THE RELATIONSHIP BETWEEN DEFENSE SPENDING AND MACROECONOMIC VARIABLES

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Abstract

In this study, the rate of Defense Spendings in the GDP, and the growth rate of GDP, and the portion of current accounts in GDP and Annual Inflation Rate are examined with getting the annual data between the 1980-2006 years, and using VAR model for Egypt, Israel, Jordan, and Turkey. In course of this examination, the results of Granger Casuality and Impulse-Response Functions and Variance Decomposition were used.

The focus point of our study is for the reason of defense spendings are effective on macroeconomic variables that while Egypt and Israel has uni-directional Granger causality from the defense spendings to inflation, for other countries there couldn`t be found any Granger causality. On the other hand when we look at the impulse response functions, in case of a shock of defense spending as a percentage of GNP, while the rate of Israel`s inflation and Current account as a percentage of GNP are affected by the pozitive direction , Turkey`s growth rate is affected negatively. For Egypt and Jordan, the significiant effects on defense spendings according to macroeconomic variables couldn`t be found any significiant effects.

Key Words: *Defense Expenditure; Macroeconomics; VAR*

JEL Classification: C22, C32, E10

1. INTRODUCTION

For Turkey, it is inevitable to make high defense expenses, because firstly, Turkey's location is unsteady doe to the problems of its border neighbors and, secondly Turkey unfortunately has difficulties in itself such as terror. As examples to these problems, there have disagreements in Syria, Iran and Iraq; recently there have been matters in Cyprus and Greece. As the dangers in Turkey itself, we can say the fight against a terror organization called PKK that has been still active in the east and southeast parts of Turkey since 1970. This organization is based on a kind of ethnic discrimination. In addition, it can also be the reason of the increase in the defense expenses that Turkey wants to take over a leader role in Mediterranean and still developing Middle East.

Because of the fact that Turkey wants to be an effective power in Middle East and Mediterranean Region, in the research, Israel, Egypt and Jordan that are both the countries of Middle East and Mediterranean will be examined. There are important reasons for these countries to be chosen. One is there are high defense expenses in that region. Second is, these countries take attention as

politically and economically. And finally, the data that will be used in the research could be taken just for these principles.

In the research the relation between macro-economic variations with its main lines and the portion of defense expenses in the Gross National Product (GNP) will be designated around the VAR model. And these effects will be commented with the help of action-reaction graphics, Granger causality test and variance decomposition analysis. As macro-economic variations; inflation, GNP growth rate and the rate of current transactions on GNP will be used. And as variables and data range; the annual data between the years of 1980 and 2006 will be used.

2. THE LITERATURE

Due to the fact that the investigation about the relation between the defense expenses and economic growth was firstly published in the book of Benoit 1973, the main interest started with the publication of an article in 1978 from that book. In the article published in 1973, Benoit examined 44 underdeveloped countries in between the years of 1950-1965. If we ignore the countries Burma, Israel and South Vietnam, he found that for the other 41 countries the relation between defense expenses and economic growth was positive on the contrary to his expectations and this started arguments as well.

In his research, Lim (1983) criticized Benoit's (1973) research on two factors. First one was the equation used was not coherent by a hypothesis proved. Second was, the measurement that was used for some variations wasn't wanted anymore. At the end of Lim's research, by using a prediction equation that was created in a specific conceptual frame, he pointed that he got the results that show the defense expenses were harmful to growth. But he added that there were important differences such as the harmful effects seen in Africa and West Europe weren't seen same in Asia, Middle East and South Europe.

Lots of researches followed these researches. Such as Lim (1983); Biswas and Ram (1986); Değer (1986); Ateşoğlu and Mueller (1990); Chowdhurry (1991). But they could not agree about the direction, impact and degree of the relation between military expenses and growth.

Even if lots of academic researches and arguments dealt with the military spending and growth, Kinsella's (1990) article, different from others, dealt also with the economic magnitudes except only the growth.

In this study, Kinsella examined the impacts of the defense expenses in the USA in 1939-1989 on macro-economic magnitudes. Kinsella drew a conclusion that there was no relation between the defense expenses and the price levels, the rate of unemployment, the rate of interest. In addition, Kinsella fixed that there wasn't any relation between the defense expenses and total output as well.

