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Do Military Expenditure and Conflict Affect Economic Growth in Sri Lanka? Evidence from the ARDL Bounds Test Approach

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Abstract

Conflicts in the form of civil war, ethnic tensions and political discord are of enduring concern and a major bottleneck to economic development in Sri Lanka. Three decades of civil war and unethical political culture have caused severe economic problems for the country, including slower rate of growth and a huge defence expenditure. The aim of this study is to examine the effect of military expenditure and conflict on per capita GDP growth rate in Sri Lanka from 1973 to 2014 using the Solow growth model and ARDL bounds test approach. The results of the bounds test are highly significant and lead to cointegration. The negative and significant coefficients of the error correction term illustrate the expected convergence process in the long-run dynamic of per capita GDP. The estimated empirical results show that, the coefficients of military expenditure and conflict are negative and statistically significant in the short-run as well as in the long-run in determining per capita GDP growth rate in Sri Lanka. Hence, it is critically important to take necessary action to decrease military expenditure and provide an efficient political solution to the problem of minorities, specifically in the post-war period.

Keywords: ARDL, conflict, military expenditure, per capita GDP growth rate, Solow model

1. Introduction

Military security is important to protect the people and the nation from internal and external threat. Similarly, security is the basis for the smooth communication of economic agents and functioning of market activities. It is also an essential factor that contributes to economic growth. Conflicts in the form of civil war, ethnic tensions and civil unrest are an on-going concern as well as a major bottleneck to economic development in Sri Lanka. Failure of good governance is the root cause of the ethnic crisis in Sri Lanka. Good governance is needed to ensure equality and to protect the rights of the minority. Implementing and obeying the law, maintaining ethics and transparency are essential for good governance. Most developed countries try to enhance good governance from the grass roots level. However, some of the developing countries, like in Sri Lanka, have failed to ensure equality for the minority group and to maintain a good political culture, ultimately resulting in 27 years of ethnic war and several political conflicts. In other words, the hidden concept of Sinhala Nationalism has caused three decades of dreadful war in Sri Lanka since 1983 (Shinoda, 2011).

The adverse effects of the conflict and higher military expenditure in Sri Lanka can be felt throughout the development path. For instance, because of the conflict, property amounting to millions of dollars has been damaged; thousands of hectares of cultivatable lands destroyed and made unusable; domestic and foreign investment, and tourist arrivals reduced (Arunatilake, Jayasuriya, & Kelegama, 2000). Due to the unsafe situation and massive human casualties, productivity of workers has declined and made even worse with the productive labour being transferred from the civilian sector to the military (Arunatilake, Jayasuriya, & Kelegama, 2000). This unfortunate situation has both directly and indirectly slowed down the rate of economic growth and is the reason for the mounting socio-economic problems, namely, unemployment, poverty, economic deficit, debt burden and weak human resources development. The confidence ellipse graph in Figure 1 clearly indicates the negative association between conflict-effect and per capita GDP growth rate in Sri Lanka.

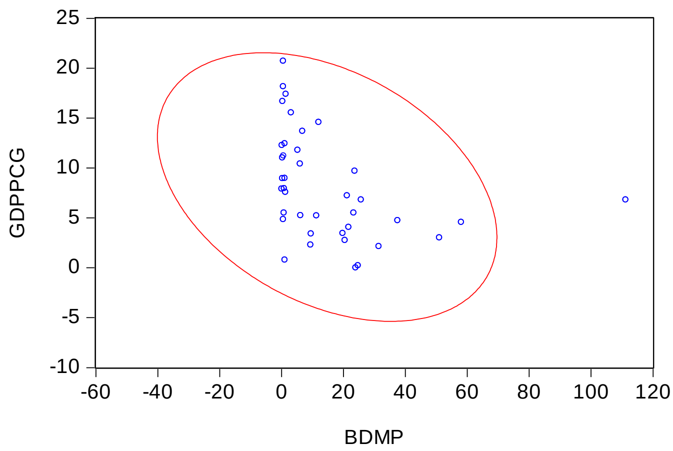


Figure 1. Association between conflict-effect (Note 1) and per capita GDP growth rate

On-going conflict, military sector's development and the ruthless political system are the main causes of increasing military expenditure in Sri Lanka. Global military budget exceeded the income of almost half of the world's population and reached over USD 1.7 trillion in 2013 (World Bank, 2014). Similarly, military expenditure in Sri Lanka increased by 23% from 2009 to USD 1.95 billion in 2014 despite the end of the civil war for the last five years (SIPRI Military Expenditure Database, 2015). The increasing and higher military expenditure may result to deplete resources from much needed productive sectors. The opportunity cost of military expenditure eventually resulting to slow down economic growth. In Figure 2, the confidence ellipse graph clearly illustrates the negative association between military burden and economic growth in Sri Lanka.

