Advances in Management & Applied Economics, vol. 3, no.6, 2013, 265-287
ISSN: 1792-7544 (print version), 1792-7552(online)
Scienpress Ltd, 2013

Does the Military Public Expenditure Matter for Economic Growth? Evidence from Egypt during the Period (1981/1982-2011/2012)

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Abstract

The relationship between the military and civilian components of public expenditure and economic growth has always been controversial. While the "*Guns and Butter Approach*" stresses on the positive externalities associated to the military expenditure through the modernization and technological channels, the "*Guns or Butter Approach*" gives more attention to the opportunity costs and crowding out effects that result from the military expenditure. Using annual data set for the real GDP growth rate and the military and civilian expenditure components of public expenditure in Egypt during the time period (1981/1982-2011/2012), the study finds the following: 1) the share of the civilian expenditure to GDP is positively and significantly correlated to the economic growth in the long run, 2) the military expenditure to GDP ratio is insignificantly correlated to the long run economic growth rates, 3) and the share of the military expenditure to total public expenditure is negatively and significantly correlated to the economic growth rates in the long run. The error correction model estimations, however, show that both shares of military and civilian expenditures to GDP are negatively correlated to the economic growth in the short run.

JEL classification numbers: C22, E62, H50, H56, O10, O40
Keywords: military expenditure, civilian expenditure, public expenditure composition, cointegration, error correction, economic growth, Egypt.

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Article Info: *Received* : November 2, 2013. *Revised* : November 29, 2013.
Published online : November 15, 2013

1 Introduction

While the neoclassical growth models, developed by Solow (1956), did not assign a role for the fiscal policy variables in affecting the long run growth rates, the endogenous growth theory stressed on the important role that the fiscal policy can play to affect economic growth rates in the long run.

According to the neoclassical growth models, output is determined by both of labor and capital as the two main factors of production, as well as by unexplained residuals or growth of total factor productivity, which is considered to be “given” or explained outside the model, and thus cannot be influenced by the various government policies [(Dodson, 2008, p.6) & (Myles, 2000, p.143)]. As a result, the long run steady state growth can’t be achieved without “exogenous” variables that are not affected by public policies such as technical progress or population growth. Thus, public expenditure and taxation levels could only affect the “level” of the output or its equilibrium path in the long run, and not the growth rate of output. Nevertheless, such models believe in the existence of temporarily (transitional) effects for the fiscal policy on economic growth that emerge during the shift of the economy towards its new equilibrium path [(Bleaney et al., 2001, p.37), (Chamorro-Narvaez, 2010, p.3), (Dodson, 2008, p.6), (Gemmell, et al., 2009, p.19), (Ireland, 1994, p.1), (Abu Nurudeen, 2010, pp.2-4), & (Myles, 2000, pp.143-144)].

On the other side, endogenous growth models which were introduced in the late 80’s and early 90’s of the 20th century through the pioneering works of Romer (1986; 1989), Lucas (1988), and Grossman and Helpman (1991), focused on the positive externalities that were ignored by the neoclassical models, and which proved to have a crucial role in explaining the long run economic growth. Such externalities may result from human capital accumulation (education, training, and experience), knowledge, and research and development activities based on innovation and risk taking [(Lee and Gordon, 2005, p.1029) & (Engen and Skinner, 1996, pp.8-9)]. According to these models, technical progress is not considered as “exogenous” variable, instead it originates from an endogenous process; the same incentives that may induce economic agents to invest in physical capital, would also encourage them to obtain a higher level of technical and technological progress (Ireland, 1994, pp.8-10).

As a result, the endogenous growth models expect that fiscal policy (public expenditure and taxation) can have effects on the long run economic growth rate through influencing economic agents’ decisions relevant to human capital accumulation and investments in knowledge, research and technology. Accordingly, fiscal policy may affect the “accumulation” of factors of production and/or the “total factor productivity”, which would ultimately affect the long run growth rate. In addition, short run temporarily effects on growth might also emerge during the transition to the equilibrium growth path [(Chamorro-Narvaez, 2010, p.3), (Abu Nurudeen, 2010, pp.2-4), (Abu-Bader and Abu-Qarn, 2003, p.570), (Baffes and Shah, 1993, .p.1), (Dodson, 2008, pp.6- 7)& (Tanzi and Zee, 1997, p.181)]. Thus, endogenous growth models allow for an effect of the fiscal policy on both the “level” of output and its “growth” as well in the long run [(Engen and Skinner, 1996, pp.8- 9) & (Gemmell et al., 2009, p.19)].

The above mentioned arguments of the endogenous growth models have encouraged many researchers to empirically test the relationship between fiscal policy variables and economic growth (see for example: Barro (1990;1991), Barro and Sala-i-Martin (1992), Deverajan et al. (1996), Easterly and Rebelo (1993) and Tanzi and Zee (1997)).

In light of this background, this study seeks to test whether fiscal variables, mainly the military and civilian components of public expenditure, matter for economic growth in Egypt during the time period that extends from 1981/1982 to 2011/2012. The study is divided into six sections in addition to the introduction (Section 1). Section 2 is specified for reviewing the theoretical and empirical literature on the relationship between military-civilian composition of public expenditure and economic growth. Section 3 explains the theoretical framework that governs the relationship under study and presents the model specification. Section 4 discusses the methodology used. Section 5 describes the variables and data sources. Section 6 discusses the estimation results and Section 7 concludes.

2 Military Public Expenditure and Economic Growth: Literature Review

The relationship between military expenditure and economic growth is assumed to be an important issue that subjects to a great deal of debate and controversy. While data on OECD countries shows a strong negative effect of military public expenditure on the capital accumulation and economic growth rates, data of less developed countries indicates to the opposite, as it shows a positive and significant relationship between military public expenditure and economic growth (Deger and Smith, 1983, p.335). Although the political and practical implications of the military expenditure are assumed to be significant, economic theory don not provide firm conclusions regarding the effects of such expenditure on economic growth (Makhool, 1999, p.298).