On the other hand, Beak (1991) developed Kinsella's (1990) studies by using structural VAR model. In his article, Baek (1991) used Kinsella's data and found that after the World War II, for the USA the price level had a noteworthy impact on the defense expenses in the years of 1946-1989.

Payne and Ross (1992) again developed Kinsella's (1990) and Baek's (1991) studies by using quarter-cycle data in the years of 1960 and 1988 for the USA. And they found the results parallel to Kinsella's findings. However, Payne and Ross (1992), unlike Kinsella, used limited VAR model instead of structural VAR model. As a result of this, they pointed that there was no relation between the defense expenses and economic performance in the USA in 19981:1, 1988:1.

Kollias and the others (2004) examined the relation between the defense expenses and economic growth for 15 European Union member countries, between the years of 1961 and 2000 by using co integration and causality tests. They got some results after that study and in it, depending upon the error correction models, causality tests ended up for Austria, Denmark and Luxembourg as bidirectional. For France, Finland and Portugal, there has been no random situation. As for Germany, Italy, Holland, Spain, Sweden and United Kingdom, it was pointed that there has been causality from growth to the defense expenses. In addition, it was found that there has been no co integration for Belgium, Greece and Iceland. Furthermore, for Belgium and Iceland there wasn't any causality, for Greece there was a unidirectional causality from growth to the defense expenses.

In their articles, Dakura and the others (2001) examined the relation between the defense expenses and the economic growth for 62 developed countries, with the data of 1975-1995 by using Granger causality test. They found, for 23 countries, there was a unidirectional causality from the defense expenses to the economic growth and vice versa. However they found bidirectional causality for 7 countries. Not only for 18 countries in the same features, there didn't arise any causality; but also for 14 countries in the different features there didn't arise any causality as well.

In his article, Dritsakis (2004) investigated the relation between the defense expenses and the economic growth between the years of 1960 and 2001 in Turkey and Greece, by using Johansen co integration test and vector error correction models (VECM). And as a conclusion, he couldn't find and co integration between the defense expenses and the economic growth. Nevertheless, for both countries (Turkey and Greece), he pointed that as a result of Granger causality test, there arose unidirectional causality from the growth to the defense expenses.

In his study in which he investigated the example of Turkey, Özsoy (2008) examined in a good detail, the relation between the defense expenses with the portion of defense expenses in GNP, the portion of government budget in GNP, the portion of the total budget deficit in GNP, growth rate of GNP, inflation rate, the portion of the government budget deficits in GNP by using VAR model and in addition to it Granger causality test. In consequence of the Granger causality test, he found unidirectional causality from the portion of defense expenses in GNP to the annual growth rate of GNP. Additionally, there didn't arise any causality between the portion of defense expenses in GNP and other variables.

3. DATA AND EMPIRICAL MODEL

3.1 Data

In this work, the original annual data between 1980 and 2006 years is going to be used. The variables that we will use in empirical model; is going to be Defense spending as a percentage of GNP, growth rate of GNP, inflation rate and the current accounts rate to GNP. All of these variables are gained separately for Turkey, Egypt, Jordan, and Israel. All of them is going to be used in this empirical work, data on defense spending was taken from SIPRI (Stockholm International Peace Research Institute) yearbooks and databas, since it is considered the most reliable source. As for that source of macroeconomics variables such as the growth rate of GNP which will be used in the model, inflation rate and the rate of current accounts to GNP, is International Monetary Fund (IMF). 2008 data statistics which are used in graphics drawing are estimated amount made by IMF.

Data sets and reductions used for countries are showned next.

DS	: Defense spending as a percentage of GNP	TR	:Turkey
GR	: GNP growth rate	ISR	:Israel
INF	: Inflation rate	EGY	:Egypt
CA	: Current account as a percentage of GNP	JRD	:Jordan

Table 1: Summary Statistics of Selected Macroeconomic Variables

Country	GR	INF	CA	DS
Egypt	[4.79](2.11)	[11.67](6.85)	[-0.56](3.63)	[4.13](1.82)
Israel	[4.29](2.44)	[49.17](91.3)	[-1.32](3.48)	[12.15](5.62)
Jordan	[4.45](5.10)	[5.55](5.60)	[-4.57](8.18)	[10.27](2.30)
Turkey	[4.40](4.18)	[52.03](28.9)	[-1.780](2.16)	[4.1](0.75)

[] Mean
( ) Standard deviation.

