The Causal Relationship between Military Expenditure and Economic Growth in Egypt during the period from 1980 to 2019

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Abstract

This study aimed to analyze the causality relationship between military expenditure and economic growth in Egypt during the period from 1980 to 2019. The study used the Autoregressive Distributed Lag ARDL (bounds test) approach to test the long-run relationships between the study's economic variables (GDP, military expenditure, and fixed capital Formation). also the study used Granger causality and Toda-Yamamoto (TY) methodology to conduct the causality test. The study's main findings are that there is a unidirectional causality relationship between these variables, where: military expenditure does not cause GDP, however GDP causes military expenditure. And military expenditure does not cause fixed capital; however, fixed capital causes military expenditure. And fixed capital causes GDP, however GDP does not cause fixed capital. Having regard to this study's findings, the study recommend that the Egyptian Government should ensure that the country's economic resources are allocated optimally to all sectors to achieve both the maximum amount of economic growth and the efficient utilization of the available resources.

Keywords*:* Military Expenditure; GDP; ARDL approach; Granger causality; Toda-Yamamoto (TY) methodology.

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Introduction

Egypt's military power plays an important role in the Middle East and North Africa. Egypt has a rich history in having a strong military force that is comparable to many other countries in the region. Costs and benefits of the military and defence expenses have been analyzed over time and different models have been used to predict if there is a casual relationship between military expenditure and economic growth in different countries and regions.

Generally, government expenditure is divided into civilian and military expenditure and often sparks interest from diverse groups who examine its contribution to economic growth. Civilian expenditure is a direct investment and, hence, its contribution can be easily tracked (Shaaba & Ngepah, 2018). However, military expenditure is an indirect investment that has sparked greater interest among economists and other policymakers. This is due to the complexity of determining the economic growth attributed to it, and the significant amounts of resources directed towards it (Dimitraki & Win, 2020).

Financing the military sector is one of the major roles of every government. Military expenditure does not lead to the existence of public goods, such as infrastructure, but reduces the amount available for investment in such activities. According to Zhao et al. (2017), military expenditure includes economic resources directed towards peacekeeping, military operations, personnel salaries, pensions and benefits attributed to the role of the military; research and development in the field; and military aid to other countries. To determine the level of economic growth, all components of government expenditure must be taken into consideration (Qureshi & Khan, 2017). Different authors have expressed, also, their views on the relationship

between military expenditure and economic growth. Some have concluded that there is a positive relationship between them while others have concluded that there is a negative relationship between them.

As at 2020, the global fire international website has ranked Egypt's military as the 9th strongest in the world. This is despite a reduction in Egypt's military expenditure over the last decade. The reduction has been initiated over this period by allowing the military personnel to control most of the economy since they are permitted to carry out economic activities aimed at reducing the government funds allocated for some costs such as military salaries and pensions (Phiri, 2019). The shift in costs has helped significantly with the inclusion of funds to the civilian expenditure. The military expenditure aids, also, in compensating senior officers who earn lesser salaries and pensions since, when compared to years before the shift, they can earn extra income and other benefits.

According to Zhao et al. (2017), the military began to control the economy in 2013 when the officials were given management roles relating to the Egyptian economy. In Egypt, the military is tasked, also, with handling contracts and managing government funded housing and infrastructure projects that account for a quarter of the overall government expenditure (Alhamdi & Alawin, 2018).

While there is a relationship between military expenditure and economic growth, the causality between them remains to be fully established because this relationship has not been explored fully. The relationship is mainly the peaceful living and working conditions that attract not only overseas markets but, also, investors.

Problem Statement:

Government spending has a great influence on a country's economic growth. Military expenditure has been studied in relation to economic growth and has yielded contradictory results in different regions. The main challenge is that the different studies produced contradictory findings. These findings may be attributed to the differences in the amounts of economic resources relative to GDP and other variables (Zhao et al., 2017). Some researchers support the view that military expenditure leads to high economic growth while others conclude that it slows the level of economic growth. Other studies' findings show that a reduction in military spending leads to an increase in GDP. Consequently, to have reliable findings that can be relied upon in decision making, it is important to use different models in carrying out country specific studies.

Consequently, this study tries to answer the following questions:

- What is the nature of the relationship between military expenditure and economic growth?
- What is the direction of the causal relationship between military expenditure and economic growth in Egypt?

This Study's Objective: is to investigate causal relationship between military expenditure and economic growth in Egypt during the period from 1980 to 2019.

Significance of Research: This study is relevant because it contributes to the existing literature and provides a rationale for the allocation of economic resources to the military. Governments are faced often with the burden of military expenditure. Therefore, it is necessary to determine the effect of military expenditure on economic growth to enable

policymakers and economists to devise effective policies and measures (Phiri, 2019). Moreover, depending on the economic benefit that is achieved in return, economists can advise the government on the resources that should be allocated to the military (d'Agostino et al., 2017). The research findings can be used to justify the allocation of economic resources to the military sector along with the transfer of economic resources from other sectors.

Literature Review:

Numerous studies have been conducted to explain the relationship between military expenditure and economic growth. This has led to the classification of causal relationships between military expenditure and economic growth into different categories. The first category relates to whether or not increased economic growth influences military expenditure. The second category relates to whether or not an increase or a decrease in military expenditure affects economic growth. The third category relates to when both military expenditure and economic growth can influence and affect each other respectively. The fourth category relates to when there is no causal relationship between military expenditure; for example, neither economic growth nor military expenditure influences or affects the other (Chang et al., 2011).

