I J A B E R, Vol. 11, No. 1, (2013): 89-98

THE RELATIONSHIP BETWEEN MILITARY EXPENDITURE AND ECONOMIC GROWTH, THE CASE OF JORDAN

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Abstract: The aim of this paper is to investigate the relationship between military expenditure and economic growth in Jordan for the period (1970-2010). In order to examine this relationship, a number of econometric techniques were used; in particular, Unit Root test, Cointegration analysis, and Granger Causality test. In order to account for the effect of the peace agreement signed in 1993 between Jordan and Israel and its effect on the size of military expenditure, the full sample was divided into two sub-samples; (1970-1992) and (1993-2010). The results showed that, for the two sub-samples, the effect of economic growth on military expenditure is statistically positive. This result indicates that the volume of military expenditure is strongly affected by the size of the countries' national income. Regarding the effect of military expenditure on economic growth, the results prove a significantly positive sign in the first period. Part of this finding could be attributed to the fact that military expenditure provides safe environment for investors and for the production process. However, for the second period, the causality from military expenditure to economic growth was not proven.

Keywords: military expenditure, economic growth, peace process, Jordan

I. INTRODUCTION

Jordan was always inside a hot and boiling political environment. Therefore, significant portions of the limited resources to Jordan, in addition to aids from foreign and Arab countries, have been allocated to military expenditures.

The military burden, defined as the share of military expenditures in GDP, has been, historically, among the highest in the world. This percentage ranged between 5% and 16% over the period 1970-2010. Some argue that this kind and level of expenditure may have an adverse impact on economic growth. Despite the gradual decrease in the Jordanian military expenditure, as a percent of GDP, it is still considered high when compared with international standards. For example, the world's average military burden during the period 1990-2005 was 2.5% (Abu-Qarn and Abu-Bader, 2008). In the same period, the military burden for the US was less than 4% despite its engagement in anti-terrorism wars and military actions in the aftermath of September 11th.

The same pattern of military expenditures was found in other Middle Eastern countries. For sure, the decline in military expenditure in the Middle East was, at

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least partially, due to the cessation of the condition of war between Israel and Egypt and Jordan and the commencement of negotiations between Israelis and Palestinians (Abu-Bader and Abu-Qarn, 2003).

A Number of studies addresses the adverse effect of the high military burden on economic growth, such as Lim (1983), Deger and Smith (1985), and Tongur and Elveren (2012). However, other studies have found a positive effect (Benoit, 1978) or no effect at all (Dakurah *et al*., 2001) of military spending on economic growth.

Similar results were found for the case of Jordan; Asfour (1988) found a negative effect of high military expenditures on economic growth. However, Al-Idwan (1998) found a positive effect of military burden on GDP but negative on investment.

The existence of a positive relationship between military expenditure and economic growth in some countries may be attributed to the fact that military expenditure provides a safe environment for investment or a convenient environment for the production process which may lead to attract foreign investors. Moreover, military expenditure could contribute positively to the rehabilitation of work force, especially those who work in the fields of research and development and technology transfer. This could be done through some programs for training and education to acquire the necessary job skills. On the other hand, the presence of a negative relationship between military expenditures and economic growth for other countries may be a result of the negative impact on some macroeconomic variables such as investment, savings, and balance of payments.

Therefore, it seems to be crucial to study the effect of the Jordanian military expenditure on economic growth for a newer sample of period and with a methodology that includes testing for the stationarity, cointegration, and causality between the two variables.

The rest of the paper is organized as follows: the next section outlines the dataset and its resources, and displays the econometric methodology of Unit Root test, Cointegration analysis, and Granger Causality test. Section III provides the results. A summary and some concluding remarks are presented in section IV.

II. DATA AND METHODOLOGY

This paper starts by checking whether the variables of interest are stationary or not, in other words if these variables have unit roots or not and whether they move toward a constant mean within a fixed range or not. In order to test the nature of the relationship between real GDP (*RGDP*) and military expenditure in real prices (*RME*) for Jordan for the period 1970-2010. This paper will examine whether the above two mentioned variables are cointegrated or not using the Johansen Cointegration test. At the same time, this research will examine whether *RGDP* Granger causes *RME* or whether it is *RME* that Granger causes *RGDP*. Accordingly, this test will help to determine which variable is the dependent variable and which one is the independent one.

