The Causal Relationship between Corruption, Military Expenditures and Economic Growth in Egypt

By

Hisham H Abdelbaki[1] & Amr E. M. El-Sherbiny[2]

ABSTRACT (141 words)

This paper aims to assess the relationship military expenditure and corruption and measure the impact of military expenditure on economic growth during the period 1981-2010. The Autoregressive Distributed Lag (ARDL) models are used to solve the problems that arise in carrying such models that involve macroeconomic variables. The main findings report that military expenditures inversely affect economic growth. However military spending contributes positively to corruption. The results also state that exports, foreign direct investment and gross capital formation have positive effects on economic growth in Egypt in the considered period. For the corruption model, the results report that the education level and foreign direct investment are inversely correlated to corruption. Furthermore, globalization and government intervention are found to have positive effects on corruption levels in the economy and are the main determinants of corruption beside military expenditures in the Egyptian economy.

Keywords: Military Expenditures, Corruption, Economic Growth, ARDL Model, Egypt.

JEL Classification: *O40, H54, H56.*

[1] Professor of Economics and head of Department of Economics, Mansoura Univereity.

[2] PhD in Law.

Introduction

There are many negative effects of military spending on economic and social development. These effects are: First, it is unlikely that military spending will greatly increase domestic demand due to the high value of imports of military equipment. In poor countries, the demand for civilian goods for military purposes, such as allowances, military boots and some construction materials, is imported from abroad. Second, the claim that military industrialization leads to increased demand for domestic labor is exaggerated, as weapons production is capital intensive and therefore requires the use of only a small fraction of the labor force at high cost. Third, the claim that military industrialization contributes to building the engineering base for industrialization is also losing much of its value. We learn that many developing countries are buying weapons and ready-made military equipment from abroad as well as spare parts, also the use of foreign expertise to maintain this complex equipment without effectively contributing local expertise. The claim that military spending leads to increased opportunities for technical training for local employment is also a claim that is not supported by the practical experience of many developing countries, including some Arab countries that have implemented some ambitious military industrialization programs, because such programs require high technical expertise which must be withdrawn from important civilian sectors such as the higher education sector, which also suffers from a serious shortage of such expertise. In other words, the remarkable progress achieved in the field of military manufacturing in these countries was at the expense of the conversion of many scientists and researchers in universities and scientific research centers, especially in the fields of engineering, physics and chemistry to the military sector and the denial of universities to benefit from them in the preparation of engineering and scientific cadres and to also build the scientific base necessary to achieve the stage of take-off or economic jump. In addition, the preparation of technical capabilities in the military fields does not necessarily serve the civilian sector because of the difficulty of converting skilled military personnel into this sector. Fourthly, the allocation of a large proportion of scarce financial resources for military purposes means depriving the civilian sector, especially in the areas of health and education, of benefiting from these resources. The claim that spending on these areas do not necessarily contribute to the process of economic growth is a claim that is not supported by the historical experience of some developing countries that have focused their investments in these areas in order to build the human capital needed for the long-term development process. Most developing countries, especially those heavily dependent on foreign loans and assistance, are in desperate need of access to their limited financial resources for development purposes and to improve their people living standards, while military expenditures for the purchase of weapons and military equipment from abroad absorb the bulk of the rare and necessary foreign exchange to finance the necessary development programs. Even if some developing countries rely on financing their military purchases through foreign loans, this policy will increase external debt burdens, which will force them to adopt tight fiscal and monetary policies, thereby reducing consumption and investment and hence economic growth.

It is clear from the foregoing discussion that the increase in military spending must be at the expense of reducing public expenditure on social services, health care, education and infrastructure projects in the early stages of economic and social development.

The focal objectives of the paper are to assess the relationship military expenditure and corruption and measure the impact of military expenditure on economic growth. The Autoregressive Distributed Lag (ARDL) models are used to solve the problems that arise in carrying such models that involve macroeconomic variables. The remainder of the paper will proceed as follows: Section two discusses the theoretical framework about world military expenditure and evolution of Egyptian military expenditure. Section three analyses literature review while section four discusses the methodology. Section five is devoted to show and analyze the results. The goodness of fit tests is examined in section. Finally, some concluding remarks are represented in section seven.