Studies to determine the causal relationship between military expenditure and economic growth have been conducted globally on a per region basis and in specific countries. Depending on the regions in which the studies were conducted, global studies have yielded different findings. Zhong et al., (2017) studied the relationship between military expenditure and economic growth in five countries in different global regions. These countries were the USA, Brazil, India, China, and South

Africa with each representing North America, South America, Asia, and Africa respectively. The researchers concluded that military expenditure influenced economic growth in the USA, Brazil, and India. However, the study's findings showed that there were no causal links between the two variables in China and South Africa. The difference across the countries was due to these countries' different economic and political conditions.

Studies, which were conducted in the Middle East and, mostly, in the Asian countries. produced contradictory results that were influenced by different economic strengths and the amounts allocated to military expenditure. From studying South Asian countries and, more specifically, Sri Lanka, Bangladesh and Nepal, Ismail's (2017) findings show that the relationship between the variables depends on the country's economic capability. This study's findings show, also, that the resources allocated for capital formation activities, have had a four times growth rate when compared to military expenditure. According to this study, the rationale for the allocation of larger amounts of resources to the military is to maintain peace which is paramount in boosting the development and availability of basic needs in the region. Countries with lower economic power do not exhibit a significant relationship while, in the region, there is a negative relationship between a strong economy and the allocation of military expenditure. Some of the countries show no relationship between the two variables. From conducting a study in Pakistan, which is in the same region, Qureshi and Khan (2017) analyzed the relationship between military expenditure and economic growth. According to the authors, the relationship between these two variables depends on the analysis of both the direct and indirect total costs and the overall benefits. This analysis is in line with the endogenous growth

theory. When compared to total government expenditure the share of military expenditure is low and there is a greater overall benefit which results in higher economic growth. In addition, Abdel-Khalek's (2019) findings show that, in India, while there is no causal relationship between military expenditure and economic growth, the link between the civil and military sectors is what led to the country's economic growth. This due to the indirect benefits which include increased foreign direct investment in the country.

The findings of further studies, conducted in different Middle Eastern countries, in have shown that military expenditure leads to economic growth in the long term. From conducting a similar study in Turkey using time series data, Taspinara and Sadeghieha's (2015) findings show that the two variables have a unidirectional relationship and that, in the long term, there is an equilibrium relationship between the military expenditure and economic growth. The authors attribute the short-term variations in their findings to the changes in macroeconomic policies. This study used Granger causality and Johansen co-integration tests to determine the relationship both in the short-term and in the long-term. From conducting a study in Jordan, where, in the long-term, there is a positive relationship between the two variables. Dimitraki and Win (2020) supported Taspinara and Sadeghieha's findings.

From a South African study, Phiri's (2019) findings show that military expenditure hinders economic growth and that there is a need to transfer most of the country's resources to non-military expenditure to boost the economy. These findings are similar to Zhong et al.'s (2017) findings that in South Africa there is no causal link between military expenditure and economic growth. However, from a similar study in Africa,

Shaaba and Ngepah's (2018) contradictory findings show that military expenditure can achieve industrialization, more economic growth and an increase in aggregate domestic products. This study used a panel causality test to determine causality and the Engle and Granger test to determine the direction of the causality. Their findings show, also, that Military Keynesianism aids the formulation of fiscal policies to boost the economy.

By using a panel of more than 30 countries including Egypt, Shaaba & Ngepah (2019) investigated the relationship between military expenditure and economic growth. Their findings revealed no causal relationship between military expenditure and economic growth in seven countries, an unidirectional causality relationship in two countries and bidirectional relationship in 12 countries. These findings suggest that a country-specific study is necessary to help to establish the exact causal relationship between that country's military expenditure and economic growth.

(Ortiz et al., 2019) Were used a panel data approach for the period 1980–2016, aiming to capture the heterogeneity among countries by income level, they found empirical evidence suggests that military expenditures and real output have long and short-term equilibrium relationships in the different income groups. The results of the causality test suggest that there is a unidirectional causal relationship from real output to military expenditures in high income countries; and from military expenditures to real output in upper-middle and lower-middle income countries, and that no causal relationship in either direction exists in lower income countries.

Where Abu-Bader and Abu-Quam (2003) carried out a study covering the period from 1975 to 1998, Their results show

that increased military expenditure led to an increase in Egypt's economic growth. However, the findings of Hassan et al.'s (2003) Egyptian study show that economic growth led to increased military expenditure. From these findings, we can conclude that both military expenditure and economic growth influence and affect each other (Abu-Bader & Abu-Qarn, 2003)

The causal relationship between military expenditure and economic growth in African countries, like Egypt, has been of keen interest to researchers in recent times (Odhiambo, 2015). These research findings show that Egypt's military expenditure causes the country's economic growth.

Egypt's national debt has been used, also, to determine the causal relationship between military expenditure and economic growth. The results show that both the national debt and economic growth have influenced each other. Consequently, Egypt's national debt causes military expenditure to affect the country's economic growth. Furthermore, the findings show that Egypt's national debt affects military expenditure. This means that Egypt's national debt can increase or decrease the amount channeled into military expenditure. For example, if the nation is paying back the debt, there is a reduction in the amount channeled to military expenditure (Ebiringa & Charles-Anyaogu, 2012)

Studies have used a panel causality test to investigate the causal relationship between Egypt's per capita spending on the military and the country's economic growth. The findings show that Egypt's economic growth has influenced and affected per capita military spending. This meant that as Egypt's economic growth increases, the per capita military expenditure grows and that, if Egypt's economic growth decreases, the per capita military expenditure reduces, also. Per capita military

expenditure is the estimated expense for each military personnel (Looney, 1995).

