Military Expenditure and Economic Growth in Chad: An Application of The ARDL Method

Ulrich KEMBENG

Faculty of Economics and Management, University of Dschang, Cameroon

Abstract: **- African countries have received little attention in defense economics literature, despite the role that Chad and some African countries have played and continue to play in maintaining peace in the Sahel region. This study attempts to partially fill this gap by providing new evidence of the effect of military spending on economic growth in Chad between 1983 and 2015. This study uses the Autoregressive Distributed lag Model (ARDL) and finds no significant effects of military spending on Chad's economic growth. The study shows that domestic investment has a positive and significant impact on economic growth.**

Keywords**: Military spending, Economic growth, ARDL, Chad**

I. INTRODUCTION

The security threat that Chad has faced for several decades has led to an exponential increase in military spending with unclear consequences for economic growth. Since 2000, the Government of Chad has allocated significant parts of the Budget to military and security spending. According to the CCFD- Earth solidarity (2012) report, Chad's military spending between 2004 and 2008 has increased eightfold (from € 53 million in 2004 to € 420 million in 2008), representing 7,1% of GDP, while Chad is ranked 183rd out of 187 countries according to UNDP's "Human Development Index". In addition, the defense sector is second in terms of budgetary allocation, in relation to infrastructure and health (Finance Act). According to the SIPRI report of 2014, Chad spent around 610 million USD in 2013 (CFAF 353 billion), far ahead of Cote d'Ivoire and Cameroon, whose military expenditure amounted to USD 453 million (CFAF 256 billion) and $ 392 million (CFAF 227 billion). This large share of Chad's national wealth devoted to military spending raises the question of the economic impact of such expenditures.

The relationship between military spending and economic growth has been the subject of a number of studies, with rather mixed conclusions since Benoit's seminal work (1973). Some authors conclude from Benoit (1973, 1978) that military spending has a positive impact on the rate of growth [Atesoglu, (2002); Yildrim et al (2005); Kollias et al. (2007); Wijeweera and Webb (2009); Farzanegan (2012)], while other studies result in an insignificant effect [Adam et al. (1991); Gerace, (2002)] even negative effect [Aye et al. (2014); Dunne and Nikolaidou (2012); Dunne et al. (2002)] of military spending on economic growth. These different findings fuel the controversy over the relationship between military spending and economic growth (Wijeweera and Webb (2009).

This paper use autoregressive distributed lad (ARDL) approach to cointegration to examine the effect of military spending on Chad economic growth, by controlling domestic investment between 1983 and 2015.To our knowledge, no such study has been carried out in Chad despite the important role that Chad has played and continues to play in the maintenance of stability and the fight against terrorism in the sub region of Central Africa and the Sahel. Our study tries to contribute empirically to the literature on the relationship between military spending and economic growth in Africa and more specifically in Chad. So far only South Africa has been the subject of such a study in Africa.

Following this introduction, the structure of this paper is as follows. Section 2 presents a brief review of the literature; Section 3 presents the methodology adopted by providing the theoretical justification for the choice of the model and the different variables, presenting the data, the treatments that have been performed and the tests performed. The fourth section presents and analyzes the results of the various estimates. This paper concludes with Section 5 which presents the conclusion.

II. LITERATURE REVIEW

The question: «Does military spending impact on economic growth? » has been debated at length over the last two decades, without arriving at a clear and unambiguous answer. The literature on the relationship between military spending and economic growth can be broadly divided into two main strands. One strand of the literature states that military spending has a positive impact on economic growth, the other strand of the literature concludes that military spending has an insignificant or even negative impact on economic growth.

The work of Benoit (1973; 1978) is considered a pioneering study of the relationship between military expenditure and economic growth. Using a panel of 45 developing countries, Benoit (1973) shows that military expenditure has a positive impact on the economic growth rate of these countries. More precisely, he shows that investing in the arms industry will improve education and health, increase employment opportunities and accentuate scientific and technological innovations. Several authors have tried to validate or refute this conclusion.