Theoretical Framework

World Military Spending

Table (1) shows that the world military spending was estimated at $1776 billion in 2014, representing 2.3% of global gross domestic product or $245 per person. Total expenditure was about 0.4% lower in real terms than that in 2013. Military spending continued to increase rapidly in Africa, Eastern Europe and the Middle East. A combination of high oil prices until the latter part of 2014 and numerous regional conflicts contributed to rising military expenditure in several of the major spending countries in these regions. The conflicts in Ukraine, Iraq and Syria, among others, are likely to continue to drive military expenditure in a number of states in these regions. However, the dramatic fall in oil prices towards the end of 2014 may herald a change in the trend for some countries that are highly dependent on oil revenues—although the effect may not be felt for some time in those countries with substantial financial reserves. Military spending in Asia and Oceania also rose in 2014, although this was almost entirely driven by the increase in China. Elsewhere in the region, there was a mixed pattern of increases and decreases. Meanwhile, military expenditure in Latin America and the Caribbean was essentially unchanged from 2013, with regional leader Brazil cutting spending due to its economic difficulties. However, the fight against drug cartels in Central America remained a key driver of increased spending in that sub-region.

Table (1) World Military Spending, 2014

Region	Spending ($ b.)	Change (%)
Africa	**-50**	**5.9**
North Africa	20.1	7.6
Sub-Saharan Africa	-30.1	4.8
Americas	**705**	**-5.7**
Central America and the Caribbean	10.4	9.1
North America	627	-6.4
South America	67.3	-1.3
Asia and Oceania	**439**	**5**
Central and South Asia	65.9	2
East Asia	309	6.2
Oceania	28	6.9
South East Asia	35.9	-0.4
Europe	**386**	**0.6**
Eastern Europe	93.9	8.4
Western and Central	292	-1.9
Middle East	**-196**	**5.2**
World total	**1776**	**-0.4**

Source: Stockholm International Peace Research Institute (SIPRI), Yearbook, 2015: Armaments, Disarmament and International Security.

Evolution of Egyptian Military Expenditure

Figure (1) shows the evolution of military expenditure in the Egyptian economy during the period 1981-2010. The military expenditure is raised from 1476 million Egyptian Pounds in 1981 to 12790 million Egyptian Pounds and to 21718.4 million Egyptian Pounds then to 26724 million Egyptian Pounds in 2001, 2008 and 2010 respectively.