Other factors have contributed to the causal relationship between military expenditure and economic growth. The first factor is military expansion – if a country's military capacity grows, the military expenditure grows, also, and this leads to economic growth. The second factor is the growth in the gross domestic income. This results from economic growth. The growth in gross domestic income increases the military expenditure. The third factor is the growth in international trade. International trade increases the country's rate of economic growth and this leads to an increase in military expenditure. These factors can be classified either as military or economic factors since they influence and affect both military expenditure and economic growth (Yildirim et al., 2005).

The studies' findings show that military expenditure affects economic growth. Military expenditure may have either a positive or negative impact on economic growth. In addition, the studies' findings show that the rate of economic growth may affect military expenditure. For example, an increase or decrease in economic growth affects military expenditure. However, this paper discusses the effects of military expenditure on Egypt's economic growth and the findings show that there is a causal relationship between military expenditure and economic growth. Thus, the conclusion is that military expenditure influences the rate of Egypt's economic growth (Hassan et al., 2003).

A causal relationship between military expenditure and economic growth means that there is a possibility that a country's economic growth depends on the amount that the government sets aside for military expenditure. Every

government has various departments into which it channels the country's finances and the military department is one of these departments. Many studies have been conducted to explain the relationship between military expenditure and economic growth and the factors that affect either one or the other (Dunne & Tian, 2013).

Consequently, by applying the Granger Causality approach proposed by Toda and Yamamoto (TY, 1995), this study tries to fill the research gap regarding the impact of Egypt's military expenditure on economic growth during the period from 1980 to 2019.

Military Expenditure and Economic Growth in the Economic Theory:

Numerous theories have attempted to explain the causal relationship between military expenditure and economic growth (Dunne et al., 2005). The first theory is called the neoclassical theory (Alptekin & Levine, 2012). This theory associates military expenditure to economic growth by specifically analyzing the supply factor. In this theory, the country acts as a multiplying factor whereby it invests huge amounts of money in its military expenditure. This results in security being heightened and, thus, increasing the opportunity cost that comes with stable security. Therefore, the advantages of taking such actions are matters of national importance. The second theory is called the Keynesian theory. This theory analyzes the impact of demand and supply on military expenditure and how it affects the country's economic growth (Alptekin & Levine, 2012).

The third theory is called the Marxist theory. This theory explains that increasing the number of resources channeled into military expenditure expands the capitalist mode of production.

This leads to an increase in the number of capitalists (Dunne et al., 2005). Often, increased military expenditure impacts negatively on a capitalist economy. This is due to an increased supply of goods and services and less demand. Measures taken to reduce the losses encountered include reductions in the production of goods and services to match the available demand. Such measures help the capitalists to obtain profits. The fourth theory is improved international relations that assist in solving different countries' political uncertainties. This enables these countries to channel their military expenditure into heightening their security and, thereby, increase their economic growth (Dunne et al., 2005).

This Study's Limitations: The study of the causal relationship study is faced with the challenge of quantifying some of the economic costs and benefits resulting from military expenditure. Most of the benefits are unrelated directly to the sectors and are instead allocated to other sectors. Also, the benefits from military expenditure, which go to foreign aid, cannot be quantified. Peace and stability are key determinants of the nature of the relationship and its dynamic nature in some regions makes it difficult to achieve viable findings from using the data. Different models and techniques have been used to determine the relationship and further research is required to identify the areas that cause disparities in the results.

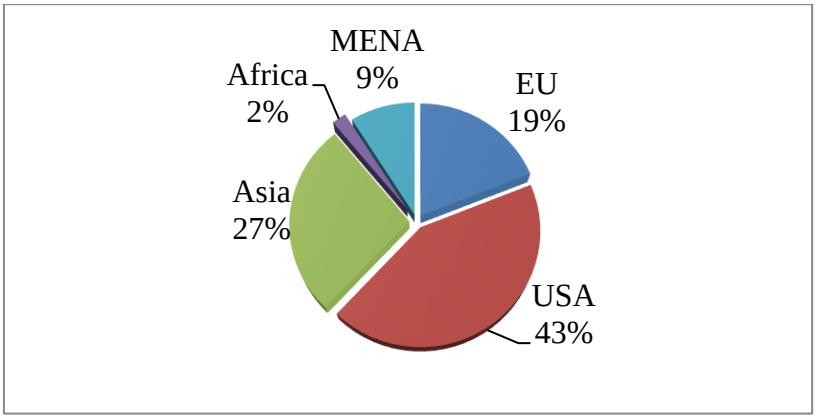
Trends in Global and Regions' Military Expenditures:

In 2019, global military expenditure[2] witnessed the largest annual increase in the past decade ($1917 billion) and accounted

[2] According to the Stockholm International Peace Research Institute's (SIPRI), military expenditure, contains all current and capital expenditure on the armed forces;

for 2.2 % of GDP. The following diagram shows the percentage of worldwide military expenditures by region in 2019.