In fact, here are two basic points of view regarding the relationship between military expenditure and economic growth. The first is related to what is known as "*Guns and Butter Approach*", according to which a complementary relationship between the military and civilian sectors exists through the positive externalities that result from the military expenditure in terms of enhanced research and development, insured external security, increased aggregate demand, highly educated and skilled labor force, and encouraged private investments. The second view is related to what is called "*Guns or Butter Approach*", which assumes that both military and civilian sectors are competing with each other. This approach focuses on the negative consequences of the military expenditure which usually relate to issues like crowding out private investments, opportunity costs, increased taxes, the effects on allocative efficiency through the creation of distortions in the relative prices, and the increased political power of the military and its associated rent seeking behavior (Brasoveanu, 2010, pp.151-153).

Thus, the theoretical framework of the relationship between military expenditure and economic growth points to a number of potential channels through which direct and indirect effects of military expenditure can be identified, and which should be taken into consideration while assessing this relationship. Such effects are presented below.

2.1 The Positive Effects of Military Expenditure on Economic Growth: the *"guns and butter approach"*

Some economists justify the need to expand military spending, particularly in the developing countries, as a means of stimulating economic growth and development due to the high unemployment rates and low levels of consumption in such countries (Lebovic and Ishaq, 1987, pp.108-109). This trend is based on what is known as the "*modernization* *model*" which concentrates on the positive external effects of military expenditure on economic growth [(Makhool, 1999, pp. 299-300) & (Abu-Bader and Abu-Qarn, 2003, pp. 571- 572)].

First of all, public expenditure on the military sector may promote the development process as a result of its favorable effects in terms of exposing population to new skills and various behavioral attitudes (Makhool, 1999, pp. 299-300) and contributing to the human capital accumulation when such expenditure is directed to education and training areas (Pradhan, 2010b, p.66). Military expenditure may also provide direct technological benefits, since the military sector can be considered as the basic channel through which new technology can be introduced to the society and applied to the civilian sector in a way that leads to a higher productivity [(Pradhan, 2010b, p.66), (Deger and Smith, 1983, pp.338-339) & (Khilji and Mahmood, 1997, pp.792-793)].

In addition, the military life may provide the military with discipline and technical skills, attitudes and modern preparations, and organizational and managerial expertise, which may be transmitted to the civilian sector as well [(Lebovic and Ishaq, 1987, p.109), (Antonakis, 1997, p.91) & (Chowdhury, 1991, p.82)]. Military expenditure on public infrastructure (such as roads, bridges, airports, electricity, and communication) and on research and development, would also strengthen the country's public infrastructure that is required for the productive sectors, and leads to direct positive externalities for the civilian sector[4] [(Makhool, 1999, pp. 299-300), (Pradhan 2010b, p.66), (Lebovic and Ishaq 1987, p.109), (Deger and Smith, 1983, p.339) & (Chowdhury, 1991, p.82)].

Moreover, the internal security and the social and political structure of the country can be considered as channels through which positive effects of military expenditure are transmitted to the economy. The assurance of an adequate level of internal security for citizens should enhance market exchanges and encourage a stable business environment which is conducive for foreign investments; it also helps in the protection of property rights, the promotion of market dynamics and the insurance of the required conditions for growth. Moreover, the military power might be necessary for preventing internal conflicts, modernizing ideologies and eliminating the traditional styles of social and political organizations. All of this should in turn reflect in an increased rate of economic growth [5][(Pradhan, 2010b, p.66) , (Brasoveanu, 2010, p.151) & (Dager and Smith,1983, p.339)] .

External relations also can be used to explain the positive effects of military expenditure on economic growth. More specifically, the maintenance of the required military balance with neighbors is expected to reduce fears of external attacks and threats and thus prevent

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[4]Studies indicate that the appropriateness and adequacy of those social effects associated with technology, infrastructure and training, resulting from the military spending, are not confirmed. There is a possibility that security activities are directed to areas that are non beneficial for civilian needs. For example, military expenditure may be directed to training on capital intensive production techniques that could not be used by the majority of population living in rural areas in developing countries. Moreover, many of the infrastructure services may be developed by military expenditures in remote areas, where their civil use will be very limited [(Deger and Smith, 1983, pp.338-339), (Khilji and Mahmood, 1997, pp.792-793) & (Antonakis, 1997, p. 1991)].

[5]This would not negate the fact that military institutions are – by nature – conservative institutions that have rigid organizational structures, and that their interest in achieving the stability and keeping the status quo might prevent them to take positive steps towards the transformation of the society (Deger and Smith, 1983, p.339).

what may result from such fears (due to the lack of confidence in the prevailing environment) in terms of decreased investment expenditure, capital flight, and brain drain [(Lebovic and Ishaq, 1987, p.109) & (Deger and Smith, 1983, p.340)].

Moreover, the military sector has the potential to link the economy with the major powers in the region and acts as a tool that facilitates the technological transfer and the provision of military and civilian aid. This could be translated in the correlation between the size of the military expenditure of a country and the magnitude of foreign aid and assistance that it acquires [(Deger and Smith, 1983, p.340)& (Khilji and Mahmood, 1997, pp.792-793)].

Last, but not least, the military expenditure can enhance the aggregate demand, and thus it may lead to: a higher employment of the available resources of production (labor and capital); greater profit rates, and more investments which might ultimately lead to higher economic growth rates [(Pradhan, 2010b, p.66), (Makhool, 1999, pp. 299-300), (Deger and Smith, 1983, p.338),(Khilji and Mahmood, 1997, pp.792-793), (Antonakis, 1997, p. 91), (Brasoveanu, 2010, pp.151-152) & (Chowdhury, 1991, p.82)].

Although the models described above noticed the presence of a number of negative effects associated to the military expenditure which usually result from crowding out the civil investments and negatively affecting their productivity, the positive (direct and indirect) effects of such expenditure assumed to be dominant according to such models (Makhool, 1999, pp. 299-300).

2.2 The Negative Effects of Military Expenditure on Economic Growth: the *"guns or butter approach"*

This line of research is more concerned with the opportunity costs of military expenditure, or in other words, with the negative effects associated with redirecting resources to military sectors and far away from other higher priority uses. Three models can be identified within this trend as described below.

