Military Expenditure and Economic Growth (the case of Egypt)

الإنفاق العسكري والنمو الاقتصادي (حالة مصر)

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Abstract

National security is essential priority for countries. It is obvious that resources distribution and allocation is one of the most important targets for governments. The Egyptian Armed Forces is one of the greatest armies in the Middle East and North Africa, and the major weapons stock in the whole area. As long as Egypt has realized the security threats surrounding, whether at the local or regional level, therefore Egypt has implemented many huge investments to modernize and train the armed forces, with average military expenditure reaching $3.8 billion during (٢٠١٠-٢٠٢٠).

This study aims at examining the impacts of military expenditure on economic growth in Egypt using Autoregressive distributed lag (ARDL) method. The paper hypothesizes that; first, military expenditure does not cause economic growth. Second, economic growth does not cause military expenditure. Basically, the study is testing causality between military expenditure and economic during the period (1971-2020) and, the study shows that there is a uni-directional causality running from economic growth to military expenditure, however no causality from military spending to economic growth is observed in the results. There is a Granger causality from general government final consumption expenditure to military expenditure.

Keywords : military expenditure, economic growth, general government final consumption expenditure and Autoregressive distributed lag (ARDL)

المستخلص:

الأمن القومي أولوية أساسية للبلدان. من الواضح أن توزيع الموارد وتخصيصها من أهم أهداف الحكومات. تعتبر القوات المسلحة المصرية من أعظم الجيوش في منطقة الشرق الأوسط وشمال أفريقيا ، ومخزون الأسلحة الرئيسي في المنطقة كلها. وطالما أدركت مصر التهديدات الأمنية المحيطة بها ، سواء على المستوى المحلي

أو الإقليمي ، فقد نفذت مصر العديد من الاستثمارات الضخمة لتحديث وتدريب القوات المسلحة ، حيث بلغ متوسط الإنفاق العسكري ٣.٨ مليار دولار خلال ((٢٠٢٠-٢٠١٠.

تهدف هذه الدراسة إلى دراسة تأثير الإنفاق العسكري على النمو الاقتصادي في مصر باستخدام طريقة الانحدار الذاتي الموزع (ARDL). تفترض الورقة أن ؛ أولا ، الإنفاق العسكري لا يسبب النمو الاقتصادي. ثانياً ، لا يتسبب النمو الاقتصادي في إنفاق عسكري. في الأساس ، تختبر الدراسة العلاقة السببية بين الإنفاق العسكري والنفقات الاقتصادية خلال الفترة (١٩٧١-٢٠٢٠) ، وأظهرت الدراسة أن هناك علاقة سببية أحادية الاتجاه تمتد من النمو الاقتصادي إلى الإنفاق العسكري ، ولكن لا توجد علاقة سببية من الإنفاق العسكري إلى النمو الاقتصادي. لوحظ في النتائج. هناك علاقة سببية جرانجر من الإنفاق الاستهلاكي النهائي للحكومة العامة إلى الإنفاق العسكري.

الكلمات المفتاحية: الإنفاق العسكري ، النمو الاقتصادي ، الإنفاق الاستهلاكي النهائي للحكومة العامة ، والتأخر الموزع الانحدار الذاتي (ARDL)

1-Introduction

Achieving the balance between national security and economic growth is a critical and challenging mission. Meanwhile national security is essential priority for countries. It is obvious that resources distribution and allocation is one of the most important targets for governments to satisfy the needs which is marked in public finance by "guns or butter". In addition, the relationship between military expenditure and economic growth has been a controversial issue among economists. One of the common point of views regarding military spending at the World Bank or the International Monetary Fund is the opportunity cost of military expenditure: slowdown in output and economic growth (Chang et al., 2011). The fundamentals of their claim are based on the crowding-out effect; that is, scarce resources are fleeting from productive sectors to military expansion. However, such resource transfers can result in fruitful economic expansion in the future, it is predicted to detect a negative causal relationship between military expenditure and economic growth for low income or developing economies, or in the region of conflicts.

Although the prevalent direction that the military expenditure affects the economic growth negatively, Benoit (1973) claimed that there is a positive impact of military expenditure on economic growth according to the country; Whether it is a weapons-producing country, or weapons-importing country, in addition to the economic classification: developed or developing country.

The Egyptian Armed Forces is one of the greatest armies in the Middle East and North Africa, and the major weapons stock in the whole area. As long as Egypt has realized the security threats surrounding, whether at the local or regional level, therefore Egypt has implemented many huge investments to modernize and train the armed forces, with average military expenditure reaching $3.8 billion during (-٢٠٢٠) ٢٠١٠. Meanwhile it represented up to 1.2% of the GDP during (2018-2020), and 4.6% of the public budget in 2020. Throughout tracking the Egyptian military spending during the period from 2010 to 2020, it has been found that there is an obvious rising direction in Egyptian military spending (SIPRI).

Therefore, this study aims at examining the impacts of military expenditure on economic growth in Egypt using Autoregressive distributed lag (ARDL) method. The paper hypothesizes that; first, military expenditure does not cause economic growth. Second, economic growth does not cause military expenditure. Basically, the study is testing causality between military expenditure and economic during the period (1971-2020).

