Bangladesh Journal of Political Economy

Vol. 39, No. 1, June 2023, pp. 91-110
Bangladesh Economic Association
ISSN 2227-3182
DOI: http://doi.org/10.56138/bjpe.v39n1.06

Does Military Spending Impede Economic Growth? ARDL and Causality Analysis for Bangladesh

Ashiqur Rahman[*]
Nourush Jahan[**]
Mohammad Sadiqunnabi Choudhury[***]

Abstract

This study investigates the causal relationship between military expenditure and economic growth in Bangladesh using data from 1980 to 2022. Aligning with methodologies employed in similar studies conducted in other countries, the study utilizes Granger causality tests and ARDL bound testing for cointegration analysis. The study findings reveal an inverse correlation between defense spending and economic growth, as well as at least one long-run equilibrium relationship among the variables. Specifically, the study finds a unidirectional causal link from military expenditure to economic growth. The results hold significant implications for policymakers, suggesting that reducing defense spending could potentially stimulate economic expansion.

***Keywords**: ARDL boundy · test · Bangladesh · Economic Growth · Granger Causality · Military Expenditures*

1. Introduction

The relationship between military spending and economic development, particularly in less developed countries, has garnered significant attention since Benoit's (1978) seminal findings. Benoit's research, suggesting a positive influence of higher military expenditures on economic growth, sparked considerable debate in the field. Subsequent studies have examined various mechanisms through which defense spending affects economic growth, including demand, supply, and security effects (Dunne et al., 2005). Despite extensive research to date, the literature offers mixed results on the true impact of military expenditure on economic growth.

This study focuses on Bangladesh as a case study to reexamine the interrelationship

[*] Lecturer, Department of Economics, Mawlana Bhashani Science and Technology University, Tangail, Bangladesh
[**] Lecturer, Department of Economics, Metropolitan University, Sylhet, Bangladesh
[***] Corresponding Author: Professor, Department of Economics, Shahjalal University of Science and Technology, Sylhet, Bangladesh; E-mail: sadique-eco@sust.edu

between military spending and economic growth. Initially established to defend against external aggression following the brutal experience of the 1971 liberation war, the Bangladesh military faces relatively minimal threats presently and in the foreseeable future. With well-defined borders with India and Myanmar, the majority of which are peaceful, military conflict is unlikely. Additionally, there are no significant disagreements between Bangladesh and India that might escalate into military conflicts with other nations. Instead, Bangladesh has focused on developing military capabilities to foster peace, such as participating in UN peacekeeping missions, rather than engaging in external military adventurism or conflicts (Choudhury, 2014). Despite this stable security environment, Bangladesh has witnessed a rise in military expenditures in recent years. Military expenditure in Bangladesh has been on an upward trajectory since 2008, reaching a high of USD 4.97 billion in FY 2021-22. According to the Stockholm International Peace Research Institute (SIPRI), Bangladesh experienced the second-largest relative growth in military spending between 2008 and 2017. In 2017, Bangladesh ranked third among South Asian countries in defense expenditure as a percentage of government spending, according to SIPRI data (Figure 1). Notably, the Bangladeshi military shares similar commercial objectives with Pakistan, with involvement in various industries including food, apparel, electronics, real estate, shipbuilding, maritime construction, and travel, as reported by the BBC. Furthermore, there have been reports that top military officers have received illegal loans from Trust Bank and Ansar VDP Bank, both affiliated with the military. The Bangladesh Army's economic ventures extend to power plants, highways, infrastructure, and bridge projects, amassing billions of dollars in private assets, according to BBC research (Smith, 2018).

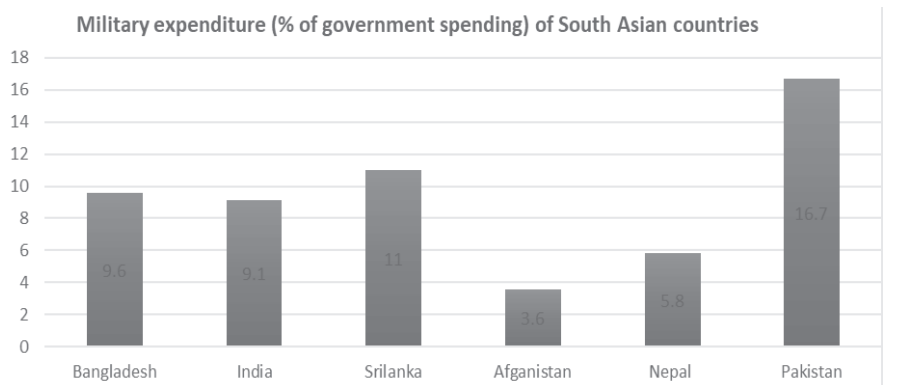

Figure 1. Military Expenditure (% of government spending) of South Asian Countries

Muravska (2012) argues that incorporating profit motives into non-profit organizations, such as the Bangladesh Armed Forces, detracts from their official duties, undermining institutional cohesion and professional integrity. This

focus on business ventures diminishes the military's proficiency and exposes the country to domestic and international threats, as funding for these ventures is sourced from the army welfare trust, which is intended to support retired army personnel. Similarly, the military procurement system in Bangladesh, like in many developing countries, is shrouded in secrecy. As part of its Forces Goal 2030, a military modernization strategy initiated by the Government of Bangladesh, the country seeks international partners for affordable defense systems to fund Special Operations Forces and emergency assistance. However, Delavallade (2006) highlights the military procurement system's susceptibility to corruption. Moreover, according to SIPRI's (2018) report, the international arms trade and arms procurement conventions in Asia, Africa, and the Middle East are vulnerable to significant risks of waste and corruption. Additionally, what were once considered non-traditional security (NTS) challenges, such as international criminal activity, terrorism, humanitarian crises, climate change, and public health emergencies, are now viewed as essential national security concerns (Walsh, 2011). Given these concerns, it is evident that the government's heavy military expenditure can be questioned on various grounds. The secrecy of the procurement system and the dominance of business interests raise the specter of corruption for personal gain, potentially jeopardizing national sovereignty and security. However, despite the negative implications associated with high military spending, the critical importance of national security and emerging non-traditional threats cannot be ignored. In light of these considerations, this study aims to address the following research questions:

1. What impact does military spending have on economic growth?
2. What is the direction of causality between the variables of interest?