Summary statistics for all countries are presented in Table 1. While Israel and Turkey approximately have the same sizes for the major macroeconomic variables, when we look at the rate of defence spendings according to GNP, we can see Israel spends nearly 3 times much more than Turkey. The most important reason of this is Israel`s current situation.

3.2 The VAR Model and The Estimation Procedure

$$(DS)_t = a_1 + \sum_{i=1}^{k} b_{1i}(DS)_{t-i} + \sum_{i=1}^{k} g_{1i}(INF)_{t-i} + \sum_{i=1}^{k} q_{1i}(CA)_{t-i} + \sum_{i=1}^{k} y_{1i}(GR)_{t-i} + u_{1t} \quad (1)$$

$$(INF)_t = a_2 + \sum_{i=1}^{k} b_{2i}(DS)_{t-i} + \sum_{i=1}^{k} g_{2i}(INF)_{t-i} + \sum_{i=1}^{k} q_{2i}(CA)_{t-i} + \sum_{i=1}^{k} y_{2i}(GR)_{t-i} + u_{2t} \quad (2)$$

$$(CA)_t = a_3 + \sum_{i=1}^{k} b_{3i}(DS)_{t-i} + \sum_{i=1}^{k} g_{3i}(INF)_{t-i} + \sum_{i=1}^{k} q_{3i}(CA)_{t-i} + \sum_{i=1}^{k} y_{3i}(GR)_{t-i} + u_{3t} \quad (3)$$

$$(GR)_t = a_4 + \sum_{i=1}^{k} b_{4i}(DS)_{t-i} + \sum_{i=1}^{k} g_{4i}(INF)_{t-i} + \sum_{i=1}^{k} q_{4i}(CA)_{t-i} + \sum_{i=1}^{k} y_{4i}(GR)_{t-i} + u_{4t} \quad (4)$$

Equations (1)–(4) represent a VAR model.The procedure starts with the test of determining the order of integration of each of the seriescovered in this study employing the Augmented Dickey–Fuller (ADF) (Dickey and Fuller,1979) unit root test. The unit root test is crucial in determining the existence of stationarity of time-series data, because if the stationarity of the time-series is violated, this could lead to a spurious regression (Granger and Newbold, 1974) and thus the estimated regressors could be invalid for interpretations. In general, a non-stationary time series is said to be integrated of Non-stationarity of a variable may simply be tested by using Augmented Dickey-Fuller test (ADF) (Dickey and Fuller, 1979; 1981). In this test, presence of unit root should be tested at level form first. If ADF test finds the variable non-stationary, the same test should be performed for the first difference of a variable. If first difference of a variable is also found non-stationary, the same test should be applied for the second difference of the variable. This process is repeated up to the rejection of the unit root hypothesis The null and alternative hypotheses are: Ho: $\alpha 1=0$, H1:$\alpha 1 <0$.

ADF test is simply significance test for the coefficient of Xt-1, $\alpha 1$, in the regression. T-value of Xt-1 is used in this test procedure but critical values are different. Under the $\alpha 1 \geq 0$ condition Xt is non-stationary, so even asymptotically its distribution diverge form the standard students t-distribution. Since, these statistics do not have the standard-distribution they are referred as τ

statistics (Davidson and MacKinnon, 1993). Critical values presented by MacKinnon (1991) are the appropriate one. Null hypothesis $\alpha 1=0$ is implying that there is a unit root in the data generating mechanism of a variable. Alternative hypothesis is that $\alpha 1 <0$ significantly different from zero. If calculated t-value of $\alpha 1$ is below the critical value than Xt is stationary. If not Xt is non-stationary.

ADF test is the OLS regression of the model:

$$\Delta X_t = a_0 + a_1 Trend + a_2 X_{t-1} + \sum_{i=1}^{n} q_i \Delta X_{t-i} + e_t \quad (5)$$

The model estimated above is used in testing the presence of unit root at the level form of the variable. In the equation, Δ is the first difference operator, Xt is the variable to be tested for unit root intime t, ε is the stationary random error, t is time, and n is the lag length. The appropriate lag length for the model was determined on the basis of Akaike information criterion (AIC) and Hannan–Quinn information criterion (HQ) likelihood ratio (LR) and final prediction eror(FPE). All lag order selection criteria suggest 2 lags for Egypt and Israel, 1 lag for Turkey and Jordan. The unit root test results are presented in Table 3.In general, if a nonstationary time series has to be differenced d times to make it stationary, that time series is said to be integrated of order d. A time series Yt integrated of order is denoted as $Yt \sim I(d)$.