The study covers the period 1970 to 2010. In order to account for the effect of the peace agreement signed in 1993 between Jordan and Israel on military expenditure, the full sample was divided into two sub-samples; (1970-1992) and (1993-2010). Data on *RGDP* are obtained from the statistics and bulletins published by the Department of Statistics and the Central Bank of Jordan. However, data on military expenditure are obtained mainly from the SIPRI online database available at http://www.sipri.org. It worths to mention that both variables were deflated using GDP deflator to get values in real terms.

The following discussion highlights the theory of the methods that will be used in this paper:

Unit Root Test

The unit root test allows examining whether a time series is stationary or not. Knowing the existence of a time series' stationarity is essential for a number of reasons: firstly, non-stationarity of the regression model invalidates the standard statistical results. Secondly, one of the most important questions in cointegration is whether the disturbance term of the cointegrating vector has a unit root or not.

If the data are found to be non-stationary, the original series is differenced and then we perform the test again. This way allows identifying the order of the integrated process for each time series. To detect if the series has a unit root, the Augmented Dickey Fuller (ADF) test is used. This test helps determining whether the series is integrated of order 1, i.e. an I(1) process (non-stationary series), or integrated of order 0, i.e. an I(0) process (stationary series). ADF test is based on estimating the following regression:

$$\Delta x_t = \alpha_0 + \alpha_1 t + \beta x_{t-1} + \sum_{j=1}^{P} \delta_j \Delta x_{t-j} + \varepsilon_t \qquad (1)$$

Where α_0 is a drift; t represents a time trend, and p is a large enough lag length to ensure that ε_t is a white noise process. The null hypothesis that the variable x is non-stationary (H_0: $\beta = 0$) is rejected if β is significantly negative. If the series is not stationary, a transformation of the variables, in the form of differencing is needed to produce a stationary series on which tests like causality test can be conducted.

Cointegration Analysis

Cointegration theory has created lots of interests and uses by economists. This paper applies Johansen test for cointegration. This approach is performed in order to estimate the number of cointegrating vectors (the cointegration rank), r, which can be formally tested with the trace and the maximum-eigenvalue statistics. The trace statistic tests the null hypothesis that the number of distinct cointegration vectors is less than or equal to r against the general alternative one that cointegrating vectors equal r. The maximum eigenvalue statistic evaluates the null hypothesis of r cointegration vectors against the alternative of (r = 1).

The likelihood ratio test for the null hypothesis that there are at most r cointegrating vectors against the alternative of more that r cointegrating vectors (the trace statistic) is computed as:

$$Trace = -T \sum_{t=r+1}^{P} \ln(1-\hat{\lambda}_t)$$

Where $\hat{\lambda}_{r+1},...,\hat{\lambda}_p$ are the $p - r$ smallest estimated eigenvalues.

The likelihood ratio test for the null hypothesis of r cointegrating vectors against the alternative of r + 1 cointegrating vectors (the maximum eigenvalue statistic) is computed as:

$$\lambda_{\max} = -T \ln(1-\hat{\lambda}_{r+1})$$

Granger Causality

The purpose of this section is to test whether real GDP (*RGDP*) Granger causes military expenditure in real prices (*RME*) and to test if *RME* would Granger cause *RGDP* in the period 1970 to 2010. According to Granger (1969); a variable X is said to Granger cause a variable Y if prediction of the current value of Y is enhanced by using past values of X. However, if X is causing Y, then X contains some useful information about Y that enables to predict the value of Y efficiently. The Granger causality test is based on estimating the following two regressions:

$$\Delta Y_t = \eta_1 + \sum_{i=1}^{n} \alpha_i \Delta X_{t-i} + \sum_{j=1}^{n} \beta_j \Delta Y_{t-j} + u_{1t} \quad (3)$$

$$\Delta X_t = \eta_2 + \sum_{i=1}^{n} \lambda_i \Delta X_{t-i} + \sum_{j=1}^{n} \delta_j \Delta Y_{t-j} + u_{2t} \quad (4)$$

Where u_{1t} and u_{2t} are the disturbance terms that are not correlated with one another, η_1 and η_2 are constant terms, and α_i, β_j, λ_i, δ_j are coefficients. The reported F-statistics are the Wald statistics for the joint hypothesis. For example, testing the null hypothesis whether $\alpha_1 = \alpha_2 \dots = \alpha_n = 0$.

