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DEFENCE EXPENDITURE AND ECONOMIC GROWTH IN TURKEY AND GREECE: A COINTEGRATION ANALYSIS

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ÖZET

Bu çalışma Türkiye ve Yunanistan'daki savunma harcamaları ile ekonomik gelişme arasındaki ilişkiyi incelemektedir. Türkiye ve Yunanistan NATO ülkeleri içinde savunma yükü en ağır olan iki ülkedir. Bununla birlikte bu ampirik çalışmanın sonuçları göstermektedir ki, Türkiye ve Yunanistan'ın savunma harcamaları, ekonomik büyümelerine zararlı görünmemektedir. Aksine ekonomik büyümelerine yardım etmektedir.

ABSTRACT

The paper explores the relationship between defence expenditure and economic growth in the case of Turkey and Greece using error correction mechanism. Turkey's and Greece's military burden is the highest in NATO. However, the empirical findings of this study showed that their high defence burden does not seem to harm, rather it helps their economic growth both in the long run and short run.

1. Introduction

Defence expenditure is important in the government budgets of all countries and is a major user of scarce resources. Although defence expenditure has been decreasing in recent years, most parts of the world still have high defence expenditures implying the sacrifice of alternative civil expenditures. Total world defence expenditure was estimated at US $864 billion in 1995. On average, 2.8 per cent of GNP and over 13 per cent of all central government expenditure are spent on defence in the developing world[1] and these are countries facing major problems of poverty, starvation, ill-health, lack of education and poor housing. Moreover, some countries continue to spend a huge amount on defence each year, apparently for security considerations. Turkey and Greece are examples of such countries. Their military burdens remain the highest in NATO, namely, 5.74% of GDP for Greece and 4.42% for

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1 US ACDA (1996) Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, US Government Printing Office, Washington DC. 3-6

Turkey compared to NATO's average of 3.5% for the last decade[2]. For these reasons defence expenditure and its economic effects needed to be carefully and critically evaluated.

An important and controversial area for defence economists is the relationship between defence spending and economic growth. Until 1973, it is difficult to find any study on defence-growth relationships. The most important contribution was made by Benoit[3]. After Benoit's work, many studies were carried out in the literature. However, there is no consensus to whether defence spending has a negative effect or a positive effect on a nations' economic growth.

In economic aspects, Turkey is the poorest member of the NATO, while Greek economy is one of the weakest in the European Union[4] . Turkey and Greece are similar in many aspects. They started to produce their own military equipment after 1980s. Turkey has the second largest of troops in NATO and Greek armed forces are also very high when compared with its population. Turkey and Greece are major arms importing countries that Turkey ranked 3 and Greece ranked 9 between 1993-1997[5].

Turkish and Greek defence-growth relationships has been analysed by number of researchers[6] and the findings are inconclusive. This paper attempts to provide further evidence on the defence-growth trade-off using Engle-Granger error correction mechanism. The study covers the period between 1955 and 1994 for Turkey and 1958-1994 for Greece. Unlike previous studies, long run and short run dynamics of defence-growth relationships for Greece and Turkey analyse.

The rest of paper is organised as follows. In the next section, the methodology is briefly explained. Section 3 is devoted to empirical analysis under two sub-section for Turkey and Greece and section 4 concludes the paper.

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2 J.P. Dunne, E. Nikolaidou, and D. Vougas, (1998) "Defence Spending and Economic Growth: A Causal Analysis for Greece and Turkey," paper presented at the ERC/METU International conference on Economics 9-12 September 1998, Ankara, Turkey 4-16

3 E. Benoit (1973) Defence and Economic Growth in Developing Countries, Heath: Boston D.C 26-28

4 C. Kollias, C. (1996) "The Greek-Turkish Conflict and Greek Military Expenditure 1960-92", Journal of Peace Research, 33 (2), 217-228

5 S. Sezgin, and K. Hartley (2001) "Introduction" Defence and Peace Economics, Special Issue on Economic Aspects of Defence in Turkey and Greece, (forthcoming)