First, according to the *"Capital Accumulation Model",* one of the transmission mechanisms of the military expenditure's effects to economic growth is the reallocation of resources. This point of view is based on the idea that the overall savings in the economy should be used in financing investments and the various components of the public expenditure including the military. Thus, a higher level of military expenditure – assuming a constant saving level- would lead to a reduction in the other forms of public investments necessary for economic development such as health and education, with an ultimate negative effect on economic growth. This implies that military expenditure crowds out the private investment and other social and civilian expenditures, and redirects the available resources away from such areas. This is known as the opportunity cost of military expenditure [(Chowdhury, 1991, p.83), (Pradhan, 2010b, p.66), (Khilji and Mahmood, 1997, pp.792-793) & (Antonakis, 1997, pp.91-92)]. This negative effect of military expenditure is derived from the fact that such expenditure is usually financed through taxes or public borrowing from domestic and foreign markets, and thus it absorbs a share of the resources that could otherwise be directed to finance private investment, leading to a wider gap between savings and investments, and accordingly to lower rates of economic growth [(Chowdhury, 1991, p. 83) & (Makhool, 1999, p.300)].

Moreover, once the new capital formation is reduced below its potential as a result of a higher military burden, the economy would suffer in this case from the lower quantity and quality of its capital stock (Chowdhury, 1991, p.83). The inflationary effects that might result from military expenditure may also negatively affect the economic growth through

influencing savings and investment decisions in favor of lower priority sectors whose effects on economic growth are negligible [(Chowdhury, 1991, p. 83), (Makhool, 1999, p. 300, (Deger and Smith, 1983, p. 338) & (Antonakis, 1997, pp.91-92)].
Second, the *"Balance of Payments or Export-Based Growth Models"* focus on the negative impact of military expenditures on the balance of payments through the continuous substitution of capital and talents from the dynamic more effective civil sector to the military sector. This would lead to slower rates of export growth and economic growth. In addition, the military expenditure in developing countries tend to rely more on imports as compared to other public expenditures, which would lead to unfavorable effects on the balance of payments [(Chowdhury, 1991, p.83), (Makhool, 1999, p.300), (Deger and Smith, 1983, p.338), (Collier, 2006, p.10) & (Khilji and Mahmood, 1997, pp.792-793)].
Third, the *"Technological Substitution Model"* usually focuses on the negative effects of the military expenditure that might result from transferring physical and human resources away from the civilian sector to be directed to the modern weapons industries, with the consequent decline in the process of research and development, and the long-term negative impact on the productivity of the state and its technological position (Makhool, 1999, p. 300).
In fact, developing countries face two types of constraints on their growth processes; "*structural constraints*" related to the role of modernization, and "*resource constraints*" related to lack of domestic savings. In this case, one would expect that the net effect of the military expenditure on economic growth should depend on its effect on each of these two groups of constraints. More specifically, it is expected that military expenditure will have a positive effect on the "*modernization*" constraints since military institutions might have a crucial role in modernizing societies in developing countries, while it may have a negative effect on the "*resource constraints*" since it reallocates resources away from productive investments, thus hampers the ability to mobilize or create additional savings, with an ultimate negative impact on economic growth (Deger, 1986, pp.193-194).
At the empirical level, several researches have been accumulated with an aim to test the economic outcomes of military expenditure, and to judge the validity of the different theoretical models that shaped the general framework of such relationship. In spite of the conflict results such studies have provided regarding the relationship between military expenditure and economic growth, there is a tendency for the dominance of the negative effects. Benoit (1978), Halicioglu (2004), and Diebolt and Grammare (2006) for example, concluded that that military expenditure might positively affect economic growth. However, many other researchers concluded that the opposite tends to be true [see for example: Dager and Smith (1983), Dager, (1986), Szymanski (1973), Cappelen et al. (1984), Mylonidis (2008), Dunne and Nikolaidou (2011), Kentor and Kick (2008), Heo (1998), Heo (1999), Dunne and Vougas (1999), Antonakis (1997), Cohen et al. (1996), Al-Jarrah (2005), Khilji and Mahmood (1997), Brasoveanu (2010), Lebovic and Ishaq (1987), Linden (1992), Ozsoy and Ipek (2010), Tiwari and Tiwari (2010), and Abu-Bader and Abu-Qarn (2003).
Researchers usually attribute this variance in their findings to a number of empirical aspects related to the nature of variables included in the estimated models, the sample size in addition to the possibility of a two-way causality relationship between military expenditure and economic growth [(Pradhan, 2010b, p.65) & (Pradhan 2010a, p.297)]. Moreover, some researchers including Antonakis (1997), Kentor and Kick (2008) and Frederiksen and Looney (1983) have shown that the relationship between military expenditure and economic growth might depend on the size of the available resources owned by a country,

thus the negative behavior would be more obvious in case of poor countries[6]. Aizenman and Glick (2006) indicated that the existence of external military threats and the corruption of the military institutions could play a significant role in influencing military expenditure-growth relationship. Accordingly, the relationship tends to be positive, the greater the external threats and/or the less corrupt the military institutions are.

3 Theoretical Framework and Model Specification

The production function provides a general framework for the empirical relationship between fiscal policy variables and economic growth. According to the production function, the output level depends on both the availability of factors of production (labor and capital) and/or their productivity. Accordingly, economic growth, as measured by the percentage change of the real GDP, would be determined by the growth in factors of production and/or the growth in total factor productivity as indicated by Solow's growth model [(Fardmanesh, 1991, p.224) & (Martin and Fardmanesh, 1990, p. 241)]. As a result, one would expect that fiscal policy variables may influence the rate of economic growth through two possible channels, namely factors "*accumulation*" and factors "*productivity*". The effects of fiscal policy variables through such two channels could be conflicting, however. Thus, the net effect of a fiscal variable on economic growth should be measured empirically, where the growth rate of the real GDP is regressed on a number of variables one of which is the concerned fiscal variable (Fardmanesh, 1991, p. 224).