The subsequent sections of the paper are structured as follows: Section 2 reviews existing literature on the relationship between the variables of interest and identifies research gaps; Section 3 discusses the data sources and methodological considerations employed to establish causal connections between the variables; Section 4 presents the empirical findings of the study; and Section 5 offers policy recommendations based on the research findings.

2. Literature Review

Benoit's (1978) seminal work initiated the exploration of the relationship between defense spending and economic growth. Subsequent academic endeavors have examined the presence and direction of causation between these two variables, either focusing on specific countries or analyzing a broad array of nations. Current literature examines the Keynesian and Neoclassical approaches as the primary frameworks through which defense spending may influence economic growth rates. The Keynesian perspective emphasizes aggregate demand, positing that

an increase in defense spending raises aggregate demand, thereby stimulating output and employment growth. Thus, defense spending is seen as conducive to economic expansion. In contrast, the Neoclassical viewpoint prioritizes aggregate supply. It argues that military investment diverts productive resources, particularly human capital, away from potential civilian sector investments. Moreover, there may be a "distortion effect," in which military expenditure disrupts other expenditures and compromises resource allocation efficiency, potentially through price inflation and the encouragement of rent-seeking behavior. Consequently, the Neoclassical framework anticipates a negative impact of defense spending on economic growth. However, the literature presents a spectrum of findings regarding the relationship between economic growth and defense spending, influenced by factors such as methodology, sample size, and the selection of nations. Below, we present a summary of some of these analyses.

2.1 Positive Relationships

Defense spending has been identified as a potential contributor to human capital development, particularly in the health and education sectors (Ram, 1995). This is especially true in emerging nations, where defense personnel and conscripts often undergo rigorous physical training and acquire a range of skills (Benoit, 1978). Moreover, greater defense expenditures are believed to stabilize a nation's political unrest, strengthening its defenses against both internal and external threats, which in turn can foster enhanced investment and market functioning (Dunne et al., 2005). Consequently, military spending may increase output, provided it enhances national security. Technological advancement plays a significant role in shaping the relationship between defense spending and economic growth. Mueller and Atesoglu (1993) incorporate this aspect, dividing the impact of defense spending into two parts: the relative size of the defense sector and the change in the pace of defense spending. Their estimates suggest that changes in defense spending positively and significantly affect the economy's growth rate, with each component of defense spending exerting noteworthy effects individually.

In examining the relationship between defense spending and economic growth, Dunne et al. (2001) utilize standard Granger causality tests and VAR Granger causality methods to account for cointegration. While conventional Granger causality tests suggest a positive impact of increased military spending on Greece's economic growth, this conclusion is challenged when VAR modeling is used to account for cointegration among the variables. Atesoglu (2002) employs cointegration analysis in the US context, finding that an increase in defense spending is associated with higher US GDP. Cuaresma and Reitschuler (2004) allow for a non-linear relationship between defense spending and growth in the United States, using an expanded version of the Barro and Sala-i-Martin

(1995) framework. Aizenman and Glick (2006) uncover intriguing findings by elucidating the nonlinear connections among defense investment, foreign threats, corruption, and growth, indicating that defense spending accelerates growth in the face of external threats.

Jalil et al. (2016) use an ARDL approach to examine the long-term link between military spending and economic growth in Pakistan and India. They initially find a positive relationship, but as both economies reach critical points, the net effect becomes negative. Yolcu et al. (2017) employ the PSTR model to investigate this relationship for Turkey and Middle Eastern countries, revealing an asymmetric relationship between military expenditure and economic growth. Ahmed and Naslmosavi (2017) find a favorable association between military spending and economic growth across five SAARC countries, while Ajmair et al. (2018) examine Pakistan and find significant positive short-run effects of military expenditure on economic growth. Desli et al. (2017) investigate the dynamic relationship between military spending and economic growth across 138 nations from 1988 to 2013. Their findings suggest little evidence of short- or long-term causality from military spending to overall economic growth, except in developing nations, where a long-term positive correlation is observed.

2.2 Negative Relationships

Manamperi (2016) has uncovered significant adverse effects for Turkey in both the short- and long-term. Zhao et al. (2017) used Granger causality tests and generalized impulse response functions based on vector error correction models (VECMs) to identify similar negative effects of defense spending on economic growth for the period 1952 to 2012 in China. Shahbaz et al. (2013) aimed to explore the relationship between military spending and economic growth in Pakistan from 1972 to 2008. Their study confirmed the cointegration of interest rates, military spending, government spending, and economic growth, revealing a negative impact of military spending on Pakistan's economic growth. Government non-military spending positively influenced economic growth, while real interest rates showed an inverse relationship with economic growth. Klein (2004) focused on Peru during 1970–1996 and demonstrated a significant crowding-out effect of defense spending using a Deger-type simultaneous equations model (Deger, 1985). Dunne and Nikolaidou (2001) examined Greece's case from 1960 to 1996, utilizing a set of four equations estimated through two-stage least squares (2SLS) and ordinary least squares (OLS). They found a substantial negative impact of defense spending on economic growth, both directly and indirectly through savings and trade balance. The use of time series data with varying horizons, sample sizes, socioeconomic conditions, and geographical locations across countries, along with diverse theoretical frameworks guiding distinct econometric specifications, makes meaningful