Figure (1): Percentage of Military Expenditure by Region in 2019



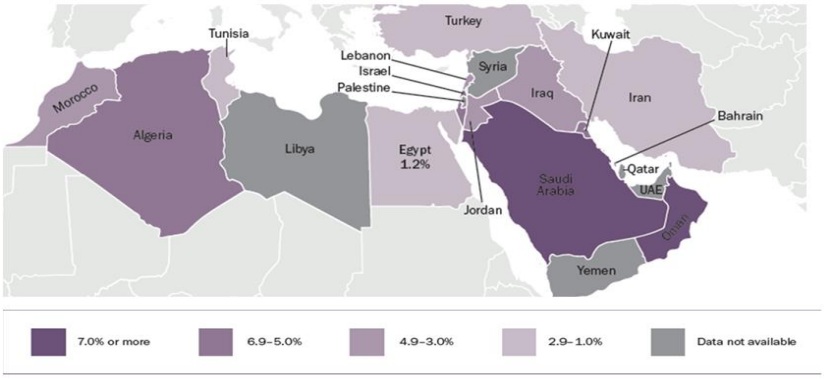
Source: SIPRI[3] Yearbook 2020.

The MENA region has 7 of the 10 countries with the highest military expenditure in the world. The MENA countries' military expenditure averages 4.4% of GDP. This is because most MENA countries become involved either directly or indirectly in regional conflicts. Figure (2) below, and Table (1) shows the statistics of the military expenditure in some MENA countries in 2019.

defence ministries and other government agencies engaged in defence projects; military space activities; and paramilitary forces. i.e., military expenditure includes expenditure on salaries, pensions, social services, procurement, military research and development, and military aid.

[3] SIPRI reported estimates of military spending for 14 of the 19 countries in the Middle East and North Africa in 2019: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Tunisia, Turkey and Saudi Arabia. Estimates cannot be made for 5 states: Libya, Qatar, Syria, the United Arab Emirates (UAE) and Yemen. SIPRI Military Expenditure Database, <https://www. sipri.org/databases/milex>.

Figure (2): Military Expenditure to GDP in MENA Countries in 2019



Source: Kuimova, 2020.

Table (1) Some Statistics of Military Expenditure in MENA countries in 2019 US$, m.

Country	Military spending	Military spending to GDP	Military spending to government spending	Number of active military personnel
KSA	61867	8%	20%	227000
Israel	20465	5.30%	13%	17000
Turkey	20448	2.70%	7.80%	355200
Iran	12623	2.30%	13%	610000
Kuwait	7710	5.60%	11	17500
Egypt[4]	3744	1.20%	4.2	439000

Source: Military Expenditure Database, April 2020

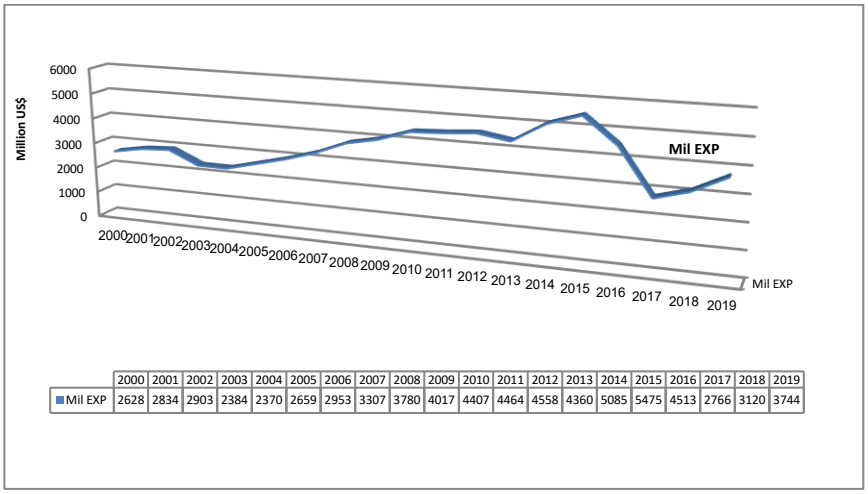
Trends in Egyptian Military Expenditure:

Egypt's military force is one of the largest military forces in the MENA region. In 2019, Egypt had the lowest

[4] Egyptian military expenditure ranks ninth in the region.

military expenditure (1.2 % of GDP) in the region, while all other countries in the region spent more than 7% of their GDP on military expenditure. When compared with the previous decade, Egyptian military expenditure increased between 2010 and 2019 and reached annual expenditure of $3.8 billion. Egypt's estimated military and paramilitary expenditure in 2020 is estimated at 14 billion Egyptian pounds or $833 million (Kuimova, 2020).

Figure (3): Egypt's Military Expenditure in the Period from 1980 to 2019



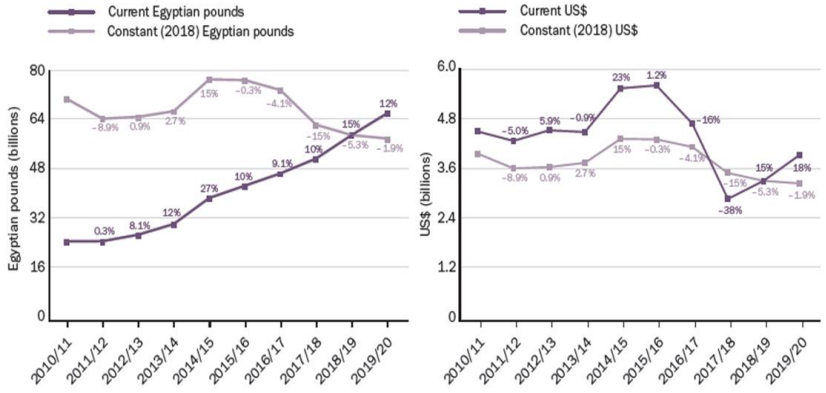
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mil EXP	2628	2834	2903	2384	2370	2659	2953	3307	3780	4017	4407	4464	4558	4360	5085	5475	4513	2766	3120	3744

Source: World Bank, World Development Indicators.