In this context, if the variables that measure the factors of production are included as explanatory variables in the regression model that explains economic growth, the estimated coefficient for the fiscal variable should reflect its impact on economic growth through "*productivity*" channel only, since the "*availability*" of factors of production is accounted for by the variables that measure labor and capital such as the gross fixed capital formation to GDP ratio and the population or labor force growth rate (Fardmanesh, 1991, p.224). If, instead, variables that measure the factors of production's accumulation are not included in the growth model, this would implicitly indicate that the estimated coefficient of the fiscal variable measures its overall impact on growth through both of factors "*availability*" and factors "*productivity*" channels[7].

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[6]Some researches refer to the fact that military expenditures in developed countries might be used as an invisible tool to provide subsidies and assistance to the highly technological corporations, which led to the appearance of the concept "*military-industry complex*". This is not the case for developing countries, where most of military equipments are imported instead of being domestically manufactured. As a result, it has been shown that military expenditure is not supposed to enhance the process of technical progress in low income countries (Collier, 2006, p.10).

[7]In their study on the relationship between fiscal policy variables and economic growth, Martin and Fardmanesh (1990) estimated a growth model twice; once without variables that measure factors of production as explanatory variables, and the other by including them, with an aim to distinguish between the effects of a fiscal variable that are induced by "*factors availability*" and those which result from "*factors productivity*". The study concluded that there is no significant difference in the magnitude of the estimated coefficient between the two models, which confirms that most of the influence of fiscal policy variables on economic growth comes through "*factors productivity*" channel.

In light of this framework, this study seeks to investigate the relationship between the civilian-military composition of public expenditure and economic growth in Egypt during the time period that extends from the fiscal year 1981/1982 to 2011/2012, employing time series analysis tools. Due to the constraints associated with the relatively small sample size, the estimated models in this study will not include proxies for factors accumulation as explanatory variables explicitly, and hence the estimated relationship between the fiscal policy variables and economic growth will reflect the effects of such variables through both of "*accumulation*" and "*productivity*" channels. For this aim, two models are specified and estimated. The first one is for testing the "*level*" effects of military and civilian components of public expenditure on economic growth. The second one, on the other hand, tests the "*composition*" effect of public expenditure (decomposed into civilian and military components) on economic growth.
According to the first model, military expenditure as a ratio of GDP (MILIT_GDP) as well as civilian expenditure as a ratio of GDP (CIVI_GDP) are used as explanatory variables in addition to other aggregate fiscal variables such as tax to GDP ratio (TAX_GDP) and other revenues to GDP ratio (OTHER_GDP) which are included in the estimation to account for the budget constraint. The cash budget deficit in this case is the omitted fiscal variable and accordingly will be considered as the financing element. This model can be represented as:

$$\text{RGDP\_GR} = \alpha_1\,\text{MILIT\_GDP} + \alpha_2\,\text{CIVI\_GDP} + \alpha_3\,\text{TAX\_GDP} + \alpha_4\,\text{OTHER\_GDP} \qquad (1)$$

The second model, however, is specified to test for the composition effects of public expenditure on economic growth, where total public expenditure is decomposed into civilian and military expenditures. In this case, military expenditure as a ratio of total public expenditure (MILIT_EXP) is used as an explanatory variable to account for the composition effect of public expenditure, while total public expenditure as a ratio of GDP (EXP_GDP) is used to account for the level effect of public expenditure on economic growth. Tax revenues as a ratio of GDP (TAX_GDP) and other non tax revenues as a ratio of GDP (OTHER_GDP) are used as explanatory variables, while budget deficit is omitted from the budget constraint, and thus considered as the financing element. This model can be presented as:

$$\text{RGDP\_GR} = \alpha_1\,\text{EXP\_GDP} + \alpha_2\,\text{MILIT\_EXP} + \alpha_3\,\text{TAX\_GDP} + \alpha_4\,\text{OTHER\_GDP} \qquad (2)$$

4 Methodology

Many economic researchers were concerned with testing the validity of the hypothesis of endogenous growth theory that fiscal policies can influence economic growth rates. Most of them, however, employed cross-sectional or panel data techniques for their estimations which are usually associated with parameter heterogeneity problems resulting from the heterogeneous political and economic systems, culture, history, geography and other characteristics of countries. As a result, it would be difficult to reach firm results regarding the long run relationship between fiscal policy variables and economic growth using panel or cross-sectional data based models[8].The time series data analysis, on the other hand, provides an alternative in this context, as it allows for analyzing the long run relationship between fiscal variables and economic growth in one country's economy to avoid problems associated with heterogeneity in sample observations (Colombier, 2011, pp.1-2).

The following sub sections provide a detailed elaboration for the methodology which is used for estimating the relationship between military and civilian components of public expenditure and economic growth in Egypt during the time period (1981/1982-2011/2012). *First*, the Augmented Decky Fuller Test (DFT) is used to judge on the stationarity of the various time series used in the estimation and their order of integration as well. *Second*, a cointegration test is employed to determine whether there exists a long run relationship between the variables under study and the number of the cointegrating vectors if there is more than one. *Third*, vector error correction models that combine both the long run and short run relationships and that show the error correction mechanism are estimated. *Fourth*, the Granger causality test is applied to test for the existence of short-run causal relationships between the components of public expenditure and economic growth rates.

4.1 Testing for Stationarity

Classical regression techniques are based on a major assumption that all variables included in the estimated model should be stationary. Non stationarity of some or all of the times series variables would lead to what is called "*spurious*" regression, in which results that indicate the existence of a statistically significant relationship between variables might emerge, while this could be a result of just a correlation or association between variables instead of a meaningful relation. Since most of economic variables are non stationary, any time series based analysis should start by conducting a test for stationarity. If all variables included in the relationship under study found to be stationary, traditional regression methods as those based on the OLS can be used. If some (or all) of the included variables proved to be non stationary, however, another methodology should be used instead, in which a long run cointegration relationship between the variables is tested. In this context, the Augmented Dickey-Fuller (ADF) test is considered as one of the most popular and efficient tests used by empirical researchers to test for the stationarity of the variables' time series, and to determine their order of integration. This test is based on the estimation of the following regression:

$$\Delta y_t = \alpha + bt + \delta y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-i} + \epsilon_t \tag{3}$$

[8]In this regard, the "fixed effects" and "random effects" methods were developed to account for the unobserved characteristics of heterogeneity within the sample as time invariant and time variant effects, respectively (Bonhomme and Manresa, 2011, p.2).