comparisons unattainable (Desli et al., 2017). Consequently, researchers have turned to panel studies to ensure more representative decision-making. For instance, Ismail (2017) investigated the connection between economic expansion in South Asia and military spending using a panel fixed-effect model. While empirical findings suggested a positive association between the variables of interest, the impact was less significant than when scarce resources were allocated to non-military purposes. The study concluded that increasing military spending to stimulate economic growth is ineffective and inefficient. Dunne and Tian (2015) used a balanced panel of 106 nations covering 1988–2010, accounting for nonlinearity and group heterogeneity. Their results indicated a short- and long-term negative impact of military spending on growth, supported by subgroup analysis. However, the body of research on the subject remains insufficient to draw firm conclusions regarding the actual relationship between military spending and economic expansion. Reviewing 170 studies, Dunne and Tian (2013) found that a growing body of recent research suggests that military spending has a detrimental impact on economic growth.

2.3 Insignificant Relationships

Biswas and Ram (1986) observed that in 80% of the nations studied, there was no statistically significant correlation between defense spending and economic growth, whereas Chowdhury (1991) found no correlation in 55% of the countries. Mintz and Stevenson (1995) utilized a multisector model based on neoclassical growth theory to investigate the external effects of defense spending across 103 nations. Their analysis revealed that while nonmilitary spending positively affects growth in many nations, military spending generally has a minimal effect on overall growth, with only about 10% of cases showing a significant boost. Huang and Mintz (1991) examined U.S. economic data from 1952 to 1988 to reassess the coefficients for the externality component of military spending. They compared their findings with those of Mueller and Atesoglu (1993) and Alexander (1990) and found no discernible externality effect of military spending on economic growth, according to their calculations. Additionally, Mintz and Huang (1990) investigated the direct and indirect effects of reduced U.S. military spending on economic growth using a two-equation model. Their study suggested that defense expenditure has a delayed, indirect impact on growth, with effects becoming apparent approximately 5 years after the spending reduction. Gerace (2002) conducted a spectral study of the growth rates of U.S. government spending, both military and nonmilitary, and GDP from 1951 to 1997. His findings indicated that military spending does not fluctuate counter-cyclically with real GDP growth rates, unlike non-military spending. Similar conclusions were drawn by Kinsella (1990) and Payne and Ross (1992) in their studies of the U.S. context. Heo (2010) analyzed the relationship between

defense spending and growth in the U.S. from 1954 to 2005 using the Feder-Ram and augmented Solow models, finding no discernible impact of defense spending on the economy. Habibullah et al. (2008) investigated the connection between military spending and economic growth in various Asian countries from 1989 to 2004. Their empirical findings, using the panel error-correction technique, suggested by Pesaran et al. (1999), indicated no correlation between defense spending and economic growth in the Asian countries studied. Abu-Qarn (2010) examined the causal connection between military spending and economic growth for the four adversaries of the Israeli-Arab conflict from 1960 to 2004 using causality tests. The analysis concluded that there is little to no causal association between economic growth and defense spending.

2.4 Research Gap

Upon examination of the existing literature, it is evident that several panel and cross-sectional studies have included Bangladesh among their sample countries. However, there is a notable absence of time-series studies specifically examining military expenditure in Bangladesh. The present study aims to address this gap by investigating the relationship between military expenditure and economic growth in Bangladesh, thus contributing to the existing body of research.

3. Data and Methods

3.1 Data Sources

The data used in this research were sourced from two main repositories: the Stockholm International Peace Research Institute (SIPRI) and the World Development Indicators (WDI). SIPRI is highly esteemed in defense literature for its transparent, easily accessible data available on its website, which ensures clarity and reliability. Significantly, SIPRI maintains consistency in defining military expenditure across different time periods and countries (Malizard, 2016). Conversely, data on variables such as GDP, real interest rates, and gross fixed capital formation (used as a proxy for investment) were obtained from the World Development Indicators (WDI).

Table 1. List of Variables and their Sources

Variables	Sources
GDP (constant 2015 US$) [lngdp]	World Development Indicator
Military expenditure (constant 2021 US$) [lnmex]	Stockholm International Peace Research Institute (SIPRI)
Real interest rate [lnrin]	World Development Indicator
Gross Fixed Capital Formation (% of GDP) [lninv]	World Development Indicator

3.2 The Model

This study employs a model akin to that of Feder (1983) to evaluate the relationship between military spending and economic growth. Feder's concept has been utilized by Biswas and Ram (1986), Ram (1986, 1995), and numerous subsequent studies. Linear variable specification often yields inefficient outcomes in developing economies (Karagol, 2006). Hence, a log-linear specification, which provides direct elasticities, is preferred for more reliable results (Sezgin, 2004). The empirical equation used is as follows:

$$lngdp_t = \alpha_1 + \alpha_2 lnmex_t + \alpha_3 lninv_t + \alpha_4 rin_t + \mu_t \quad (1)$$

In the equation, $lnrgdp_t$ represents real GDP (a proxy for economic growth), $lnmilex_t$ denotes military expenditure, $lninv_t$ signifies investment, and $realin_t$ represents the real interest rate. The residual term, μ_t is assumed to follow a normal distribution.