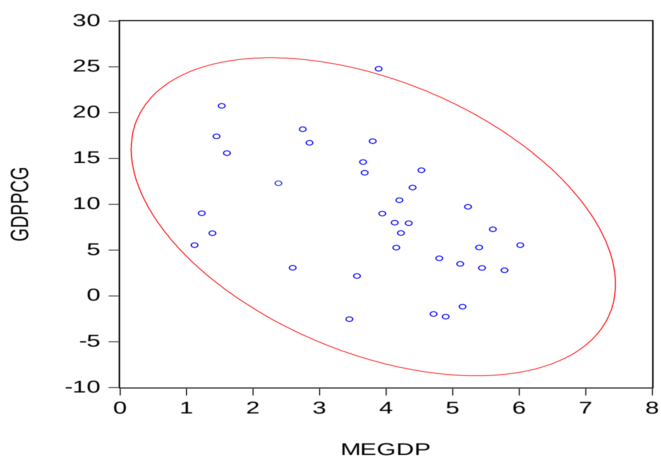


Figure 2. Association between military expenditure and per capita GDP Growth in Sri Lanka

Studying the effect of military expenditure and conflict on per capita GDP growth rate in Sri Lanka is important, as the country has experienced a long lasting civil war and slower rate of economic growth. However, empirical research in this area has not received much attention in Sri Lanka. Nevertheless, of late, Wijeweera and Webb (2009), Ganegodage and Rambaldi (2014) and Selvanathan and Vanathan (2014) have researched into the effect of military expenditure on economic growth. However, the theory and the variables that they used and their findings show the necessity for further investigation in Sri Lanka. Moreover, military expenditure affects economic growth by crowding out resources and conflict affect economic growth by decreasing economies of scale. Therefore, we cannot estimate all the effects by using only the military expenditure component. Moreover, conflict is not the only reason for increasing military expenditure. Political factors and military expansion have also significantly contributed to increased military expenditure. This study aims to investigate the partial effect of military expenditure and conflict on per capita GDP growth rate in Sri Lanka. To achieve this research objective, this study employs the theoretical Solow growth model and the ARDL bounds test approach to cointegration. The rest of the paper is organised as follows. Section 2 reviews the existing literature. Section 3 provides the theoretical model and discusses the econometric methods employed to achieve the research objectives. Section 4 presents and discusses the empirical findings. Finally, section 5 provides a conclusion.

2. Literature Review

Since the innovative empirical contribution by Benoit (1973, 1978), a significant number of empirical studies have been undertaken to study the effect of military expenditure and conflict on economic growth using theoretical and econometric approaches. Compared to other theoretical models, the Solow model is highly accepted as an important theoretical model to study the defence–growth nexus (Dunne, Smith, & Willenbockel, 2005). Knight, Loayza, and Villanueva (1996) applied this Solow model to examine the relationship between military expenditure and economic growth in 79 countries. They found a significant negative relationship between these two variables. The findings of Dunne and Nikolaidou (2012) are consistent with the earlier findings using the same theoretical model for 15 European Union countries (EU15). In contrast to the above findings, a more recent study by Cyril, Signage, and Febrianti (2013) used the same theoretical approach, who found a significant positive result between military spending and economic growth in Indonesia.

There are few other empirical studies that have traced the impact of conflict on economic growth. Murdoch and Sandler (2002a & 2002b) applied the Solow model to test the effect of the civil war on steady-state income per capita for a many countries and concluded that civil war strongly deteriorates economic growth both at home and in neighbouring countries. More recently, Dunne (2012) examined the war effect on economic growth by grouping cross-country panel into income groups and Sub-Saharan Africa (SSA) into war and non-war groups. Dunne’s study found a significant negative impact of the military burden on economic growth in the short-run in all countries (except the higher income group of countries) and it was more serious in the poorest countries. Additionally, he observed no significant impact in the countries experiencing conflict and a significant negative impact in the short-run for countries with no-conflict in SSA.

Very few published studies have focused on the military-growth nexus in Sri Lanka. Among these studies, Wijeweera and Webb (2009) found positive results between military expenditure and economic growth by employing the Keynesian demand side model and Feder-Ram model. This finding is consistent with the research findings of Selvanathan and Vanathan (2014), who found that military expenditure positively Granger cause economic growth in Sri Lanka. In addition, more recently, Ganegodage and Rambaldi (2014) examined the impact of war on economic growth in Sri Lanka by employing the Solow model. The war effort variable was constructed based on the combination of military participation and military spending; they found a significant negative effect of war on economic growth in both the short-run and long-run.

Although there are evidences of the effect of military expenditure and conflict on economic growth, empirical research on this topic has not received much attention it deserves in Sri Lanka. In addition, the variables, the theoretical model and the econometric approach that researchers have used for studies on Sri Lankan, have encouraged us to carry out further investigation on the effect of military expenditure and conflict on economic growth. It is felt that, the effects of military expenditure and conflicts vary and military consequences on economic growth cannot be examined by only using the expenditure component of the military. In addition, most of the existing literature has measured the effect of conflict using a dummy variable. Nevertheless, a dummy variable representing ‘one’ for conflict and ‘zero’ for non-conflict does not reflect the seriousness of the conflict and it is not applicable if the country experienced conflict in whole sample periods.

3. Methodology and Data

3.1 Theoretical Model

The augmented Solow neoclassical growth model is widely used in empirical research to examine the relationship between economic growth and its determinants. The basic Solow model with labour-augmenting technological progress can be written as;

$$Y(t)=K(t)^{\alpha}\left[A(t)L(t)\right]^{1-\alpha} \quad ; 0\langle \alpha \langle 1 \tag{1}$$

Where, $Y(t)$ is real output at the time t, and $K(t)$, $L(t)$ and $A(t)$ are physical capital, labour and the level of technology parameter, respectively.

Mankiw, Romer, and Weil (1992) established this model, with the inclusion of human capital. Knight et al. (1996) went further by including military expenditure. Existing studies have argued that military expenditure affects economic growth in a number of ways. Benoit (1973, 1978) and Knight et al. (1996) highlighted that defence spending can enhance economic growth through the short-run multiplier effect by utilisation of resources. On the other hand, Dunne and Uye (2010) and Chowdhury (1991) argued that decreasing and reallocating scarce resources from socioeconomic functions to manage heightened and increasing military expenditure may hurt economic growth in various ways. Similarly, Harris (1996) also highlighted that utilisation of tax revenue or print money or use of foreign resources to manage military expenditure, may hurt economic growth.