Proponents of the first group argue for a positive effect of military spending on economic growth. For example, Farzanegan (2012) shows that in the case of IRAN, military spending has a positive and significant effect on economic growth over the period 1959-2007. Furthermore,Atesoglu

(2002) uses cointegration analysis and shows that there is a positive and significant effect of military spending on growth in the US over the period 1947-2000. Abu-qarn (2010), who studies the Arab-Israeli conflict, finds no persistent negative effect of military spending on economic growth. Dicle and Dicle (2010) examine the Granger causality between military spending and growth in 65 countries for the periods 1975-2004. They find a positive and bi-directional causal relationship between these variables in 54 of the 65 countries. Feridun et al (2011) study the relationship between military expenditure and economic growth in the case of Northern Cyprus over the period 1977 to 2007. Their results show a strong and positive unidirectional causality from military expenditure to economic growth. Yildirim et al (2005) examine the effect of military expenditure on economic growth in a panel of Middle Eastern countries and Turkey and find positive effects on the growth of military expenditure from 1989 to 1999.

In contrast to the first group, proponents of the second group argue that military spending is likely to reduce economic growth through various channels [Mintz and Huang (1990), Scheetz (1991), Asseery (1996); Dunne (1996); Gupta et al. 2001; Dunne et al., 2002; Dunne and Nikolaidou, 2012;Aye et al., 2014;]. For these authors, military spending is likely to lead to lower savings and investment rates, reduced other spending on health and education, higher budget deficits, exploding debt, and increased corruption. Mylonidis (2008) analyses the impact of military spending on economic growth in 14 EU countries over the period (1964-2000). Using a Barro-type model, he concludes that military spending has a significant negative effect on economic growth. Kollias and Paleologou (2010) focus their analysis on the relationship between growth, investment and military expenditure. Applying both fixed and random effect models on a panel of 15 EU countries over the period 1961-2002, they find no evidence of any significant effect of military spending on economic growth. This conclusion is confirmed by the work of Dunne and Nikolaidou (2012) for the same panel of 15 EU countries over the period 1961-2007. Their results show that military spending has no positive effect on economic growth. In the case of African countries, Aye et al (2014) showed from a Granger causality test that there is no causality between military spending and economic growth.

Although there are a few studies on the relationship between military expenditure and economic growth in Africa, particularly in South Africa (Aye et al. , 2014; Dunne et al. , 2000), this is not the case for Chad and other African countries facing serious social crises and engaged in several armed conflicts. This study attempts to fill this gap in the literature on the link between military expenditure and economic growth in Africa, and more specifically in Chad.

III. DATA AND METHODOLOGY

3.1 Data

Our study covers the period from 1983 to 2015. The data are drawn from two databases. Military expenditure is taken from the Stockholm International Peace Research Institute (SIPRI) database. GDP per capita and domestic investment, measured as gross fixed capital formation as a percentage of GDP, are taken from the World Bank database (WDI). Descriptive statistics for the variables are presented in Table 1.

Table 1: Descriptive statistics

Variables	Comments	Average	Standard deviation	Min	Max	Source
ln(GDP)	33	6.422347	.2672563	6.136708	6.874305	WDI(2016)
ln(DM)	33	18.37917	1.130752	16.61131	20.32209	SIPRI(2016)
ln(IDOM)	33	2.639737	.8660088	.6578199	4.089718	WDI(2016)

3.2 Methodology

In this paper, the cointegration test is done by applying the autoregressive distributed delay model (ARDL) developed by Pesaran and Pesaran (1997), extended and popularised by Pesaran et al. (2000) and Pesaran et al.

The Engel and Granger (1987) and the Johansen-Juselius (1990) tests are the most commonly used to identify a cointegrating relationship (long-term relationship) between several variables. These methods require that all variables are stationary in first difference. However, these methods have limitations in the case of small sample sizes (Chaudhary and Choudhary, 2006). To overcome these limitations, Pesaran, Shin and Smith (1996) developed the staggered lag cointegration test (ARDL) popularised by Pesaran et al. This method is unique in that it does not require all variables to be integrated of the same order, i.e. I(1). This method is equally valid for I(0), I(1) or both (Pesaran and Pesaran, 1997). Given the endogeneity problem that may exist between military expenditure and economic growth, the long-run cointegration relationship can be estimated using the following equation:

$$\Delta PIB_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} \Delta PIB_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta ME_{t-i} + \sum_{i=1}^{q} \beta_{3i} \Delta IDOM_{t-i} + \lambda_0 PIB_{t-1} + \lambda_1 ME_{t-1} + \lambda_2 IDOM_{t-1} \quad (1)$$

Where GDP represents the logarithm of GDP per capita, ME represents the logarithm of military expenditure and IDOM for the logarithm of domestic investment.