3.2.1 Diagnostic Tests on Residuals

Results of diagnostic tests indicate that the models do not have problems of serial correlation and heteroscedasticity.The inverse roots graph proves the stability of the system. Therefore, the systems are free from problems and can be used to draw conclusions. (Diagnostic tests results are available upon request).

Table 2: The Results of ADF Tests for Stationarity

Variables	I(0)	I(1)	Variables	I(0)	I(1)
Dsegy	-1.57	-3.15***	**Dsisr**	-1.78	-5.88*
Gregy	-1.94	-3.97*	**Grisr**	-4.18*	-4.42*
Infegy	-2.96	-5.61*	**Infisr**	-2.53	-3.23***
Caegy	-2.67	-4.12*	**Caisr**	-1.83	-5.12*
Dsjrd	-4.65*	-5.01*	**Dstr**	-2.48	-4.13**
Grjrd	-4.46*	-4.58*	**Grtr**	-5.95*	-6.29*
Infjrd	-4.36*	-4.35*	**Inftr**	-3.36***	-4.35*
Cajrd	-3.01	-4.94*	**Catr**	-3.19***	-6.14*

Note: (*,**,***) indicates significance at 1%,5%,10%level. Asymptotic critical values reference: Davidson and MacKinnon (1993) −3.96, −3.41, −3.13 for 1%, 5%, 10% significant levels respectively.

3.2.2 Granger Causality

Egypt Granger Causality Analyse results indicate that there is an unidirectional causality from DSEGY to INFEGY and from CAEGY to INFEGY. Israel Granger Causality Analyse results indicate that there is an bidirectional causality between CAISR and INFISR,and unidirectional causality from DSISR to INFSR. Hovewer made for Jordan Granger Causality Analyse results

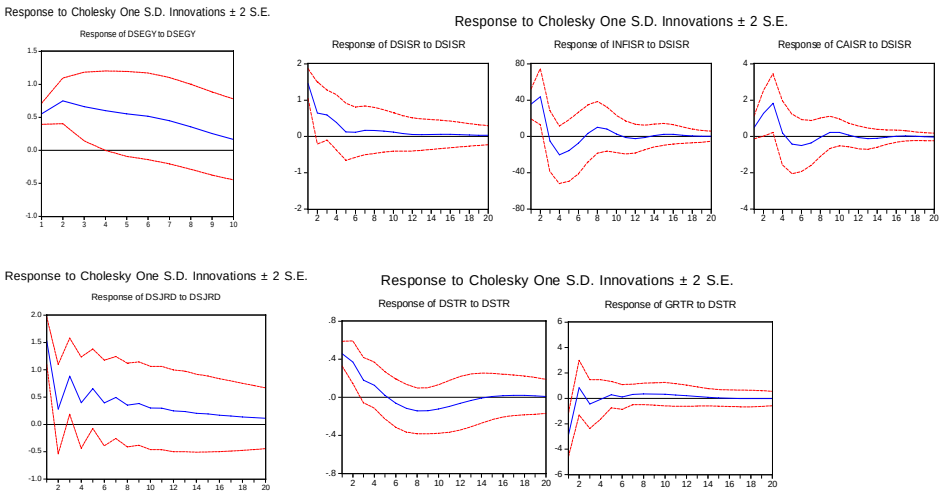
indicate only unidirectional causality from INFJRD to CAJRD. For Turkey Analyse couldn`t be found any Granger Causality between variables.

3.2.3 Impulse Response Analysis

In impulse response analysis, the ordering of the variables is important to analyse the effect of the shocks. The residual correlation matrixes suggest the correct ordering based on the magnitude of the correlation matrixes; however, low correlation in our estimation results indicate that the different ordering of the variable would not produce significantly different results. IRF figures are presented respectively for Egypt, Jordan, Israel Turkey in Figure 2.

When we search Impulse- Response Figures we are focus on effects of DS shock on macro economic variables.In a possible DSEGY shock , DSEGY`s reaction is positive and significiant in the 1st and 3rd periods but its reaction is less than first period. In a DSISR shock, DSISR`s reaction is significiant and positive in the first and third periods but declining, however INFISR`s reaction is again in the first 2 periods significiant, positive and increasing, and its CAISR reaction to the same shock is significiant and positive in only 2 periods.