6 For extensive literature review see Brauer 1999

2. The Methodology

This study is focusing on the relationship between the defence spending and economic growth in Turkey and the studies further developed by Sezgin. Sezgin (2001)[7] investigated Turkish defence-growth relation using Deger type multi-equation model and the same methodology has been employed to Greece in Sezgin (2000)[8]. They both found a positive impact of defence spending on economic growth. Although these two studies useful contributions to defence-growth trade-offs, they do not consider cointegration methodology hence long run and short run dynamics. In this study, the reliability and robustness of these two studies are is tested in using error correction mechanism. In the defence-growth literature, a few studies compared demand and supply factors of economic growth. They all estimates very similar multi-equation models. The studies by Sezgin[9] and Dunne and Nikolaidou[10] has estimated defence growth relationships for Turkey and Greece, respectively sin Deger type model[11]. Although they consider endogenity of the variables then used simultaneous equation method (SEM), they did not give much attention on the stationarity of the variables. In this study, the growth equation used in Deger model is re-estimated using error correction mechanism. The extracted growth equation from the Deger model is:

$$Y = a_0 + a_1 S + a_2 B + a_3 M + a_4 L + \gamma_t \qquad (1)$$

Where Y is real gross GDP, S is gross domestic savings, B is balance of trade, M is real military expenditure, L is labour force. Given these, it is predicted that S and L are positively correlated to economic growth, which is standard from any basic growth theoretic model[12]. The negative sign for the coefficient of balance of trade imply the net capital inflow from abroad which stimulate economic growth. Defence spending variable assumed to have direct

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7 S. Sezgin. (2000) "The Defense-Growth Relation: Evidence from Greece," in Jurgen Brauer and Keith Hartley (eds.) The Economics of Regional Security: NATO, the Mediterranean and South Africa, Amsterdam, Harwood Academic Publishers 113-138

8 Sezgin, S. (2001) "An Empirical Analysis of Turkey's Defence-Growth Relationship with a Multi Equation Model (1956-1994)," Defence and Peace Economics, Special Issue on Economic Aspects of Defence in Turkey and Greece, (forthcoming)

9 see Sezgin 2000 and 2001

10 P. Dunne & E. Nikolaidou. (1998),"Military Spending and Economic Growth: A Case Study of Greece, 1960-1996", Paper presented at the International Conference on "Defense Economics and Security in Mediterranean and Sub-Saharan Countries", Universidade Technical of Lisboa, 5 & 6 June 1988, Lisbon, Portugal

11 S. Deger (1986) " Economic Development and Defence Expenditure," Economic Development and Cultural Change,@ 35 (1), 179-196

12 See Deger and Smith, 1983; Faini et. al, 1984; Deger, 1986; Lebovic and Ishaq, 1987

positive effect on economic growth through Keynesian aggregate demand and modernisation effect.

Reliable data are crucial element of econometric studies. However, reliable data are a major problem when studying LDCs. Not do only defence expenditure data have problems but also general economic data may not be reliable[13]. The data for this study were taken from various sources. The data for defence expenditure are taken from various issues of SIPRI (The Stockholm International Peace Research Institute) yearbooks both Turkey and Greece. Other data sources for Turkey as follows: labour force data are obtained from OECD (Organisation for Economic Co-operation and Development) Labour Force Statistics from 1960 to 1994. The data between 1955-1959 are not available from OECD, or SIS (State Institute of Statistics) for Turkey, so it is constructed from population using labour force/population ratio. GDP, saving and balance of trade and GNP deflator are taken from IMF/IFS (International Monetary Fund/International Financial Statistics) yearbooks. All Turkish financial data were millions of Turkish Liras which are deflated to million of 1985 Turkish Liras using IMF/IFS GNP deflator. Greek GDP, saving (it is calculated from national accounts) and balance of trade data were taken from IMF/IFS yearbooks. The data for Greek labour force are not available. Therefore population is proxied and these data were also taken from IMF/IFS yearbooks. All Greek financial data were deflated to 1990 billion Greek drachmas using Greek GNP deflators of IMF/IFS.

In this study, we employ the Engle-Granger two stage procedure[14]. The first step of the estimation is to determine the order of integration of the series. Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests use to test whether variables were stationary or needed to be different[15] . The number of time series need to be different is given by the order of integration *i.e.* If the variable is integrated of order 1, it will be differenced one. The second stage of the two step Engle-Granger cointegration methodology is that each variable for unit roots, the formal test for cointegration relationships requires the application of the DF and ADF tests for residuals. The residual based test results represent whether cointegration exists among the variables involved.

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13 T. Scheetz. (1991) "The Macroeconomic Impact of Defence Expenditures: Some Economic Evidence for Argentine, Chile, Paraguay and Peru", Defence Economics, 3 (1), 65-81 .