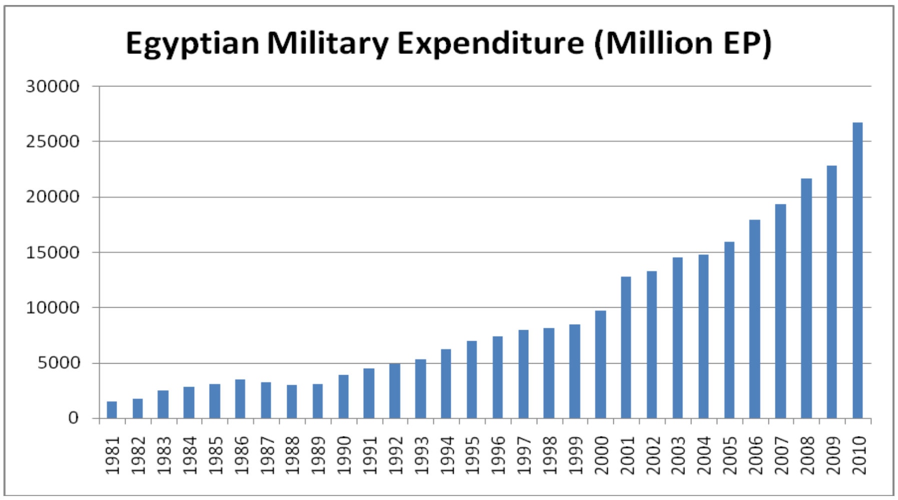


Figure (1) Evolution of Egyptian Military Expenditure

Literature Review

Al-jarrah (2005) used Johansen’s cointegration procedure, VECM, and standard Granger causality to study the causation relationship between economic growth and military spending in the Saudi economy through the period 1970-2003. The study stated the existence of a bi-directional causality between economic growth and defense spending, and a uni-directional causality running from non-oil economic growth to defense spending. Moreover, the dynamic effect of one variable on the other beyond the sample period was assessed. **Chung-Jen Wu, and Cheng-Te Lee (without year)** set up an endogenous growth model to investigate the impact of the government's resources allocation between the defense sector and the non-defense sector on economic growth. They prove that shifting resources from the defense sector to the non-defense public sector will stimulate the steady-state growth rate. **Abu-Bader and Abu-Qarn (2003)** stated the fact that reallocating resources from the defense sector to the non-defense sector may stimulate economic growth. In their paper, **Abu-Qarn, A. S., et. al. (2010)** estimated an econometric model of the Egyptian demand for military spending, taking into account important strategic and political factors. The results showed that both economic and strategic factors play a role in determining military burden with clear positive effects of lagged military burden, suggesting some sort of institutional inertia, plus negative output and net imports effects. The main strategic effect is the impact of Israel's military burden. The results also suggest that simple arms race relationships are not an adequate representation of the relevant strategic factors. **Zaman, K., et al., (2013)** examine the impact of military expenditure and economic growth on external debt for a panel of five selected AA countries including Bangladesh, India, Nepal, Pakistan and Sri Lanka, over the period of 1988-2008. The study finds that external debt is elastic with respect to military expenditure in the long run and inelastic in the short run. In the long run, 1% increase in military expenditure increases external debt between 1.18 % and 1.24%, while 1% increases in economic growth reduces external debt between 0.64% and 0.79%, by employed and M estimator respectively. In the short run, 1% increase in military expenditure increases external debt by 0.15%, while 1% increase in economic growth reduces external debt by 0.47 %. **Duella A (2014)** examines the causal relationship between aggregate government spending and economic growth in Algeria for the period 1980-2010. The author breaks down the aggregate government spending into military and civilian spending and assesses their impact on economic growth. Both bi-variate and multivariate co-integration is utilized to determine the type and direction of causality. Using Johansen's co-integration procedure and VECM, the study showed the existence uni-directional causality between economic growth and military spending. The study also uses the variance decomposition analysis to assess the dynamic effect of one variable on the other two in the model beyond the sample period. **Hirnissa, M.T., et al., (2009)** employ the bounds testing procedure and dynamic OLS to test the robustness of the causal effect and long-run relationships between military expenditure and economic growth in ASEAN-5 countries from the year 1965 to 2006. The results suggest that: (1) only three, Indonesia, Thailand and Singapore, out of the five countries analyzed exhibit a long–run relationship between military expenditure and economic growth; (2) While for the case of Singapore, the causality is bidirectional, for Indonesia and Thailand, it is unidirectional from military expenditure to economic growth; and (3) For the remaining countries, (Malaysia and the Philippines), no meaningful relationship could be detected. The results are robust, producing similar results employing both Auto Regressive Distributed Lag (ARDL) and Dynamic Ordinary Least Square (DOLS). **Chung-Jen Wu, and Cheng-Te Lee (2015)** explored the effects of military spending on economic growth using a stochastic endogenous growth model. They found that crowding out effect and portfolio effect plays an important role in determining growth rate in a small open economy. They also stated the non-linear relationship between the defense burden and the economic growth.

Methodology

The Models Structure

Based on literature, the main factors that determine economic growth are exports, foreign direct investment and gross domestic investment **(Abdelbaki & Abdalla, 2014)**. To investigate the impact of the military spending on economic growth, we add military spending as an independent variable to the previous variables as follows:

$$GR_{it} = \alpha + \beta_1 ME + \beta_2 EXP + \beta_3 FDI + \beta_4 GFC + \xi_{it} \quad (1)$$

Where GR is growth rate of GDP, ME is military spending as a ratio to GDP, EXP is exports as a ratio to GDP, FDI is foreign direct investment as a ratio to GDP, and GFC is gross capital formation as a ratio to GDP. All variables are adjusted by GDP deflator and all are annual covering the period 1981-2010.

Statistical studies have shown a positive association between corruption and increased military spending. Some aspects of defense spending encourage corruption, such as the large amount of assets allocated for defense including land, equipment and military barracks. There is less transparency in the purchases of military equipment, which are often excluded from legislation requiring the provision and dissemination of information and statistics. The magnitude of military spending on equipment and weapons also encourages some less efficient companies or those who want to get rid of an old-fashioned weapon to bribe officials to get contracts. Some experts have estimated the proportion of bribes to be 15% of total arms spending. **Abdelbaki (2017)** investigated the economic determinants of corruption in Egypt under the Mubarak regime (1981-2010) by using the Autoregressive Distributed Lag

(ARDL) approach. The main findings of the paper show that globalization and the government intervention in the economy influences positively on the corruption level. Whereas the education level and FDI have inverse effects on the corruption level in the short run. Furthermore, in the long run, only the education level and government intervention record significant effects on the level of corruption at 5% and 10% levels of significance. To investigate the effect of military spending on corruption, we add the military expenditures as a ratio to GDP to the above independent variables as follows:

$$CORR_{it} = \alpha + \beta_1 ME + \beta_2 EDU + \beta_3 GLOB + \beta_4 FDI + \beta_5 SIZE + \xi_{it} \qquad (2)$$