Where "Δy_t" represents the first difference of the variable "y_t", "k" is the number of lags used in the model[9], "t" is the time trend, "α" is the drift, and "b" is the deterministic trend parameter. Accordingly, the existence of a unit root (non stationarity) in the variable is tested as the null hypothesis against the absence of the unit root (stationarity) as the alternative hypothesis. In other words, the hypothesis that $\delta = 0$ is tested versus $\delta < 0$ (Charemza and Deadman, 1992, pp.131, 135).
Accordingly, if the null hypothesis of this test is rejected, then the time series of the concerned variable does not have a unit root, which means that it is considered as stationary or integrated of order zero. Otherwise, the time series is considered as non stationary or integrated of order greater than zero, where the order of integration can be determined based on the number of differences that should be taken to transform the series into a stationary one. As stated by Engle and Granger (1987), a time series is said to be integrated of order (d) if it can be transformed into a stationary series after differencing it (d) times.

4.2 Testing for Cointegration

When some or all of the variables concerned in the model are non stationary at level (integrated of an order greater than zero), it should be tested whether a cointegration relationship between such variables exists. Generally, a set of integrated variables is considered cointegrated if there exists a linear combination of them that is stationary (integrated of order zero). For example, X_t and Y_t are said to be cointegrated of order d and b, where $0 \leq \ b \leq d$ if: 1) both X_t and Y_t are integrated of order (d); and 2) there exists a linear combination of these two variables such as $\varepsilon_t = Y_t - \beta X_t$ that is integrated of order (d-b), where (d) is the integration order of the two variables, and (b) is the reduction in the integration order which is necessary to have a stationary linear combination of the two variables [(Engle and Granger, 1987, p.253) &(Charemza and Deadman, 1992, p.145)].
The application of the cointegration test requires as a prerequisite that all variables concerned are integrated of the same order (in their level). However, Charemza and Deadman (1992) showed that a cointegration might exist even between variables which are integrated of different orders as long as the dependent variable is integrated of an order not greater than the integration order of any of the explanatory variables, and that all explanatory variables are either integrated of the same order or at least two of them have the same integration order which is higher than that of the dependent variable. In this study, the method of Johansen (1988) will be used to test for the existence of cointegration between variables and to determine the number of cointgrating vectors in one step.

[9]The number of lags (k) that should be included in the ADF test should be relatively small to allow for enough number of degrees of freedom, and relatively high to allow for the potential of autocorrelation in the error terms y_t (Charemza and Deadman, 1992, p.135). The new versions of the E-views statistical package, such as the one used in this study, allows for the electronic selection of the number of lags based on Schwarz or Akiaki Information Criteria.

4.3 Error Correction Models (ECMs)

The cointegrated series can be represented using error correction models that combine both the long run relationship (which is represented by the cointegrating vector) and the short run relationship that includes a mechanism for the error correction which insures that any deviation in the short run from the equilibrium long run relationship should be corrected in the consequent periods. In this system of equations, a model is estimated for each of the variables that are included in the cointegration equation, in which the current value of the variable is regressed on an error correction term lagged one period, the lagged value of the variable itself, and the lagged values of all other variables concerned in the model[10], taken into account that all variables are expressed in their first difference form (Engle and Granger, 1987, pp. 254-255). Assuming a system that consists of three variables, error correction models can be represented as follows:

$$\Delta Y_t = \mu_y + \alpha_y\, ECT_{t-1} + \sum^{p}_{k=1} \beta_{yx,k}\, \Delta X_{t-k} + \sum^{p}_{k=1} \beta_{yy,k}\, \Delta Y_{t-k} + \sum^{p}_{k=1} \beta_{yz,k}\, \Delta Z_{t-k} + \varepsilon_{yt} \tag{4}$$

$$\Delta X_t = \mu_x + \alpha_x\, ECT_{t-1} + \sum^{p}_{k=1} \beta_{xx,k}\, \Delta X_{t-k} + \sum^{p}_{k=1} \beta_{xy,k}\, \Delta Y_{t-k} + \sum^{p}_{k=1} \beta_{xz,k}\, \Delta Z_{t-k} + \varepsilon_{xt} \tag{5}$$

$$\Delta Z_t = \mu_z + \alpha_z\, ECT_{t-1} + \sum^{p}_{k=1} \beta_{zx,k}\, \Delta X_{t-k} + \sum^{p}_{k=1} \beta_{zy,k}\, \Delta Y_{t-k} + \sum^{p}_{k=1} \beta_{zz,k}\, \Delta Z_{t-k} + \varepsilon_{zt} \tag{6}$$

In this system, X, Y, and Z are the variables included in the cointegration equation, ECT is the error correction term or the difference between the actual path of the dependent variable and its equilibrium path in the long run, lagged for one period. Accordingly, the estimated coefficient of the error correction term "α" in this case would measure the adjustment speed to reach the equilibrium path, and thus it should be significant and negatively signed to ensure that any deviation from the long run equilibrium relationship at any period will be corrected for in the next period. The coefficients $\beta_{ij,K}$ measure the lagged effect of the explanatory variable "j" (where j is X, Y, or Z) on the current value of the dependent variable "i" (where i is X, Y, or Z), and "K" is the number of lags.

4.4 Granger Causality Test

The Granger Causality Test is used to determine whether there exists a short run causality relationship between two variables. The test is based on whether the lagged values of one variable can help in improving the explanation power of the current value of another variable. Accordingly, the test's equation is designed so that the current value of one of the two variables is a function of the sum of lagged values of the variable itself and the sum of lagged values of the other variable, as follows:

$$y_t = A_0 D_t + \sum^{k}_{j=1} \alpha_j\, y_{t-j} + \sum^{k}_{j=1} \beta_j\, x_{t-j} + \epsilon_t \tag{7}$$

where "D_t" is the deterministic component of the equation and "A_0" is the vector of estimated coefficients for this part, "k" is the number of lags included in the test, "α_j" represents the coefficients of the lagged effect of the variable "y" on the current value of

[10]The specification of the number of lags to be included in the system is usually based on "*Akaike Information Criterion*" or *Schwarz Criterion*".

itself, "β_j" represents the estimated coefficients for the lagged effect of the variable "x" on the current value of the variable "y", and "ϵ_t" is the error term. It should be mentioned that this test requires that both variables included in the equation (x_t and y_t) are entered in their stationary form. According to this test, the hypothesis that $\beta_1 = \beta_2 = \ldots = \beta_k = 0$ is tested as a null hypothesis against the hypothesis that at least one of the β_s does not equal to zero. If the null hypothesis was rejected, this would indicate that the lagged values of the variable "x" explain the current values of the variable "y", and thus "x" (granger) causes "y".