Over the period from 2010 to 2020, Egypt's military expenditure increased by more than 161% in the year 2010/2011. Over the same 10-year period, the annual levels of nominal growth ranged between 0.3 and 27 % with the largest increases being in 2013/2014 and 2014/2015. The nominal growth rate in expenditure may be referred to as the growth rate in military salaries since 2010. However, the overall nominal

increases in military expenditure can be reduced due to high inflation rates which fluctuated between 6.9% and 24% between 2010/2011 and 2019/2020. Figure (4) below shows that the trend was due to the significant devaluation[5] of the Egyptian pound (Kuimova, 2020).

Figure (4): Egypt's Military Expenditure in the Period from 2010 to 2020 in Current and Constant Egyptian Pounds and US$



Source: Kuimova, 2020.

However, in real terms, the official military expenditure declined over the period from 2010 to 2019. This is puzzling because, in real terms, Egypt acquired military equipment and strengthened its military efforts to combat terrorism. Between 2015 and 2019, Egypt became the third largest importer of arms in the world and the second largest importer of weapons in the Middle East and North Africa, after Saudi Arabia.

Since 2015 SIPRI has not estimated total military expenditure in the Middle East because of a lack of data for some countries

[5] Currency devaluation made military goods and services more costly in US dollars.

(Qatar, Syria, the United Arab Emirates (UAE) and Yemen). In 2019, the total military expenditure in 2019 for the 11 countries is estimated to be $147 billion (Tian et al., 2020)

In the decade from 2000 to 2009, Egypt's major arms supplier was the USA which funded Egypt with about $1.3 billion of military aid each year. That aid is probably not included in Egypt's defense and national security budget. Through the period from 2000 to 2009, Egypt signed 23 orders with 8 different arms suppliers and, through the period from 2010 to 2019 agreed 75 deals with 15 different suppliers. Over the period from 2014 to 2019, Egypt strengthened its arms trade relationships with Germany and Russia and developed its arms trade relationships with China, France and Italy. Egypt completed one deal with France through the period from 2000 to 2009. Also, in the period from 2014 to 2019, Egypt received from Russia advanced weapon systems such as Rafale combat aircraft and MiG-29 combat aircraft from Russia.

Through 2019–2020 Egypt signed new major arms deals with Russia, Germany, and Italy and planned to procure other major arms from Italy. The estimated cost of these deals totals $16 billion. Assuming that half of the amount could be paid for using foreign financing loans on a multi-year repayment, so Egypt would still need to pay the remainder $8 billion over five years, it would mean that Egypt would pay annually at least $1.6 billion. This is equivalent to 40 % of its average annual military expenditure. Based on the official data, Egypt's average military expenditure in the period from 2010 to 2019 was about $3.8 billion annually as compared with $4.3 billion in 2000–2009. In real terms, Egypt's official military expenditure followed, also. a downward trend from financial year 2015/2016.

The factors, discussed above, serve as indicators that funding for Egypt's arms procurement may be drawn from outside the regular military budget through either from foreign loans or foreign assistance or military aid or off-budget revenue. Also, there are claims that some Gulf States may have funded some of Egypt's arms procurement. This foreign funding may explain Egypt's high level of imports relative to comparatively low official military expenditure. In addition, the Egyptian army manages many infrastructure projects and through the National Service Products Organization and the Armed Forces Engineering Authority, affiliated to the Ministry of Defence, operates business enterprises in different sectors by. In every likelihood, these enterprises have achieved profits that have been used to finance the army procurement (Kuimova, 2020).

This Study's Econometric Model:

In aiming to analyze Egypt's relationship between military expenditure and economic growth in the period from 1980 to 2019, this study uses a time series approach. The researcher extracted the data from the World Bank Open Data website, the study's econometrics model will be as follow:

$$GRGDP_t = \alpha_0 + MEGDP_t + GRFC_t + \varepsilon_t \ldots\ldots\ldots(1)$$

- **Gross Rate of GDP (GRGDP):** The gross rate of GDP is a measure of economic growth and aggregates the total goods and services produced and sold in a country at a given time (Phiri, 2019). Government expenditure affects GDP by increasing disposable income among the population and, hence, leading to a higher rate of investment and demand for goods and services (Zhao et al., 2017).

- **Military Expenditure to GDP (MEGDP):** The ratio of military expenditure to GDP is the share of economic resources allocated to the military sector compared to the country's GDP (Anwar, 2017). The ratio is used to determine the extent of resources allocated to the military sector.
- **Gross Rate of Fixed Capital (GRFC):** According to d'Agostino (2017), the gross rate of fixed capital is the net investment that results in the change of a country's fixed assets and the formation of capital formation. The Keynesian theory supports the view that, due to the new aggregate demand that is created, an increase in the gross rate of fixed capital increases the rate of economic growth.

