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The Impact of Economic Determinants on the Defence Burden in Selected NATO Countries

Gitana Dudzevičiūtė
Generolo Jono Žemaičio Lietuvos karo akademija
Šilo g. 5A., LT-10322 Vilnius

Agnė Šimelytė
Generolo Jono Žemaičio Lietuvos karo akademija
Šilo g. 5A., LT-10322 Vilnius

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Abstract. *The paper examines the links between economic indicators and the defence burden in selected NATO countries during the period between 1980 and 2020. Three of the largest NATO spenders in terms of defence, such as Greece, Turke, and the USA, have been chosen for the investigation. The question being posed by this research is whether economic factors have an impact on the defence burden. To answer this question, the Autoregressive Distributed Lag (further ARDL) modelling has been employed. The results reveal that, in the long-run, the defence burden responds negatively to output changes in the cases of Turkey and Greece. Inflation and the number of military personnel have positive effects on the defence burden in all three countries in the long-run. While in Greece the government gross debt affects the defence burden positively, in the United States and Turkey the government gross debt affects the defence burden negatively. Moreover, the investigation has shown that defence expenditure is less affected by economic determinants in the short term rather than in the long term. The outcomes of the study could be incorporated into the economic development policies of Greece, Turkey and the USA.*

Keywords: *economic determinants; defence burden; NATO; ARDL model*
Raktažodžiai: *ekonominiai veiksniai; gynybos našta; NATO; ARDL modelis*

Introduction

Various countries are mired in what appears to be a growing level of instability that is being generated by security threats, terrorist attacks and various conflicts. According to Waszkiewicz (2018), the role of defence expenditure seems to grow as a result of security-related threats around the world. In many countries, questions about defence contain an economic dimension (Hartley, 2011). Questions regarding defence expenditure have generated public debate in terms of the following issues: the appropriate size of the defence budget; is it a worthwhile investment? Is defence a benefit or a burden? Could peace be maintained at lower levels of military expenditure? Is NATO an efficient military alliance? (Hartley, 2011). In 2020, defence expenditure in NATO countries came to about 2.8 per cent of real GDP. Over the period between 1980 and 2020, the US, Greece, and Turkey have been the biggest spenders when it comes to defence budgets. Average spending for defence in these countries, respectively, amounted to 4.5%, 4.3%, and 3.3% of real GDP (NATO, 2020).

The issue of defence is controversial. It raises the issues of security, life and death (Hartley & Sandler, 2011). Societies have contrasting views about the value of life, security and protection (Hartley, 2011). Furthermore, if resources in the economy are efficiently and fully employed, greater defence expenditure means less money for civil goods and services. In this case, defence expenditure tends to have adverse effects on economic development. However, another study (EDA, 2014) has revealed the opposite approach. This outlined the economic gains of investing into the European

defence industry. The results of the study have shown that the decrease in defence expenditure of the European Union (EU) influences a decrease in GDP and tax revenues (EDA, 2014). The available literature with a focus on defence and economic growth has analysed the relationship from various points of view, such as those of military and social welfare (Zhang et al., 2017a), defence and income inequality (Zhang et al., 2017b), military spending and growth (Lin & Wang, 2019; Raju & Zobayer, 2019), military and budget deficits (Caruso & Domizio, 2017), defence, science and technology (Malik, 2018), military and private investment (Malizard, 2015), military and unemployment (Qiong & Junhua, 2015), guns, highways and growth (Kollias & Paleologou, 2013), and defence and health (Fan et al., 2018). From the perspective of economic development, a growing economy offers greater opportunities to increase defence funding. In addition, Hartley (2011) has found out that defence expenditure is determined by strategic, political and economic factors. Thus, defence expenditure is supposed to be assessed in terms of both economic and political impact (Hartley and Sandler, 2011).

The statement of the problem. The interconnections between defence and economic factors are discussed by both scholars and politicians. Various studies have revealed that the defence sector drives economic growth, while others see adverse effects. Hence, the main dispute is on the efficient allocation of scarce resources that would ensure national security and economic development. Moreover, most of the studies are devoted to the assessment of the influence of defence spending on economic development, but there is a lack of determination of the opposite effect, that is, the impact of economic indicators on the defence burden. This investigation has focused on resolving this issue.

The objective of the research is the relationships between the defence burden and main economic factors in the US, Greece, and Turkey. Based on the results of the investigation, the authors answer the question of whether economic factors affect defence spending in the NATO countries that spent the most on defence during the period between 1980 and 2020.

The aim of the research is to assess the links between economic indicators and defence expenditure in the selected NATO countries.

The novelty of the research relates to the examination of the impact of the economic indicators on the defence burden in three NATO countries with the largest shares of military in GDP. The authors note the lack of such research and therefore hope to partially fill this gap.

The article is divided into the following sections: a literature review, methodology, research results and discussion, and conclusions.

