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AN ECONOMETRIC STUDY OF THE LONG-RUN RELATIONSHIP BETWEEN DEFENCE EXPENDITURE AND ECONOMIC GROWTH: EVIDENCE FROM A DEVELOPING COUNTRY

Cyril Ayetuoma Ogbokor
Department of Accounting, Economics and Finance,
Polytechnic of Namibia/Namibia University of Science and Technology, Windhoek, Namibia
cogbokor@polytechnic.edu.na; ayetuoma@hotmail.com

Abstract

The high levels of financial allocations to Namibia's defence budgets have been heavily criticised because such expenditures is considered as a leakage to the country's economy. In light of this, the study assessed the impact of military spending on economic growth in Namibia by employing the two-step Engle-Granger approach in the context of a single equation setting. The macro-economic time-series data sets utilised stretches from 1990 to 2014. The study found co-integration relationships among the variables used, suggesting the existence of a long-run relationship among the variables used in the econometric model. Furthermore, the model used passed the stability test. However, the predictive power of the model was found to be very weak given the low value of the adjusted coefficient of determination. In addition, a unidirectional causality relationship running from economic growth to military expenditure was found implying that military spending does not promote or lead to economic growth. Therefore, the need for the government to control its expenditure on defence cannot be over stressed given the findings of the study. Concomitantly, further studies concerning the issue under examination should consider the use of quarterly data sets as against annual data sets.

Keywords: Namibia, defence, economic growth, co-integration, causality, error correction model, long-run

INTRODUCTION

Military spending has received an enormous amount of attention by researchers across various disciplines, especially for the past thirty years. This is so, since researchers are still unsure about the exact impact of such expenditures on economic growth. The fundamental issue addressed in most of the previous studies is whether a high military expenditure would necessarily stifle or lead to higher economic growth in developing countries. The existing literature presents two fundamental differences in opinion concerning the relationship between military expenditure and economic growth. The school of thought in support of military expenditures maintains that it can lead to a positive multiplier effect on the national economy through various channels. In specific terms, it could lead to an increase in aggregate demand, as well as, a sense of increased security on the part of the populace (Hassan et al., 2003).

Contributing to the discussion Benoit (1978) explained that military expenditure could be used effectively in stimulating the economies of developing countries through investment in human capital, as well as in physical infrastructures such as highways, road networks, airports and information technology. This is especially true during periods that are characterised by high unemployment levels. In addition, the researcher maintained that since security is increasingly becoming a primary concern in most modern economies it would be wise to allocate more of the state financial resources towards it.

On the contrary Deger & Smith (1983) states that increased military spending can retard or harm economic growth in the following ways: Firstly, military spending encourages the diversion of resources from growth-oriented sectors. Secondly, it could exert unwarranted pressure on the balance-of-payment account of a country due to the use of a country's hard-earned foreign reserve in importing arms, armaments and military hardware. Thirdly, if the situation is not controlled it has the potential to create a protracted impression that a country will be better-off with increasing spending on defence.

In consideration of this background, the study employs the two-step Engle-Granger approach in examining the connection between military spending and economic growth in Namibia. Therefore, the study is driven by the following inter-related objectives: Firstly, the study econometrically estimates the possibility of a long-run relationship between military expenditure and economic growth in Namibia. Secondly, a causality analysis is performed to establish the nature of the relationship between military spending and economic growth. Thirdly, the results obtained from the econometric analysis would provide important information for macroeconomic policy modelling, as well as to policy-makers. The author of this research work is not aware of any published empirical study concerning Namibia that has specifically employed the two-step

Engle-Granger approach in examining the connection between military spending and economic growth in Namibia, hence a further justification of the use of this technique in the study.

The rest of the research paper is structured in the following way. Section two presents the empirical literature relevant to the study. The third section concerns itself with sources of data, model construction and econometric approach. The fourth section reports and interprets the estimated econometric results. Conclusion and policy recommendations constitute the final section. In this study, the terms military expenditure, defence spending and military spending are used interchangeably.