Table (2) below shows the descriptive statistics of those variables.

Table (2): The Descriptive Statistics of the Variables

	GRGDP	MEGDP	GRFC
Mean	4.974810	3.593810	21.90949
Median	4.744525	2.974812	21.09034
Maximum	10.01133	8.265232	34.12711
Minimum	1.125405	1.247069	12.44560
Std. Dev.	2.066341	2.099596	5.978201
Skewness	0.667229	1.112483	0.295208
Kurtosis	3.539280	2.864229	2.001795
Jarque-Bera	3.366349	8.074470	2.185635
Probability	0.185783	0.017646	0.335271
Sum	194.0176	140.1586	854.4702
Sum Sq. Dev.	162.2511	167.5155	1358.078
Observations	39	39	39

To achieve this study's objective the researcher tested the following hypotheses:

The null hypothesis H_0 (as in Equation 2): military expenditure does not cause the rate of economic growth.

$$GRGDP_t = \alpha_0 + \sum_{i=1}^{n1} \alpha_{1i} GRGDP_{t-i} + \sum_{i=1}^{n2} \alpha_{2i} MEGDP_{t-i} + \sum_{i=1}^{n3} \alpha_{3i}\, GRFC_{t-i} + \lambda EC_{t-1} + e_t \dots\dots\dots (2)$$

Where:

- H_0: $\alpha_{2i} = 0, \lambda = 0,$ for $i = 1, \dots, n.$ & H_1: $\alpha_{2i} \neq 0, \lambda \neq 0,$ for at least one i.
- EC: Error correction.
- e: Is the error term.
- t: Time in years.
- n : Is the lag periods.
- α_{2i} : The Granger casualty in the short run.
- λ: The Granger casualty in the long run.
  The null hypothesis H_0 is rejected if the coefficients of military expenditure α_{2i} are statistically significant I, for example. error correction (EC) coefficient (λ) is significant. Whereas the coefficients of military expenditure (α_{2i}) indicate the causality in the short run, and the EC coefficient (λ) indicates causal relationship in the long run.

The alternative hypotheses H_1 (as in Equation 3): The rate of economic growth does not cause military expenditure.

$$MEGDP_t = \beta_0 + \sum_{i=1}^{m1} \beta_{1i} MEGDP_{t-1} + \sum_{i=1}^{m2} \beta_{2i} GRGDP_{t-i} + \sum_{i=1}^{m3} \beta_{3i}\, GRFC_{t-i} + \varphi EC_{t-1} + u_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where:

- $H_0 = \beta_{2i} = 0, \lambda = 0,$ for $i = 1, \dots\dots, m$ & $H_1: \beta_{2i} \neq 0, \lambda \neq 0,$ for at least one i
- φ: The Granger casualty in the long run.
- β_{2i}: The Granger casualty in the short run.

Hypothesis H_1 is rejected if GDP coefficients (β_{2i}) is statistically significant. Also, the coefficient of GDP (β_{2i}) indicates the causality in the short run, and the EC coefficient (φ) refers to the causal relationship in the long run.

To examine the causality relationship between Egypt's military expenditure and the rate of economic growth, the researcher performed the following steps:

First: Testing the Unit Root (or Stationarity) of the Model Variables:

To analyze if this study's variables have unit roots, the researcher used the Augmented Dickey Fuller (ADF) and

Phillips-Perron (PP) test. This is because Granger & Newbold's (1974) findings show that, if the model variables are unstable, there can be a spurious regression problem. Table (3) shows the unit root tests of the variables.

Table (3): The results of the Unit Root Tests

	ADF			**Phillips-Perron**		
	intercept	**trend & intercept**	**none**	**intercept**	trend & intercept	none
GRGDP	**level**					
	intercept	trend & intercept	none	intercept	trend & intercept	none
	-3.697358	-3.599842	-1.739	-4.094456	-4.166387	-1.676928
	0.0084	0.0439	0.0778	0.0028	0.0114	0.088
MEGDP	**level**					
	-2.311076	-2.331171	-2.903789	-0.994979	-1.93724	-1.587937
	0.1739	0.4077	0.0049	0.7453	0.6156	0.1046
	1st difference					
	-4.496663	-4.575842	-3.992983	-4.503096	-4.571496	-4.082059
	0.0009	0.0041	0.0002	0.0009	0.0042	0.0002
GRFC	**level**					
	-0.757613	-3.784136	-1.460076	-1.147718	-4.053623	-0.839469
	0.8182	0.0295	0.1324	0.6866	0.015	0.3457
	1st difference					
	-3.82008	-3.693984	-3.707775	-8.623566	-8.474671	-8.295698
	0.0065	0.0369	0.0005	0.0000	0.0000	0.0000

As illustrated in Table (3), the results of the ADF and P.P tests show that the GRGDP series is stationary at the level value I(0), However, the other two variables, MEGDP & GRFC, are not stationary at the level value, Consequently, the

researcher reapplied the unit root tests for these two variables and the variables became stationary at the first difference I(1).

Second: Determining the Appropriate Lag Structure of the Variables:

Irrespective of either cointegration or causality, the determination of optimal lag length has a great impact on subsequent inferences (Gonzalo, & Pitarakis, 2000). The selection criteria of the VAR lag order (or the proper lag structure) are 2 lags according to: LR, Schwarz (SC), and Hannan & Quinn (HQ).