Figure 2: Impulse Response Functions for Egypt, Israel, Jordan and Turkey



In a possible shock in DSJRD, DSJRD`s reaction is significiant and positive in the 1st and 3rd periods, on the other hand while its affect is less than 1st period. Finally, a possible shock happens in DSTR, that will affect DSTR positive in the first 3 periods, nevertheless this effect will decrease by degrees. And the same shock affects GRTR only in the first period and it is negative. All of the shocks also becomes stable after 20 periods.

3.2.4 Variance Decompositions

Variance decompositions offer a slightly different method of examining VAR dynamics. They give the proportion of the movements in the dependent variables that are due to their "own" shocks, versus shocks to the other variables. This is done by determining how much of the *s*-step ahead forecast error variance for each variable is explained innovations to each explanatory

variable (s = 1,2, …).The variance decomposition gives information about the relative importance of each shock to the variables in the VAR. (Brooks, 2002: 300-301).

Table 5: Variance Decompositions for Egypt, Jordan, Israel and Turkey

	DSEGY				**GREGY**				**INFEGY**				**CAEGY**			
P	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**
1	100	0	0	0	14	86	0	0	5	12	83	0	1	11	0	88
2	96	2	1	1	11	81	7	1	16	15	68	1	1	28	2	69
3	92	4	1	2	18	65	4	13	16	16	49	19	8	36	4	52
	DSJRD				**GRJRD**				**INFJRD**				**CAJRD**			
P	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**
1	100	0	0	0	7	93	0	0	1	33	66	0	0	27	0	73
2	92	1	1	7	10	78	10	2	12	18	66	4	2	21	12	65
3	90	1	1	8	22	65	10	3	15	17	63	5	5	17	27	51
	DSISR				**GRISR**				**INFISR**				**CAISR**			
P	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**
1	100	0	0	0	0	100	0	0	54	0	46	0	9	6	1	84
2	98	2	0	0	0	98	0	2	69	1	26	4	23	10	24	43
3	93	4	0	3	1	97	0	2	59	5	25	11	39	13	19	29
	DSTR				**GRTR**				**INFTR**				**CATR**			
P	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**	**Ds**	**Gr**	**Inf**	**Ca**
1	100	0	0	0	37	63	0	0	0	5	95	0	8	30	15	47
2	100	0	0	0	35	65	1	1	2	5	91	2	12	24	24	40
3	92	4	4	1	34	62	4	1	4	9	86	1	11	21	34	34

In the light of Egypt`s variance decomposition`s statistics, it is seen that in a possible shock in GREGY, it is seen that 18% of it is explained by DSEGY in the 3th period. In this way, while DSEGY`s explanation rate of INFEGY is 16% in the 2nd period.When we look at the results of variance decomposition for Jordan, we see that DSJRD explains GRJRD at the rate of 22% in the 3rd period, and explains INFJRD at the rate of 15% also in the 3rd period.According to results of variance decomposition for Israel, DSISR`s explanation for a INFISR shock is 69% in the 2nd period, and for CAISR is 39% in the 3rd period.When we look at the statistics for variance decomposition of Turkey, in process of a shock abouth growth rate, GRTR`s explanation rate for itself in the first period is 63%, and DSTR`s explanation rate of this shock is 36% in the first period. In fact, the 12 percentage rate of a shock in CATR is explained by DSTR from 2nd period on.

4. CONCLUSIONS

In this study, the rate of Defense Spendings in the GDP, and the growth rate of GDP, and the portion of current accounts in GDP and Annual Inflation Rate are examined with getting the annual data between the 1980-2006 years, and using VAR model for Egypt, Israel, Jordan, and Turkey. In course of this examination, the results of Granger Casuality and Impulse-Response Functions and variance decomposition were used.

The focus point of our study is for the reason of defense spendings are effective on macroeconomic variables that while Egypt and Israel has uni-directional Granger causality from the defense spendings to inflation, for other countries there couldn`t be found any Granger causality. On the other hand when we look at the impulse response functions, in case of a shock of defense spending as a percentage of GNP, while the rate of Israel`s inflation and Current account as a percentage of GNP are affected by the pozitive direction , Turkey`s growth rate is affected negatively. For Egypt and Jordan, the significiant effects on defense spendings according to macroeconomic variables couldn`t be found any significiant effects.

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