Conflict is a unique factor that deteriorates economic growth. It leads to the reduction of local and foreign investment; destruction of physical and commercial asserts; and destruction of infrastructure and cultivatable land. In addition, productivity of labour diminishes due to the unsafe situation, human casualties, disability and diversion of skilled labour from the civilian sector to the military sector. The effect of war on per capita GDP growth rate has been studied by several researchers, such as, Knight et al. (1996) and Murdoch and Sandler (2002b). Most of the empirical studies have examined the war effect by including a dummy variable as an exogenous factor in the growth model. However, this study measure conflict-effect through the ratio of battle related death to military participation. The Uppsala conflict database differentiates conflict into major and minor based on battle-related death. Empirical studies by Gates et al. (2012), Austin and Mckinney (2012), Jeanty and Fred (2006) and Murdoch and Sandler (2002a & 2002b) have also used battle related death in their studies to measure conflict-effect.

Dunne et al. (2005) highlighted that the Solow model is the most suitable among the existing theoretical models to examine the military-growth nexus. This is because the Keynesian demand side model considers only the demand side factors and completely ignores the supply side factors. On the other hand, the Feder-Ram model considers only the supply side factors and completely ignores the demand side factors. However, the Solow model considers both the demand side and supply side factors and allows the model to include other determinants of economic growth. Recently, Dunne and Nikolaidou (2012), Dunne (2012), and Ganegodage and Rambaldi (2014) made use of this approach to examine the impact of military spending on economic growth.

Dunne et al. (2005) presented military expenditure share of output as follows;

$$A(t) = A(t,M) = A_0 e^{gt} m(t)^{\vartheta} \tag{2}$$

Based on the equation (2), this study adds the conflict-effect on the Solow model as,

$$A(t) = A(t,M) = A_0 e^{gt} [m(t)\,(conflict)]^{\vartheta} \tag{3}$$

In equation (3), (M) represents military expenditure and conflict-effect. Equation (3) assumes that conflict and military expenditure share '$m = M/Y$' affect factor productivity via an efficiency parameter that controls labour-augmenting technical changes. The Solow model, including labour, physical capital, human capital, military expenditure and conflict is given in equation (4):

$$Y(t) = A(t,M)\,K(t)^{\gamma}\,H(t)^{\lambda}\,L(t)^{1-\gamma-\lambda} \;;\; 0 \langle \gamma + \lambda \langle 1 \tag{4}$$

The steady state model for GDP per capita growth with military expenditure and conflict can be written as follows:

$$\ln y_e(t) - \ln y(0) = \left(1 - e^{-\mu t}\right) \begin{bmatrix} (\ln A(0,M) + gt) + \left(\dfrac{\gamma}{1-\gamma-\lambda}\ln(s_k)\right) + \left(\dfrac{\lambda}{1-\gamma-\lambda}\ln(s_h)\right) - \\ \left(\dfrac{\gamma+\lambda}{1-\gamma-\lambda}\ln(g+n+d)\right) \end{bmatrix} - (1-e^{-\mu t})\ln y(0) + \varepsilon(t) \tag{5}$$

Where, ‘ M ’ represents the military expenditure and conflict. Hence, equation (5) can be rearranged as follows:

$$\ln y_e(t) - \ln y(0) = \left(1 - e^{-\mu t}\right) \begin{bmatrix} \ln A(0) + \left(\dfrac{\gamma}{1-\gamma-\lambda}\ln(s_k)\right) + \left(\dfrac{\lambda}{1-\gamma-\lambda}\ln(s_h)\right) - \\ \left(\dfrac{\gamma+\lambda}{1-\gamma-\lambda}\ln(g+n+d)\right) \end{bmatrix} \tag{6}$$

$$-(1-e^{-\mu t})\ln y(0) + (1-e^{-\mu t})(g.t) + \vartheta(1-e^{-\mu t})\ln(me) + \vartheta(1-e^{-\mu t})\ln(conflict) + \varepsilon(t)$$

The steady state long run GDP per capita can be re-parameterised in detail by setting $(1-e^{\mu t})\ln A - (1-e^{-\mu t})\ln y(0) = \phi_0$ in equation (6) as follows:

$$gr=\phi_0+\left(1-e^{-\mu t}\right)\frac{\gamma}{1-\gamma-\lambda}\ln s_k+(1-e^{-\mu t})\frac{\gamma}{1-\gamma-\lambda}\ln s_h-(1-e^{-\mu t})\frac{\gamma+\lambda}{1-\gamma-\lambda}\ln(n+g+d)$$
$$+(1-e^{-\mu t})(g.t)+\vartheta(1-e^{-\mu t})\ln m(t)+\vartheta(1-e^{-\mu t})\ln conflict(t)+\varepsilon(t) \quad (7)$$

Equation (7) can be further re-parameterised in reduced form, including other control variables such as trade openness and total expenditure, as follows:

$$gr=\phi_0+\phi_1\ln(s_k)+\phi_2\ln(s_h)-\phi_3\ln(g+n_1+d)+\phi_4(g.t)+\phi_5\ln me+\phi_6\ln conflict+\theta_7\ln to+\varepsilon \quad (8)$$

In equation (8) all the variables follow natural log, as this equation is derived by linearising the transition path of output per capita around its steady state level (Knight et al., 1996, p. 14), whereby gr is the per capita GDP growth rate (dependent variable); and $m(t)$ is the military expenditure as a percentage of GDP. As an important component of central government expenditure, the coefficient of military expenditure is expected to be positive in the short-run. Empirical studies of Wijeweera and Webb (2009) found positive effects and Dunne et al. (2000); Tiwari and Shahbaz (2013) found a significant negative effect in determining economic growth. Generally, conflict, decreases economic growth in various ways and its sign is expected to be negative in determining economic growth. Murdoch and Sandler (2002a & 2002b) and Ganegoda and Rambaldi (2014) found a significant negative effect of war on GDP per capita growth.