Economic analysis frequently indicates the existence of a stable, long-term relationship among specific variables, suggesting that their means and deviations remain constant over time. This stable relationship is captured using a fundamental econometric technique called cointegration. Various methods exist for conducting cointegration testing, including the residual-based Engle and Granger (1987) test, the Gregory and Hansen (1996) test, the Johansen (1988) test, and the Johansen and Juselius (1990) test. In recent years, the autoregressive distributed lag (ARDL) approach pioneered by Pesaran and Shin (1998) and Pesaran et al. (2001) has gained attention. The ARDL model offers distinct advantages, particularly its application independence compared to other cointegration methods, which require similar degrees of integration for all variables. Unlike these methods, the ARDL technique does not necessitate the use of Augmented Dickey-Fuller unit root tests or autocorrelation function tests when assessing the order of integration. It also addresses the issue of limited sample size. Furthermore, ARDL models incorporate an error correction term in their lagged periods, fully capturing both the long- and short-run relationships among the variables under study. Since the error-correction term in the model is not subject to restricted error-correction, ARDL is considered an unconstrained error-correction model (UECM), thereby eliminating endogeneity issues commonly associated with other methods (Jalil et al., 2016). In this study, we applied the ARDL bound-testing method of estimation proposed by Pesaran et al. (2001), including the error-correction (EC) version of the ARDL model, to analyze the effects of military spending on GDP. We estimated the following unrestricted error correction model (UECM) within the ARDL framework:

$$\Delta lngdp_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta lngdp_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta lnmex_{t-j} + \sum_{l=o}^{m} \alpha_k \Delta lnin_{t-l} \sum_{n=0}^{n} \alpha_l \Delta rin_{t-n} + \alpha_G lngdp_{t-1} + \alpha_M lnmex_{t-1} + \alpha_K lninv_{t-1} + \alpha_R rin_{t-1} + \mu_i \quad (2)$$

where, $lngdp$, $lnmex$, $lninv$ and $lnrin$ are gross domestic product, military expenditures, investment, and real interest rate in log form, respectively, Δ is the operator of first-difference, and $p, q\, m, n$ are lag length. The null for no co-integration among variables: $H_0: \alpha_G = \alpha_M = \alpha_K = \alpha_R = 0$ against the alternative $H_1: \alpha_G \neq \alpha_M \neq \alpha_K \neq \alpha_R \neq 0$ is tested by comparing the calculated F-statistic with LCB (lower critical bound) and UCB (upper critical bound) tabulated by Narayan (2005). According to Narayan (2005), CVs from Pesaran et al. (2001) created for bigger sample sizes shouldn't be applied to smaller ones. CVs of the F test are reported by Narayan (2005) for sample sizes ranging from 30 to 80 observations. The 99%, 95%, and 90% critical values from Narayan (2005) are presented in Tables 5 and 6 for this sample of 43 observations. If the observed F-statistic value exceeds the upper critical value, then we perceive the presence of cointegration by rejecting the null hypothesis of no cointegration. If it is below the lower critical value, we conclude that there is no cointegration. Lastly, if it falls between the upper and lower critical bounds, we conclude the test as inconclusive. Optimal lag length selected using SBC criteria. The aim is to estimate the short-run dynamics and derive the error-correction coefficient from the validated long-run model. The specification of the error correction model is

$$\Delta lngdp_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta lngdp_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta lnmex_{t-j} + \sum_{l=o}^{m} \alpha_k \Delta lninv_{t-l} + \sum_{n=0}^{n} \alpha_l \Delta rn_{t-n} + \varphi ECM_{t-1} + \vartheta_t \quad (3)$$

Where ECT_{t-1} represents the error correction term resulting from the established long-run equilibrium relationship, while φ denotes the parameter indicating the speed at which the system adjusts to the equilibrium level following a shock. The coefficient of ECT_{t-1} must exhibit a negative and statistically significant value to ensure that the dynamics of the system converge towards the long-run equilibrium. Both stability and diagnostic tests are performed to ensure the model fits the data well. The diagnostic test looks at the selected model's serial correlation, functional form, normality, and heteroscedasticity. According to Pesaran and Smith (1998), stability tests should be used. Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) are other names for this method. Plotting of the CUSUM and CUSUMSQ data against the break points is done iteratively. It is not possible to reject the null hypothesis that the presented regression has stable coefficients if the plots of the CUSUM and CUSUMSQ

statistics remain within the critical bounds of the 5% level of significance. Next, this study deployed the Pair-wise Granger causality test to determine the direction of causality.

3.3 Causality Analysis

Cointegration analysis implies that there is at least one-way causality. However, it is meaningless to detect the direction of causality between the parameters. Thus, the Granger test for causality has been undertaken in this investigation. The variables must be integrated in the same sequence in order to estimate Granger causality using the VEC model. Regretfully, two of the four variables in this study are $\mathbf{I(1)}$ while the other two are stationary at the level, i.e. $\mathbf{I(0)}$. As a result, Granger causality based on the VEC environment cannot be used in this study due to the current circumstances. In this scenario, following Jalil et al. (2016), this study has employed pairwise Granger causality to test the direction of causation between the dependent and independent variables. Pairwise Granger causality, in a bivariate environment, estimates the following two equations:

$$Y_t = \sum_{j=1}^{m} \alpha_j Y_{t-j} + \sum_{i=1}^{n} \beta_i X_{t-i} + D_t + \varepsilon_t \quad (4)$$

$$X_t = \sum_{j-1}^{m} \alpha_j X_{t-j} + \sum_{i=1}^{n} \beta_i Y_{t-i} + D_t + \mu_t \quad (5)$$

for all possible pairs of (x, y) series in the group. The reported *F-statistic*s are the Wald statistics for the joint hypothesis: $\beta_1 = \beta_2 = \ldots\ldots\ldots\ldots \beta_n = 0$ for each equation.