Third: Testing the Co-integration among the Variables:

As shown in Table (2), the model variables are a mixture of mixed order of integration I(0) and I(1). Consequently, the researcher used the ARDL cointegration approach, developed by Pesaran & Shin (1999) and Pesaran, Shin, & Smith (2001), to test the long-run relationships. Also, the researcher formulated the ARDL model as in following Equation:

$$\Delta GRGDP_t = \alpha_0 + \sum_{k=1}^{p} \alpha_{1k}\, \Delta GRGDP_{t-k} + \sum_{k=0}^{q1} \alpha_{2k}\, \Delta MEGDP_{t-k} + \sum_{k=0}^{q2} \alpha_{3k}\, \Delta GRFC_{t-k} + \alpha_4 GRGDP_{t-1} + \alpha_5 MEGDP_{t-1} + \alpha_6 GRFC_{t-1} + u_t \dots\dots\dots (4)$$

Where: Δ denotes to the difference operator; $\alpha_4 \sim \alpha_6$ are the long terms; and p and q1,q2 are the optimal leg length of this model (which is defined by Schwarz Bayesian criterion (SBC), or the Akaike information criterion (AIC).

While, in adopting the ARDL approach, the researcher used the bounds test to test the long-run relationship. As shown in Equation 4, the researcher used the F-statistic of the lagged terms to test the long-term equilibrium relationship and if there is a cointegration between the variables. The null hypothesis H_0 is: $\alpha_4 = \alpha_5 = \alpha_6 = 0$, while the alternative hypothesis H_1 is: $\alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$.

Table 4 below shows the result of the bounds tests for ARDL. Where the upper bound assumes that all the regressors are I(1), and the lower bound assumes that the regressors are I(0). Also, the null hypothesis of F-Bounds test is that there is no cointegration between the variables. Therefore, if the calculated F-statistic (or t-statistic) is below the lower bound, the null hypothesis is accepted. If the F-statistic (or t-statistic) is higher than the upper bound, the null hypothesis is rejected and the cointegration between the variables is verified.

Table (4): Results of the Bounds Tsts (1987 to 2018)

Dependent variable	Function	F-Statistics
GRGDP	F(GRME, GRFC)	6.038388
Asympotic Critical values		
5%		
I(0)	I(1)	
4.87	5.85	

Since the calculated value of the F-statistic is 6.038388 and this is above the upper bound 5.85 at the 5% significance level, the researcher reject the null hypothesis that no cointegration exists between the series. Therefore, these results confirm that the existence of a long-run equilibrium relationship between this study's variables.

Fourth: Conducting the Causality Test based on Toda-Yamamoto (TY) Methodology:

This study's final step is the verification of the direction of causality between its variables. These are: namely, Gross rate of GDP; Ratio of military expenditure to GDP; and Gross rate of fixed capital using the Toda and Yamamoto causality test. The existence of a long-run relationship between the variables suggests that there must be Granger-causality. The researcher did this by using the modified Wald Procedure to test for VAR (k). Also, the model's optimal lag length is equal to k where k =($p+d_{\max}$) .The WALD test has an asymptotic chi squared distribution, with p degrees of freedom in the limit when a VAR($p+d_{\max}$) is estimated. To test for Toda and Yamamoto causality between the variables, the researcher constructed the following bivariate VAR (k) model:

$$GRGDP_t = \alpha_0 + \sum_{i=1}^{h+d} \alpha_{1i}\, GRGDP_{t-i} + \sum_{j=1}^{l+d} \alpha_{2j}\, MEGDP_{t-j} + \sum_{s=1}^{k+d} \alpha_{3s}\, \Delta GRFC_{t-s} + \varepsilon_{1t} \ldots . (5)$$

$$MEGDP_t = \beta_0 + \sum_{i=1}^{h+d} \beta_{1i} MEGDP_{t-i} + \sum_{j=1}^{l+d} \beta_{2j} GRGDP_{t-i} + \sum_{s=1}^{k+d} \beta_{3s} GRFC_{t-s} + \varepsilon_{2t} \dots (6)$$

$$GRFC_t = \delta_0 + \sum_{i=1}^{h+d} \delta_{1i} GRFC_{t-i} + \sum_{j=1}^{l+d} \delta_{2j} GRGDP_{t-i} + \sum_{s=1}^{k+d} \delta_{3s} MEGDP_{t-s} + \varepsilon_{3t} \dots (7)$$

Where:

- *d:*is the maximum order of integration.
- *h* and *d* are the optimal lag length.

Table (5) below shows the results of T.Y causality between this study's variables.

Table (5): Toda –Yamamoto Causality MWLAT Test Results

Null hypothesis	Chi-sq	d.f.	Prpb.	Granger causality
MEGDP does not Granger cause GRGDP	4.40022	2	0.2213	Unidirectional causality: GRGDP cause MEGDP
GRGDP does not Granger cause MEGDP	9.02906	2	0.0289	
MEGDP does not Granger cause GRFC	3.094465	2	0.3773	Unidirectional causality: GRFC cause MEGDP
GRGFC does not Granger cause MEGDP	11.35759	2	0.0099	
GRFC does not Granger cause GRGDP	8.282718	2	0.0405	Unidirectional causality: GRFC cause GRGDP
GRGDP does not Granger cause GRFC	4.868649	2	0.1817	

The T.Y Granger causality results indicate that the null hypothesis cannot be rejected. MEGDP does not Granger cause GRGDP and, therefore, the null hypothesis can be rejected. GRGDP does not Granger cause MEGDP and, consequently, there is a unidirectional Granger causality at 5%, where:

- Military expenditure does not cause GDP. However, GDP causes military expenditure.
- Military expenditure does not cause fixed capital. However, fixed capital causes military expenditure.
- Fixed capital causes GDP. However GDP does not cause fixed capital.