The Autoregressive Distributed Lag (ARDL) approach adopted in this study was introduced by **Pesaran et al (1996).** The ARDL procedure yields precise estimates of long run parameters and valid t-statistics even in the presence of endogenous variables. It can be used for testing the existence of a long-run relationship among variables regardless of whether the underlying regressors are purely I(0), purely I(1), or mutually integrated (**Abdelbaki, 2013; Pesaran & Pesaran, 1997**). The model estimates (ρ + 1)k number of regressions to obtain optimal lag-length for each variable, where k is the number of variables and p is the maximum lag to be used. The ARDL model allows capturing the data generating process by using sufficient number of lags. Finally, the model provides vigorous results for a small size of cointegration analysis (**Gujarati, 2006**). A dynamic error correction model (DECM) can be derived from ARDL through a simple linear transformation (**Banerjee et al, 1993**). The error correction version of ARDL framework relevant to the variables in the equations (1) and (2) can be rewritten as follows:

$$GR_t = \alpha + \sum_{j=1}^{k1} \beta_j \Delta GR_{t-j} + \sum_{j=0}^{k2} \delta_j \Delta ME_{t-j} + \sum_{j=0}^{k3} \phi_j \Delta EXP_{t-j} + \sum_{j=0}^{k4} \varphi_j \Delta FDI_{t-j} + \sum_{j=0}^{k5} \gamma_j \Delta GFC_{t-j} + \lambda_1 ME_{t-j} + \lambda_2 EXP_{t-j} + \lambda_3 FDI_{t-j} + \lambda_4 GFC_{t-j} + \xi_t \quad (3)$$

and

$$CORR_t = \alpha + \sum_{j=1}^{k1} \beta_j \Delta CORR_{t-j} + \sum_{j=0}^{k2} \delta_j \Delta ME_{t-j} + \sum_{j=0}^{k2} \delta_j \Delta EDU_{t-j} + \sum_{j=0}^{k3} \phi_j \Delta FDI_{t-j} + \sum_{j=0}^{k4} \varphi_j \Delta GLOB_{t-j} + \sum_{j=0}^{k5} \gamma_j \Delta SIZE_{t-j} + \lambda_1 ME_{t-j} + \lambda_2 EDU_{t-j} + \lambda_3 FDI_{t-j} + \lambda_4 GLOB_{t-j} + \lambda_5 SIZE_{t-j} + \xi_t \quad (4)$$

Data Sources

The variables used in this paper, its proxies, and data sources are shown in table (2) as follows:

Table (2) variables, proxies, and data sources

Variable	Proxy	Source
Economic Growth Rate	Economic Growth Rate	GDP data from the World Bank
Military Expenditures	Military Expenditures	Stockholm International Peace Research Institute (SIPRI), Yearbook
Exports as a ratio to GDP	exports as a ratio to GDP	Gulf Organization for Industrial Consulting
Gross capital formation as a ratio to GDP	gross capital formation as a ratio to GDP	Gulf Organization for Industrial Consulting
Corruption level	Corruption index	Transparency International
Economic growth	Annual percentage growth rate of GDP at market prices	The World Bank
Level of education	Total enrollment in secondary education expressed as a percentage of the population of official secondary education age.	UNESCO
level of development	Per capita GDP	The World Bank
International integration	Globalization Index	The World Bank
Foreign direct investment	Foreign direct investment as % of GDP.	The World Bank
Government intervention in the economy	Government spending, percent of GDP	The World Bank
Fiscal freedom	Fiscal freedom index	The Heritage Foundation

Empirical Results and Analysis

The following are the results and analysis of running the models:

Stationary Test

To avoid spurious regression, we need to test the time-series characteristics of all the variables and determine whether they are stationary with Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The null hypothesis is that the series has a unit root. As shown in tables (3A and 3B), the test results show that some variables are stationary and the others have unit roots, but these variables become stationary after first differences i.e. all variables are I(0) or I(1), so bounds test approach could be used.

Table 3A: Unit Root Results for Model 1

	Level				First difference			
	ADF		PP		ADF		PP	
Variable	L. length	Value	L. length	Value	L. length	Value	L. length	Value
GR		1.97331		1.73902		4.56853***		4.36466***
ME		1.873402		1.24061		5.71785***		5.69750***
EXP		1.462487		0.90378		4.21514***		4.02514***
FDI		1.09939		1.80895		2.80751**		1.64935*
GFC		2.06081		2.02381		3.74719***		3.68274***

