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Growth: Evidence from Jordan

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**Military Spending and Economic Growth:  
Evidence from Jordan**

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## **ABSTRACT**

The purpose of this research is to investigate the causal relation between military spending and economic growth in one of the MENA countries, Jordan using annual data over the period 1988-2007. The methodology used in this study follows Toda and Yamamoto (1995) procedure in order to test the Granger causality between economic growth and military spending. The empirical results reveal that military spending Granger causes economic growth in Jordan. Thus, these findings lend support to the hypothesis that military spending positively affect economic growth through increasing aggregate demand.

***Keywords:*** Military spending; Economic growth; Jordan; Causality

***JEL Codes:*** C22, H56.

## **INTRODUCTION**

Literature review shows that the debate over the relationship between defense spending and economic growth goes back to Benoit (1973; 1978) study where he examined such relation for forty-four developing countries and found a positive impact of defense spending on economic growth. The literature also shows that there are mixing results over the relationship between military spending and economic growth, (see for example, among others, Chowdhury (1991); Chen (1993); Kusi (1994); Masih et. al (1997); Dunne and Vougas (1999); Dakurah et. al (2001); Dunne et al (2001); Wolde-Rufael (2001); Galvin (2003); Hassan et.al. (2003); Dritsakis (2004); Kollias et al (2004); and Narayan and Singh (2007)). It also shows that less work has been done on the developing countries, particularly those in the Middle East and North Africa (See for example, Asseery (1996); and AL-Yousif (2002)). As the statistics show, one of the problems that those countries have in common is that they have been suffering from increasing defense spending as a percentage of GDP over the past years.

The purpose of this research is to investigate the direction of the causal relationship between military spending and economic growth for Jordan as one of the Middle Eastern & North African Countries (MENA) over the period 1988 to 2007 using a newly developed procedure of Granger non-causality by Toda and Yamamoto (1995). In light of recent budgetary problems, our investigation should help identify structural adjustments and proper reforms to cope more efficiently with the current challenges facing the country.

## **DATA AND METHODOLOGY**

To investigate the causal link between military spending and economic growth in the case of Jordan, the paper will use annual data for the period 1988-2007 on real gross domestic product

(RGDP), and military spending: the ratio of military spending to GDP (Milex/GDP). Data on real GDP and military spending as a percentage of GDP are extracted from the World Bank, World Development Indicators.

The methodology used in this study follows Toda and Yamamoto (1995) procedure in order to test the Granger causality between economic growth and military spending. As an advantage of this method, Toda and Yamamoto (1995) stated that “Our method is applicable whether the VAR’s may be stationery (around a deterministic trend), integrated of arbitrary order, or cointegrated of an arbitrary order. Consequently, one can test linear or nonlinear restrictions on the coefficients by estimating a levels VAR and applying the Wald criterion, paying little attention to the integration and cointegration properties of the time series data in hand (Toda and Yamamoto (1995), p.227)”. This procedure involves two steps. First, to determine the lag length ( $k$ ) of the VAR model and augment that with the maximum order of integration ( $d_{max}$ ) of the variables used in the model. We used both Akaike Information Criterion (AIC) and Schwarz criterion (SC) to determine the optimal lag structure ( $k$ ) of the VAR model. We also used the Augmented Dickey-Fuller (ADF) test to determine the order of integration ( $d_{max}$ ) of the variables used in the model. Second, to test for Granger causality by using the modified Wald (MWALD) test in order to test the coefficients of the first  $k$  coefficients of the VAR ( $k+d_{max}$ ). This test, according to this procedure of causality developed by Toda and Yamamoto (1995), has an asymptotic Chi-square distribution when a VAR ( $k+d_{max}$ ) is estimated (given that  $d_{max}$  is the maximum order of integration that is suspected to occur in the system). Zapata and Rambaldi (1997) argued that the MWALD test requires no priori knowledge of cointegration or no cointegration of the system and it can be applied regardless of the order of integration (i.e.,  $I(0)$ ,  $I(1)$ , or  $I(2)$ ) of the series as long as  $k \geq 1 = d$ .