Moreover, in equation (8) s_k is the fixed capital formation ratio to GDP used as a control variable and expected to be positive to determine economic growth. Dunne *et al.*(2005) and Baldacci, Clements, Gupta and Cui (2008), used capital formation as a control variable and found a positive contribution. In this equation, 'n' is the population growth rate. Due to the unavailability of time series data for the labour force over a longer period, population growth rate is used as a proxy for the labour force growth rate and the sign of its coefficient is hypothesized to be negative to determine economic growth, where, the function ($n+(g+d)$) (Note 2) is equivalent (Note 3) to $n+0.05$. Empirical research by Nonneman and Vanhoudt (1996); and Baldacci *et al.* (2008) also used population growth rate as a proxy for the labour force growth rate and found a negative contribution in determining GDP per capita growth. Another important control variable is human capital (s_h) proxied by education and health expenditure and the coefficient is expected to be positive. Baldacci et al. (2008) and Rahman (2011) used education expenditure and health expenditure as a proxy for human development and found positive effects in determining GDP per capita. Trade openness ratio to GDP ($to(t)$) is used as a control variable and its sign is expected to be positive. Knight et al. (1996); and Baldacci et al. (2008) found trade openness positively determines GDP per capita growth.

3.2 Econometric Model: ARDL Bound Test Approach to Cointegration

Testing the equilibrium relationship through cointegration technique provides a meaningful relationship between non-stationary time-series variables. A number of methods are available in the literature to examine the equilibrium relationship. The ARDL bounds test approach proposed by Pesaran, Shin and Smith (2001) chosen in this study, since it can be applied to estimate the cointegration relationship, where the variables are integrated in mixed order [$I(0)$, $I(1)$] or mutually. In addition, the ARDL approach to cointegration test is relatively more efficient for a small sample and allows estimating unbiased estimates of the short-run dynamic with the long-run equilibrium model (Harris & Sollis, 2003; Tiwari & Shahbaz, 2013). Further, the ARDL model does not suffer from the problem of endogeneity and allows differentiating dependent and explanatory variables (Ahmed, Muzib, & Roy, 2013). A number of studies, for instance, Tiwari and Shahbaz (2013); Shahbaz, Afza, and Shabbir (2014) have employed the ARDL bounds test approach to cointegration in order to examine the military - growth nexus.

Determining optimal lag length leads to meaningful cointegration results (Ng & Perron, 2001). The Akaike Information Criterion (AIC) statistics and Schwarz Bayesian Criterion (SBC) statistics are used in this study to select an optimal lag length. Pesaran et al. (2001) also employed AIC and SBC statistics to select an optimal lag length. The first steps of ARDL bounds test approach is to estimate the unrestricted ARDL model as presented in equation (9) to determine the decision of cointegration.

$$\begin{aligned}\Delta GDP^{PCG} &= \pi + \sum_{i=1}^{p_1}\pi_{1i}\Delta GDP_{i-1}^{PCG} + \sum_{i=0}^{p_2}\pi_{2i}\Delta \ln S_{t-i}^{K} + \sum_{i=0}^{p_3}\pi_{3i}\Delta \ln S_{t-i}^{HC} + \sum_{i=0}^{P_4}\pi_{4i}\Delta \ln TO_{t-1} + \\ &+ \sum_{i=0}^{p_5}\pi_{5i}\Delta \ln ME_{t-1} + \sum_{i=0}^{p_6}\pi_{6i}\Delta \ln ngd_{t-i} + \eta_1 GDP_{t-1}^{PCG} + \eta_2 \ln S_{t-1}^{K} + \eta_3 \ln S_{t-1}^{HCE} \\ &+ \eta_4 \ln TO_{t-1} + \eta_5 \ln ME_{t-1}^{GDP} + \eta_6 ngd_{t-1} + u_t\end{aligned} \tag{9}$$

Where, π_{ij} is the short-run coefficient, η_{ij} is the long-run coefficients, GDP^{PCG} is the per capita GDP growth rate, S^K is the fixed capital percentage of GDP, S^{HCE} is the human capital expenditure percentage of GDP, TO is the trade openness percentage of GDP, ME^{GDP} is the military expenditure percentage of GDP, $ngd = n + 0.05$ is the population growth rate with technical progress and depreciation rate.