Table 3B: Unit Root Results for Model 2

	Level				First difference			
	ADF		PP		ADF		PP	
Variable	L. length	Value	L. length	Value	L. length	Value	L. length	Value
CORR	0	-1.87331	1	-1.86902	0	-5.58853***	4	-5.46466***
ME	1	1.973402	4	1.11061	1	4.697851***	3	4.597503***
EDU	0	-1.36242	3	-1.03378	0	-5.23514***	1	-5.12514***
FDI	2	-0.99939	4	-1.93895	1	-5.82751**	3	-2.04935**
GLOB	0	-1.96081	3	-2.15381	0	-4.76719***	4	-4.78274***
SIZE	0	-1.84193	2	-1.77494	0	-4.66227***	3	-4.63562***

*Note: *** and ** denote significance at the 1% and 5% levels respectively.*

The lag lengths included in the models are based on the Akaike Information Criteria (AIC). The tests of ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) are based on the two models: (1) with constant and trend; and (2) without constant and trend.

Bounds Test

Bound testing as an extension of ARDL modeling uses *F* and *t*-statistics to test the significance of the lagged levels of the variables in a univariate equilibrium correction system when it is unclear if the data generating process underlying a time series is a trend or a first difference stationary. To determine whether economic growth and the corruption level have a long-run co-integration relationship with their independent variables, an ARDL Error Correction Model is formed for the bounds test. Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) are used to determine the optimal number of lags to be included in the unconditional ARDL-ECMs. If the optimal lag length selected by AIC and SBC standards are not the same, then all lag numbers between them should be tested. Thus, the order of selected ARDL model is of **(1,1,0,1,0) and (1,0,1,1,0,1)** for model 1 and model 2 respectively (table 4).

Table (4) Bound Test

Model 1	t-statistic	Value	k	I(0)	I(1)
	F-statistic	4.240380	4	2.17*	4.11*
Model 2	t-statistic	Value	k	I(0)	I(1)
	F-statistic	5.013054	5	2.36*	4.43*

***** Pesaran et al. (2001) critical bound @ 5% level of significance
Note: K is the number of observations minus 1.

As shown in table (4), the computed F-statistic is compared with upper and lower critical bounds generated by Pesaran et al. (2001) to test for the existence of cointegration. The null hypothesis is H0: λ=0, (where j = 1, 2, …, 5) in equation (1) for model 1 and in equation (2) for model 2. These imply no long run relationship among the variables, against the alternative hypothesis, H1: λ does not equal 0, implying the existence of long run relationship among the variables. The results in table 4 show that the computed F-statistic for model 1 is (4.240380) which is greater than the upper bound (4.11) at a 5% level of significance with unrestricted intercept and no trend (Upper bound is 4.11 and Lower bound is 2.17). F-statistic for model 2 is (5.013054) which is greater than the upper bound (4.43) at a 5% level of significance with unrestricted intercept and no trend (Upper bound is 4.43 and Lower bound is 2.36). This implies that there is evidence to reject the null hypothesis of no long run relationship among the variables. Hence, the alternative hypothesis is accepted that there is a long run equilibrium relationship among the variables, i.e. the set of variables in equation (1) for model 1 and (2) for model 2 are cointegrated with economic growth and the corruption level in Egypt over the period of analysis.

The Error Correction (ECM) Models

To examine whether a long-run equilibrium exists among the independent variables, economic growth and economic corruption in Egypt through the considered period, ARDL cointegration and long run form tests at the chosen lag level are conducted. If the series are cointegrated, this would imply that they share a common stochastic trend and any deviations from long-run equilibrium is likely to lead to short-run adjustment or realignment of the series to restore equilibrium. Because cointegration relationships among variables exist, there must be an error– correction specification that can be applied to the data (**Engle and Granger, 1987**). The error correction term refers to the speed with which the model returns to equilibrium following an exogenous shock. It should be negatively signed, indicating a move back towards equilibrium; a positive sign indicates movement away from equilibrium. The coefficient lies between 0 and 1, 0 suggests no adjustment one-time period later, and 1 indicates full adjustment. Tables 5A and 5B show error correction representation for the ARDL models.

The results state that the long run relationship between economic growth and military expenditures, exports, foreign direct investment, and gross capital formation in model 1 and between the corruption level and military expenditures, education level, foreign direct investment, globalization and size of the government in model 2 exist. The sign of the ECM equation states that the model has movements in the long run towards equilibrium which means that if the model is shocked, the system can return back to its equilibrium.