14 R. F. Engle. and C. W. J. Granger (1987) "Co-integration and Error Correction: Representation, Estimation and Testing," Econometrica, 55 (2), 251-276

15 A. D. Dickey and W. Fuller (1979) "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," Journal of the American Statistical Association, 74 427-431Dickey Fuller 1981

3. Empirical Results:

3.1. Turkey

The visual inspection of the variable in hand (i.e. Y, S, B, M, L) shows that they are all non-stationary. We then apply the DF test and ADF test for unit root as formal test. Table 1 shows except balance of trade variable, all the variables are non-stationary in both (DF and ADF) tests and stationary when they are first differentiated. The tests results confirm that the variables are integrated order I (1).

Table 1. Unit Root Tests in Levels and First Differences

Variable (x)		Unit Root in x [1]		Unit Root in Δx [1]	
		DF	ADF	DF	ADF
Y		-1.439	-0.593	-7.473**	-3.612*
S		-0.779	-0.878	-5.741**	-4.242**
B		-5.151**	-3.597*	-7.319**	-7.61**
M		-1848	-2.674	-4.807**	-4.93**
L		-1.051	-1.259	-5.197**	-3.266*
Critical values	1%	-4.209	-4.216	-4.216	-3.617
	5%	-3.528	-3.531	-3.531	-2.942

The reported values are obtained from PC-Give 8.0 version by Doornik and Hendry, 1995. For calculated values intercept and trends are included in both DF and ADF equations for levels and intercept include for first differences.

[1] where x represents level of variables and Δx represents first differences of variables.

Y is GDP, S is gross domestic savings, M is defence expenditure, L is labour force, INFRT is inflation rate,

*significant at 5%

** significant at 1%

The results from cointegration regression for the period 1955-1994 are shown in Table 2. We run the equation 1 to show long run relationships between GDP and defence expenditures and other determinants. It can be shown from the Table 1 that the relationships between defence spending and economic growth is positive statistically significant. Saving, labour force variables are also have a positive and significant signs, while balance of trade variable is negative as expected.

The second stage of the two step Engle-Granger cointegration method is to establish the stationary of the residuals where would be an indication of the

existence of a long run equilibrium relationships between the variables. To test the study employed residual based DF and ADF tests. In both test results, that null hypothesis of non-cointegration is rejected. These results indicate that there exist a long run relationships between the dependant variable and its determinants (the results are represented bottom line of Table 2).

Table 2. The Engle-Granger First Stage (Long-Run) Estimation for Growth Equation (1955-1994)

	Constant	**S**	**B**	**M**	**L**	**Trend**
Y	-1323900***	0.84***	-0.46**	3.01***	1.49***	231640 ***
T statistics	-5.52	8.67	-2.23	3.41	6.79	6.52
Statistics						
R^2	0.99		F statistics		2058 (0.0000)	
DF: -3.266***				ADF: -3.647***		

Where Y is GDP, S is gross domestic savings, M is defence expenditure, L is labour force, B is balance of trade
* significant at 10%
** significant at 5%
*** significant at 1%

In the next step of cointegration methodology employed here the residuals from cointegrating regression are used as the ECM variable in the short run dynamic tests. In these tests a number of other explanatory variables are used where may affect the adjustment process of real GDP from the one time period to the next. The error correction coefficient (ECM_{t-1}) has the expected negative and significant sign. In this estimation, saving, labour force and defence spending are positively correlated with economic growth and coefficient of balance of trade is negative and significant. The test statistics of this estimation is also acceptable with a high R^2. The major findings of this estimations are that defence expenditure of Turkey has a positive and significant impact on its economic growth both in the log run and short run. This is consistent with Sezgin[16] .

16 See Sezgin 1997 and 2000 studies

Table 3. The Engle-granger Second Stage

(Short-run and ECM) Estimation for Growth Equation

Dependent Variable ΔY			
Explanatory Variables	Coefficient	t statistics	probability
Constant	201960**	1.70	0.08
ΔS	0.78***	7.57	0.00
ΔB	-0.56***	-5.20	0.00
ΔM	2.39***	3.22	0.00
ΔL	1.75***	4.19	0.00
RES_{t-1}	-0.45***	-3.03	0.00
Summary Statistics		Diagnostic	
R^2	0.84	AR 1- 2F(2, 31)	0.43
DW	1.79	ARCH 1 F(1, 31)	0.43
SE	494229	NORM $chi^2(2)$	5.57
F (5, 33)	35.743	Xi^2 F(10, 22)	0.36

Where Y is GDP, S is gross domestic savings, L is labour, M is defence spending, B is balance of trade and RES is Residuals from cointegrating regression.
* significant at 10%
** significant at 5%
*** significant at 1%

3.2. Greece

To test the reliability and robustness of the results and to make a similar comparative study, the same analysis is carried out for Greece. The equation used for Turkey is re-estimated using Engle-Granger[17] method. At first, stationary of the variables are tested. It is shown in Table 4 that the variables are non-stationary in level and stationary when they are first differentiated.