The null hypothesis of no cointegration $(H_o : \eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = \eta_6 = 0)$ from equation (9) is tested using Narayan's (2005) critical value table for bounds test (Note 4). Pesaran et al.'s (2001) critical value table based on large sample (500 to 1000) and large replications (20,000 to 40,000), is not appropriate for small sample observation (Narayan, 2005). Since the sample size of this study is 40, we use Narayan (2005) critical value table that he generated it for a small sample between 30 and 80 observations. The critical value of the $'F'$ statistics depends on the sample size and the number of independent variables. If the null hypothesis is rejected, then the long-run and short-run coefficients can be estimated through ARDL error correction model, as presented in equation (10).

$$\begin{aligned}\Delta GDP^{PCG} &= \pi + \sum_{i=1}^{p_1}\pi_{1i}\Delta GDP_{i-1}^{PCG} + \sum_{i=0}^{p_2}\pi_{2i}\Delta \ln S_{t-i}^{K} + \sum_{i=0}^{p_3}\pi_{3i}\Delta \ln S_{t-i}^{HC} + \sum_{i=0}^{P_4}\pi_{4i}\Delta \ln TO_{t-1} + \\ &\sum_{i=0}^{p_5}\pi_{5i}\Delta \ln ME_{t-1} + \sum_{i=0}^{p_6}\pi_{6i}\Delta \ln ngd_{t-i} + \lambda ECT_{t-1} + \varepsilon_t\end{aligned} \tag{10}$$

Before estimating the coefficients of the ARDL model, confirming the robustness by testing for serial correlation, functional form, normality of residuals and heteroscedasticity is important for any econometric approach. Moreover, the stability of the estimated model tested using the cumulative sum of recursive residual (CUSUM) and the cumulative sum of square recursive residual (CUSUMS) tests. It is important to highlight here that, this study aims to examine the partial impact of military expenditure (ME) and conflict on GDP per capita growth in Sri Lanka. During the estimation, the variable 'conflict' was replaced instead of military expenditure in equations (9) and (10).

3.3 Units-Root Test (Note 5)

Stationary test is not required to run the ARDL bounds test. However, it is necessary to confirm none of the variables follows $I(2)$. Recently developed unit root tests, such as DF-GLS test and Ng-Parror tests are used to determine stationarity of the variables. These tests provide good explanatory power and size and they are good for a small sample (Martin et al., 2012; Shahbaz et al., 2013).

3.3.1 Dickey Fuller Generalised Least Squares (DF-GLS) Test

Elliott, Rothenberg and Stock (1992) (hereinafter ERS) introduced a modified version of ADF test statistics by omitting deterministic trend in the original ADF test model, and this is presented in equation (11). They revealed that the DF-GLS test has greater power and is even good for small sample data.

$$\Delta X_t^d = \delta X_{t-1}^d + \sum_{J=2}^{p}\delta_j \Delta X_{t-j}^d + \varepsilon_t \tag{11}$$

The null hypothesis of $H_0 : \delta = 0$ is tested for two possible alternatives to non zero constant, with no linear trend ($D_t = 1$) and with the constant and linear trend ($D_t = 1, t$).

3.3.2 Ng-Perron Test

Ng and Perron (NP, 2001) modified their previous (Ng & Perron, 1995) test statistics. They developed their new test statistics from GLS detrended data and modified information criteria (MIC) (Note 6) for lag length selection.

This new statistic improves the power property significantly. They highlighted that detrended data with autoregressive representation from ADF test regression (Note 7) provides higher power.

The modified statistics are;

$$MZ_t = MZ_P \times MSB \tag{12}$$

Where, $MZ_P = \left(T^{-1}X_t^d - \hat{\lambda}^2\right)\left(2T^{-2}\sum_{t=1}^{T} X_{t-1}^d\right)^{-1}$ and $MSB = \left(T^{-2}\sum_{t=1}^{T} X_{t-1}^d / \hat{\lambda}^2\right)^{1/2}$

Where λ^2 is the long-run variance (Note 8).

3.4 Data

Data used for this study, including GDP per capita, gross capital formation, trade openness, total government expenditure, and population growth rate are collected from World Bank's World Development Indicator, 2015. Data for government expenditure on education and health care, and military expenditure are collected from the Central Bank annual reports (various issues). Military participation data is collected from military balance (various issues) of Stockholm International Peace Research Institute. Battle related death are from Upsala conflict database, 2015. Due to the unavailability of data before 1973 for military expenditure, military participation and education and health expenditure, this study use annual time-series data from 1973 to 2014.

4. Empirical Findings and Discussion

Unit root test results using the Ng-Perron and DF-GLS tests are presented in Table 1. Both statistics confirm that human capital expenditure ratio to GDP and conflict effect variables are stationary at level, while fixed-capital ratio to GDP is stationary at a level in DF-GLS test and stationary at first difference in Ng-Perron test. However, all the other variables included in this study are stationary at first difference in both statistics. The unit root test confirms that none of the variables follows $I(2)$ and this result resembles to proceed ARDL cointegration test with $I(0)$ and $I(1)$ variables.

Table 1. Unit root test

Variables	Ng-Perron (MZ_t Statistics)			DF-GLS		
	Level	1st Difference	Conclusion	Level	1st Difference	Conclusion
GDP_{PCG}	-1.076	-2.963*	$I(1)$	-1.263	-5.930*	$I(1)$
$Lngd$	-1.153	-2.892*	$I(1)$	-1.458	-7.261*	$I(1)$
lS_{gdp}^K	-1.729	-2.803*	$I(1)$	-2.271**	-	$I(0)$
lTO_{gdp}	-1.296	-2.863*	$I(1)$	-1.398	-4.738*	$I(1)$
lS_{gdp}^{HCE}	-2.149**	-	$I(0)$	-2.615**	-	$I(0)$
lME_{gdp}	-1.306	-2.452**	$I(1)$	-1.285	-3.112*	$I(1)$
$lconflict$	-2.612	-	$I(0)$	-3.300	-	$I(0)$

N.B: ***, ** and * denote 10%, 5% and 1% level of significance respectively. L denotes logarithmic and S and NS denotes Stationary and Non-stationary respectively.