4. Findings and Discussion

4.1 Unit Root Test

This study has conducted both the Augmented Dickey-Fuller and Phillips-Perron unit root tests to assess robustness. Figure 2-5 below shows the graphical representation of the variables under study. From the figure, it is evident that all variables show a positive trend. Owing to this scenario, the null hypothesis of each test is represented as 'the series has both a constant and a linear trend'. The results of these two tests are shown in the following tables.

Table 2. Unit Root Test

Variables	ADF test		Phillips-Perron Test			
	Level		Level		First difference	
	Trend & intercept	Decision	Trend & intercept	Decision	Trend & intercept	Decision
Lngdp	-4.428***	I (0)	-9.024***	I (0)		
Lnmex	-3.250*	I (0)	-2.373	I (1)	-4.563***	I (0)
Lninv	-4.124**	I (0)	-2.106	I (1)	-5.993***	I (0)
Lnrin	-4.991***	I (0)	-4.892***	I (0)		

N.B: *, **, and *** resemble the 10%, 5%, and 1% level of significance, respectively.

Table 2 shows that all variables are non-stationary at the level when using the ADF test. However, the Phillips-Perron test for a unit root yields somewhat different results. The military expenditure and investment variables are not stationary at the level but become stationary after first differencing. Therefore, we need to perform the ARDL bound testing approach.

4.2 Cointegration Test

The first task is to identify the optimal lag length. Pesaran et al (1999) warn that selecting the lower limit of the lag length to prevent the conditional ECM from being over-parameterized and the upper limit of the lag length to lessen the serial correlation issue must be done in moderation. Because SBC is parsimonious, choosing lag structure through it is traditionally recommended. Because it requires the fewest parameters among all other lag selection criteria, empirical researchers refer to it as a strict algorithm (Jalil et al., 2016). Taking the above suggestions into account, this study used an unrestricted vector autoregressive model to determine the optimal number of lags.

Table 3. Selection of Optimal Lag Length

Lag	LogL	LR	FPE	AIC	SBC	HQ
0	-95.40843	NA	0.001693	4.970422	5.13931	5.031486
1	36.40497	230.6735*	5.20E-06	-0.820248	0.024191*	-0.514926*
2	53.02147	25.75557	5.18e-06*	0.851073*	0.668918	-0.301493
3	63.35332	13.94799	7.35E-06	-0.567666	1.627877	0.226173

Table 3 shows that the upper limit of lags is 2 according to AIC and 1 according to SBC. Therefore, in the next stage, the ARDL bound test will be performed with lag 1, as confirmed by the SBC (due to its parsimonious nature).

Table 4. Bound Testing To Cointegration [based on SBC]

Estimated model	$lnrgdp_t = f(lninv_t, lnmilex_t, realin_t)$	
Optimal lag structure (based on SBC)	(1, 0, 1, 0)	
F-statistics	6.499***	
Significance level	Lower bound	Upper bound
1%	4.428	6.250
5%	3.202	4.544
10%	2.660	3.838
R^2	0.99994	
Adjusted R^2R^2	0.99993	
Decision	Cointegration	

Critical bounds for the F-statistics apply to 35 observations with an unrestricted intercept and no trend (Narayan, 2005). Critical values (T = 40)

To ascertain the presence of a long-run relationship, we examine the estimated F-statistics of equation 2, as presented in Table 4. The results indicate that the model contains at least one cointegrating vector when lngdp is used as the dependent variable. However, it's essential to consider potential endogeneity issues in the association between military spending and economic growth. To address this concern, we employ a method proposed by Ang (2010) within the ARDL framework. This method involves testing for cointegration by regressing the major independent variable on the other variable, as suggested by Ang (2011). Specifically, we conduct a cointegration test using military spending as the dependent variable. The results of this test reveal that, at the 5% and 10% levels of significance, lnmex exhibits an F-statistic below the lower bound of critical values. This suggests there may be no evidence of endogeneity in the relationship between military spending and economic growth.

Long-run Results

Based on the findings presented in Table 4, we proceed with the ARDL model with lnrgdp as the dependent variable. Before estimating the long-run model and determining the coefficients of the regressors and the error-correction term, it is crucial to select the optimal lags for the ARDL model. In ARDL cointegration analysis, researchers often select models based on both the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) criteria (Ahmed et al., 2013). In this study, we employ the lags chosen by the BIC criterion. The subsequent tables present the results of this analysis.

Table 5: Estimated Long Run Coefficients using the ARDL Approach based on SBIC

Dependent variable: lngdp			
Regressor	Coefficient	Standard Error	T-ratio [Prob]
Lnmex	-0.00692***	0.0024415	-2.8378 [0.007]
Lninv	0.33640***	0.0061770	54.4596 [0.000]
Lnrin	0.00032***	0.0001087	2.9851 [0.000]
F-stat = 4.68			

N.B: *, **, and *** indicates 10%, 5%, and 1% level of significance, respectively.

Table 5 illustrates the significant relationships between lnmilex, lninv, realin, and lnrgdp. Specifically, lnmilex, lninv, and realin exhibit significant effects on lnrgdp at the 1% level of significance. Notably, a 1% increase in military expenditure, as indicated by lnmilex, corresponds to a decrease of approximately 0.692% in economic growth, holding other variables constant. This finding is consistent with prior research by scholars such as Abu-Bader & Abu-Qarn (2003), Manamperi (2016), and others, suggesting an inverse relationship between defense spending and economic growth, implying that the defense industry lacks beneficial externalities or spin-offs for the economy (Dunne & Nikolaidou, 2001). Moreover, investment emerges as a key driver of economic growth, exerting a substantial positive impact. The significant influence of investment on growth underscores its pivotal role in economic performance. Thus, the negative impact of military spending on economic performance may be attributed to its crowding-out effect on investment, indicating an indirect impact of military expenditure on growth through investment (Mintz & Huang, 1990). On the other hand, real interest rates exhibit a minimal positive impact on economic growth. While the impact is small, it remains highly significant. This suggests that higher interest rates may attract new investment, both through higher savings and through foreign direct investment, thereby potentially contributing to economic growth. However, given the significant but small impact rate, careful consideration of the implications of military expenditure on economic growth is warranted (Mintz & Huang, 1990).