LITERATURE REVIEW

A huge amount of documented empirical studies concerning the relationship between military expenditure and economic growth are found in the existing literature. This study will only review some of the existing empirical literature in a chronological order. Indeed, any effort to review all the previous studies regarding the issue under discussion will tantamount to a futile exercise.

Chowdhury (1981) investigated the possibility of a causal relationship between economic growth and defense spending covering fifty five developing countries. The researcher employed co-integration procedures and found that in some of the countries there seems to be a causality running from defense spending to economic growth, while the results obtained from the other countries proved to be contrary. The researcher, therefore, cautioned against generalization of results across countries.

Contributing to the empirical literature Deger (1986) using co-integration and error correction procedures found a negative relationship between military expenditure and growth for a selected number of developing countries. He further stated that defense expenditure generally constitutes a form of leakage to the national economy since resources that would have been used to promote investments are relocated to non-productive economic activities.

Frederiksen & LaCivita (1987) explored the causality between defense spending and economic growth for the economy of Philippines for the period stretching from 1956 to 1982. The authors found that a unidirectional relationship running from economic growth to defence spending suggesting that it is economic growth that drives military spending and not the other way round.

Dakurah et al., (2000) assessed a number of LDCs for causality relationships between their military spending and economic growth by employing co-integration methods. The author found 13 countries showing unidirectional causality running from military expenditure to growth; 10 cases running from economic growth to military expenditure; 7 countries suggest

bidirectional causality, while the remaining countries showed no evidence of causality relationship.

Hassan et al., (2003) econometrically probed into the effect of military expenditure on economic growth covering five selected Asian countries for the period spreading from 1980 to 1999. The author employed panel data sets for purposes of estimation. The finding of the study suggests a positive connection between military expenditure and economic growth.

Aizenman & Glick (2006) estimated the long-run relationship between military expenditure and economic growth for a number of selected developing countries. The study found that military expenditure that comes about as a result of external threat can increase economic growth, while military spending driven by corruption would dampen or retard economic growth. There is, therefore, the need for countries to block as much as possible corruption channels in their economies.

Dunne & Uye (2009) attempted to empirically establish if high spending on arms can reduce or slow down a country's economic growth through the use of econometric time series procedures. The results arising from the study, indeed, found a negative relationship between defense expenditure and economic growth.

Also contributing to the existing empirical literature Dunne et al., (2011) explored the relationship between corruption, military spending and economic growth by employing co-integration procedures. The outcome of the study supported the work of (Deger, 1986).

Three distinct inferences can be gathered from the existing literature so far reviewed. Firstly, some of the studies found a positive connection between defence expenditure and economic growth. The second set of empirical studies found a negative link between military expenditure and economic growth, while the third set of enquiries did not find any reason to assert that military expenditure and economic growth are co-integrated. Therefore, this study investigates the possibility of a long-run relationship between military expenditure and economic growth using Namibia as a test centre. The author of this study is unaware of previous works in Namibia regarding the issue under consideration, hence the further necessity for this type of study in Namibia.

METHODOLOGY

The study employed time-series annual data-set for the period running from 1990 to 2014. The explanatory variables used in this study are military, health and education expenditures, while real gross domestic product serves as a proxy variable to economic growth. The data-sets utilise in this study are collated from the Bank of Namibia and the Namibia Statistical Agency Bulletins. All the data sets used in the estimation process were first of all converted into their

respective natural logarithms for the following reasons. Ogbokor & Samahiya (2014) listed the following as the advantages of converting a time series data sets into their respective natural logarithms before proceeding with the process of estimation: Firstly, from an econometric standpoint, this process could potentially lead to an improvement in the results obtained from the estimation process. Secondly, it provides useful information concerning the responsiveness of economic growth to changes in the explanatory variables used in the estimation process. In addition, all the data sets used in the estimation process/econometric model were deflated using appropriate price deflators in order to cancel the unwarranted influence of the price disturbances.