Selecting the optimal lag length is an important requirement in ARDL bounds test approach. The optimal lag length three is selected in each model based on AIC statistic. Before proceeding to test the equilibrium relationship, it is necessary to confirm the evidence of cointegration. Thus, our target is to estimate the cointegration relationship for per capita GDP growth rate as a dependent variable with other independent variables including military expenditure and conflict separately. Thereby, we estimate only two $'F'$ statistics for per capita GDP growth rate with military expenditure and conflict separately. The results of the estimated $'F'$ statistics for equation (9) are given in Table 2. Therefore, the null hypothesis of no cointegration is rejected and the existence of long-run equilibrium relationship in both models are confirmed. Conclusion of cointegration is derived from Narayan's (2005) critical value table for the respective independent variables ($k = 5$) and number of observations ($n = 40$) for lower and upper bounds at 1% and 5% significance level.

Table 2. ARDL bound test statistics and critical value (unrestricted intercept; no trend)

Model	Right Hand Side Variables	F Statistics	Conclusion of Cointegration
F_{gdppcg}	$Lngd, IS_{gdp}^{K}, lTO_{gdp}, lS_{gdp}^{HCE}, lME_{gdp}$	5.7426	exist at 5%
F_{gdppcg}	$Lngd, IS_{gdp}^{K}, lTO_{gdp}, lS_{gdp}^{HCE}, lConflict$	5.6106	exist at 5%

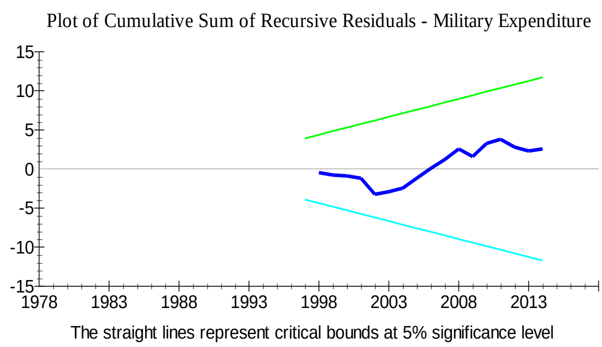
Narayan (2005) critical value for 5% significance level is $I(0) = 2.962$ $I(1) = 2.338$ and for 1% significance level is $I(0) = 4.045$ $I(1) = 5.898$.

The optimal ARDL model (p_1, p_2, p_3, p_4, p_5) is selected based on SBC statistics. The ARDL (0,1,1,0,0,0) is selected for per capita GDP growth rate with military expenditure and ARDL (1,2,0,0,0,0) is selected for the same dependent variable with conflict. Diagnostic and stability tests are important to determine the appropriateness of the estimated long-run and short-run coefficients of the ARDL models. The diagnostic results presented in Table 3 confirm that the estimated models are free from serial correlation, functional form error, heteroscedasticity and non-normality of residuals. Another important property of a good ARDL model is the stability of the long-run coefficients that are used to proceed with the error-correction terms in conjunction with the short-run dynamic (Ahmed et al., 2013). In line with this, we applied CUSUM plot and CUSUM square of recursive residuals against the critical bounds of five percentage significance level. Both plots for ARDL (0,1,1,0,0,0) and ARDL (1,2,0,0,0,0) presented in Figure 3 and Figure 4, clearly illustrate that cumulative sum of the residuals and the cumulative sum of square residuals lie within the confidence limits and confirm the stability of the model.

Table 3. Diagnostic test results

	ARDL (0,1,1,0,0,0) Model with military expenditure		ARDL (1,2,0,0,0,0,0) Model with conflict	
Test Statistics	LM version	F version	LM version	F version
Serial Correlation	0.337(0.562)	0.257 (0.616)	3.292 (0.070)	2.655 (0.144)
Functional Form	0.245 (0.621)	0.187 (0.669)	2.960 (0.085)	2.365(0.135)
Heteroscedasticity	0.298 (0.585)	0.285 (0.597)	0.719 (0.694)	0.147 (0.704)
Normality	1.189 (0.552)	-	1.821 (0.820)	-

The probabilities are in parentheses.



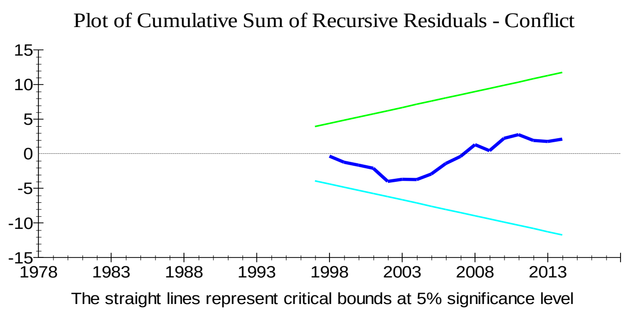
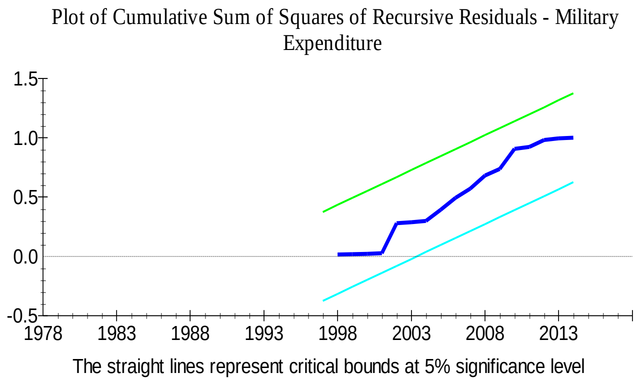