III. EMPIRICAL RESULTS

Unit Root Test Results

The results for the ADF test, for the first sub-sample (1970-1992), as they appear in Table 1-a and Table 1-b, show that *RGDP* and *RME* are both non stationary on their level values. This result is confirmed whether we include an intercept, or both an intercept and a time trend in the regression equations. When taking the first difference, variables appear to be stationary and the null hypothesis for unit root is rejected for all variables at the 5% significant level or less. The same result is also confirmed for the second sub period (1993-2010); the period following signing the peace agreement. In other words, both variables were found to have unit roots on the level and to be stationary on the first difference. The results, for the second sub-sample were reported in tables 2-a and 2-b.

Table 1-a
Unit Root Test Results (Intercept is Only Included)(1970-1992)

Variables	*ADF (natural logarithms of level)*		*ADF (first difference-Rates of growth)*		
Log(*RME*)	-1.299	[0]	-4.407	[0]	***
Log(*RGDP*)	-1.388	[0]	-3.142	[0]	**

Table 1-b
Unit Root Test Results (Intercept and Time Trend are Included)(1970-1992)

Variables	*ADF (natural logarithms of level)*		*ADF (first difference-Rates of growth)*		
Log(*RME*)	0. 952	[0]	-4.481	[0]	***
Log(*RGDP*)	-0.059	[3]	-1.341	[4]	

1) The ***, **, and * indicate rejection the null hypothesis of unit root at 1%, 5%, and 10% significant levels, respectively.
2) The lag length of the ADF regression is specified in brackets [ ].
3) The lag length of the ADF regression is based on the Schwarz Information Criterion (SIC) for appropriate lag length.

Table 2-a
Unit Root Test Results (Intercept is Only Included)(1993-2010)

Variables	*ADF (natural logarithms of level)*		*ADF (first difference-Rates of growth)*		
Log(*RME*)	0.323	[0]	-4.532	[0]	***
Log(*RGDP*)	2.432	[0]	-2.292	[0]	

Table 2-b
Unit Root Test Results (Intercept and Time Trend are Included)(1993-2010)

Variables	*ADF (natural logarithms of level)*		*ADF (first difference-Rates of growth)*		
Log(*RME*)	-2.428	[0]	-4.808	[0]	***
Log(*RGDP*)	-0.279	[0]	-3.792	[0]	**

1) The ***, **, and * indicate rejection the null hypothesis of unit root at 1%, 5%, and 10% significant levels, respectively.
2) The lag length of the ADF regression is specified in brackets [ ].
3) The lag length of the ADF regression is based on the Schwarz Information Criterion (SIC) for appropriate lag length.

Cointegration Test Results

This paper seeks to verify whether *RGDP* and *RME* are cointegrated or not. Johansen's approach is performed in order to estimate the cointegration relationship between the non-stationary variables using trace and maximum eigenvalue tests to examine the rank (*r*); the number of cointegrating vectors.

The test was performed on the first sub-sample and the second sub-sample, and the results reported in tables 3 and 4, respectively. The results appear along with the null hypotheses and the alternative ones.

Table 3
Johansen Cointegration Test Results between *RME* and *RGDP*
(1970-1992)

Trace test:			
Null	*Alternative*	*Trace Statistic*	*5% critical value*
r = 0	r > = 1	11.304	15.495
r <= 1	r = 2	4.829 **	3.841
Maximum Eigenvalue test:			
Null	*Alternative*	*Eigen. Statistic*	*5% critical value*
r = 0	r = 1	6.475	14.265
r = 1	r = 2	4.829 **	3.841

- The ***, ** and * indicate rejection the null hypothesis of unit root at 1%, 5% and 10% significant levels, respectively.
- Values of variables are in natural logarithms.