5 Variables and Data Sources

The study uses annual data for the fiscal policy variables and real GDP growth rate for Egypt's economy during the time period from fiscal year 1981/1982 to 2011/2012. Table 1 describes the variables used in estimation and how they are measured. All such variables were calculated by the authors using the raw data on GDP (on current and fixed prices) provided by the Ministry of Planning (MoP), and the data on final accounts of the State's General Budget issued by the Ministry of Finance (MoF) and published in the official gazette.

Table 1: List of variables used in the estimation

Variable name/symbol	*Variable description and measurement*
Growth Rate of Real GDP *(RGDP_GR)*	Annual growth rate of GDP in fixed prices (base year is 1981/1982).
Public Expenditure to GDP Ratio *(EXP_GDP)*	The sum of the first six chapters in the expenditure side of the State's General Budget (wages, goods and services, interests, subsidies and social benefits, other expenditures, and investments) as a ratio of GDP at current prices.
Military Expenditure to Total Public Expenditure Ratio *(MILIT_EXP)*	Public expenditure on military (as represented in the second chapter of the State's General Budget) as a ratio of total public expenditure.
Civilian Expenditure to Total Public Expenditure Ratio *(CIVI_EXP)*	Non-military public expenditure as a ratio of total public expenditure.
Military Expenditure to GDP Ratio *(MILIT_GDP)*	Public expenditure on military (as represented in the second chapter of the State's General Budget) as a ratio of GDP at current prices.
Civilian Expenditure to GDP Ratio *(CIVI_GDP)*	Non military public expenditure as a ratio of GDP at current prices.
Tax Revenues to GDP Ratio *(TAX_GDP)*	Tax revenues (the first chapter of the revenues' side of the State's General Budget) as a ratio of GDP at current prices
Other "Non Tax Revenues" to GDP Ratio *(OTHER_GDP)*	The sum of the second "grants" and third "other non tax revenues" chapters of the revenues' side of the State's General Budget as a ratio of GDP at current prices.

Before moving to discuss the results of estimation, Table 2 presents the descriptive statistics for all variables that are included in the quantitative analysis of the relationship between military-civilian composition of public expenditure and economic growth in Egypt during the time period (1981/1982-2011/2012).

Table 2: The variables' descriptive statistics during the period (1981/1982-2011/2012)

Statistic/ Variable	*Mean*	*Median*	*Maximum*	*Minimum*	*Standard Deviation*	*No. of obs.*
RGDP_GR	4.655795	4.668993	8.028144	1.909114	1.622654	30
EXP_GDP	32.98065	31.99000	43.58000	24.59000	3.898450	31
TAX_GDP	16.51061	16.34326	21.99131	13.23243	2.182518	31
OTHER_GDP	8.306823	8.271775	17.48608	4.811441	2.563999	31
MILIT_EXP	12.38513	10.58632	29.42793	5.524061	5.866505	28
CIVI_EXP	87.61487	89.41368	94.47594	70.57207	5.866505	28
MILIT_GDP	4.151152	3.405683	12.82500	1.763535	2.452170	28
CIVI_GDP	28.59807	29.08116	33.12017	21.25004	2.679902	28

6 Results and Discussion

This section presents and discusses the estimation results of the methodology described above to analyze the relationship between military/civilian components of public expenditure and economic growth in the Egyptian economy. *First*, the ADF test's results for stationarity will be presented, specifying the order of integration of each variable. *Second*, the Johansen-cointegration test results will be presented to show whether there exists a long run relationship between the variables under study. *Third*, error correction models (ECM) that allow for the distinction between long run relationship and short run correction dynamics will be estimated. *Finally*, the results of Granger causality test will be discussed.

6.1 ADF Test Results

ADF test for stationarity is applied to all variables under analysis. The specification of the test allows for both an intercept "α" and a trend "t" when it is applied on variables at their "*level*" form, however, it allows for just an intercept when applied on variables measured at their "*first difference*" form. The optimal lag length to be included in the test specification was determined automatically by the E-views statistical package based on Schwarz Information Criterion. Table 3 presents the ADF results for all variables at their "*level*" and "*first difference*" forms, and shows the order of integration for the variables whose times series were non stationary at a 5% level of significance.

Table 3: ADF test results for stationarity

Variable	ADF test statistic		Order of integration (at 5% level of significance)
	at level (with intercept and trend)	at first difference (with intercept)	
RGDP_GR	-3.793619 (**)	-	Stationary (integrated of order zero).
EXP_GDP	- 3.741525 (**)	-	Stationary (integrated of order zero).
TAX_GDP	-2.518533	-3.997544 (***)	Non stationary (integrated of order one).
OTHER_GDP	-3.381034 (*)	-8.748778 (***)	Non stationary (integrated of order one).
MILIT_EXP	-3.854356 (**)	-	Stationary (integrated of order zero).
CIVI_GDP	-4.618308 (**)		Stationary (integrated of order zero).
MILIT_GDP	-4.421895 (**)		Stationary (integrated of order zero).

(*), (**) and (***) indicate to the rejection of the null hypothesis of ADF test at (10%), (5%) and (1%) level of significance respectively.

As shown in Table 3, all variables' time series are considered stationary at their level form at 5% level of significance, except for tax to GDP ratio (TAX_GDP), and other revenues to GDP ratio (OTHER_GDP), whose respective time series were non stationary at level, but stationary at the first difference, and thus considered as integrated of order one. Since the order of integration is not the same for all of the variables, the authors had to make sure that the previously mentioned conditions stated by Charemza and Deadman (1992) for testing cointegration are satisfied, which was the case within the sample under study.