Literature Review

Defence expenditure as part of government spending may serve to influence economic development in various ways. In accordance to Keynesian theory, growing government expenditure promotes aggregate demand and boosts economic development. Meanwhile, Wagnerian approach is based on the opposite view. Thus, economic development gives a rise to more government expenditure (Al-Bataineh, 2012). Moreover, the neo-classical school argues that government expenditure may hold back total economic development. Rising spending may force the government to raise taxes or to borrow from international markets. According to Odehnal and Neubauer (2012), military Keynesianism as a form of an economic policy was implemented within the US at the end of the 20th century. As a consequence, the heavy growth of defence expenditure stimulated economic performance. This had a negative aspect, namely, the untapped human, financial or material potential in the civilian sector, which entailed considerable expenses (Odehnal & Neubauer, 2012). Benoit's (1978) research has spurred the debate on the links between defence expenditure and economic development. Thus, for more than forty years, the number of studies examining relationships between defence and economic development has been increasing. These studies have revealed both negative and positive influence on economic development (Antonakis, 1997; Manamperi, 2016; Zhang et al, 2017; Fan et al., 2018; Dudzevičiūtė et al. 2021). Dunne and Tian (2013) found that 75% of a total of 168 investigations into defence expenditure showed negative effects on economic development. However, barely one fifth of studies have unfolded positive impact (d'Agostino et al., 2017). In general, the results of recent studies have found three propositions (Andriamahazoarivo & Ravalison,

2016), namely: first, the interrelationship between economic development and defence expenditure has been both significant and negative; second, the relationship between economic development and defence expenditure has been both significant and positive; and third, the relationship between economic development and defence expenditure has not been significant. The first proposition has stated that defence expenditure has negatively impacted on economic development. Thus, the countries in question have to choose between two sectors in which to spend their scarce resources: the defence sector or civilian production. A negative effect on economic development could be seen as a result of allocating the greater part of government expenditure on defence. This approach results in other sectors receiving less funding. Hence, defence expenditure slows down economic development through the reduction of investment as well as harming non-military budgetary funding of the health system, education, environment, cultural, infrastructure expenditure, etc. (Manamperi, 2016). The second proposition has pointed out that defence expenditure has been directly proportional to economic development. The effect of defence expenditure turns out to be positive through the delivery of an increased employment level and output. Moreover, it increases the growth of human capital through the provision of greater levels of technological training, education, improving social conditions and a stable political situation (Manamperi, 2016). Defence expenditure boosts economic development if part of this expenditure is used to create a socio-economic infrastructure (Pradhan, 2010). In addition, defence has protected trade and property rights, ensuring investment security (Lilico, 2013). The third proposition has argued that defence expenditure bears an insignificant level of the relationship with economic performance. In this case, scientific studies have not detected any significant coefficient of a correlation between the two variables (Andriamahazoarivo & Ravalison, 2016). Odehnal et al.'s recent studies (2021, 2020) identified the determinants of military expenditure in NATO member states, including the Baltic States. The authors divided the determinants influencing military expenditure into two groups (Odehnal et al., 2020). The first group of factors described economic environment including real GDP per capita, inflation, general government gross debt, government deficit/surplus. The other group of factors described security environment which has been evaluated by the risk of foreign pressure, democratic accountability and the risk of cross-border conflict. The factors describing the economic environment have been measured in percentage while factors indicating the security environment have been estimated in score of points. This study reveals that defence expenditure depends on the state's budget deficit in the cases of Lithuania and Estonia. The earlier studies of Kollias and Makrydakis (1997) and Kollias and Paleologou (2003) have explored defence issues in the cases of Turkey and Greece. Kollias and Makrydakis (1997) raise the question whether arm race has existed between Greece and Turkey. The defence burden has been expressed as the share of military spending to GDP. The study discovered the evidence of competition between these two countries. However, the defence policy in Greece has been changed due to a gradual increase of public debt. Shahbaz et al. (2013) explore interconnections between defence spending and economic development in Pakistan. His study has revealed a unidirectional causal link between defence expenditure and economic growth. Thus, in the case of Pakistan, spending on defence has boosted economic performance. Bove and Cavatorta (2012) analyse the links among defence burden and changes in NATO military expenditure shares on personnel, equipment, infrastructure and other costs, including shifts in the number of military personnel. Their study covers the period from 1970 to 2008. Nikolaidou (2008) developed a model for the analysis of demand for military expenditure in the US and EU-15. This study indicated greater dissimilarities in the determinants of each country's demand for defence expenditure.

To summarize, the links between defence expenditure and various economic variables have been widely studied and therefore the findings are contradictory and inconclusive due to the geopolitical situation of the countries under consideration, international relationships among the countries, differences in the levels of socio-economic development, methodology applied, period analysed, the country's strategy regarding its defence policy and other factors.