This study is structured as follows; Section 1 presents Introduction, Section 2 presents an overview of the related literature. Section 3 presents a theoretical background Data and methodology will be presented in Section 4. At last, section 5 presents conclusion.

2-Literature review

Bildirici (2015), study aimed at testing the dynamic relationship between economic growth, energy consumption, and military expenditure during (1987-2013). The study applied Autoregressive Distributed Lag (ARDL), and co-integration tests to determine both long and short-term relationships between variables. Bildirici concluded the positive impact of military expenditure, and energy consumption on economic growth. In addition to the bidirectional relationship between GDP and military expenditure, and GDP and energy consumption. The study assured the influence of military expenditure on energy consumption is remarkable because it is one of the first studies that investigated the relationship between those variables. Therefore, it is considered great participation in military economics and energy economics.

Manamperi (2016), investigated the impact of military expenditure on economic growth in two NATO countries: Turkey and Greece as they are two of the highest in military expenditure from 1970 to 2013. The researcher used various variables such as military expenditure, education, economic growth, investment, and population growth. The model resulted that military expenditure has negative and significant impacts on economic growth in Turkey in both long and short terms moreover the nonlinear long-run model. However, in Greece, it is an insignificant relationship between military expenditure and economic growth. The study recommended reallocating a proportion of military expenditure to civilian expenditure as education, health, and infrastructure to achieve economic growth taking all political and social factors into account.

Gokmenoglu et al (2015), aimed at testing the causality relationship between military expenditure and economic growth in Turkey which is considered as one of the rapidly developing countries that have high military expenditure rates. The study illustrated the long-term relationship between military expenditure and economic growth and the unidirectional relationship from economic growth to military expenditure. The paper also concluded that there is no relationship between military expenditure to economic growth. The researchers explained that Turkey is a developing country with limited resources and it is an importing country of weapons. Meanwhile, military expenditure is limited by GDP and growth rate.

Abu Bader and Abu Qarn (2003), study aims at testing the causality relationship between government expenditure and economic growth. The study measured the impact of military expenditure on economic growth by using cointegration tests and variance decomposition techniques in three MENA countries; Egypt, Syria and Israel. The researchers concluded that when testing government expenditure with economic growth there is a bidirectional causality from government expenditure and economic growth in addition to the negative long term relationship in Syria and Israel. Nevertheless, Egypt’s economic growth affects government expenditure negatively in the short term. The study classified the government expenditure into military expenditure and civilian expenditure to test the causality relationship with the economic growth. It revealed that military expenditure has a negative impact on economic growth in the three countries. Meanwhile, civilian expenditure had a positive impact on economic growth in both Egypt and Israel, and a negative impact in Syria. The study recommended redirecting a part of the military expenditure to civilian expenditure in Egypt and Israel to increase economic growth. However, Syria should allocate the resources to productive sectors to reach economic growth.

Ajefu (2015), analyzed the relationship between military expenditure and real GDP in Nigeria by using various variables such as real education expenditure and real health expenditure by employing Johanson's cointegration approach. The study resulted in revealing the negative relationship between military expenditure and economic growth. The study recommended cutting military expenditure and spending more for investment for development.

Hussain, et al. (2015), represents the importance of efficient administration of expenditure and its vital role to reduce poverty in order to accomplish development objectives. The study investigated the emphasis of military expenditure and its impact on poverty levels. The researchers employed Autoregressive Distributed Lag (ARDL) from 1973 to 2011. The study concluded that military expenditure is not anti-poor in both long and short terms.

Abdel Khalek et al, (2019), studied the relationship between military expenditure and economic growth in India in the period (1980-2016). The researcher employed Johansen cointegration test and Granger causality test. The study concluded there is no relationship between military expenditure and economic growth even after joining India, the weapon production zone.

Ortiz et al (2018), measured the impact of growth in military expenditure on growth in real GDP in 126 countries by applying Johansen cointegration and Granger causality tests for panel data. It ended up with results illustrating that there is a positive impact on upper income countries (UIC) and upper middle income countries(UMIC). There is an insignificant relationship in lower income countries(LIC) and lower middle income countries (LMIC). in addition to The Granger-type causality tests show that there is bidirectional causality as the global level, unidirectional causality from output to military spending in UIC; and from military spending to output in UMIC and LMIC, while there is causal relationship between the variables in the LIC. The study recommended redirecting the expenditure in the military to other activities for development to lower middle income countries and lower income countries.

(Warda et al., 2015), study aimed at studying and analyzing the impact of military expenditure on the economic growth rate in Egypt during the period (1995-2012). Moreover, the researchers analyzed the Egyptian and Israeli military expenditure and its relationship with the GDP, total investment expenditure and defense burden.

The study found that there is a bi-directional relationship between economic growth and military expenditure in Egypt.

3-The theoretical background

the relationship between military expenditure and economic growth is divided into two parties. On one hand, the first party argued that there is a positive relationship between military expenditure and economic growth. On the other hand, the other party stated that there is a negative relationship between military expenditure and economic growth.