Figure 3. CUSUM plot for stability



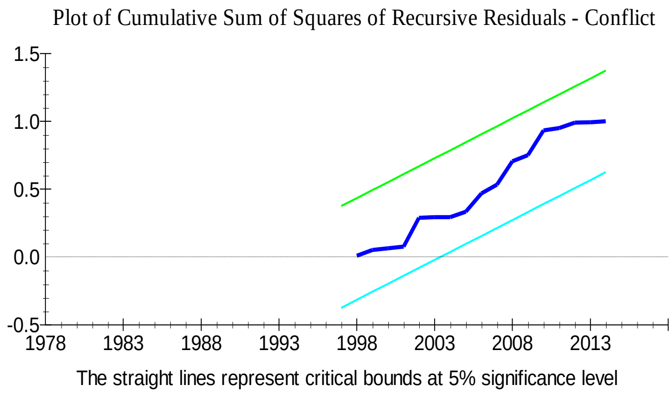


Figure 4. CUSUM square plot for stability

The long-run and short-run results for equations (10) are reported in Tables 4 and 5 respectively. The higher value of adjusted R^2 in both models indicates the overall goodness of fit of the estimated models. Beginning with the results of the long-run model, as expected the coefficients of military expenditure and conflict are negative and statistically significant. The results suggest that a one percent increase in military expenditure will decrease per capita GDP growth rate by 5.2% and the coefficient of conflict accounts for the decrease in per capita GDP growth rate by 2.4%. When we look at the sign of the coefficient of control variables in the long-run, only the coefficient of human capital expenditure is positive and significant in both models to determine per capita GDP growth rate in Sri Lanka.

Table 4. Long-run estimated ARDL model based on SBC

	Long-run Model DV: per capita GDP growth rate			
Variables	Military Expenditure ARDL (0,1,1,0,0,0)		Conflict ARDL (1,2, 0,0,0,0)	
	Coefficient	't' Value	Coefficient	't' Value
lfcgdp	-11.0356	-1.638	15.795	1.311
ltogdp	-6.2641	-1.150	-11.363	-1.215
lhcegdp	17.552	2.424**	44.720	2.424**
ln *gd*	-3.699	-1.696	0.686	0.199
lmegdp	-5.224	-3.126*	-	-
Conflict	-	-	-2.409	-2.351**
C	51.839	1.700	-51.145	0.839

The short-run result of ARDL models is also reported in Table 5. As expected, the error correction coefficients in both models are highly significant at the 1% level and its signs are negative as expected, which are (-0.563) in ARDL (0,1,1,0,0,0) and (-0.587) in ARDL (1,2,0,0,0,0). This implies that disequilibrium of the previous year is adjusted towards the equilibrium in the current year in both models at the rate of 56% and 59% respectively.

Interestingly, similar to the long-run, the coefficient of military expenditure and conflict are negative and statistically significant in the short-run as well. This implies that in the short-run, one percent increase in military expenditure will decrease per capita GDP growth rate by 5.2% and conflict will account for a decrease in per capita growth by 1.4%. In the short-run, coefficients of fixed capital, its first lag and human capital expenditure are positive and they are statistically significant in both models. Coefficient of trade openness is significant only in ARDL (0,1,1,0,0,0) model but its sign is negative. However, (population growth rate +0.05) is not significant in both long-run and short-run.

Table 5. Short-run estimated ARDL model based on SBC

	Short-run Model DV: per capita GDP growth rate			
Variables	Military Expenditure: ARDL (0,1,1,0,0,0)		Conflict: ARDL (1,2, 0,0,0,0)	
	Coefficient	't' Value	Coefficient	't' Value
$\Delta lfcgdp$	32.201	5.441*	28.360	4.691*
$\Delta lfcgdp(-1)$	-	-	16.155	2.364**
$\Delta ltogdp$	-27.518	-2.667**	-6.676	1.183
$\Delta lhcegdp$	17.552	2.424**	26.217	2.871**
$\Delta \ln gd$	-3.699	-1.696	0.404	0.201
$\Delta lmegdp$	-5.224	-3.126*	-	-
$\Delta Conflict$	-	-	-1.415	-2.778**
Δc	51.839	1.701	-30.045	-0.868
ECT_{t-1}	- 0.563	-3.636*	- 0.587	-4.054*
$\overline{R}^2$	0.816		0.812	

In general, results from the ARDL approach conclude that military expenditure and conflict are detrimental to per capita GDP growth rate in the long-run as well as in the short-run in Sri Lanka. However, the effect of military expenditure on per capita GDP growth rate is more severe than conflict. The empirical finding of the negative impact of military expenditure contradicts the earlier findings reported by Wijeweera and Webb (2009), which found military expenditure enhances economic growth; however, the coefficient in their study is not significant. The reason for positive and insignificant finding in their study could be due to the theory that they employed being a Keynesian demand side model and Feder-Ram model. However, as explained in section 3, both these models have several weaknesses. Moreover, most of the existing literature based on these two theoretical models generally shows a positive relationship. However, the present finding of the negative impact of military expenditure on per capita GDP growth rate with the application of the Solow growth model is supported by Knight et al. (1996) and Dunne and Nikolaidou (2012). Similarly, the finding of this study clearly illustrates that conflict also depletes per capita GDP growth rate in the long and the short-runs in Sri Lanka. The result is in line with the earlier results of Murdoch and Sandler (2002a & 2002b) and also consistent with the findings of Ganegodage and Rambaldi (2014) in Sri Lanka. However, they measured the war effect using the ratio of military participation and military expenditure.