The estimation process is based on the following explicit econometric model that accommodates three explanatory variables and one independent variable:

$$LnEcong_t = \alpha_0 + \alpha_1 LnMilex_t + \alpha_2 LnEducex_t + \alpha_3 LnHethex_t + \mu_t \quad (1)$$

Where:

α_0 = numerical constant

α_1, α_2 and α_3 = coefficients of the explanatory variables

$Econg$ = dependent variable

t = time factor

Ln = natural logarithm and

μ = error term

The choice of the model is influenced by the following considerations: The theoretical literature reviewed, existing empirical literature, the nature of the issue under investigation, *a priori* knowledge and more fundamentally the driving objectives of the study. Ecog serves as a proxy to economic growth. Further Ecog represents real gross domestic product, while Milex, Educex and Hethex represent expenditures on defence, education and health in that order. The inclusion of the error term allows the model to capture the influence of other factors on economic growth which may not necessarily have a major impact on economic growth. The study is primarily concerned about the relationship between defence expenditure and economic growth. Nonetheless the model used in the study accommodates two other factors namely education and health so as to control the behaviour of defence expenditure in the econometric model.

This is an econometric time series study. Several econometric time series techniques are available in the literature. However, for purposes of this study, the two-step Engle-Granger

approach is employed in a single equation framework. First, this approach always requires the estimation of the residuals within a static OLS framework. Afterwards, the estimated residuals are subjected to a unit root test in order to determine if the datasets are stationary. Following this is a co-integration test, which is used to determine the existence of long-run relationships amongst the variables used in the econometric model. The existence of co-integration relationships provides a plausible justification for the estimation of an error correction model. Further, the study also conducted the following useful tests: Stability and causality tests. The main challenge associated with the use of this approach is that, it is very sensitive to small samples. Despite this weakness the use of this approach remains an essential part of most econometric time-series studies (Enders, 2010).

ECONOMETRIC RESULTS

Stationarity Test Results

The possibility of producing spurious correlation results from time-series data as a result of the problem of non-stationary time series, makes unit root test a useful starting point for all econometric time series studies.

Table 1 summarises the unit root test results. The Augmented-Dickey Fuller technique was employed to test for the presence of unit roots in the model. Economic growth (Y) and military expenditure variables assumed a stationary status after 1st difference, while the education (X2) and health (X3) variables became stationary after they have been subjected to second difference.

Variable	Levels		1st Difference		2nd Difference		Order of Integration
	Optimum lag	P-value	Optimum lag	P-value	Optimum lag	P-value	
Y	4	0.8878	4	0.0188	4	0.0010	2
X1	4	0.5653	4	0.0001	4	0.0917	2
X2	4	1.0000	4	0.2628	4	0.0048	2
X3	4	1.0000	4	0.8734	4	0.0035	2

Table 1: Unit Root Test Results

Co-integration Test Results

Table 2 represents the results of the test for co-integration on all the variables. Indeed, the results indicate, at least, one co-integrating equation.

Table 2: Co-integration Test Results

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.981646	113.2483	47.85613	0.0000
At most 1 *	0.718209	33.29025	29.79707	0.0190
At most 2	0.319146	7.958446	15.49471	0.4699
At most 3	0.013423	0.270287	3.841466	0.6031
Trace test indicates 2 co-integrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Error Correction Model Estimation Results

The co-integration results provide a prima facie justification for the inclusion and subsequent estimation of the error correction model. Since, the study is based on a single equation framework a vector error correction model estimation is not applicable. The error correction estimation results are displayed in Table 3.