The first party depended on the Keynesian model by considering the military expenditure as a part of the public budget that is a part of government expenditure. Therefore, military expenditure is a tool of fiscal policy that can be controlled in economic reform and enhance economic growth. Hussain, et al (2015), claimed that the theory focused on military expenditure as a component of aggregate demand which can increase the output and create jobs.

Various studies stated that there is a positive impact between military expenditure and GDP. The most remarkable studies are conducted by Benoit (1973), who discussed that investment in military sectors leads to economic growth because research and development in military sectors have several applications in commercial sectors and increase exports.

Brasoveanu (2010), concluded the positive impacts to include the following points:

- Military expenditure encourages research and development in the military sector which can be used in civilian and commercial sectors that lead to an increase in growth rate.
- Military expenditure leads to economic growth when a part of it is used in infrastructure.
- Military expenditure creates a secure environment that encourages investment whether is domestic or forging.
- Military expenditure affects economic growth as a part of aggregate demand.

Dunne and Tian (2013), concluded the negative impacts to include the following points:

- Military expenditure has a crowding-out effect on investment and civilian production according to the classical and neo-classical theories which illustrate that the increase in public spending substitutes public goods for private good.

- The opportunity cost of military expenditure is directing the resources to more productive sectors to increase development. However, military expenditure decreases savings and misallocates resources, in addition to the waste of resources to prepare for wars.
- Under the assumption of fixed government expenditure, the increase of military expenditure reduces the opportunity of increasing the other public psrojects such as infrastructure which enhances economic growth.

4-The Data and Methodology

To examine the relationship between military expenditure and economic growth during the period year 1971 to year 2020, the formulation of the quantitative model as we mentioned will be based on the logarithm of four main variables as follow: military expenditure, economic growth (GDP), General government final consumption expenditure and Exports of goods and services. Therefore, the hypotheses of the study are as follow:

H_1. Military expenditure does not cause economic growth.

H_2. Economic growth does not cause military expenditure.

The quantitative model for testing these hypotheses can be formulated as follows:

$$logM_t = \beta_0 + \beta_1 logG_t + \beta_2 logGC_t + \beta_3 logE_t + u_t \quad (1)$$

$$logG_t = \beta_0 + \beta_1 logM_t + \beta_2 logGC_t + \beta_3 logE_t + u_t \quad (2)$$

Where,

M = Military expenditure.

G = Economic growth (GDP).

GC = General government final consumption expenditure (% of GDP).

E = Exports of goods and services (% of GDP).

u = The error term.

t = Represents time

β_0 = intercept

$\beta_1,\ldots,\beta_3$ = regression coefficients.

The paper adopts the Autoregressive Distributed Lag (ARDL) bound testing framework (Pesaran and Shin 1995 and 1999, Pesaran et al. 1996, Pesaran 1997) to estimate the long-run equilibrium relationship among the variables and the Error Correction Mechanism (ECM). ARDL model is a model that has both lagged values of the dependent variables (autoregressive) and lagged values of the independent variables (distributed lag) as one of the explanatory variables. The ARDL cointegration is used to establish whether there is a long-run equilibrium relationship among the variables under review when the variables are integrated of both order zero I(0) and order one I(1). The advantages of using the ARDL technique instead of the conventional Johansen (1998) and Johansen and Juselius (1990) cointegration approach are that while the latter estimates the long-run relationships within the context of a system of equations, the former employs only a single reduced form equation (Pesaran and Shin 1995). In addition, the ARDL method avoids configuring a larger number of specifications in the standard cointegration test. These include decisions regarding the number of endogenous and exogenous variables to be included and the treatment of deterministic elements. Furthermore, the ARDL approach allows the use of different optimal lags for the different variables, which is not possible in the standard cointegration test. Since time series data could be vulnerable to unit root problems, Augmented Dickey– Fuller (ADF) and Phillips–Perron (PP) unit root tests are implemented on the series to avoid spurious regressions. Unit root tests are first conducted to determine the stationarity of the variables, which must be a combination of I(0) and I(1) series. Following Pesaran et al. (2001), the ARDL approach to cointegration is done as shown in Equation (3) and (4).

$$\Delta M_t = \beta_0 + \beta_1 \Delta G_t + \beta_2 \Delta GC_t + \beta_3 \Delta E_t + \beta_4 (M)_{t-1} + \beta_5 \Delta (G)_{t-1} + \beta_6 \Delta (GC)_{t-1} + \beta_7 \Delta (E)_{t-1} + ECT_{t-1} \quad (3)$$

$$\Delta G_t = \beta_0 + \beta_1 \Delta M_t + \beta_2 \Delta GC_t + \beta_3 \Delta E_t + \beta_4 (M)_{t-1} + \beta_5 \Delta (G)_{t-1} + \beta_6 \Delta (GC)_{t-1} + \beta_7 \Delta (E)_{t-1} + ECT_{t-1} \quad (4)$$

To obtain the optimal number of lags for each variable, a lag length test is conducted by estimating single equation Vector Autoregressive (VAR) and using the lag length criteria. This is followed by the estimation of a single equation unrestricted Error Correlation (EC) model with the number of estimated lags as shown in Equation (5) and (6).