6.2 Cointegration and Error Correction Models' Estimation

This section presents the estimation results of the relationship between military-civilian components of public expenditure and economic growth in Egypt during the time period (1981/1982-2011/2012). The Johansen cointegration test is used to decide whether there exists a long run relationship (cointegration equation) between the variables under study and to estimate such relationship if it exists. Following that, vectors error correction models will be estimated that show the error correction dynamics in the short run while moving towards the equilibrium long run relationship[11]. All estimations are done using EViews 6 statistical package.

[11]While the lag length that is used in the estimation of the cointegrating equation and the vector error correction models should be based on specific criteria like Akaike Information Criterion or Schwarz Criterion, we had to use just one lag in our estimation due to limited number of observations which does not allow for the use of higher number of lags.

6.2.1 The long run relationship

The results of Johansen cointegration test using (Maximum Eigenvalue) for the two specified models are shown in Appendix (A). As for model (1), the results indicate to the existence of two cointegrating vectors for the specified relationship at 5% level of significance. However, the first cointegrating equation will be considered since it includes all variables specified in the model. The estimated cointegrating equation can be represented by the first column of Table 4.

The results show that the civilian public expenditure as a share of GDP is positively and significantly correlated to real GDP growth rate in the long run, which indicates to the positive externalities that might result from such kind of public expenditure in terms of enhancing the accumulation of factors of production and their productivity, which in turn affect growth rate positively. Given that cash budget deficit as a ratio of GDP is assumed to be the financing variable and thus omitted from the budget constraint, the positive correlation between civilian expenditure as a ratio of GDP and real GDP growth rate confirms that the positive effects of such expenditure on economic growth may exceed the distortions that result from the increased budget deficit required to finance such expenditure.

On the other hand, the results show that a significant long run relationship does not exist between military public expenditure as a ratio of GDP and real GDP growth rate. Thus, increasing the level of the military expenditure as a ratio of GDP, which is assumed to be financed through an increase in the level of the budget deficit, has an insignificant impact on the real GDP growth rate in the long run.

As for the tax revenues as a share of GDP, results indicate that a positive and significant relationship exists between this variable and the long run growth rate. The increase in tax revenues, associated with a reduction in the budget deficit as the omitted fiscal variable, is positively linked to economic growth. This may indicate that the tax distortions are less than those which result from the budget deficit.

Table 4: The estimated cointegrating equations using Johansen Cointegration Test

Variable	(1)	(2)
	Coefficient (standard error)	
CIVI_GDP	0.48*** (0.06)	-
MILIT_GDP	0.05 (0.09)	-
MILIT_EXP	-	-0.13*** (0.03)
EXP_GDP	-	0.44*** (0.05)
TAX_GDP	0.26** (0.13)	0.14 (0.12)
OTHER_GDP	0.03 (0.11)	0.11 (0.10)

(**) and (***) indicate to the significance of the estimated coefficients at (5%) and (1%) level of significance respectively.

As for model (2), Johansen cointegration test indicates to the existence of two cointegrating (long run) equations for the specified relationship. However, the first cointegrating equation that includes all variables of the model will be considered, which is presented by the second column of table (4). According to the estimated results, total public expenditure as a share of GDP is significantly and positively correlated with real GDP growth rate in the long run. Given that the budget deficit is the omitted fiscal variable from the budget constraint, this indicates that the positive effects that result from productive public expenditures exceed the negative impacts and distortions that may result from the expansion in the budget deficit accompanying the increased public expenditure.

The share of public expenditure allocated to military is, however, negatively correlated to real GDP growth. Thus, increasing the share of public expenditure that is allocated to the military sector at the expense of that of the civilian public expenditure is associated with a lower rate of economic growth in the long run. Accordingly, the composition of public expenditure that favors civilian components is assumed to be conducive to economic growth in the long run. The other two fiscal variables of tax and other revenues showed insignificant relationship with the real growth rate in the long run.

The results of the estimated models in this study seem to be consistent with the theoretical predictions about the relationship between military expenditure and economic growth, which were reviewed above. Given the fact that contradicting (positive and negative) effects on economic growth might result from the military expenditure as described by the *"Guns and Butter Approach"* versus the "*Guns or Butter Approach",* one may expect that the net effect of the level of military expenditure as a ratio of GDP should be insignificant, with positive effects outweigh negative ones. This was exactly what we reached from estimation of model (1). However, if the "*share*" of military expenditure in total public expenditure is considered instead, one would expect a negative correlation with the economic growth rate, since the expansion in military expenditures in this case comes at the expense of the other more productive components of public expenditure.

6.2.2 The short run relationship

The vector error correction estimations of the two models are shown in Table 5. The coefficients of the error correction terms are significant and negatively signed in both models, which is consistent with the theory. This would indicate that any deviation from the long equilibrium relationship that occurs in the current period will be corrected in the consequent period. More specifically, around 73% and 74% of the disequilibrium between actual rate of economic growth at any year and the long run rate of economic growth should be corrected in the next year, according to models (1) and (2) respectively.

Moreover, both shares of military and civilian expenditures to GDP have a significant and negative relationship with the real GDP growth rate in the short run, according to model (1). Increasing military and civilian expenditures by one percentage point in a given year is associated with a reduction in the real GDP growth rate by almost 0.97 and 0.54 percentage point respectively in the following year. This finding is also confirmed by the error correction model estimation for model (2), where the estimated coefficient of total public expenditure as a ratio of GDP is negative and significant. Thus, although total public expenditure (and especially its civilian component) has positive effect on economic growth in the long run, this relationship seems to be different in the short run. More specifically, in the short run, the level of total public expenditure (and the level of its civilian and military components as well) may have a negative impact on real GDP growth rate due to the increased budget deficit necessary for financing such expenditure. However, in the long run, positive effects of total public expenditure and civilian expenditure as ratios of GDP might be great enough to outweigh the negative impact on economic growth of the increased budget deficit.