Table 5A: Results of the Error Correction Model (ECM) Associated with ARDL Cointegrating Form (model 1)

Variable	Coefficient	Standard Error	t- statistic	Prob.
C	4.31094	0.901456	2.64019	0.0113
GR(-1)	5.815612	4.944611	3.049569	0.0036
ME	-6.033411	5.096511	-2.658493	0.0472
ME(-1)	-2.096621	1.609148	-3.650221	0.0634
EXP	1.560675	1.029616	3.548749	0.0049
EXP(-1)	1.633213	1.138763	4.456825	0.0023
FDI	2.382196	1.824583	2.40161	0.0678
FDI(-1)	5.306391	5.30762	1.749201	0.0719
GFC	8.321704	5.29421	3.81306	0.0474
GFC(-1)	1.933213	1.238763	3.69685	0.0553
ECM (-1)	0.655441	1.03803	-4.994184	0.0064
R^2	0.8463			
Adjusted R^2	0.8135			
F-statistic	32.4868 (prob. 0.00011)			
Durbin-Watson	2.281393			

Table 5B: Results of the Error Correction Model (ECM) Associated with ARDL Cointegrating Form (model 2)

Variable	Coefficient	Standard Error	t- statistic	Prob.
C	-3.31094	0.401456	-2.64019	0.0113
CORR(-1)	1.382196	1.324583	2.40161	0.0346
ME	7.306391	4.80762	5.749201	0.01472
ME(-1)	7.321704	4.79421	5.81306	0.0034
EDU	-1.223889	1.184683	-4.759606	0.0349
EDU(-1)	-1.252278	1.217054	-4.34079	0.0223
FDI	-4.815612	4.444611	-3.049569	0.0678
FDI(-1)	-5.033411	4.596511	-2.658493	0.0719
GLOB	-1.096621	1.109148	-3.650221	0.0474
GLOB(-1)	0.560675	0.529616	2.548749	0.0553
SIZE	0.633213	0.638763	5.456825	0.0064
SIZE(-1)	0.933213	0.738763	5.696825	0.0038
ECM (-1)	-0.344559	0.53803	-4.994184	0.0145
R^2	0.9154			
Adjusted R^2	0.8793			
F-statistic	42.7548 (prob. 0.00000)			
Durbin-Watson	2.132893			

Table 6A: Results of the Error Correction Model (ECM) Long Run Coefficients (model 1)

Variable	Coefficient	Standard Error	t- statistic	Prob.
ME	5.233411	4.796511	2.458493	0.05282
EXP	0.760675	0.729616	3.348749	0.01651
FDI	1.582196	1.524583	2.20161	0.03225
GFC	7.521704	4.99421	4.01306	0.00526
C	3.510948	0.601456	2.44019	0.06887

Table 6B: Results of the Error Correction Model (ECM) Long Run Coefficients (model 2)

Variable	Coefficient	Standard Error	t- statistic	Prob.
ME	6.87136	0.427064	4.25819	0.0157
EDU	-0.792184	0.71643	-3.46753	0.0365
FDI	0.03283	0.021832	-0.43254	0.3472
GLOB	0.215783	0.02564	1.308728	0.4536
SIZE	0.084217	0.08277	4.182536	0.06139
C	-3.42739	1.446931	-2.30869	0.037941

The results of the ECM in tables 5A, 5B, 6A and 6B show the short and long run effects of the independent variables on economic growth and the level of corruption in Egypt in the considered period. The results in table (5A) state that military expenditures are significant (t-statistic is -2.658493) and has a negative effect on the economic growth level in the Egyptian economy during the period 1981-2010. The figures in the table state that at a 1% change in military expenditures, other factors are remaining the same; the economic growth will change however by 6.033411 units in the opposite direction. However, the results state that exports, foreign direct investment and gross capital formation have positive effects on economic growth in Egypt in the considered period. Results in table 6A show that all determinant factors of economic growth are significant at 5%, 5% level of significance and they explain 85% and 81% of total variation in economic growth level in the considered period according to R-squared and adjusted R-squared respectively. The entire model is significant at 5% of significance level. Table 5B shows that military expenditures are significant (t-statistic is 5.749201) and has a positive effect on the corruption level in Egypt during the period 1981-2010. These results state that a 1% change in military expenditures, other factors are remained the same, but will change the corruption level by 7.306391 units in the same direction. The education level (proxied secondary schools' enrollment as % of total population) is significant as well (t-statistic is -4.759606) and it has a negative effect on the level of corruption in the Egyptian economy during the mentioned period. This means that a 1% change in secondary schools' enrollment of total population, other things being equal, will change the level of corruption by 1.223889 units in the opposite direction. This result is compatible with the results of **Ghulam, S. and A. Mumtaz (2007)**, which showed that the level of corruption in developing countries increases with the decrease in the level of education. Table (5B) shows also that the level of foreign direct investment (FDI) (proxied by FDI/GDP) is significant (t-statistic is -4.049569) and is inversely correlated with the corruption level in the short run. This means that a 1% increase in FDI to GDP ratio will decrease the level of corruption by 4.815612 units. This is in contrary with the *a priori* expectation of negative relationship between globalization and corruption levels where an increase in globalization is expected to reduce corruption norms. The results also show that the government intervention in the economy influences positively on the corruption level in the considered period as an increase in government expenditure value to GDP level by 1% will increase the corruption level by 0.633213 units. Furthermore, in the long run, military expenditures, education level and government size record significant effect on the level of corruption at 5%, 5% and 10% level of significance respectively. The independent variables, education level, foreign direct investment, globalization and size of the government, explain 91% and 88% of total variation in the corruption level in the considered period according to R-squared and adjusted R-squared respectively. The entire model is significant at 5% of significance level.