Short-run Dynamics

The following table presents the short-run model estimates in panel A, while the results of the diagnostic tests are shown in panel B.

Table 6. Short-run Results

Panel A			Panel B		
ARDL (1,0,1,2) based on SBC			Diagnostics Tests		
Regressor	Coefficient	T-ratio [prob]		F-stat	[prob]
Dlnmex	-0.00153	-2.6528[0.012]	Serial Correlation	1.6215	0.211
Dlninv	-0.34857	-112.24[0.000]	Heteroscedasticity	8.2258	0.007
Drin	-0.22164	3.0670[0.004]	Functional form	1.6181	0.000
Ecm (-1)	-0.22164	-4.4945[.000]		LM-version	[Prob]
			Normality	1.8211	0.402

Table 6 highlights significant findings regarding the impact of various factors on economic growth. The first lag of lnmex is significant at the 5% level, negatively affecting short-term economic growth. Similarly, the investment's first lag is significant at the 1% level and exerts a negative influence on economic growth. Real interest rates negatively impact economic growth in the short term as well. However, the ECM term emerges as the most crucial component, signifying a projected convergence process in long-term economic growth trends and other macroeconomic indicators. Its negative sign indicates a corrective adjustment process, with approximately 22% of previous-year disequilibrium addressed in the current year. Moreover, the stability of long-run coefficients, combined with short-run dynamics to generate the error-correction term, is discussed. To address this, the CUSUM and CUSUMQ tests developed by Brown et al. (1975) have been applied to the residuals of each model. If the cumulative sum crosses critical lines, the model is deemed unstable according to the CUSUM test. Similarly, instability occurs when CUSUMQ, based on squared recursive residuals, crosses critical lines. Figure 6 illustrates the CUSUM and CUSUMQ of the SBIC-based model. Examining the two figures plainly shows that both models pass the parameter stability test.

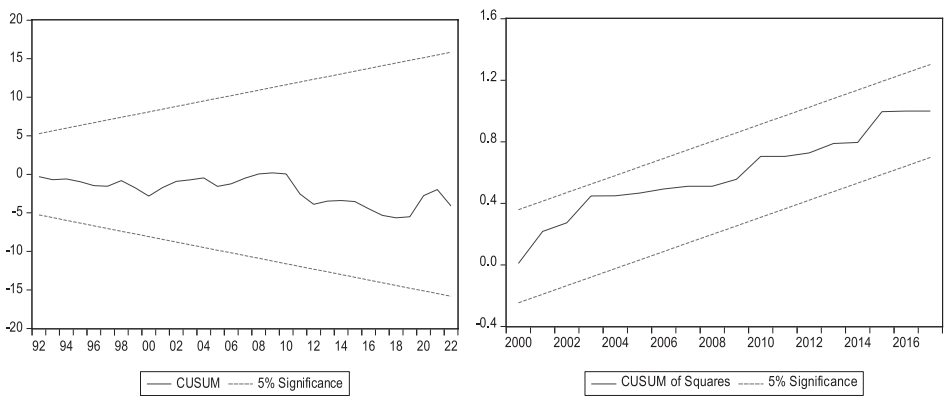

Figure 2. CUSUM and CUSUMQ

4.3 Granger Causality Test

It is widely recognized that Granger causality is typically observed when a long-term relationship exists between the variables, at least in one direction. To identify causally related variables, researchers commonly employ a pairwise Granger causality test proposed by Engle and Granger (1987). This method has been utilized in prior studies, including those conducted by Jalil et al. (2016) and Manamperi (2016), to determine the direction of causality between military spending and economic growth. The results of the Granger causality test (equations 4-5) are presented in the following table.

Table 7. Granger Causality Test Results

Null Hypothesis	Observation	F-Statistic	Prob.
lnmex does not Granger-cause *lngdp*	41	5.06128	0.0116
lngdp does not Granger-cause *lnmex*		0.81953	0.4487
lninv does not Granger-cause *lngdp*	41	1.54318	0.2275
lngdp does not Granger-cause *lninv*		1.63318	0.2094
lnrin does not Granger-cause *lngdp*	41	4.26413	0.0218
lngdp does not Granger-cause *lnrin*		0.44137	0.6466
lnmex does not Granger-cause *lninv*	41	5.78598	0.0066
lninv does not Granger Cause *lnmex*		0.87348	0.4262
lnrin does not Granger Cause *lninv*	41	3.86680	0.0301
lninv does not Granger Cause *lnrin*		0.50421	0.6082
lnrin does not Granger Cause *lnmex*	41	0.74204	0.4833
Lnmex does not Granger Cause *lnrin*		0.46005	0.6349

Table 7 shows unidirectional Granger causality running from military expenditure to economic growth. There is no causality running between economic growth and investment. The real interest rate Granger-causes economic growth, but economic growth does not Granger-cause the real interest rate. Military expenditure Granger-causes investment by building military infrastructure and enhancing capacity. But investment does not Granger-cause military expenditures. There is a unidirectional Granger causality running from real interest rate to economic growth, while there is no causal relation running from investment to real interest rate. Lastly, there is no causality running between the real interest rate and military expenditures.