$$\Delta M_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta (M)_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta (G)_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta (GC)_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta (E)_{t-i} + \beta_5 (M)_{t-1} + \beta_6 (G)_{t-1} + \beta_7 (GC)_{t-1} + \beta_8 (E)_{t-1} + u_t \quad (5)$$

$$\Delta G_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta (M)_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta (G)_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta (GC)_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta (E)_{t-i} + \beta_5 (M)_{t-1} + \beta_6 (G)_{t-1} + \beta_7 (GC)_{t-1} + \beta_8 (E)_{t-1} + u_t \quad (6)$$

Here, Δ is first difference operator, p is the optimal lag length, and all other variables remain the same. Wald tests on the coefficients of unrestricted ECT variables are conducted to obtain F-statistics, which are used to test the existence of a long-run relationship. The F-test has a non-standard distribution, which depends on whether the variables included in the model are I(0) or I(1), the number of regressors, and whether the model contains an intercept and/or a time trend. The F-statistics are compared with Pesaran’s critical value at the 5% level of significance. The test involves asymptotic critical value bounds depending on whether the variables are I(0) or I(1) or a mixture of both. Upper and lower bound critical values derive from the I(1) and I(0) series, respectively. When an F-statistic is above the upper bound value, we reject the null hypotheses of no cointegration among the variables and therefore conclude that there is evidence of a long-run relationship among the variables regardless of the order of integration of the variables. If it falls below the lower bound value, we do not reject the null hypotheses of no cointegration, and if it lies between the bounds, the result is inconclusive. When it is established that variables are cointegrated (i.e., there is a long-run or equilibrium relationship between them), in the short-run there may be disequilibrium. Error correction mechanism is used to correct the dis-equilibrium. The short-run dynamics can be derived by estimating the Error Correlation Term (ECT) with the specified lags as shown in Equation (7) and (8).

$$\Delta M_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta(M)_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta(G)_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta(GC)_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta(E)_{t-i} + \beta_5 ECT_{t-1} \quad (7)$$

$$\Delta G_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta(M)_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta(G)_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta(GC)_{t-i} + \sum_{i=1}^{p} \beta_4 \Delta(E)_{t-i} + \beta_5 ECT_{t-1} \quad (8)$$

where ECT_{t-1} is the error correction term. All coefficients of the short-run equation relate to the short-run dynamics of the model's convergence to equilibrium, and β_5 represents the speed of adjustment.

Results

4-1. Descriptive Statistics

Descriptive Statistics summary (Minimum Value, Maximum Value, Mean, Standard Deviation) for all variables are presented in Table (1).

Table (1): Descriptive Statistics

Variables	Sample Size	Minimum	Maximum	Mean	Std. Dev.
Log(M)	50	0.166	2.849	1.352	0.770
Log(G)	50	24.266	26.745	25.626	0.733
Log(GC)	50	2.036	3.248	2.564	0.300
Log€	50	2.337	3.498	2.980	0.282

4-2. Correlation

Pearson correlation coefficients are conducted (Table (2)) to determine if there any relationship between the independent and dependent variables, knowing that the correlation coefficient is coded as r and it ranges from -1 and +1. The closer the correlation value to one (regardless of the sign), the greater the correlation between the variables. The closer the correlation value to zero, the weaker the relationship between the variables. On the other hand, the correlation coefficient sign describes whether the relationship is positive or negative. If the correlation sign is negative, it indicates that the relationship between the two variables is indirect, and if the correlation sign is positive, it indicates that the relationship between the two variables is direct.

Table (2): Correlation Matrix

Variables	M	G	GC	E
Log(M)	1			
Log(G)	-0.973*	1		
Log(GC)	0.923*	-0.881*	1	
Log(E)	-0.069	-0.121	-0.017	1

Note: * denote significant at 5%

Table (2) shows that:

1- There is a statistically significant negative relationship between M and G at 5% significance level, whereas correlation coefficient is -0.973 and *p*-value is less than the significance *p*-value < $\alpha = 0.05$.

2- There is a statistically significant positive relationship between M and GC at 5% significance level, whereas correlation coefficient is 0.923 and *p*-value is less than the significance *p*-value < $\alpha = 0.05$.

3- There is a statistically significant relationship between G and GC at 5% significance level, whereas correlation coefficient is -0.881 and *p*-value is less than the significance *p*-value < $\alpha = 0.05$.

4-3. Stationarity test (Unit root tests)

A stationarity test using Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests is conducted to determine the order of integration for each variable as shown in Table (3).

Table (3): Unit root tests

Variables	Dickey–Fuller (ADF) test			Phillips–Perron (PP) test		
	Level	1st Diff.	I(d)	Level	1st Diff.	I(d)
Log(M)	-2.8256**	-6.3166**	I(1)	-2.5111**	-6.2775**	I(1)
Log(G)	-1.2498**	-4.7752**	I(1)	-1.8506**	-3.5779**	I(1)
Log(GC)	-2.2618**	-4.8011*	I(1)	-2.3215**	-4.8608**	I(1)
Log(E)	-3.0253*	---	I(0)	-2.6916*	---	I(0)

Note: * indicates a model with a constant; ** indicates a model with both a constant and a trend.