17 Engle and Granger (1987), 251-276

Table 4. Unit Root Tests in Levels and First Differences

Variable (x)		Unit Root in x [1]		Unit Root in Δx [1]	
		DF	**ADF**	**DF**	**ADF**
Y		-1.539	-0.299	-5.189**	-5.188**
S		-1.96	-1.583	-6.328**	-6.328**
B		-1.522	-3.986*	-6.732**	-6.731**
M		-1.324	-0.913	-5.724**	B5.724**
P		0.342	-1.303	-3.482**	-3.481*
Critical values	1%	-3.623	-4.232	-3.629	-3.629
	5%	-2.945	-3.539	-2.947	-2.947

The reported values are obtained from PC-Give 8.0 version by Doornik and Hendry, 1995. For calculated values intercept and trends are included in both DF and ADF equations for levels and intercept include for first differences.

[1]where x represents level of variables and Δx represents first differences of variables.

Y is GDP, S is gross domestic savings, B is balance of trade, M is defence expenditure, P is population,

* significant at 5%

** significant at 1%

Like the earlier test of each variable for unit roots, the formal test for cointegration relationship requires the application of the DF and ADF tests for the residual. The residual based test results support stable, genuine long run relationships (Table 5). The rejection of the non-cointegration hypothesis show that imposed relationship is a valid cointegrating vector. The long run estimation enables us to decide whether or not the variables in the level equation are cointegrated (Table 5). In this estimation Greek economic growth is positively affected by its saving and defence spending in the long run. The results are consistent with expectations.

Table 5. The Engle-Granger First Stage (Long-run)

Estimation for Growth Equation

	Constant	**S**	**B**	**M**	**P**	**Trend**
Y	2861.2	1.133***	-0.189	1.662***	-157.69	260.40***
T statistics	0.827	10.435	-0.998	5.106	-0.371	8.945
Statistics						
R^2	0.99		F statistics		3427 (0000)	
ADF	-3.515***		DF		3.811***	

Y is GDP, S is gross domestic savings, B is balance of trade, M is defence expenditure, P is population,
* significant at 10%
** significant at 5%
*** significant at 1%

The second stage of the Engle-Granger (short-run) estimation for Greece is shown in Table 6. The validity of the RES_{t-1} specification requires the existence of a long run relationships or cointegration between the variables. The error correction terms are significant at 1% and have the expected negative signs. Saving variable is as expected positive and significant in the short run. Surprisingly, labour force did not give significant result. It might be a reason that population is not a good proxy for labour force. More importantly, defence spending has a positive impact on Greek economic growth in the short run as well.

The overall goodness of fit of the error correction specification to defence-growth data is satisfactory in terms of R^2 and the statistical test reported in Table 6.

Table 6. The Engle-Granger Second Stage (Short-run and ECM) Estimation for Growth Equation

Dependent Variable ΔY			
Explanatory Variables	Coefficient	t statistics	Probability
Constant	187.26***	4.21	0.00
ΔS	0.89***	9.67	0.00
ΔB	-0.27**	-2.15	0.03
ΔM	1.07***	3.04	0.00
ΔP	1028.2	1.63	0.11
RES_{t-1}	-0.66***	-4.43	0.00
Summary Statistics			
R^2	0.81	SE	119.40
DW	1.41	F (5, 30)	25.936 ***

Where Δ represents first differences of variables. Y is GDP, S is gross domestic savings, B is balance of trade, M is defence expenditure, P is population, and RES_{t-1} is Residuals from cointegrating regression. L represents natural logarithms and Δ represents first differences of variables.

* significant at 10%

** significant at 5%

*** significant at 1%

4. Conclusions

This paper has empirically analysed the relationships between defence expenditure and economic growth in the case of Greece and Turkey using error correction mechanism. The evidence showed that there is a positive and significant relationship between defence spending and economic growth for Turkey and Greece both in the long run and short run. The findings of our analysis are consistent with much of the related literature[18]. However, to see the robustness and reliability of these findings, more country studies needed from developing world using similar model and estimation method.

18 see Kollias, (1995), Chletsos and Kollias, (1995), Sezgin, (1997: 2001)

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