The results of Table 3 indicate that the null hypothesis of no cointegration is rejected by both the trace and the maximum eigenvalue tests. Thus, *RGDP* and *RME* during the first sub-sample period are cointegrated and have a long-run relationship.

Table 4
Johansen Cointegration Test Results between RME and RGDP
(1993-2010)

Trace test:			
Null	*Alternative*	*Trace Statistic*	*5% critical value*
r = 0	r > = 1	17.816 **	15.495
r <= 1	r = 2	0.386	3.841
Maximum Eigenvalue test:			
Null	*Alternative*	*Eigen. Statistic*	*5% critical value*
r = 0	r = 1	17.430 **	14.265
r = 1	r = 2	0.386	3.841

- The ***, ** and * indicate rejection the null hypothesis of unit root at 1%, 5% and 10% significant levels, respectively.- Values of variables are in natural logarithms.

Regarding the second sub-sample period, the results of the Johansen cointegration test, as reported in Table 4, indicate that the null hypothesis of no cointegration is also rejected by both the trace and the maximum eigenvalue tests. Therefore, *RGDP* and *RME* appear to be cointegrated and to have long-run relationships in both sub-sample periods.

These results allow us to use the values of both variables on their levels and to use the OLS technique when measuring the marginal effect of the independent variable on the dependent variable (Bader and Magableh, 2009). However, the Granger causality test will be used, in the case of our variables, to determine which variable is the dependent variable and which one is the independent one. For example, if the causality test shows that *RGDP* causes *RME*, then we will consider *RGDP* to be the independent variable and *RME* is the dependent variable. At the same time, if the other direction is not proven, then this paper will consider no meaning for reporting the results of regressing *RGDP* on *RME*.

Granger Causality Test Results

Tables 5 and 6 summarize the results of causality between *RGDP* and *RME*. Table 5 shows the causality result between the two variables for the first sub-sample period. The results reveal that there is a bi-directional causality between the two variables at a lag length of two years period. This result explains the growth in *RGDP* helped to encourage larger military expenditure in the period (1970-1992). At the same time, we find from the results that military expenditure had a direct role in affecting *RGDP*.

Table 5
Granger Causality Results (1970-1992)

The null hypothesis	*The result*	*p-value for the significant level*
RGDP does not Granger Cause *RME*	Cannot be rejected	1%
RME does not Granger Cause *RGDP*	Cannot be rejected	5%

*: The lag length used in the causality equation is 2. This lag length is determined based on the Schwarz Information Criterion (SIC) for appropriate lag length.

Regarding the second period, we find from Table 6 that the direction of causality runs only from *RGDP* to *RME*. This result explains that military expenditure is still a function of the country's domestic income. However, since the peace agreement was signed in 1993, military expenditure witnessed stable but a gradual decline as percent of GDP. This proves that its effect on *RGDP* wasn't proven in the second period. A summary of the directions of causality for both sub-samples are explained in Table 7.

Table 6
Granger Causality Results (1993-2010)

The null hypothesis	*The result*	*p-value for the significant level*
RGDP does not Granger Cause RME	Rejected	1%
RME does not Granger Cause RGDP	Cannot be rejected	-

*: The lag length used in the causality equation is 2. This lag length is determined based on the Schwarz Information Criterion (SIC) for appropriate lag length.

Table 7
Summary of Granger Causality Results (Directions of Causality)

Period	*Variable 1*	*directions of causality*	*Variable 2*
(1970-1992)	RGDP	↔	RME
(1992-2010)	RGDP	→	RME

*: Arrows indicate the direction of causality between the variables.

Accordingly, this research runs three simple regression models. Two of them are for the first period since the causality was proven in both directions between the two variables, and third regression is for the second sub-sample period since the causality direction was found from *RGDP* to *RME*. Therefore, *RME* was presented as a dependent and an independent variable in the two regressions for the first sub-sample period. Regarding the second sub-sample, *RME* was presented only as a dependent variable. The results for these three regressions appear in Table 8.