Since the stationarity test of the variables under consideration is a mixture of I(1) and I(0), the ARDL approach was deemed appropriate for estimation and testing our hypothesis.

4-4. Lag structure

Table (4) shows the results of lag structure determination using Akaike information criterion (AIC). The results reveal that two lags period will be selected.

Table (4): Optimum lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	7.887727	NA	9.92E-06	-0.16903	-0.01002	-0.10947
1	261.6938	452.4369	3.22E-10	-10.5084	-9.713364*	-10.2106
2	290.7624	46.76249*	1.86e-10*	**-11.07662***	-9.64551	-10.54052*
3	299.7859	12.94689	2.62E-10	-10.7733	-8.70614	-9.99893
4	311.5806	14.8715	3.42E-10	-10.5905	-7.88725	-9.57782

* Indicates lag order selected by the criterion

4-5. Granger Causality Test

Before testing our hypothesis and for examining causality relationship between military expenditure and economic growth, using time series approach, we will run Granger Causality Test to examine the possibility of causality relationship between military expenditure and economic growth. If so, we will determine the direction of relationship, unidirectional or bidirectional relationship.

Table (5): Results of Granger causality test

Null Hypothesis:	No. of observations	F-Statistic	p-value
Log(G) does not Granger Cause Log(M) **Log(M) does not Granger Cause Log(G)**	**48**	**6.55936** **0.41712**	**0.0033** **0.6616**
Log(GC) does not Granger Cause Log(M) Log(M) does not Granger Cause Log(GC)	48	11.1394 1.49756	**0.0001** 0.2351
Log(E) does not Granger Cause Log(M) Log(M) does not Granger Cause Log€	48	0.04234 1.816	0.9586 0.1749
Log(GC) does not Granger Cause Log(G) Log(G) does not Granger Cause Log(GC)	48	1.64252 2.32979	0.2054 0.1095
Log(E) does not Granger Cause Log(G) Log(G) does not Granger Cause Log(E)	48	1.82445 0.93846	0.1736 0.3991
Log(E) does not Granger Cause Log(GC) Log(GC) does not Granger Cause Log(E)	48	0.8198 1.46046	0.4473 0.2434

Table (5) shows that with two lag period, there is a Granger causality from economic growth (G) to military expenditure (M) whereas p-value = **0.0033** < α = 0.05. There is no Granger causality from military expenditure (M) to economic growth (G), whereas p-value = 0.6616 > α = 0.05. Moreover, there is a Granger causality from general government final consumption expenditure (GC) to military expenditure (M) whereas p-value = **0.0001** < α = 0.05. The results also reveal absence of Granger causality from government consumption expenditure (GC) and exports (E) to economic growth (G) a, whereas p-value > α = 0.05.

4-6. Results of the 1st hypothesis

Thus, the first step is to estimate and conduct a lag length test to estimate the optimum lag length for the variables. The maximum order of lags was set as two in the ARDL options using Akaike information criterion (AIC) to determine the optimum lag length to be included in the unrestricted ECM as shown in Table (6). The results suggests that the optimum lag length for M and E it is two; and for G and GC is one it is zero (e.g. ARDL(2, 2, 0, 0)).

Table (6): Estimating the optimum lag length for each variable in the 1st model

Variable	Coefficient	Std. Error	t-Statistic	p-value
LOG(M(-1))	0.999731	0.113906	8.776773	0.0000
LOG(M(-2))	-0.452199	0.105589	-4.282627	0.0001
LOG(G)	-1.104854	0.590173	-1.872084	0.0685
LOG(G(-1))	2.419705	0.963219	2.512103	0.0161
LOG(G(-2))	-1.626740	0.581871	-2.795706	0.0079
LOG(GC)	0.437729	0.092459	4.734290	0.0000
LOG(E)	-0.029240	0.044116	-0.662810	0.5113
Constant	7.528601	1.877579	4.009739	0.0003

R-squared	0.990675	Mean dependent var	1.294907
Adjusted R-squared	0.989044	S.D. dependent var	0.730933
S.E. of regression	0.076509	Akaike info criterion	-2.151800
Sum squared resid.	0.234146	Schwarz criterion	-1.839934
Log likelihood	59.64321	Hannan-Quinn criter.	-2.033946
F-statistic	607.0995	Durbin-Watson stat	1.642733
Prob(F-statistic)	0.000000		

Note: p-values and any subsequent tests do not account for model selection.

The next step is to estimate and examines the long-run relationships among the variables. Conducting a Wald test on the coefficients of unrestricted ECM variable, we obtain an F-Bounds test for the joint significance of lagged levels of the variables as shown in Table (7).

Table (7): Cointegration testing

Test Statistic	Value	Sig. Level	I(0)	I(1)
F-statistic	8.992651	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Table (7) shows that the calculated F-statistic of the Bounds test (8.992651) is higher than the upper bound critical value (3.67) at the 5% level of significance using a restricted constant and no trend. Thus, the null hypothesis (H_0) of no co-integration among the series can be rejected. This implies that there is a long-run relationship among all the variables.