The F-statistic is used to test for the existence of a long-term relationship. The null hypothesis tests for the absence of a long-term relationship and is given by $H_0 : \lambda_0 = \lambda_1 = \lambda_2 = 0$.

After estimating the ARDL (m, n, o) model and calculating the associated long-run multipliers, the final step will be to estimate the coefficients of the short-run dynamics using the following error correction model:

$$\Delta PIB_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta PIB_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta ME_{t-i} + \sum_{i=0}^{o} \alpha_{3i} \Delta IDOM_{t-i} + \lambda ECT_{t-1} + \eta_t \quad (2)$$

Where ECT is the error correction term and λ $(-1 \leq \lambda \leq 0)$ the parameter that indicates the speed of adjustment towards equilibrium after a shock. The error correction coefficient must be negative and significant to ensure that the dynamics converge towards the long run equilibrium.

IV. RESULTS

4.1 Unit Root Test

Augmented Dickey-Fuller (DFA) and Phillips-Perron (PP) stationarity tests were performed to ensure that no variable is integrated at an order higher than 1, without which the staggered lag cointegration test proposed by Pesaran et al (1999, 2001) ceases to be valid. These tests indicate that all the variables respect the ARDL application standards, the maximum integration order of the variables being 1. The results are presented in Table 2.

Table 2: Unit root test

	ADF test			PP test		
	A level	Difference 1st	Conclusion	A level	Difference 1st	Conclusion
Variable						
GDP	-5,17***	-7,78***	I(0)	-5,19***	-11,43***	I(0)
ME	-1,31	-5,48***	I(1)	-0,28	-4,28***	I(1)
IDOM	-0,31	-5,27***	I(1)	-1,32	-5,48***	I(1)

Notes: *** indicates significance at the 1% level. Only t-statistics are reported here.

Our results show that the GDP variable is stationary at level. On the other hand, the variables military expenditure (ME) and domestic investment (IDOM) are stationary in first difference. Thus our variables are either I(0) or I(1). These different results justify the application of the ARDL method.

Table 3: Delay selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-275.7398	NA	44796.61	19.22344	19.36488	19.26774
1	-240.6968	60.41895*	7472.959	17.42737	17.99315*	17.60456
2	-230.5089	15.45753	7051.287	17.34544	18.33555	17.65553
3	-218.8058	15.33516	6209.218*	17.15902*	18.57346	17.60201*
4	-211.0485	8.559700	7605.932	17.24473	19.08350	17.82061

Note: * indicates the lowest value of each criterion.

4.2. Results of the ARDL Assessment

The results of the estimation of the impact of military expenditure on economic growth using the ARDL technic are presented in Table 4 and Table 5. Several tests such as the serial correlation test (LM test), the normality of error terms test (JB) and the heteroscedasticity test (ARCH test) were performed. The results show that these tests are conclusive. Indeed, there is no serial correlation and the error terms are normally distributed. There is no evidence of traditional autoregressive heteroscedasticity. Therefore, our model is well specified.

Table 4 presents the results of the Pesaran cointegration test. The F-statistic is 10.05. This value is larger than the upper bound at 1% which is 6.36. Therefore, it can be stated that the variables used in this paper are cointegrated or that there is a long term relationship between these variables. Thus, the ARDL model can now be estimated to examine the long-run and short-run dynamics between the variables.