The empirical findings of this study are consistent with the expectations of the theoretical argument of the Solow model, where military expenditure is expected to deplete economic growth in the long-run and short-run. However, when the government allocates resources efficiently in the military sector, economic growth may increase only in the short-run. In addition, we highlight that conflict has undeniably decrease per capita GDP growth rate.

Empirical findings of this study are very obvious in Sri Lanka. Since the civil war erupted in 1983, military expenditure has increased drastically relative to other productive expenditures. Other minor and political conflicts have also resulted in increasing defence expenditure. Total military expenditure share of GDP was 6.02% in 1996, while the education and the health expenditure share of GDP remained at only 2.6% and 1.5% respectively. Even after the war, the government of Sri Lanka has given higher priority to military sector's development compared to socioeconomic development. Therefore, institutional capacity is declining in the civilian sector, eventually resulting in lower economic growth. According to a United Nations report, three decades of long lasting civil war have caused nearly hundred thousand of deaths and has made thousands of Sri Lankans disabled. In addition, millions of people have been displaced, thousands of people have disappeared and huge number of productive workers have been transferred from civilian to military. These evidences and insecure condition have led to decreased productivity of workers and lower institutional capacity in the civilian sector resulting in slower economic growth. The war has led to a drop in local and foreign investments, decreased tourist arrivals, destruction of infrastructure, commercial activities and capital assets all of which have resulted in weak economic growth in Sri Lanka (Arunatilaka et al., 2000).

5. Conclusions and Policy Recommendations

This study intends to examine the impact of military expenditure and conflict on per capita GDP growth rate in Sri Lanka over the period from 1973 to 2014 by applying the Solow theoretical growth model and ARDL bound test approach to cointegration. Prior to the ARDL bounds test approach to cointegration, the important time-series property of unit root of variables is tested using DF-GLS and Ng-Peron test. The unit root test confirms that variables included in this study follow a mixed order of integration with $I(0)$ and $I(1)$. Robustness test for autocorrelation, heteroscedasticity, normality of residuals, functional form and stability of the model confirm the adequacy of the estimated model. In addition, the high values of adjusted R^2 further validate the estimated ARDL models.

The results for long-run and short-run coefficients of military expenditure and conflict are negative and clearly highlights that they decrease per capita GDP growth rate in Sri Lanka. Despite the war, having ended in 2009, the government of Sri Lanka is still prioritising the military sector and neglecting the much-needed socioeconomic functions. Sri Lanka is a developing nation facing fundamental socioeconomic challenges. Meeting these challenges and addressing the need for more spending on social and development priorities, requires more efficient use of the available scarce resources by the military sector. Reduction in military expenditure would provide a “dividend” in the form of increase consumption and investment opportunities. The findings of this study are an eye-opener for policy-makers and the government to take steps to minimise military expenditure and give more priority to other economic sectors.

Despite several attempts, no political solution has been found even after the civil war ended in 2009. Approximately 300,000 people were displaced in the war’s final phase and many are still living under constant military scrutiny and extreme poverty, and without proper housing. Solving the fundamental problems of displaced peoples is very important to bring back peace to Sri Lanka. Therefore, urgent steps need to be implemented to tackle the issues of poverty and unemployment, and to resettle these displaced people. It is important to highlight that, initial efforts by the present government have brought a new wave of hope to nearly 25% of the minority population in Sri Lanka. It is a key responsibility of all political parties, religious heads and the general public, support this initiative, to restore peace and stability in Sri Lanka, which are the most crucial factors to ensure a steady economic growth

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Notes

Note 1. Conflict-effect variable is measured through the battle death ration to (1000) military participation.

Note 2. n is the population growth rate, g is the technological progress and d is the capital depreciation rate.

Note 3. Mankiw *et al.* (1992) assumed $(\delta + g) = 0.05$. According to their empirical study based on U.S. data on capital consumption allowance, they obtained $\delta = 0.03$ and $g = 0.02$

Note 4. The null hypothesis is tested using non-standard $'F'$ statistics (irrespective of order of integration of variables). Decision is taken from two sets of critical values (upper bound and lower bound), for a given significance level with and without a time trend. Cointegration is determined, if the calculated $'F'$ statistics exceed the upper critical bound value and decision of no cointegration derives if calculated $'F'$ statistics stayed below the lower critical bound value. The area in between upper and lower critical value is inconclusive region.

Note 5. This section is developed based on Martin, Hurn, and Harris (2013).

Note 6. Modification of AIC and BIC with sample dependent penalty factor $MIC(p) = \ln(\hat{\sigma}_p^2) + \frac{2(\tau(p)+p)}{T - p_{\max}}$

Where, $\tau(p) = \frac{\hat{\delta}^2 \sum_{t=p\max+1}^{T} X_{t-1}^d}{\hat{\sigma}_p^2}$ and $\hat{\sigma}_p^2 = \frac{1}{T - p_{mas}} \sum_{t=p\max+1}^{T} \hat{\varepsilon}_t^2$

Note 7. $\Delta X_t = \eta' D_t + \delta X_{t-1} + \sum_{J=2}^{Q} \delta_j \Delta X_{t-j+1} + \varepsilon_t$

Note 8. $\hat{\lambda}_{AR}^2 = \frac{\hat{\sigma}_p^2}{\left(1 - \hat{\delta}(1)\right)^2}$ Where, $\hat{\delta}(1) = \sum_{j=1}^{p} \hat{\delta}_j$ and $\hat{\sigma}_p^2 = \frac{1}{T-p} \sum_{t=p+1}^{T} \hat{\varepsilon}_t^2$ are obtained from ADF regression.