In order words, the model variables co-move together in the long run. Moreover Table (8) shows the estimated model and the relationship between all variables at the long-run.

Table (8): Long-run model

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
Log(G)	-0.6893	0.0791	-8.7110	0.0000
Log(GC)	0.9674	0.1978	4.8916	0.0000
Log(E)	-0.0646	0.0980	-0.6596	0.5133
Constant	16.6390	2.5570	6.5073	0.0000

Table (8) shows that G and GC are significant variables at the long-run, where *p*-value = 0.0000 < 0.05. To estimation the model in the short-run, ECM short-run dynamics is conducted as shown in Table (9).

Table (9): Short-run error correction model

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
DLOG(M(-1))	0.452199	0.093761	4.8229	0.0000
DLOG(G)	-1.10485	0.459423	-2.40487	0.0209
DLOG(G(-1))	1.62674	0.489637	3.32233	0.0019
ECT(−1)*	-0.45247	0.064337	-7.03275	0.0000

R-squared	0.615928	Mean dependent var	-0.05011
Adjusted R-squared	0.589742	S.D. dependent var	0.113891
S.E. of regression	0.072949	Akaike info criterion	-2.31847
Sum squared resid	0.234146	Schwarz criterion	-2.16253
Log likelihood	59.64321	Hannan-Quinn criter.	-2.25954
Durbin-Watson stat	1.642733		

The results of the ECM presented in Table (9) show that all variables are significant, where *p*-value < 0.05. Overall, the model performs well in terms of goodness of fit: R^2 = 0.615928 and Durbin-Watson (1.642733). Results also reveal a coefficient value for ECT(−1) of −0.45247, implying rejection of the null hypothesis of no co-integration. This represents the speed of adjustment from the short run equilibrium to the long run equilibrium and suggests that 45% of the error is corrected annually. This adjustment speed implies that it will take approximately 2.25 years to bring the economy back to equilibrium. Moreover, Breusch–Godfrey serial correlation LM test and Heteroskedasticity test are applied as shown in table (10).

Table (10): Heteroskedasticity and Serial Correlation tests

Heteroskedasticity Test (ARCH)			Serial Correlation LM Test (Breusch-Godfrey)		
F	*df*	*p*-value	*F*	*Df*	*p*-value
0.530344	(1,45)	0.4702	1.416811	(2,38)	0.2550

From Table (10), we cannot reject the null hypothesis of no Serial Correlation ($F_{(2,38)}$=1.416811, *p*-value = 0.2550>0.05), and we cannot reject the null hypothesis of no Heteroskedasticity ($F_{(1,45)}$=0.530344, *p*-value = 0.4702>0.05) thus, the model satisfies this assumption. Moreover, ensuring stability of the model, Figure (1) provides evidence from Cumulative Sum Chart (CUSUM) stability test supporting the stability of the model at the 5% level because the blue line never deviates beyond the critical red lines.