5. Conclusion and Policy Recommendations

In this study, we examined the relationship and direction of causation between military spending and economic growth in Bangladesh over the period 1980–2022. Using time-series data and the ARDL bounds test for cointegration, as

well as Pairwise Granger causality, we sought to shed light on this complex relationship. The results of the ARDL bounds test revealed the presence of at least one cointegrating vector, indicating a long-run relationship between military spending and economic growth in Bangladesh. Interestingly, our findings suggest that military expenditure has a negative impact on economic growth in the long run, aligning with prior research conducted by scholars such as Abu-Bader & Abu-Qarn (2003), Manamperi (2016), Hou & Chen (2013), and others. Contrastingly, investment and real interest rates positively affected economic growth, underscoring their importance in driving economic expansion. Furthermore, the error-correction term (-0.221) indicated that approximately 22% of the disequilibrium from the previous year was corrected in the current year, suggesting a rapid adjustment in the relationship following a shock. Using pairwise Granger causality testing, we found a short-term, unidirectional negative relationship between military spending and economic growth. This implies that reducing Bangladesh's defense budget could bolster economic health, leading to a "peace dividend" if the resources were redirected to more productive sectors. However, it is important to acknowledge the role of security concerns in dictating the military burden. As long as increased military spending enhances national security, it may contribute to output growth, as Dunne et al. (2005) note. Given Bangladesh's commitment to maintaining friendly relations with its neighbors, increased military spending may not necessarily translate into economic well-being, as it could deter investment without substantially improving security. Thus, policymakers face a delicate balance between security needs and economic priorities in allocating resources effectively.

References

Abu-Bader, S., & Abu-Qarn, A. S. (2003). Government expenditures, military spending and economic growth: causality evidence from Egypt, Israel, and Syria. J*ournal of Policy Modeling*, 25(6-7), 567-583.

Abu-Qarn, A. (2010). The Defense-growth nexus: An application for the Israeli-Arab conflict.

Ahmed, M. U., Muzib, M., & Roy, A. (2013). Price-wage spiral in Bangladesh: Evidence from ARDL bound testing approach. *International Journal of Applied Economics*, 10(2), 77-103.

Ahmed, N., & Naslmosavi, S. (2017). Military Expenditure and Economic Growth in SAARC Countries: Pooled and Panel Data Analysis. *Journal of Applied Finance and Economic Policy*, 1(1), 1-7.

Aizenman, J., & Glick, R. (2006). Military expenditure, threats, and growth., *Journal of International Trade & Economic Development*, 15(2), 129-155.

Ajmair, M., Hussain, K., Abbassi, F. A., & Gohar, M. (2018). The Impact of Military Expenditures on Economic Growth of Pakistan. Applied Economics and Finance, 5 (2), 41-48.

Al-Beruni, R. (2017). What strategic defense looks like. Dhaka Tribune. Retrieved from https://www.dhakatribune.com/opinion/op-ed/2017/10/20/strategic-defense-looks-like

Ang, J. B. (2010). Finance and inequality: the case of India. *Southern Economic Journal, 76*(3), 738-761.

Ang, J. B. (2011). Financial development, liberalization and technological deepening. *European Economic Review, 55*(5), 688-701.

Atesoglu, H. S. (2002). Defense Spending Promotes Aggregate Output in the United States--Evidence from Cointegration Analysis. Defence and peace economics, 13(1), 55-60.

Benoit, E. (1978). Growth and defense in developing countries. Economic development and cultural change, 26 (2), 271-280.

Biswas, B., & Ram, R. (1986). Military expenditures and economic growth in less developed countries: An augmented model and further evidence. Economic development and cultural change, 34(2), 361-372.

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. J*ournal of the Royal Statistical Society*. Series B (Methodological), 149-192.

Chang, H.-C., Huang, B.-N., & Yang, C. W. (2011). Military expenditure and economic growth across different groups: A dynamic panel Granger-causality approach. Economic Modelling, 28(6), 2416-2423.

Chowdhury, A. R. (1991). A causal analysis of defense spending and economic growth. *Journal of Conflict Resolution*, 35(1), 80-97.

Cuaresma, J. C., & Reitschuler, G. (2004). A non-linear defence-growth nexus? Evidence from the US economy. Defence and peace economics, 15(1), 71-82.

Deger, S. (1985). Human resources, government education expenditure, and the military burden in less developed countries. *The Journal of Developing Areas*, 20(1), 37-48.

Desli, E., Gkoulgkoutsika, A., & Katrakilidis, C. (2017). Investigating the dynamic interaction between military spending and economic growth. Review of Development Economics, 21(3), 511-526.

Dunne, J. P., Smith, R. P., & Willenbockel, D. (2005). Models of military expenditure and growth: A critical review. Defence and peace economics, 16(6), 449-461.

Dunne, J. P., & Tian, N. (2013). Military expenditure and economic growth: A survey. The Economics of Peace and Security Journal, 8(1).

Dunne, J. P., & Tian, N. (2015). Military expenditure, economic growth and heterogeneity. Defence and peace economics, 26(1), 15-31.

Dunne, P., & Nikolaidou, E. (2001). Military expenditure and economic growth: A demand and supply model for Greece, 1960–96. Defence and peace economics, 12(1), 47-67.

Dunne, P., Nikolaidou, E., & Vougas, D. (2001). Defence spending and economic growth: a causal analysis for Greece and Turkey. Defence and peace economics, 12(1), 5-26.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. Econometrica: J*ournal of the Econometric Society*, 251-276.

Feder, G. (1983). On exports and economic growth. Journal of development economics, 12(1-2), 59-73.