Here, let  $Y_t$  be the natural logarithm of real GDP and  $M_t$  be the natural logarithm of the ratio of military spending to GDP. Rambaldi and Doran (1996) have explained that the MWALD test used for testing Granger non-causality can be more efficient when using a Seemingly Unrelated Regression (SUR) method. Thus based on Toda and Yamamoto (1995) procedure, the Granger non-causality between economic growth and military spending can be tested using the following VAR system given in equations (1-2):

$$Y_t = \alpha_1 + \sum_{i=1}^{k+dmax} \alpha_{2i} Y_{t-i} + \sum_{i=1}^{k+dmax} \alpha_{3i} M_{t-i} + \varepsilon_{1t} \dots \dots \dots (1)$$

$$M_t = \beta_1 + \sum_{i=1}^{k+dmax} \beta_{2i} Y_{t-i} + \sum_{i=1}^{k+dmax} \beta_{3i} M_{t-i} + \varepsilon_{2t} \dots \dots \dots (2)$$

For example, when using Toda and Yamamoto (1995) approach to test the Granger non-causality from  $M$  to  $Y$ , we need to test the  $H_0: \alpha_{3i} = 0$  for all  $i \leq k$  in equation 1 and causality from  $M$  to  $Y$  can be established through rejecting the null hypothesis stated above. A similar procedure can be used to test the causality from  $Y$  to  $M$ , i.e., to test  $H_0: \beta_{2i} = 0$  for all  $i \leq k$  in equation 2 and causality from  $Y$  to  $M$  can be established if  $\beta_{2i} \neq 0$  for all  $i \leq k$ .

### EMPIRICAL RESULTS

Following Toda and Yamamoto (1995) method, before testing for the non-causality between economic growth and military spending, we need to establish the lag length ( $k$ ) of the VAR model and the order of integration ( $dmax$ ) of the variables used in the model. We used Schwarz Information Criterion (SC) to establish the lag length ( $k$ ) of the VAR model. According to the SC, the optimal lag length ( $k$ ) for the VAR was established at 1, i.e.  $k=1$ . For the order of

integration (dmax) of the variables used, the ADF test was used. The ADF results given in Table 1 show that all the variables are integrated of order of one (i.e.,  $I(1)$ ).

**Table 1**  
**ADF Unit Root Test**  
(The null hypothesis: Y and M have a unit root)

Country/Period	Variables	Level	First Difference
Jordan (1988-2007)	Y	-1.194 (3)	-5.949*** (0)
	M	-2.582 (0)	-5.614*** (0)

Notes: Y and M as defined above. Optimal lags according to Schwarz Information Criterion (SIC) are given in parenthesis.

\*\*\*, \*\*, and \* indicate significance levels of the 1%, 5%, and 10%, respectively.

Table 2 reports Chi-square statistics and the p-values for the purpose of testing the Granger-no causality using Toda-Yamamoto method. The results show that the null hypothesis of Granger-no-causality from military spending to economic growth can be rejected lending support to a unidirectional Granger causality from military spending to economic growth. However, the null hypothesis of Granger-no-causality from economic growth to military spending cannot be rejected.

**Table 2**  
**Granger Causality Test Results Based on Toda-Yamamoto Method**

Ho:	Lag Length/Var order	MWald Statistics(d.o.f.)	p-value
$M \nrightarrow Y$	1/2	17.97 (1)	0.0000***
$Y \nrightarrow M$	1/2	1.41 (1)	0.2356

Notes: Y and M as defined above. Optimal lags are determined according to Schwarz Information Criterion (SIC). Degrees of freedom (d.o.f.) are given in parentheses. \*\*\*, \*\*, and \* indicate rejection of the null hypothesis at significance levels of the 1%, 5%, and 10%, respectively.

## CONCLUSION

Using time series data, this study empirically examines the causal relationship between military spending and economic growth in Jordan using the Granger-no-causality method developed by Toda and Yamamoto (1995). The empirical results give no support to the hypothesis that economic growth causes (in the Granger sense) military spending. It was military spending that Granger causes economic growth. The results support the aggregate demand hypothesis for Jordan that military spending promotes growth through increasing the aggregate demand. This suggests that the results lend support to the Keynesian model that military spending affects economic growth in a positive way. The results should, however, be interpreted with cautious due to omission of some variables. It should also be noted that the results may be sensitive to sample size and the choice of the measures that are used for variables used in the study.

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