Methodological approach

Research question. Based on the findings from previous studies, the authors have raised the following research question: Do economic factors influence defence financing decisions in NATO's largest defence spenders?

Data sources. The current study uses statistical annual data from NATO and the United Nations over the period between 1980 and 2020. NATO provides data on the defence expenditure of its member countries and has been doing so since the year in which each of the member countries joined the alliance. The United States is one of the founding members of the alliance, having signed the North Atlantic Treaty in 1949. Meanwhile, in 1952 Turkey and Greece became the members of NATO. The figures are in line to the NATO definition of defence expenditure (NATO, 2020). The study has been based on the estimation of defence expenditure as a share of real GDP in percentage. Economic growth is measured as real GDP per capita using United Nations (2020) annual data. Real GDP per capita has been chosen as it is main indicator to compare different countries in terms of economic development. General government debt is defined as accumulated government debt as per cent of GDP, while inflation shows up as an increase in prices each year in percentage terms (Table 1).

Table 1. ***A description of variables***

VARIABLES	IDENTIFIER	DEFINITION	MEASUREMENT
Defence burden	DB	Defence expenditure	% of GDP
Military personnel	MP	Number of military personnel available for missions	Number in thousands
Economic growth	EG	Total economic output of the country per year divided by population and adjusted for inflation	Real GDP per capita in US dollars
General government debt	GD	Accumulated government debt as a per cent of GDP	% to GDP
Inflation	IN	Increase in prices per year	%

Source: composed by the authors.

The ARDL model is one of the most widely and frequently used approaches in various studies analysing links between socio-economic and safety factors that influence defence expenditure (Odehnal et al., 2021; Odehnal et al., 2020; Shahbaz et al., 2013). Research employs the ARDL model, adjusting for co-integration (Pesaran & Shin, 1999). For ARDL modelling, the following economic factors are used: economic growth (real GDP per capita), general government debt (GD) percentage to GDP, inflation rate (IN). The defence burden (DB) and the number of military personnel (MP) are factors describing the military sector. Based on the study of Nikolaidou (2008), real GDP per capita has been chosen as a better value to express economic growth. In order to get more appropriate and efficient results, the linear specifications of the two variables, real GDP per capita and number of military personnel, have been converted to logarithmic ones. The ARDL model combines both exogenous and endogenous variables. The ARDL model includes lagged values or values of regressors and values of dependant variable. The essential condition for employing the ARDL model is that variables are supposed to be either I(0) or I(1). Based on ARDL methodology, variables may be purely I(1) or I(0), or they may be cointegrated instead (Pesaran et al., 2001). I(1) represents the upper bound and the lower bound is indicated by I(0). Cointegration does exist amongst the research variables if the value produced by the estimated F-statistics is larger than critical value of I(1). If the estimated value from the F-statistics is less than the lower bound of critical value of I(0), then there is no cointegration amongst the variables. The principle benefit of ARDL is that it might be used irrespective of any variables (regressors) having unit roots (Kollias & Paleologou, 2003). However, if the sample is small and finite, ADF tests are applied to assess the stationarity of the sequences. Thus, it is necessary to check whether none of these variables are at the second difference I(II). ARDL is applied across the three stages. In the first stage, based on five different criteria, the maximum number of lags for both regressors and the dependent variable is estimated.

Testing for the long-term relationship between the defence burden and other variables is performed in the second stage. If the assumption of a long-term relationship is confirmed, the coefficients for a long-term relationship are estimated in the third stage. If the assumption of a long-term relationship is rejected, the model estimates only short-term coefficients in the third stage. In order to confirm or reject any long-term relationship, F-statistics is used. Furthermore, F-statistics has been applied to indicate cointegration. A null hypothesis states that a co-integration relationship does not exist between dependent and independent variables in the long term. The error correction term (ECT) is used for a careful examination of the long-term relationship between variables. The estimated ECT coefficient is supposed to be negative and significant (Khan et al, 2019). ARDL (p, q1, q2,…qk), p represents the number of lags of the dependent variable Yt, in this case Yt=DB, which denotes the presence of a defence burden. Meanwhile, q1, q2,..qk represent the number of lags of independent variables, Xit, i=1,2…k (Pesaran et al., 2001). The length of lags p and q may not be necessarily the same. In this case the explanatory variables are military personnel (MP), economic growth (EG), general government debt (GD) and inflation (I). The general ARDL model is expressed as follows:

$$Y_t = \alpha + \sum_{i=1}^{p} \gamma_i Y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{q_j} \beta_{j,i} X_{j,t} + \epsilon_t \quad (1)$$

ϵ_t is one-dimentional zero mean error term. The equation might easily be transformed into a model for long-term indicating the associations between the dependent variable to a change in the regressors (Odehnal et al., 2020). The ARDL equation to obtain the coefficient of the relationship in the long term and short term:

$$\Delta \boldsymbol{Y_t} = \sum_{i=1}^{p-1} \boldsymbol{\gamma_i^* \Delta Y_{t-i}} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \boldsymbol{\beta_{j,i}^* \Delta X_{j,t-1}} - \boldsymbol{\hat{\phi} ECT_{t-1}} + \boldsymbol{\epsilon_t} \quad (2)$$

