ^2 statistics indicate that there is an evidence of bilateral causality between defence expenditure and economic growth. This contradicts the earlier papers in Malaysia (e.g., Chowdhury, 1991; and Kusi, 1994). Unfortunately, this is negative causality. Therefore, the higher defence expenditure will not positively lead to Malaysia's economic growth, but would lead to retarding economic development, because of the utilization of available resources to the nonproductive sector.

Table 2: The Results of the MWALD Causality Test

Null Hypotheses	χ^2 -Statistics
DEG $\nrightarrow$ OEG	14.565*
EG $\nrightarrow$ DEG	20.439*

Note: *, ** and *** denote significance at 1%, 5% and 10% levels respectively; $\nrightarrow$ represents "does not Granger cause". Both of the models passed a battery of diagnostic tests, and thus the models are complied with the linear regression assumption.

Conclusions

The aim of this study is to reinvestigate the relationship between defence expenditure and economic growth in Malaysia through cointegration and causality analyses. According to the bounds test, it was found that the variables are cointegrated after taking into consideration the structural break(s). The estimated short and long-run coefficients imply that defence expenditure and economic growth are negatively correlated. In terms of causation, the MWALD test results suggest that the causality direction is running from both sides (bilateral causality).

From an economic perspective, these results indicate that discouraging defence expenditure will benefit Malaysia's economy, because the military sector seems to be nonproductive. However, this sector is needed to prevent and protect the economy from unexpected events such as terrorist attacks and crime in Malaysia. Therefore, this sector has to be retained and the role of the policymaker to monitor and balance the defence expenditure in order to avoid overburdening the economy.

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