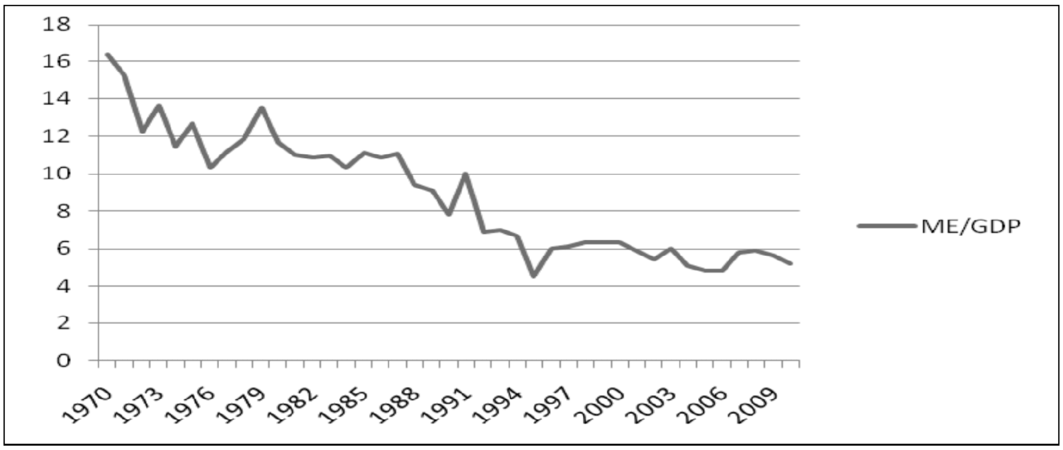
Table 8
The Regression Equations' Estimates According to the Causality Test Results

Period	*Dependent variable*	*Independent variable*	*Coefficient estimates*	*t-Statistic*	*p-value for the significant level*
1970-1992	*log*(*RME*)	*log*(*RGDP*)	0.610	6.784	1%
1970-1992	*log*(*RGDP*)	*log*(*RME*)	1.126	6.784	1%
1993-2010	*log*(*RME*)	*log*(*RGDP*)	0.831	9.309	1%

The regression results show that the elasticity for the effect of *RGDP* on *RME* on both periods is positive and statistically significant at 1% level. The same result was found for the elasticity for the effect of *RME* on *RGDP* for the first period. This result is consistent with the high percentage of military expenditure to GDP which reached 16% at the beginning of the first period compared to only 5% at the end of the second period (Figure 1).

The regression results are consistent with the finding of the study of Al-Idwan (1999) which aimed investigating the role of the Jordanian military corporation for the period (1975-1995). That research concluded that military expenditure affects economic development (represented by GDP) positively. However, it affects investment negatively.

Figure 1: Military Expenditure as Per cent of GDP (1970-2010)



Source: SIPRI database (*http:// sipri.org*).

On the other hand, Asfour (1988) found negative effect of military expenditure on economic growth for the period (1968-1989). This study was performed on selected confrontation countries (Jordan, Syria, Egypt, and Israel). The negative effect of military expenditure on economic growth was found for all countries except Egypt. However, different scenarios were introduced to the model. These scenarios based on the assumption of peace agreement. When we insert that assumption to the model, this will convert the results.

IV. CONCLUSION

The military expenditure in Jordan was always, compared to other countries, among the highest in the world. Some argue that this kind of expenditure has a negative impact on the economy while others discuss the positive effect would appear for such an expenditure. This paper investigated the relationship between the two variables for two sub-samples; (1970-1992) and (1993-2010). The results show that the two variables are cointegrated and have a long-run relationship. In addition, they show that during the two sub-samples, the effect of economic growth on military expenditure is statistically positive. On the other hand, and for the first period, the effect of military expenditure on economic growth was found statically significant. These results could be attributed, partly, to the fact that military expenditure provides for the cases, of Jordan safe environment for investors and for the production process.

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