While ECT represents the error correction term, μ_1 shows the value of ECT. ECT unveils the speed of dynamic adjustments for the short-term deviations of the variables from those of the long-term, and the length of the period it may take in order to achieve its equilibrium over the long term. For testing whether the long-term relationship exists between the dependent variable and regressors, the model expressed as follows (Pesaran et al., 2001):

$$\Delta \boldsymbol{Y_t} = \sum_{i=1}^{p=1} \boldsymbol{\gamma_i^* \Delta Y_{t-i}} + \sum_{j=1}^{k} \sum_{i=0}^{q_j-1} \boldsymbol{\beta_{j,i}^* \Delta X_{j,t-i}} - \boldsymbol{\rho Y_{t-1}} - \boldsymbol{\alpha} - \sum_{j=1}^{k} \boldsymbol{\delta_j X_{j,t-1}} + \boldsymbol{\epsilon_t} \quad (3)$$

Residual diagnostics is performed, while applying the heteroscedasticity and Breusch–Godfrey Serial Correlation LM tests. The null hypothesis is rejected if the probability values are below 5% level. This would indicate that the model is not free from serial correlation and heteroscedasticity (Pasara & Garidzirai, 2020). The CUSUM and CUSUM square are applied to test whether ARDL long-run model is stable. ARDL long-run model is stable if at significance level of 5% the plots of CUSUM and CUSUMSQ residuals fall within the critical bounds (Khan et al., 2019).

Research Results and Discussion

For the modelling, Eviews v. 12 software has been used. Series of economic data are often non-stationary and contain a unit root. Thus, the modelling starts with testing all the variables for unit roots while applying Augmented Dickey Fuller (ADF). Two hypotheses are tested, namely: (i) the variables are not stationary and (ii) the variables are stationary. ADF tests the hypothesis whether the variables are stationary at the significance level of 1%, 5% and 10%. In the ADF test, two models, i.e., constant (M1) and constant and trend (M2) have been considered (Table 2).

Table 2. ***Augmented Dickey-Fuller test statistic***

	LEVEL		1ST DIFFERENCE	
	Constant (M1)	*Constant and trend (M2)*	*Constant (M1)*	*Constant and trend (M2)*
Greece				
DB	-0.758	-2.917	-7.105***	-6.989***
MP	-0.423	-2.088	-5.652***	-5.667***
EG	-6.326***	-6.292***	-7.246***	-7.145***
GD	-0.297	-2.439	-6.361***	-6.290***
IN	-1.634	-2.327	-6.225***	-6.282***
Turkey				
DB	-1.013	-1.886	-5.633***	-5.553***
MP	-0.687	-2.690	-5.926***	-5.876***
EG	-0.374	-4.617***	-11.668***	-11.580***
GD	-4.796***	-4.860***	-8.407***	-8.549***
IN	-2.019	-2.752	-8.301***	-8.214***
United States				
DB	-3.498***	-2.422	-0.833	-0.229
MP	-1.451	-1.761	-2.835**	-2.843
EG	0.589	-3.504**	-4.719***	-4.502***
GD	0.801	-1.083	-6.464***	-6.831
IN	-5.866***	-5.980***	-5.874***	-5.737***

*Source: composed by the authors. Note: *p<0.1; **p<0.05; ***p<0.01.*

It might be noticed that in the cases of Greece, the United States and Turkey, all the variables appeared to be stationary either at level or at the first difference. Therefore, the ARDL model might be employed in all three countries under consideration. The first stage of the ARDL is devoted to select the optimal length of lags. Taking into consideration the assumption that the number of lags might be different in all cases and the number of the dependent variables and regressors are different as well, five criteria were applied (Table 3).

Table 3. ***VAR test for lag selection***

COUNTRY	LAG	LOGL	LR	FPE	AIC	SC	HQ
Greece	0	-28.95336	NA	0.367550	1.835317	2.053009	1.912063
	1	-16.78515	20.38997*	0.201220*	1.231630	1.492860*	1.323726*
	2	-16.34629	0.711675	0.207775	1.261961	1.566730	1.369407
	3	-16.01808	0.514481	0.215959	1.298275	1.646581	1.421069
	4	-13.73676	3.452813	0.202116	**1.229014***	1.620859	1.367158
Turkey	0	-27.92719	NA	0.347717	1.779848	1.997540	1.856595
	1	19.52074	**14.08649***	**0.233286***	**1.379499***	**1.640729***	**1.471595***
	2	-18.74050	1.265249	0.236482	1.391378	1.696147	1.498823
	3	-18.73896	0.002420	0.250175	1.445349	1.793656	1.568143
	4	-18.73783	0.001701	0.264852	1.499342	1.891187	1.637486
USA	0	-19.98092	NA	0.255058	1.469466	1.693931	1.546015
	1	-11.91531	13.28454	0.168587	1.053842	1.323200*	1.145701
	2	-11.91327	0.003250	0.179181	1.112545	1.426796	1.219713
	3	-8.846710	**4.690026***	**0.159150***	**0.990983***	**1.350127**	**1.113461***
	4	-8.835890	4.594532	0.178243	0.991096	1.230487	1.034592