Table 4: ARDL bounds test results

Dependent variable	F-Stat	k
GDP per capita	10.05	2
Critical values		
Level of significance	Terminal I(0)	Terminal I(1)
10%	3.17	4.14
5%	3.79	4.85
1%	5.15	6.36

Notes: k represents the number of independent variables, the critical values are taken from the study by Pesaran et al (2001). I(0) is the lower bound and I(1) the upper bound of the test.

Table 5 shows that military expenditure has a negative and insignificant impact on economic growth, both in the short and long term in Chad. Our results are consistent with those found by Adam et al. (1991) and Gerace (2002). Moreover, we find that domestic investment has a significant positive impact on economic growth in Chad, both in the long and short run. The coefficient of the error correction term is found to be negative and significant. This result indicates that the dynamics of the model converge towards the long term.

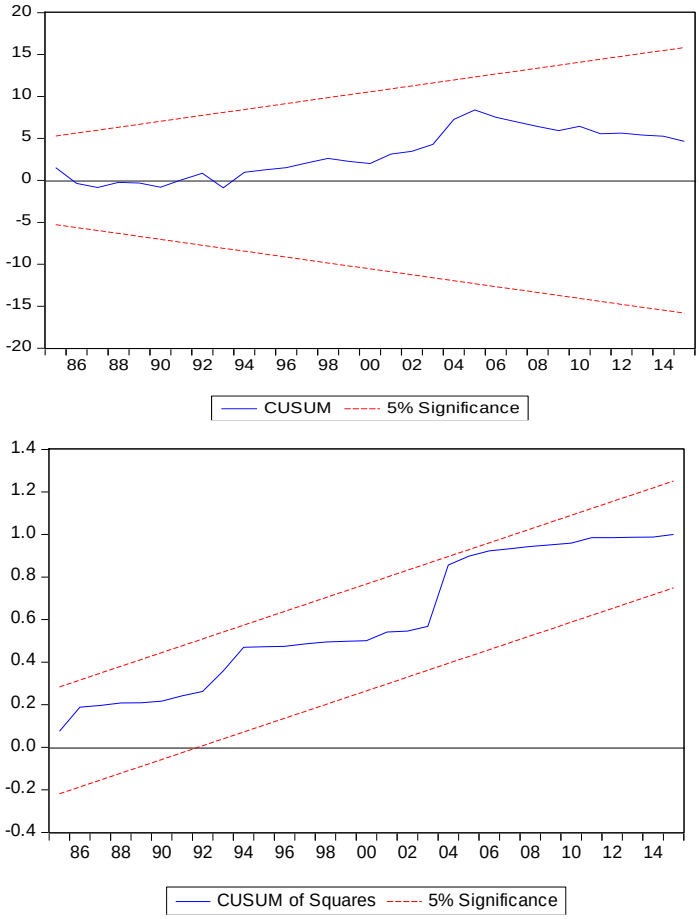
Table 5: Results of the ARDL model

Variables	Coefficient	Standard deviation	t-Stat	Prob
Long term equation				
Military expenditure	-0,219	0,522	-0,419	0,6783
Domestic investment	0,228**	0,083	2,755	0,011
Short term equation				
ECT	-1,464***	0,269	-5,422	0,0000
ΔPIB_{t-1}	0,186	0,169	1,100	0,282
ΔME	-0,321	0,765	-0,419	0,6785
$\Delta IDOM$	0,156	0,209	-0,746	0,4631
$\Delta IDOM_{t-1}$	0,478*	0,233	-2,050	0,0514
Diagnostic test				

	F- stat	p-value
(A) Serial correlation	F(3,24)=1,25	0,314
(B) Heteroscedasticity	F(3,21)=0,52	0,675
(D) normality test		
(E) CUSUM and CUSUMSQ	Stable	

Notes: ECT represents the error correction term. ***, ** and * show significance at 1%, 5% and 10% confidence level respectively.

Figure 1: Residue stability test (CUSUM and CUSUMSQ)



V. CONCLUSION

The objective of this paper was to analyse the impact of military expenditure on economic growth in Chad. The autoregressive distributed lag model (ARDL) was used for the period 1983-2015. The results show that military expenditure has a negative but insignificant impact on economic growth. In addition, domestic investment has a positive and significant impact on economic growth in Chad.

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