Military expenditure and economic growth in Sri Lanka: A dynamic model analysis

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Introduction

Study of cost of military expenditure acquired prominence with the study of Benoit (1973). This study says that countries with heavy military expenditure had rapid growth rate and countries with lowest military expenditure had less growth rates. Sri Lanka faced a problem of civil war for 3 decades. Military expenditure was 2.37 as a percentage of Gross Domestic Product (GDP) in 1988. It was increased to 5.88 as percentage of GDP in 1995. In 2015, it was decreased to 2.2 as a percentage of GDP. Shahbaz and Shabbir (2012) indicated that, there is a long run relationship between military spending and economic growth using by rolling window approach. Further, negative unidirectional causality was found running from defense spending to economic growth. No evidence showing the Chinese economy had an effect on its military development or the reverse. Nevertheless, military spending benefited the economy after 1989 when the development of defense was running on a new path. This study is to find the impact of military expenditure on economic growth in Sri Lanka during the period spanning from 1961 to 2016.

Methodology

The study used annual time series data of the Gross Domestic Product (GDP) (constant 2010US$) and military expenditure as a percentage of the GDP between 1961 and 2016. These data were gathered from annual report of the Central Bank of Sri Lanka and World Bank data base. For analyzing these data, study mainly used times series econometrics techniques. A unit root test was performed to examine the stationarity of time series. The study has tested the stationarity of variables statistically by using Augmented Dickey-Fuller (ADF) unit root test and study used Akaike Information Criterion(AIC) to decide the optimal lag length. Next, the study applied the Engle and Granger (1987) cointegration method to examine long-run equilibrium relationship between military expenditure and economic growth. If two or more series are integrated of order one, $I(1)$, but a linear combination of them is integrated order zero, $I(0)$, and thus stationary, then series is said to be cointegrated. If both series are cointegrated, there exists a long-

run equilibrium relationship among the variables. The following equations (Equation 1 and Equation 2) are specified for the study,

$$LGDP_t = \beta_{10} + \beta_{11}ME_t + u_{1t} \quad (1)$$

$$ME_t = \beta_{20} + \beta_{21}LGDP_t + u_{2t} \quad (2)$$

Where$LGDP_t$ denotes log values of GDP at time t and ME_t denotes the military expenditure as a percentage of GDP.

The equilibrium error terms of the models are given by the following equations.

$$\hat{u}_{1t} = LGDP_t - \hat{\beta}_{10} - \hat{\beta}_{11}ME_t \quad (3)$$

$$\hat{u}_{2t} = ME_t - \hat{\beta}_{20} - \hat{\beta}_{21}LGDP_t \quad (4)$$

For cointegration, if GDP and ME are integrated order one I(1) and equilibrium errorsu_{1t} *and* u_{2t}, are integrated order zero $I(0)$ then there exists a long-run equilibrium relationship between military expenditure and GDP. However, if they are not cointegrated this study might estimate a Dynamic Model in first differencing given bellow.

$$\Delta LGDP_t = \propto + \propto_1 \Delta LGDP_{t-1} + \delta_0 \Delta LME_t + \delta_1 \Delta LME_{t-1} + u_t$$

Where $\Delta LGDP_{t-1}$ is differencing of lag of $\Delta LGDP_t$ and similarly for ΔLME_t. In this model, δ_0 is the short-run impact of military expenditure and $(\delta_0 + \delta_1)/(1 - \propto_1)$ is the long run propensity.

Finally, this study applied Granger (1969) Causality model given below to find the causal relationship between military expenditure and economic growth.

$$\Delta LGDP_t = \delta_1 + \sum_{i=1}^{n} \beta_i \Delta LGDP_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta ME_{t-1} + u_{1t} \quad (4)$$

$$\Delta ME_t = \delta_2 + \sum_{i=1}^{n} \rho_i LGDP_{t-i} + \sum_{i=1}^{n} \theta_i ME_{t-1} + u_{2t} \quad (5)$$

The null hypotheses of model (4) is that military expenditure does not Granger cause economic growth ($H1$: $\sum_{i=1}^{n} \gamma_i = 0$) and null hypothesis of model (5) is that economic growth does not Grange cause military expenditure. ($H2$: $\sum_{i=1}^{n} \rho_i = 0$).

Table 1 Results of Augmented Dickey-Fuller (ADF) test

Variables	Level		First Difference		Decision
	tau-value	p-value	tau value	p-value	
LME	-2.083	0.543	-7.191	0.000	I(1)
LGDP	-1.334	-0.868	-5.965	0.000	I(1)

Table 2 Results of Phillips Perron Unit root test

Variables	Level		First Difference		Decision
	tau-value	p-value	tau value	p-value	
LME	-2.264	0.445	-7.260	0.000	I(1)
LGDP	-1.518	0.811	-5.828	0.000	I(1)

Results and discussion

Table 1 and Table 2 show the estimated results of ADF and PP unit root test. The results of both ADF and PP test gives same results. The results of tau- statistics and p-value conclude that both series of log values of military expenditure (LME) and log values of GDP (LGDP) are integrated order one, $I(1)$. This means that series of both variables are non-stationary at level but it turns to be a stationary at first differencing level of series.

Table 3 shows the results of Engel Granger cointegration test. Linear combinations of each model are not stationary because tau-statistics and Z-statistics are less than the critical value. This result shows that military expenditure and economic growth were not cointegrated, therefore, there were no long-run equilibrium relationship between military expenditure and economic growth in Sri Lanka between 1961 and 2016.

Table 3 Results of Engel and Granger co-integration test

Residuals series	tau-statistics	p-value	Z-statistics	p-value
$\hat{u}_{1t}$	-1.627	0.711	-5.876	0.645
$\hat{u}_{2t}$	-1.825	0.620	-6.853	0.561

Table 4 shows the results of dynamic model where dependent variable is first deference of logarithm of GDP. The military expenditure had positive but no significant impact on GDP in short run and long-run as well.

Table 4 Results of Autoregressive Distributed Lag Model (Dynamic Model)

variables	Coefficient	t-statistics	p-value
Constant ($\propto$)	0.0369	5.3739	0.000
ΔLME_t	0.0052	0.4976	0.621
ΔLME_{t-1}	-0.0163	-1.5545	0.126
$\Delta LGDP_{t-1}$	0.2355	1.7121	0.931

Table 5 shows the results of Granger causality test between military expenditure and economic growth in Sri Lanka for the period from 1961 to 2016. The results concluded that there was no causal relationship between these variables.

Table 5 Results of Granger Causality test

Causality		p-value at lag order one
From	To	
Military Expenditure	Economic Growth	0.1861
Economic Growth	Military Expenditure	0.2326

Conclusion

This study examined the relationship between military expenditure and economic growth in Sri Lanka from 1961 to 2016 by using Engel Granger cointegration, Autoregressive Distributed Lag model and Granger causality test to find relationship between these two variables. From Engel Granger cointegration test found that there was no long run stable equilibrium relationship between military expenditure and economic growth. Dynamic model showed that military expenditure had a positive but no significant impact on economic growth in short-run and long-run as well. Further, Granger causality test revealed that there was no causal relation between these variables. Since no causal relationship between military expenditure and economic growth the policy makers would concentrate other factors that determine the economic growth in Sri Lanka.

Keywords: *Cointegration, economic growth, granger causality, military expenditure.*

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