On the revenues side, other “non tax” revenues as a ratio of GDP shows positive and significant relationship with real GDP growth rate in the short run. Increasing other “non tax” revenues as a share of GDP by one percentage point in a given period is associated with an increase in the growth rate of real GDP by 0.61 and 0.57 percentage points in the following period, in each of the two estimated models respectively.

Table 5: Estimations of the vector error correction models

Dependent Variable: Δ(RGDP_GR)	(1)	(2)
	Coefficient (standard error)	
Error Correction Term	-0.73*** (0.17)	-0.74*** (0.18)
Δ (RGDP_GR(-1))	0.21 (0.16)	0.25 (0.17)
Δ (MILIT_GDP(-1))	-0.97** (0.38)	-
Δ (CIVI_GDP(-1))	-0.54*** (0.18)	-
Δ (MILIT_EXP(-1))	-	-0.14 (0.14)
Δ (EXP_GDP(-1))	-	-0.58*** (0.20)
Δ (TAX_GDP(-1))	0.20 (0.23)	0.23 (0.24)
Δ (OTHER_GDP(-1))	0.61*** (0.21)	0.57** (0.22)
C	-0.23 (0.26)	-0.20 (0.27)

(**) and (***) indicate to the significance of the estimated coefficients at (5%) and (1%) level of significance respectively.

6.3 Granger Causality Test Results

The Granger causality test is applied to test for the existence and the direction of any causality relationship between the real GDP growth rate from one hand, and the military and civilian components of public expenditure from the other hand, during the time period (1981/1982-2011/2012). The test’s results as presented in Table 6 indicate to the absence of any causal relationship between the variables at 5% level of significance.

Table 6: Pair-wise Granger causality tests

Sample: 1982 2012			
Lags: 1			
Null Hypothesis:	No. of observations	F-Statistic	Prob.
CIVI_GDP does not Granger Cause RGDP_GR	26	2.38008	0.1365
RGDP_GR does not Granger Cause CIVI_GDP		0.36926	0.5494
MILIT_GDP does not Granger Cause RGDP_GR	26	2.04243	0.1664
RGDP_GR does not Granger Cause MILIT_GDP		0.09447	0.7613
MILIT_EXP does not Granger Cause RGDP_GR	26	0.97878	0.3328
RGDP_GR does not Granger Cause MILIT_EXP		0.11428	0.7384

6.4 Data Limitations

The sample size of this study, which extends from fiscal year 1981/1982 to fiscal year 2011/2012, is relatively small, which is a result of the difficulty that the authors faced to obtain data on final accounts of the State's General Budget for a longer period of time. The limited number of observations represents a major constraint for the methodology employed by the study, especially given the fact that the estimation of vector error correction models is based on the lagged values of the differenced variables, and thus would lead to a significant loss of observations and degrees of freedom. This led the authors to the arbitrary use of one lag in the specification of the cointegration test and the estimation of vector error correction models, instead of what would be suggested by Akaiki or Schwarz Information Criteria for the optimal number of lags. In general, the sample size is considered as one of the crucial factors affecting the preciseness of the estimates and the validity of results. Accordingly, the re-estimation of the models specified in this study using longer time series dataset would help in the verification of the estimated results.

Moreover, the economic classification system of the State's General Budget has changed since 2005/2006, as Egypt started to adopt the IMF's Government Finance Statistics Manual (GFS 2001) according to which public expenditures are presented within eight chapters and public resources are presented within five chapters, as compared to the old classification system where both expenditures and resources were presented within four chapters for each. This change in the budget classification system represented one of the constraints on the consistency of the fiscal variables' time series used in this study, which enforced the authors to introduce some amendments on the data provided by the national final accounts to make sure that the data on fiscal variables is consistent overall the whole period under analysis, given that the Ministry of Finance does not provide time series data for the time period prior to 2005/2006 based on the new budget classification system. The lack of such data represents a major obstacle for further researches on the relationship between economic growth and fiscal variables in Egypt.

7 Concluding Remarks

Using annual data for the real GDP growth rates and the military and civilian components of public expenditure in Egypt during the time period from 1981/1982 to 2011/2012, and given the data limitations mentioned above, the study reached the following conclusions:

First, the level of civilian public expenditure as a share of GDP is positively correlated to real GDP growth rate in the long run, while the corresponding share for the military expenditure is not statistically significant. This gives support for both the "*Guns and Butter Approach*" and the "*Guns or Butter Approach*", and indicates to the coexistence of positive and negative impacts of the military expenditure on economic growth, which lead to an insignificant relationship in the long run. However, in the short run, both civilian and military expenditures as shares of GDP are negatively correlated to economic growth. This would confirm that the positive effects of public expenditure (especially its civilian component) may need some time to emerge.

Second, the composition of public expenditure that favors the military component at the expense of the civilian one seems to be negatively associated with the economic growth rate in the long run. Thus, any reallocation of the total public expenditure in Egypt should try to avoid the expansion of the military share, if increased growth rates are to be achieved in the long run.

Third, the total public expenditure as a share of GDP is positively correlated to economic growth rates in the long run, but negatively correlated to it in the short run. Since the budget deficit is omitted from estimation and thus considered as the financing element of the other fiscal variables included in the budget constraint, this result might confirm that the positive impacts that result from the productive expenditure in Egypt might exceed any distortions resulting from the increased budget deficit accompanying such expenditure. Accordingly, fiscal policy reforms that are based on constraining the public expenditures in Egypt should be reconsidered.

Finally, no causal relationships are found between the real GDP growth rates and the military and civilian components of the public expenditure, during the time period under analysis.

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Appendix

Johansen Cointegration Test Results

Model 1

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.910941	58.04289	33.87687	0.0000
At most 1 *	0.735919	31.95594	27.58434	0.0128
At most 2	0.518433	17.53702	21.13162	0.1481
At most 3	0.327653	9.527542	14.26460	0.2448
At most 4	0.108411	2.754013	3.841466	0.0970

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Model 2

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.917374	59.84247	33.87687	0.0000
At most 1 *	0.760444	34.29526	27.58434	0.0059
At most 2	0.497484	16.51508	21.13162	0.1962
At most 3	0.310839	8.934737	14.26460	0.2916
At most 4	0.077815	1.944224	3.841466	0.1632

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values