*Lag selection: * demonstrates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion. Source: composed by the authors.*

Based on the AIC, the optimal lag length was set. The dependent variable is the defence burden (DB). In the case of Greece, one lag might exist for military personnel, while for the other factors four lags may exist. The results reveal that the ARDL model is stable (F-statistics is 47, and $p<0.001$) and the regressors of this model explain 96% of the variation in defence burden (Table 5). In the case of Turkey, one lag might exist for the dependent variable (the defence burden) and inflation

(IN). The regressors of the model explain 92% of the variation in the defence burden; the model is stable as F-statistics is 79 and $p<0.001$. In the case of the USA, three lags may exist for the dependent variable, one lag for military personnel and three lags for government debt and inflation. The regressors explain almost 96% of the variation in the defence burden.

Table 4. ***ARDL model and optimal number of lags***

	GREECE	TURKEY	USA
Model	ARDL (4, 1, 4, 4, 4)	ARDL (1, 0, 0, 0, 1)	ARDL (3, 1, 3, 3, 3)
Optimal number of lags	DB(-1), DB(-2), DB(-3), DB(-4), LnMP, LnMP(-1), LnEG(-1), LnEG(-2), LnEG(-3), LnEG(-4), GD, GD(-1), GD(-2), GD(-3), GD(-4), IN, IN(-1), IN(-2), IN(-3), IN(-4)	DB(-1), LnMP, LnEG, GD, IN, IN(-1)	DB(-1), DB(-2), DB(-3), LnMP, LnMP(-1), LnMP(-2), LnMP(-3), GD, GD(-1), GD(-2), GD(-3), IN, IN(-1), IN(-2), IN(-3)
R	0.985	0.935	0.979
R^2	0.964	0.923	0.957
F-statistics	47.009	79.069	44.464
Prob. (F-statistics)	0.000	0.000	0.0000

Source: estimated by the authors.

The next stage is devoted to perform the long-term form and bound test. The conclusions drawn from the ARDL bound test is supported by the comparison of the results of F-statistics with the critical value. The ARDL long-term and bound test show that in all three cases the null hypothesis is not accepted as F-statistics value is much larger than critical value of upper bound (Table 5). Therefore, the results indicate that the relationships among the variables exist in the long term. These outcomes are in line with the case study of Greece and Turkey by Sezgin and Yildirim (2002), who find the existence of the links between the defence burden and other variables in the long term.

Table 6 presents the findings of estimated long-run coefficients. In the case of Greece, the defence burden appears to respond negatively to output changes. It might be assumed that in Greece, defence is not funded on the cost of economic growth. Meanwhile, the number of military personnel, inflation rate and government debt have a positive effect on the defence burden. It is likely that in the long term, defence funding could have been increased by government borrowing in international markets. Moreover, the military budget includes personnel and other inputs to contribute to defence output, such as security, peace and protection (Hartley, 2011). In the case of Turkey, the economic growth has a negative impact on the defence burden, which implies that the defence burden does not really depend on economic performance. It might be assumed that in the case of increasing real GDP per capita, Turkey would focus more on the reallocation of financial resources amongst civilian activities, such as healthcare, social security, education and other than on military performance.

Table 5. ***ARDL long-term form and bounds test***

	F-STATISTICS	SIGNIFICANCE	I(0)	I(1)
Greece	5.407	10%	2.45	3.52
Turkey	4.458	5%	2.86	4.01
USA	7.034	1%	3.74	5.06

Source: estimated by the authors.

Table 6. ***Estimated long-term coefficients for Greece, Turkey and the USA***

VARIABLE	GREECE	TURKEY	USA
EG	-0.364*** (0.065)	-0.000112*** (3.91E-05)	6.891 (4.501)
MP	2.157*** (0.502)	0.572*** (0.229)	0.0065*** (0.002)
GD	0.0092* (0.0049)	-0.015 (0.0155)	-0.048 (0.036)

VARIABLE	GREECE	TURKEY	USA
IN	0.154*** (0.026)	0.024*** (0.007)	0.517*** (0.400)

*(Standard errors are presented in parenthesis.) Note: *p<0.1; **p<0.05; ***p<0.01.*
Source: estimated by the authors.