Table 3: Error Correction Estimation Results

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.136272	0.182905	0.745040	0.4664
DX1	7.73E-09	3.01E-07	0.025703	0.9798
DDX2	1.54E-06	5.01E-07	3.079192	0.0068
DDX3	-1.77E-06	7.36E-07	-2.406427	0.0278
U	0.203597	0.126399	1.610744	0.1256
R-squared	0.453336	Mean dependent var		0.459636
Adjusted R-squared	0.324710	S.D. dependent var		0.757387
S.E. of regression	0.622391	Akaike info criterion		2.086219
Sum squared resid	6.585295	Schwarz criterion		2.334183
Log likelihood	-17.94841	Hannan-Quinn criter.		2.144632
F-statistic	3.524434	Durbin-Watson stat		2.402388
Prob(F-statistic)	0.028620			

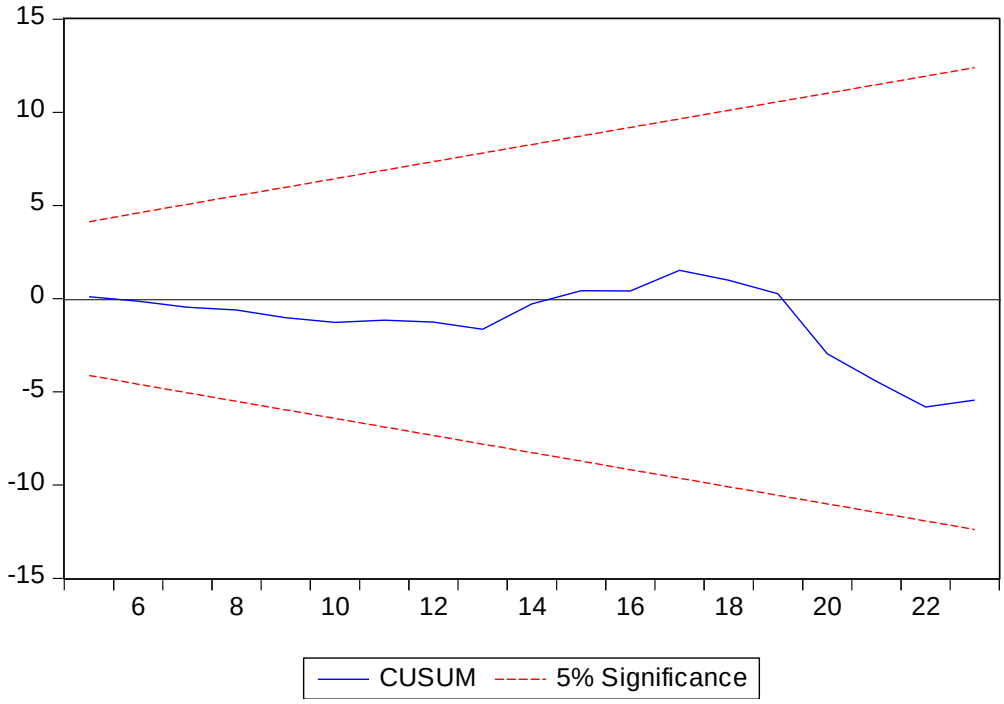
From Table 3, it is observed that the model coefficients (C), (DX1) and (U) appear to be insignificant. However, this result should not be over stretched. This is because the overall model still proved to be non-spurious and significant given the fact that both the unadjusted and

adjusted coefficient of determination values turned out to be less than the D-W statistic. Similarly, the F-statistic value was observed to be less than 0.05% implying that the model as a whole is significant. Furthermore, the D-W statistic value of 2.4024 is an indication that serial correlation is not likely to be an issue in the model, since it is very close to 2. The adjusted coefficient of determination value of 0.325 implies that approximately 33% of the systematic changes in economic growth in Namibia have been explained by the variables included in the error correction model. Presumably, the explanatory variables used in the error correction model are not good predictors of economic growth in Namibia.

Stability Test Results

The study employed the Cumulative Sum of Recursive Residuals (CUSUM) approach to test the stability of the model. The result of this test is displayed in Figure 1.