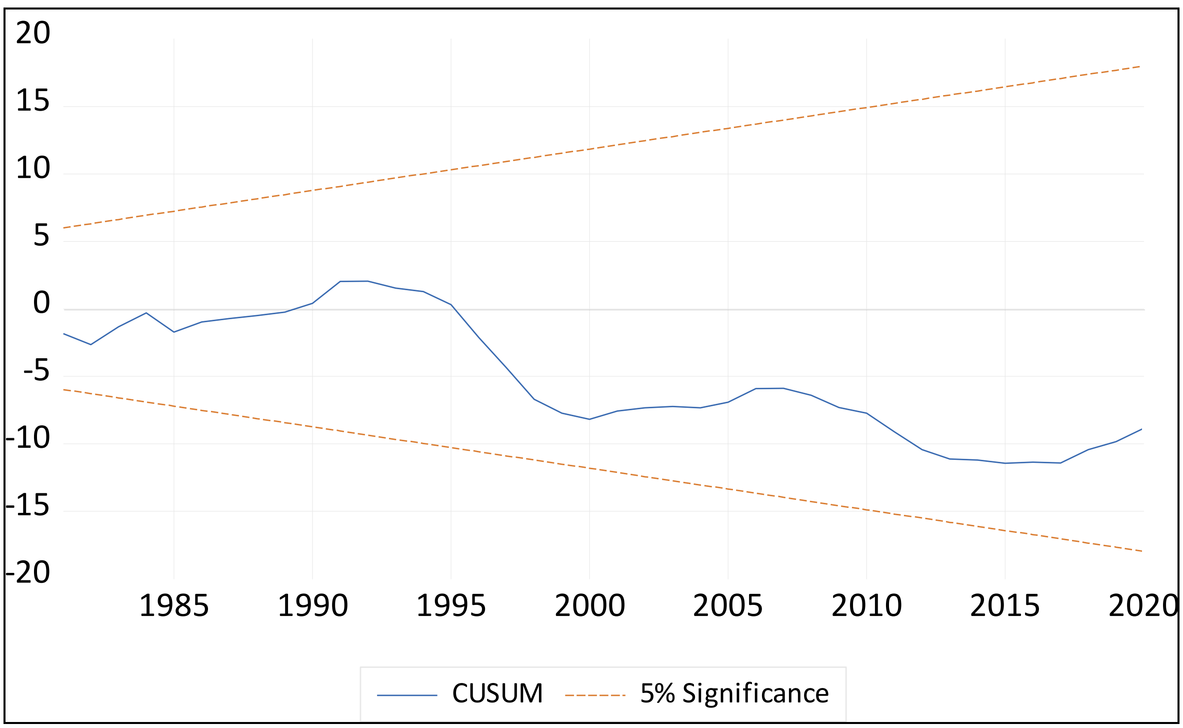

Figure (1): Stability of the model

4-7. Results of the 2nd hypothesis

Thus, the first step is to estimate and conduct a lag length test to estimate the optimum lag length for the variables. The maximum order of lags was set as two in the ARDL options using Akaike information criterion (AIC) to determine the optimum lag length to be included in the unrestricted ECM as shown in Table (11). The results suggests that the optimum lag length for G, GC and E it is two; and for M it is zero (e.g. ARDL(2, 0, 2, 2)).

Table (11): Estimating the optimum lag length for each variable in the 1st model

Variable	Coefficient	Std. Error	t-Statistic	p-value
LOG(G(-1))	1.194719	0.1395	8.56427	0.0000
LOG(G(-2))	-0.20894	0.140512	-1.48698	0.1453
LOG(M)	-0.0147	0.02252	-0.65289	0.5178
LOG(GC)	-0.04396	0.053356	-0.82383	0.4152
LOG(GC(-1))	-0.04331	0.084355	-0.51346	0.6106
LOG(GC(-2))	0.124206	0.052951	2.34568	0.0243
LOG(E)	-0.00674	0.017921	-0.37593	0.7091
LOG(E(-1))	-0.02434	0.02353	-1.03439	0.3075
LOG(E(-2))	0.051148	0.017896	2.858071	0.0069
Constant	0.265181	0.477639	0.555191	0.5820

R-squared	0.999434	Mean dependent var	25.68207
Adjusted R-squared	0.9993	S.D. dependent var	0.693294
S.E. of regression	0.018345	Akaike info criterion	-4.97588
Sum squared resid.	0.012788	Schwarz criterion	-4.58605
Log likelihood	129.4211	Hannan-Quinn criter.	-4.82856
F-statistic	7454.425	Durbin-Watson stat	1.952573
Prob(F-statistic)	0.00000		

Note: p-values and any subsequent tests do not account for model selection.

The next step is to estimate and examines the long-run relationships among the variables. Conducting a Wald test on the coefficients of unrestricted ECM variable, we obtain an F-Bounds test for the joint significance of lagged levels of the variables as shown in Table (12).

Table (12): Cointegration testing

Test Statistic	Value	Sig. Level	I(0)	I(1)
F-statistic	6.468587	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Table (12) shows that the calculated F-statistic of the Bounds test (6.468587) is greater than the upper bound critical value (3.67) at the 5% level of significance using a restricted constant and no trend. Thus, the null hypothesis (H_0) of no co-integration among the series can be rejected. This implies that there is a long-run relationship among all the variables. In order words, the model variables co-move together in the long run. Moreover Table (13) shows the estimated model and the relationship between all variables at the long-run.

Table (13): Long-run model

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
Log(M)	-1.03396	0.74705	-1.38406	0.1744
Log(GC)	2.59745	3.29430	0.78847	0.4353
Log(E)	1.41150	2.12747	0.66347	0.5110
Constant	18.64834	10.79984	1.72672	0.0923

Table (13) shows that all variables are not statistically significant at the long-run, where *p*-value > 0.05. To estimation the model in the short-run, ECM short-run dynamics is conducted as shown in Table (14).

Table (14): Short-run error correction model

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
DLOG(G(-1))	0.208939	0.121698	1.716867	0.0941
DLOG(GC)	-0.04396	0.048106	-0.91375	0.3666
DLOG(GC(-1))	-0.12421	0.048261	-2.57366	0.0141
DLOG(E)	-0.00674	0.015522	-0.43403	0.6667
DLOG(E(-1))	-0.05115	0.015886	-3.21967	0.0026
ECM(-1)*	-0.01422	0.002378	-5.97892	0.0000
R-squared	0.499262	Mean dependent var		0.051021

Adjusted R-squared	0.43965	S.D. dependent var	0.023311
S.E. of regression	0.017449	Akaike info criterion	-5.14255
Sum squared resid	0.012788	Schwarz criterion	-4.90865
Log likelihood	129.4211	Hannan-Quinn criter.	-5.05416
Durbin-Watson stat	1.952573		

The results of the ECM presented in Table (14) show that all variables are significant (except for GC and GC(-1), where *p*-value < 0.05 or 10% for these variables. However, M is the major variable of interest which is used to achieve the major objective of this study has no significant effect on G, so that it does not enclouded in the model. Overall, the model performs well in terms of goodness of fit: R^2 = 0.499262 and Durbin-Watson (1.952573). Results also reveal a coefficient value for ECM(−1) of 0.01422, implying no rejection of the null hypothesis of no cointegration. Moreover, Breusch–Godfrey serial correlation LM test and Heteroskedasticity test are applied as shown in table (15).