Meanwhile, the number of military personnel and inflation rate have a statistically significant impact on the defence burden while government debt has an insignificant impact. The findings of the cases of Greece and Turkey support the research results which were published by Pradhan (2010), when the impact of economic development on defence expenditure was discovered to exist in Thailand, Indonesia, Malaysia and Singapore. Greece and Turkey are free-riders which means that they do not follow the requirement to spend 2% of GDP on defence as their military spending is based on other issues (Odehnal et al., 2021).

In the long term, inflation and the number of military personnel have a statistically significant impact on the defence burden in the United States. Both economic growth and government debt have a statistically insignificant impact on the variation in the defence burden. These findings contradict the research results of Gadea et al. (2004), where income has been found as one of the main determinants of defence expenditure. Furthermore, their study showed that in most countries defence behaved as a normal good. The implication is that in times of an economic expansion, defence expenditure would increase while in times of a decline it would decrease. Moreover, in some ways the findings fall in line with the insights of Dudzevičiūtė et al. (2021) that show that the course of government gross debt have no clear links with the defence burden in the selected EU countries.

Furthermore, the test for the short-term coefficients was performed. In the short term, inflation rate, economic growth, government debt, military personnel explain 58 % of the variation in the defence burden of Greece (Table 8). In this case, the defence burden appears to respond negatively to the changes in economic factors. In the case of Turkey, the influence of government debt and inflation rate amounted to 56 % on the defence burden. Government debt positively affects defence financing while inflation rate has a negative impact. The case of the USA shows that the combination of the influential factors, such as economic growth, the number of military personnel, government gross debt and the inflation rate explain approximately 76 % of the variation in defence burden. The defence burden appears to respond positively to the changes in output, the number of military personnel and government debt. The Iiflation rate has a negative impact on the defence burden in the USA. In view of the outcomes of the study, we support the insights of Nikolaidou (2008), who reveals the differences in the process determining defence expenditure in the long-run and short-run. It could be assumed that in the long term the influence of economic determinants on defence financing is greater than in the short term. Meanwhile, non-economic factors, such as internal and external threats, and the political environment have an impact in the short term while the other risks have more influence on defence expenditure than in the long term. This insight appears to be in line with the studies by Avramides (1997), Amara (2007), Sahin and Ozsoy (2008) and Karagol and Turhan (2008). Avramides (1997) maintains that the Greek defence burden could decrease if international relationships with Turkey were to be improved. Sahin and Ozsoy (2008) also associate the defence burden of Greece and Turkey with their international relationships and the mutual threats being posed towards each other. Amara's (2007) research confirms that such a high defence burden in Turkey and Greece is linked to defensive and threat concerns, and is not shared with either country's allies.

Table 7. ***Error correction representation (short-run estimates)***

VARIABLE	GREECE	TURKEY	USA
ΔEG	-0.086*** (0.016)		
ΔEG(-1)	0.141*** (0.031)		
ΔEG(-2)	0.099** (0.022)		10.518*** (3.181)

VARIABLE	GREECE	TURKEY	USA
ΔEG (-3)	0.031*** (0.012)		
ΔMP	-0.168 (0.662)		0.006*** (0.001)
			0.006*** (0.002)
ΔGD	-0.016*** (0.005)		0.023*** (0.006)
ΔGD(-1)		0.017*** (0.004)	0.049*** (0.008)
ΔGD(-2)	-0.023*** (0.005)		0.0181** (0.006)
ΔGD(-3)	-0.012*** (0.005)		
ΔIN	-0.100*** (0.023)	-0.008*** (0.003)	
ΔIN(-1)	-0.183*** (0.032)	-0.015** (0.005)	-0.251*** (0.045)
ΔIN(-2)	-0.115*** (0.029)		-0.212*** (0.044)
ΔIN (-3)	-0.204*** (0.030)		-0.086** (0.034)
C	-4.401*** (0.727)	-0.168*** (0.057)	-36.953*** (4.744)
ECT	-0.808*** (0.138)	-0.691*** (0.119)	-0.471*** (0.061)
R	0.778	0.644	0.881
R^2 adjusted	0.579	0.558	0.763
F-statistics	3.919	7.494	7.431
Prob(F-statistics)	0.002	0.000	0.000

*(Standard errors are presented in parenthesis.) Note: *p<0.1; **p<0.05; ***p<0.01*
Source: estimated by the authors.

Diagnostic tests based on F-Statistics indicated that long-term and short-term models do not suffer from serial correlation and heteroscedasticity problems as p values in all three cases are above 0.05 (Table 8).

Table 8. ***Diagnostic tests***

	GREECE	TURKEY	USA
Heteroskedasticity Test	0.968 (0.537)	0.328 (0.971)	1.1691 (0.400)
Breusch-Godfrey Serial Correlation LM Test	1.569 (0.250)	0.595 (0.669)	2.597 (0.117)

(P-values are presented in parenthesis.) Source: estimated by the authors.