Gerace, M. P. (2002). US Military Expenditures and Economic Growth: Some Evidence from Spectral Methods. Defence and peace economics, 13(1), 1-11. doi:10.1080/10242690210966

Gregory, A. W., & Hansen, B. E. (1996). Practitioners corner: tests for cointegration in models with regime and trend shifts. Oxford bulletin of Economics and Statistics, 58(3), 555-560.

Habibullah, M. S., Law, S.-H., & Dayang-Afizzah, A. (2008). Defense spending and economic growth in Asian economies: A panel error-correction approach.

Hendry, D. F., Pagan, A. R., & Sargan, J. D. (1984). Dynamic specification. Handbook of econometrics, 2, 1023-1100.

Heo, U. (2010). The relationship between defense spending and economic growth in the United States. Political Research Quarterly, 63(4), 760-770.

Hou, N., & Chen, B. (2013). Military Expenditure and Economic Growth in Developing Countries: Evidence from System Gmm Estimates. Defence and peace economics, 24(3), 183-193. doi:10.1080/10242694.2012.710813

Huang, C., & Mintz, A. (1991). Defence expenditures and economic growth: The externality effect. Defence Economics, 3 (1), 35-40. doi:10.1080/10430719108404713

Ismail, S. (2017). Military Expenditure and Economic Growth in South Asian Countries: Empirical Evidences. *International Journal of Economics and Financial Issues*, 7 (3), 318-325.

Jalil, A., Abbasi, H. K. N., & Bibi, N. (2016). Military expenditures and economic growth: allowing structural breaks in time series analysis in the case of India and Pakistan. Quality & Quantity, 50(4), 1487-1505.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3), 231-254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210.

Karagol, E. (2006). The relationship between external debt, defence expenditures and GNP revisited: The case of Turkey. Defence and peace economics, 17 (1), 47-57.

Kinsella, D. (1990). Defence spending and economic performance in the United States: a causal analysis. Defence and peace economics, 1(4), 295-309.

Klein, T. (2004). Military expenditure and economic growth: Peru 1970–1996. Defence and peace economics, 15(3), 275-288.

Lebovic, J. H., & Ishaq, A. (1987). Military burden, security needs, and economic growth in the Middle East. *Journal of Conflict Resolution*, 31(1), 106-138.

Malizard, J. (2016). Military expenditure and economic growth in the European Union: Evidence from SIPRI's extended dataset. T*he Economics of Peace and Security Journal*, 11(2).

Manamperi, N. (2016). Does military expenditure hinder economic growth? Evidence from Greece and Turkey. *Journal of Policy Modeling*, 38(6), 1171-1193.

Mintz, A., & Huang, C. (1990). Defense expenditures, economic growth, and the "peace dividend". American Political Science Review, 84(4), 1283-1293.

Mintz, A., & Stevenson, R. T. (1995). Defense expenditures, economic growth, and the "peace dividend" A Longitudinal Analysis of 103 Countries. *Journal of Conflict Resolution*, 39(2), 283-305.

Mueller, M. J., & Atesoglu, H. S. (1993). Defense spending, technological change, and economic growth in the United States. Defence and peace economics, 4(3), 259-269.

Muravska, K. G. J. (2012). Military-owned businesses: corruption & risk reform. Retrieved from UK: http://ti-defence.org/wp-content/uploads/2016/03/2012-01_Military Owned Businesses.pdf

Narayan, P. K. (2005). The saving and investment nexus for China: evidence from cointegration tests. Applied economics, 37 (17), 1979-1990.

Payne, J. E., & Ross, K. L. (1992). Defense spending and the macroeconomy. Defence and peace economics, 3(2), 161-168.

Pesaran, M. H., & Shin, Y. (1998). An autoregressive distributed-lag modelling approach to cointegration analysis. Econometric Society Monographs, 31, 371-413.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94(446), 621-634.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Ram, R. (1986). Government size and economic growth: A new framework and some evidence from cross-section and time-series data. The American Economic Review, 76(1), 191-203.

Ram, R. (1995). Defense expenditure and economic growth. Handbook of defense economics, 1, 251-274.

Scheetz, T. (1991). The macroeconomic impact of defence expenditures: Some econometric evidence for Argentina, Chile, Paraguay and Peru. Defence Economics, 3(1), 65-81. doi:10.1080/10430719108404715

Sezgin, S. (2004). An empirical note on external debt and defence expenditures in Turkey. Defence and peace economics, 15(2), 199-203.

Shahbaz, M., Afza, T., & Shabbir, M. S. (2013). Does defence spending impede economic growth? Cointegration and causality analysis for Pakistan. Defence and peace economics, 24(2), 105-120.

Stockholm International Peace Research Institute (2018). Why arms procurement goes wrong. https://www.sipri.org/yearbook/2018.

Smith, R. (2018, March 10). The Trouble with Bangladesh's Military. The Diplomat. Retrieved from https://thediplomat.com/2018/03/the-trouble-with-bangladeshs-military/

Walsh, E. (2011). Non-traditional security threats in Asia: Finding a regional way forward. Retrieved from http://www.eastasiaforum.org/2011/06/04/non-traditional-security-threats-in-asia-finding-a-regional-way-forward/

Yolcu K. D., Yildirim, J., & Öcal, N. (2017). Military expenditure and economic growth in Middle Eastern countries and Turkey: a non-linear panel data approach. Defence and peace economics, 28(6), 719-730.

Zhao, L., Zhao, L., & Chen, B.-F. (2017). The interrelationship between defense spending, public expenditures, and economic growth: Evidence from China. Defence and peace economics, 28(6), 703-718.