Table (15): Heteroskedasticity and Serial Correlation tests

Heteroskedasticity Test (ARCH)			Serial Correlation LM Test (Breusch-Godfrey)		
F	*Df*	*p*-value	*F*	*Df*	*p*-value
0.502193	(1,45)	0.4822	0.196761	(2,36)	0.7714

From Table (15), we cannot reject the null hypothesis of no Serial Correlation ($F_{(2,36)}$=0.196761, *p*-value = 0.7714>0.05), and we cannot reject the null hypothesis of no Heteroskedasticity ($F_{(1,45)}$=0.502193, *p*-value = 0.4822>0.05) thus, the model satisfies this assumption. Moreover, ensuring stability of the model, Figure (2) provides evidence from Cumulative Sum Chart (CUSUM) stability test supporting the stability of the model at the 5% level because the blue line never deviates beyond the critical red lines.

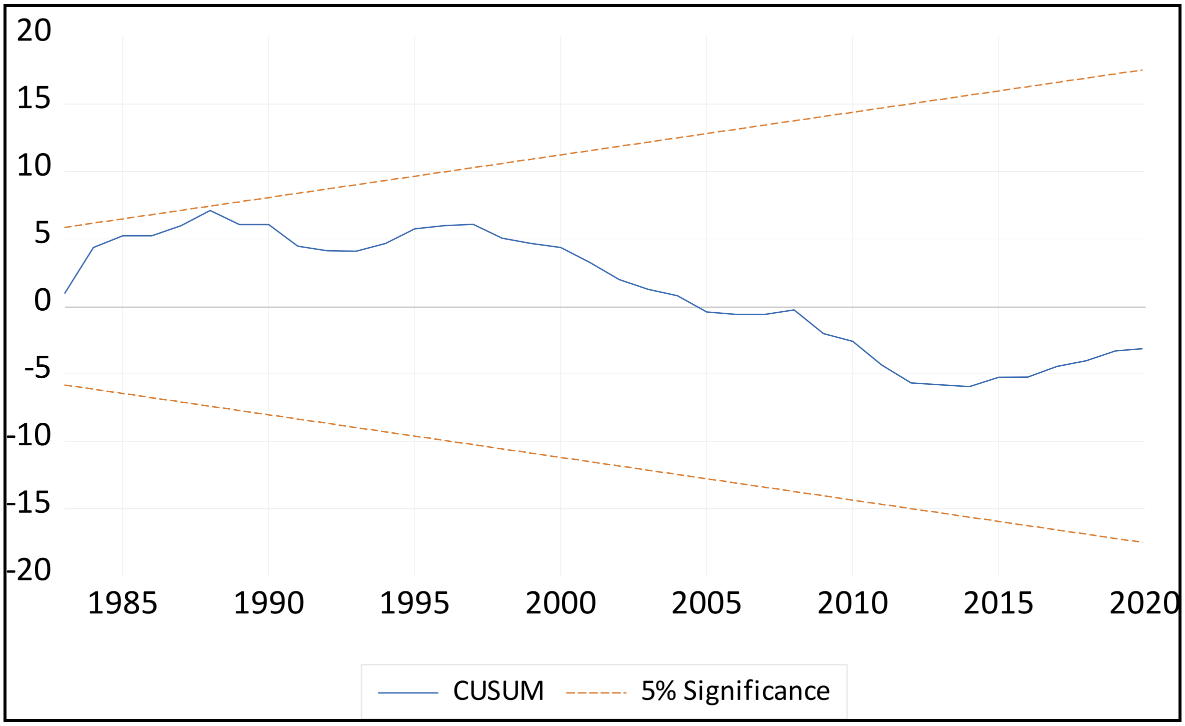

Figure (2): Stability of the model

5-Conclusion

This study aims at investigating the relationship between military expenditure and economic growth in Egypt which has been ranked as one of the most armed countries in the middle east. The empirical results indicate that military spending and economic growth have long-run equilibrium relationship. Moreover, there is a uni-directional causality running from economic growth to military expenditure, however no causality from military spending to economic growth is observed in the results. Warda et al, (2015) and Abu Bader and Abu Qarn (2003) studies findings agreed with these findings. Furthermore, there is a Granger causality from general government final consumption expenditure to military expenditure. The results also reveal absence of Granger causality from government consumption expenditure and exports to economic growth .

Because of the threats that face the country internally or externally .The findings can be interpreted as Egypt is a developing country with limited resources and low income, therefore when growth in GDP increase the military expenditure increase. Egypt is a net arm importer which means military expenditures should be financed by the scarce resources and foreign exchange reserves of the country. So, only with a higher GDP growth rate Egypt can finance its military expenditures. Supporters of spin-off effect claim that military expenditures contributes to economic growth via modernization, training and infrastructure (see Dunne and Nikolaidou, 2001), however, it seems that this effect is only relevant for developed countries those have more sophisticated military technology and export capacity .Egypt should be allocate more resources to education ,infrastructure and other productive civilian goods .

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