To further examine the stability of the model in the short term and in the long term, the tests of CUSUM and CUSUM square were run. The results are presented in Figures 1-3.

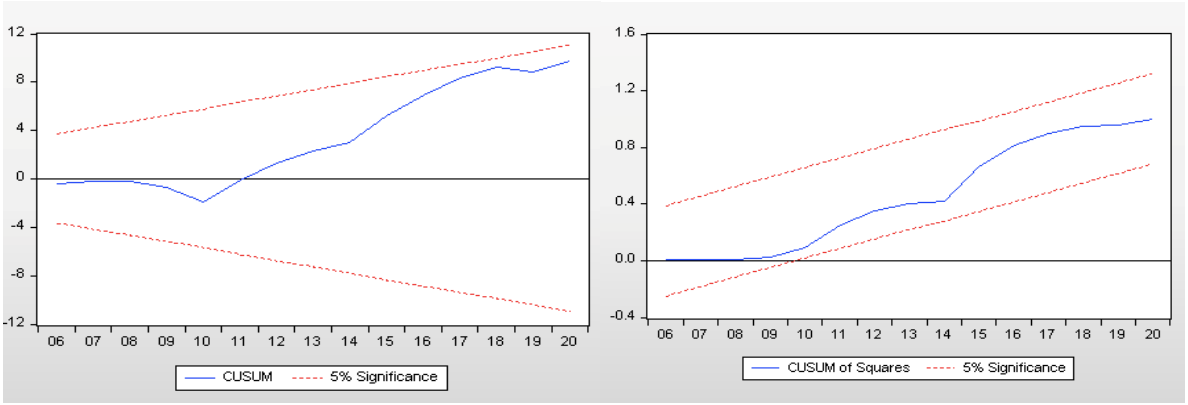

Figure 1. ***Results of CUSUM and CUSUMQ in the case of Greece***
Source: estimated by the authors

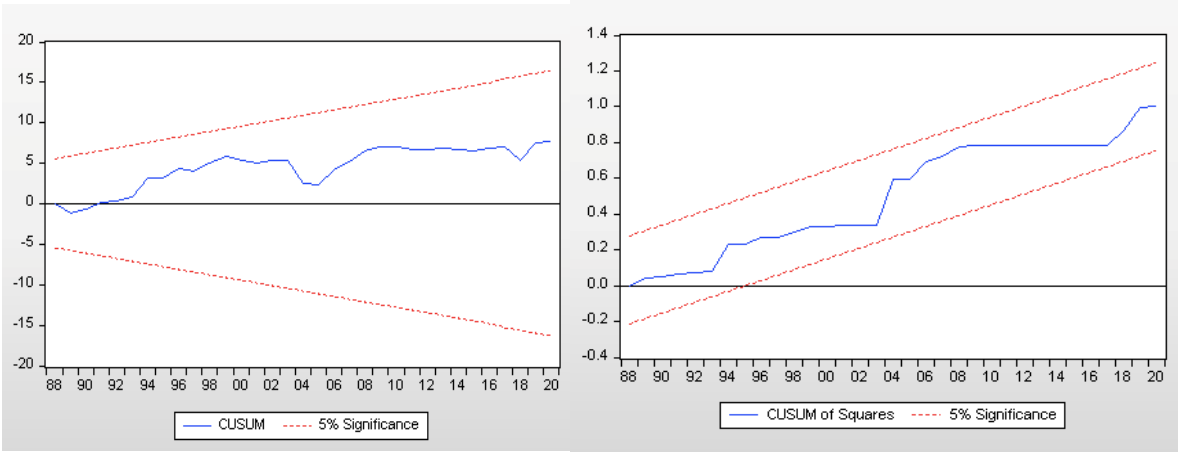

Figure 2. ***Results of CUSUM and CUSUMQ in the case of Turkey***
Source: estimated by the authors