The Stability of the Model:

The stability test of the model is required to avoid misspecification of the model. To ensure the stability of the model, it is normal to use the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests (Pesaran and Esaran). The statistics of the CUSUM and CUSUMSQ test indicating that the model is stable.

Figure (5): The result of the Cumulative Sum test of the model

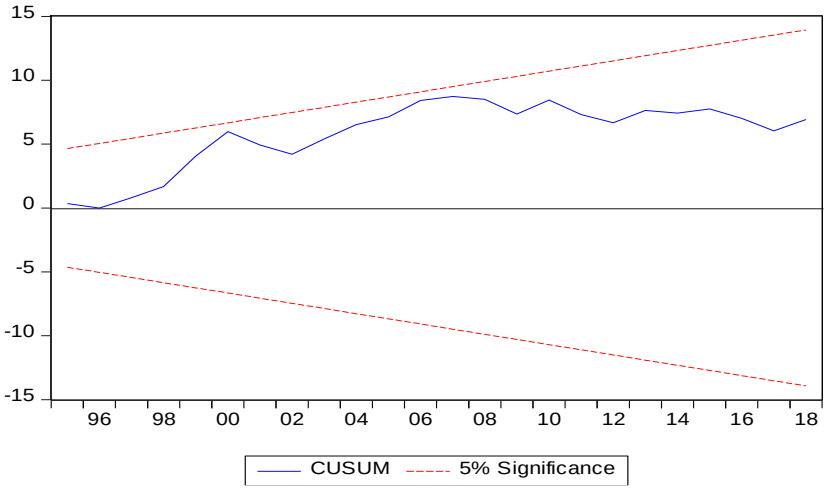
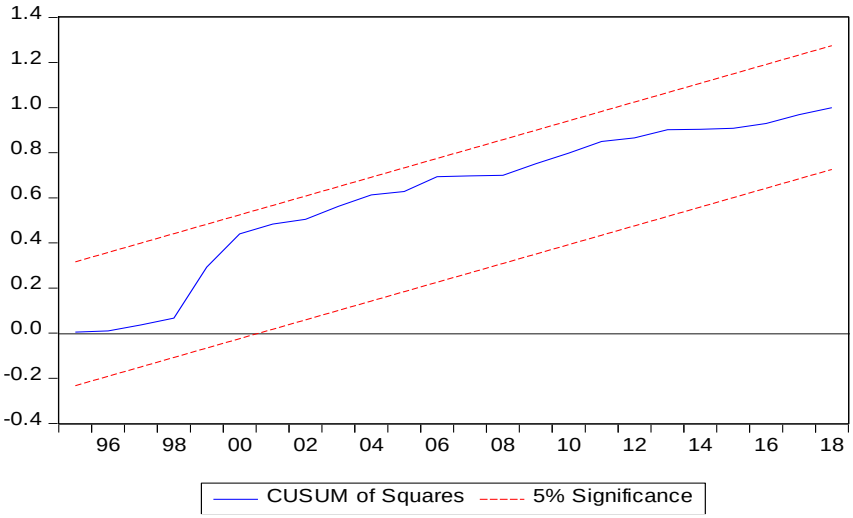


Figure (6): The result of the Cumulative Sum of Squares of the model



Also, the model passes the entire diagnostic test such as heteroscedasticity, the normality of the residues and serial correlation. In addition, Ramsey's reset test shows that the model is well specified.

Conclusion:

Egypt has one of the largest armed forces in the MENA region and, due to the permanent tensions in the region, Egypt tries continuously to upgrade its capacity of. While Egypt has the lowest military expenditure in the MENA countries (1.2 % of GDP), its military expenditure increased in real terms in the period from 2010 to 2019. The nominal rate of growth in military expenditure may have resulted from both the rate of growth in military salaries since 2010 and high rates of inflation which, between 2010 and 2020, fluctuated between 6.9% and 24%. However, generally, it is difficult to determine the funding sources of the army's procurement of equipment. This is because funding of Egypt's arms procurement may be drawn from outside the military budget through: either foreign loans or foreign assistance or military aid or off-budget revenue. In addition, there are the profits that the Egyptian army receives from owning many business enterprises in different sectors.

Consequently, this study attempted to examine the causality relationship between Egypt's military expenditure and economic growth in the period from 1980 to 2019. In this study, as proposed by Pesaran, et al. (2001), the researcher employed the ARDL bounds test for cointegration. The bounds test results show that there is a long-run relationship between this study's variables. As proposed by Toda and Yamamoto (TY) (1995), the

researcher applied, also, the Granger Causality approach. The major findings of the TY Granger Causality test are as follows:

- Military expenditure does not cause GDP. However, GDP causes military expenditure.
- Military expenditure does not cause fixed capital. However, fixed capital causes military expenditure.
- Fixed capital causes GDP. However GDP does not cause fixed capital.

In view of this study's findings, the researcher recommend that the Egyptian Government should ensure that economic resources are allocated optimally to all sectors to achieve maximum economic growth and the efficient utilization of the available resources.

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