Goodness of Fit Tests

Diagnostic Tests for the Model

The Diagnostic Tests for the ARDL (1,1,0,1,0) and (1,0,1,1,0,1) for model 1 and model 2 respectively (absence of serial correlation, heteroskedasticity, non-normal distribution of the error terms and specification errors) are examined by means of Breusch- Godfrey, Breusch-Pagan-Godfrey, Jarque Bera, Ramsey Reset Tests respectively. The results in table (7) show that the model ARDL (1,1,0,1,0) and (1,0,1,1,0,1) are appropriate to examine the relationship between economic growth and corruption level as dependent variables and considered independent variables.

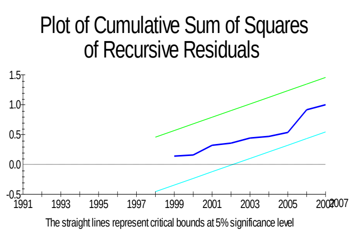
Table 7: diagnostic statistics results for the ARDL models

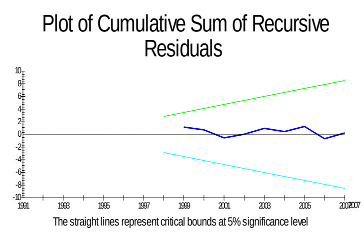
	Model (1,1,0,1,0,)		**Model (1,0,1,1,0,1)**	
Diagnostic Statistics	**Statistic**	**Probability**	**Statistic**	**Probability**
BG LM serial correlation Test F St.	0.668599	F(2, 18) 0.72594	0.608599	F(2, 19) 0.68749
BPG Heteroskedasticity Test F St.	2.075433	F(8, 20) 0.14729	2.015433	F(8, 20) 0.13582
JB Normality Test	3.122752	0.453808	3.062752	0.473808
RR Specification Length Test	2.107474	0.2965	2.047474	0.3165
	AIC: 3,15 BIC: 8,16 HQ: 6,10			

Testing the Models for the Structural Stability

To ascertain the goodness of fit of the used ARDL model, the diagnostic and the stability test are conducted. The structural stability test employs the cumulative sum of recursive residuals (CUSUM), which is based on the first set of (N) observations and is updated recursively and then plotted against the break point. If the plot of CUSUM remains within the critical bounds at a 5% significance level, the null hypothesis that all coefficients and error correction model are stable cannot be rejected. However, if the two lines are crossed, the null hypothesis of coefficient constancy can be rejected at 5%. The same analysis can be used for the cumulative sum of square of recursive residuals (CUSUMMSQ) test, which is based on the square recursive residuals. The stability tests of the long-run coefficients together with the short-run dynamic based on **Pesaran and Pesaran (1997)** by CUSUM and CUSUMSQ are applied. Figure (2) shows that the plots of CUSUM and CUSUMSQ are within the critical lines which states that neither the CUSUM nor CUSUMSQ indicate evidence of any structural instability for model 1 and model 2.