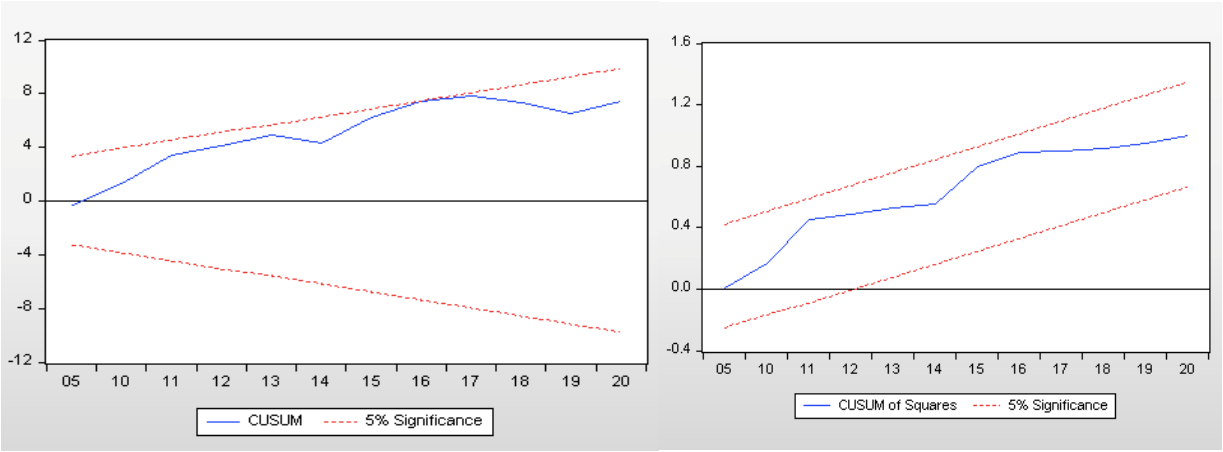

Figure 3. ***Results of CUSUM and CUSUMQ in the case of the United States***
Source: estimated by the authors

The results presented in the figures above indicate that short-term and long-term ARDL models are stable at significance level of 5%.

Conclusions

1. The outcomes of the study have revealed that the ARDL long-term models explain more than 90% of the variation in the defence burden in all the cases under consideration. In the long term, in Greece, economic growth has a negative impact on the defence burden while the number of

military personnel, government debt and inflation have a positive relationship with defence spending. In the case of Turkey, economic growth, military personnel and the inflation rate have a statistically significant impact on the defence burden. Meanwhile, the impact of government gross debt is insignificant. In the case of the United States, the defence burden appears to respond positively to the changes in military personnel and the inflation rate. The impact of economic growth and government gross debt appeared statistically insignificant in the long term.

2. Additionally, the investigation has shown that the defence burden is mostly determined by long-term economic performance while in the short term, economic growth, government debt, the number of military personnel and the inflation rate have less effect on the variation in the defence burden.

3. The current study has some limitations. Firstly, this research has used only the main economic variables without considering other non-economic factors. Secondly, the investigation does not focus on the possible changes in Greek or Turkish defence expenditure due to the potential armed interactions between these countries. Thirdly, this study assesses only the impact of economic indicators on defence spending, but does not examine the impact of defence expenditure on the economic development of Greece, Turkey and the United States. Despite these limitations, the authors believe that the research could be helpful in terms of defence solutions within the context of economic development.

4. The authors propose the following guidelines for the application of the outcomes of the study: (i) to include the findings into the economic development policies of the USA, Turkey and Greece; (ii) to exploit the insights to extend the scope of research across both NATO countries and other countries; and (iii) to use the outcomes of the research as learning and teaching materials related to studies of defence and peace economics and public security at universities.

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Gitana Dudzevičiūtė, Agnė Šimelytė

Ekonominių veiksnių poveikis gynybos naštai pasirinktose NATO šalyse

Anotacija

Tyrimo tikslas – išnagrinėti ekonominių veiksnių poveikį gynybos naštai NATO šalyse 1980–2020 m. laikotarpiu. Tyrimui pasirinktos trys NATO šalys – Graikija, Turkija ir JAV, kurios per nagrinėjamą laikotarpį daugiausia skyrė gynybai, vertinant procentine išraiška nuo BVP. Ekonominių veiksnių poveikiui įvertinti naudojamas ARDL modeliavimas. Gauti rezultatai rodo, kad ilgalaikėje perspektyvoje gynybos našta neigiamai reaguoja į gamybos apimties pokyčius Graikijoje ir Turkijoje. Karinio personalo skaičius ir infliacijos lygis turi teigiamą poveikį gynybos naštai visose trijose šalyse. Valstybės skolos įtaka gynybos išlaidoms yra teigiama ir statistiškai reikšminga Graikijoje, o JAV ir Turkijoje – neigiama ir statistiškai nereikšminga. Tyrimas atskleidė, kad gynybos našta labiau priklausoma nuo ekonominių veiksnių ilguoju laikotarpiu nei trumpuoju.

Gitana Dudzevičiūtė, Assoc. Professor of Defence Economics and Management Research Group, General Jonas Žemaitis Military Academy of Lithuania
E-mail: gitana.dudzeviciute@lka.lt

Agnė Šimelytė, Senior Researcher of Defence Economics and Management Research Group, General Jonas Žemaitis Military Academy of Lithuania
E-mail: agne.simelyte@lka.lt

Gitana Dudzevičiūtė, Gynybos ekonomikos ir vadybos mokslo grupės docentė, Generolo Jono Žemaičio Lietuvos karo akademija
El. paštas: gitana.dudzeviciute@lka.lt

Agnė Šimelytė, Gynybos ekonomikos ir vadybos mokslo grupės vyresnioji mokslo darbuotoja, Generolo Jono Žemaičio Lietuvos karo akademija
El. paštas: agne.simelyte@lka.lt