Figure 1: Model Stability test



A model is considered to be stable if its CUSUM statistics are within the bounds of the critical region (red dotted lines). If the line representing the CUSUM statistics (blue line) alternates beyond the bounds of the critical region (red dotted lines), the model will be regarded as unstable. It is, therefore, evident from figure 1 that the model under consideration is stable. This result makes the econometric model a potent and reliable tool from a policy perspective.

Granger-Causality Test results

The Granger causality test results are displayed in Table 4 below.

Table 4: Granger-Causality Test Results

Null Hypotheses:	Obs	F-Statistic	Prob.
DX1 does not Granger Cause DY	20	0.00273	0.9973
DY does not Granger Cause DX1		0.09275	0.9119
DDX2 does not Granger Cause DY	20	0.33431	0.7210
DY does not Granger Cause DDX2		1.03081	0.3807
DDX3 does not Granger Cause DY	20	0.16427	0.8500
DY does not Granger Cause DDX3		6.51093	0.0092
DDX2 does not Granger Cause DX1	20	3.17219	0.0710
DX1 does not Granger Cause DDX2		1.25624	0.3130
DDX3 does not Granger Cause DX1	20	5.99311	0.0122
DX1 does not Granger Cause DDX3		0.34361	0.7146
DDX3 does not Granger Cause DDX2	20	1.85353	0.1908
DDX2 does not Granger Cause DDX3		5.98974	0.0122

The Granger-causality test results displayed in Table 4 implies the existence of a unidirectional causality relationship running from economic growth to health, education to military expenditure, health to military expenditure, as well as, health to education expenditure. This suggests that, the economy would generally need some form of economic growth in order to boost activities in the health sector. No causality relationship was found between economic growth and education, as well as, between economic growth and military expenditure. It is, therefore, important for Namibia to exercise restraints, when it comes to military spending, especially during peace time. Further, the anti-proponents of increased defence spending in Namibia are probably justified considering the results obtained by this study.

CONCLUSION AND POLICY RECOMMENDATION

This study assessed the long-run relationship between military spending and economic growth using annual data sets for the period, 1990-2013 for Namibia. The study employed the two-step Engle-Granger approach in determining the possibility of a long-run relationship between military expenditure and economic growth. Firstly, the research finding suggests co-integrating relationships among the variables used in the study implying the existence of a long-run relationship. Secondly, the model in general was statistically significant and also passed the

stability test. However, its predictive power was weak considering the value of the adjusted coefficient of determination which was approximately 33%. Indeed, these three explanatory variables, when combined together only accounted for approximately 33% of the systematic changes occurring with respect to economic growth. On a sarcastic tone, the anti-proponents of high military spending in Namibia are probably right. Thirdly, the Granger-causality test result implies the existence of a unidirectional causality relationship running from economic growth to health, education to military expenditure, health to military expenditure, as well as, health to education expenditure. This finding implies that military spending does not promote economic growth. The research findings also agrees with the outcome of the research works of (Deger, 1986), (Frederiksen & La Civita, 1987), as well as the research work of (Dunne, 2009) which generally did not find strong reasons to support high defence expenditure.

From a policy perspective, there is the need for Namibia to control its military expenditure instead of continuously allowing it to compete with expenditures relating to basic needs such as education, health, housing and food production just to mention a few without necessarily compromising the country's defence needs.

It would be necessary for further studies to be undertaken concerning the issue under investigation by employing other econometric approaches and models. In addition, further studies should consider the inclusion of more countries in the SADC region. Furthermore, it is suggested that further studies should also consider the use of quarterly data sets, as well as the inclusion of more explanatory variables. Besides, paying particular attention to causality analysis in further studies is highly recommended. Finally, the author of this research article shall be gratified if the findings and recommendations flowing from this study assist in provoking further research regarding the relationship between defence spending and economic growth in Namibia.

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