Model 1





Model 2

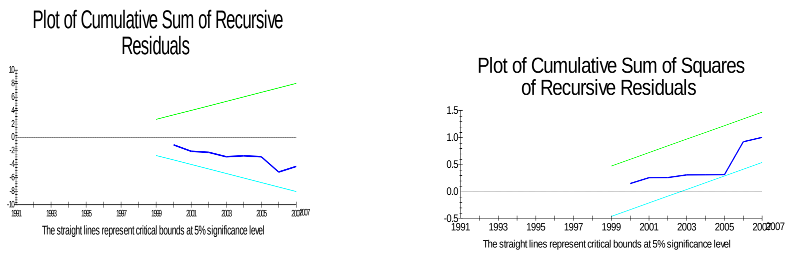


Figure 2: CUSUM and CUSUMSQ statistics for coefficient stability

Concluding Remarks

The main objectives of the paper are to investigate the effect of military expenditures on both economic growth and corruption levels in the Egyptian economy during the period 1981-2010 by using the ARDL model. The results report that military expenditures inversely affect economic growth. However military spending contributes positively to corruption where a 1% change in military expenditures, other factors remain the same, will change the level of economic growth by 6.033411 units in the opposite direction and will change the corruption level by 7.306391 units in the same direction. The results also state that exports, foreign direct investment and gross capital formation have positive effects on economic growth in Egypt in the considered period. For the corruption model, the results report that the education level and foreign direct investment are inversely correlated to corruption. Furthermore, globalization and government intervention are found to have positive effects on corruption levels in the economy and are the main determinants of corruption beside military expenditures in the Egyptian economy. Rationality of military expenditures is a crucial factor for pushing economic growth and combating corruption. Increasing exports, attracting foreign direct investment and pushing capital accumulation are important factors in achieving higher economic growth rates. Accordingly, combating corruption in Egypt should be done through eliminating the government intervention, increasing education levels (quantity and quality), improving the investment climate to attract more foreign investments, and finally integrating more in the international economy.

References

Abdelbaki, H. (2013), "Causality relationship between macroeconomic variables and stock market development: evidence from Bahrain", *The International Journal of Business and Finance Research*, Vol. 7(1): 69-84

Abdelbaki, H. (2017), **"**Investigation of Economic Determinants of Corruption in Egypt under Mubarak Regime", International Research Journal of Finance and Economics, Issue No. 160 March.

Abdelbaki, H and Abdalla, M., (2014),**"** Determinants of Economic Growth in GCC Economies", Asian Journal of Research in Business Economics and Management Vol. 4, No. 11, November 2014, pp. 46-62.

Abu-Bader, S. and Abu-Qarn, A. S. (2003), "Government Expenditures, Military Spending and Economic Growth: Causality Evidence from Egypt, Israel, and Syria", *Journal of Policy Modeling*, Vol. 25, pp. 567-583.

Abu-Qarn, A. S. et al., (2010), "The Demand for Military Spending in Egypt," Working Papers 1001, Department of Accounting, Economics and Finance, Bristol Business School, University of the West of England, Bristol.

Al-jarrah, M., (2005), "Defense spending and economic growth in an oil-rich country: The Case of Saudi Arabia", *Pakistan Economic and Social Review*. Volume XLIII, No. 2 (Winter 2005), pp. 151-166.

Banerjee, A., Dolado, J.J., Galbraith, J.W. & Hendry, D. F. (1993), "*Cointegration, Error-Correction and the Econometric Analysis of Non-Stationary Data"*, United Kingdom: Oxford University Press.

Chung-Jen Wu, and Cheng-Te Lee (without published year), "Defense Spending and Economic Growth: An Endogenous Growth Model", http://www.jgbm.org/page/23%20Cheng-Te%20Lee%20.pdf.

Cheng-te Lee & Shang-fen Wu, (2015). "Military Spending and Stochastic Growth: A Small Open Economy", Economics Bulletin, Access Econ, vol. 35(4), pages 2026-2036.

Duella A. (2014), "Military Burden and Economic Growth: Evidence from a Multivariate Cointegration Analysis", Journal of Global Economics. Volume 2 . Issue 3. pp. 1-6.

Engle, R. and Granger, F. (1987), "Cointegration and error correction regression: estimation and testing", *Econometrica*, Vol. 55, No. 2, pp. 251-76.

Gujarati, D. N. (2006), *"Essentials of Econometrics"*, McGraw- Hill/ Irwin, third edition, New York: USA.

Hirnissa, M. T., Habibullah, M. S., and Baharom, A.H. (2009), "Military Expenditure and Economic Growth in Asean-5 Countries", Journal of sustainable Development. Vol. 2, No. 2. pp. 192-202.

Pesaran, M. H. & Pesaran, B. (1997), "*Working with Microfit 4.0: interactive econometric analysis"*, Oxford University Press, UK.

Pesaran, M.H., Shin, Y. and Smith, R.J. (1996), "Testing for the existence of a long –run relationship", *DAE Working Paper*: No. 9622, Department of Applied Economics. University of Cambridge.

Stockholm International Peace Research Institute (SIPRI), Yearbook,(2015), Armaments, Disarmament and International Security.

Zaman K., Iqtidar A. S., Khan, M. M. and Ahmad, M. (2013), **"**Impact of Military Expenditure and Economic Growth on External Debt: New Evidence from a Panel of SAARC Countries", Journal of Economic and Social Studies. Volume 3 Number 2 Fall 2013. Pp. 131-146.