Military Expenditures and Economic Growth: The Case of EU Countries[1]

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Abstract

This contribution examines the relationship between military expenditures and economic growth in 28 EU countries between 1993 and 2014. The paper aims to verify the first pioneering hypothesis which claims that there is a negative relationship between military expenditures and economic growth in relatively poorer countries and a positive relationship in relatively richer countries. A cluster analysis is used to divide the nations into individual groups. The Feder-Ram model and multiple regression analysis with modified variables are then estimated for all groups based on the cluster analysis. The findings of the regression analysis mainly verified the hypothesis and showed a significant positive relationship between defence spending and economic growth in the case of more resource-abundant countries, and a significant negative relationship in the case of more resource-constrained countries. However, the Feder-Ram model showed statistically insignificant effects of military expenditures on economic growth.

Keywords: *military expenditures, economic growth, security, GDP*

JEL Classification: C10, H56, O40

1. Introduction

The relationship between military expenditures and economic growth has been extensively researched by many economists for the last 35 years. However, it is noteworthy that the results and findings have prompted much disagreement among economists. Some scholars have found that defence spending has an

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adverse effect on economic growth as it displaces investment on productive sectors of the economy; however, others are of the view that military spending improves economic performance as it tends to expand aggregate demand. Thus, the defence sector could have a spill-over effect on the economy through technological progress, infrastructure, and human capital formation. Each country usually needs some level of security to deal with internal and external threats; therefore, there are opportunity costs as the money could be used for other purposes that might improve the pace of development.

This paper hopes to contribute to the existing pool of literature by examining the above mentioned relationship among European countries, because there is an obvious lack of studies in this area. Moreover, the motivation is much higher because of the current defence issues in the European Union (EU): There is actually no common EU defence policy as this area is principally the domain of each country as a whole. While exploring the existing studies, another interesting issue appeared and subsequently became a motivation of this contribution. As was stated above, there is significant dissent amongst economists over whether there is some relationship (either positive or negative) between military expenditures and economic growth. Frederiksen and Looney (1985) assumed that this is due to the fact that many papers have failed to take into account the relative financial constraints faced by individual countries. Thus, they examined the hypothesis which claimed there to be a negative relationship between military expenditures and economic growth in relatively poorer countries (more resource constrained) and a positive relationship in relatively richer countries (more resource abundant).The authors used a sample of developing countries, so this prompts the question as to how the situation evolves in the case of developed countries

Developing a theoretical model is important for any empirical study, but much of economic theory does not have an explicit role for military spending as a distinctive economic activity. In investigating the relationship between defence spending and economic growth, applied work is usually restricted to economic growth because of the problems of defining and measuring development. Of course, there are many indicators that need to be taken into account, e.g. individual military spending conflicts and economic capacity as R&D, education, institutions, governance, labour, capital, technology, debt, and socio-political effects. Therefore, many relatively poorer countries try to save as much as they can. Consequently, they spend much less in order to involve other, for them, more essential parts of public expenditures. Obviously, all of the indicators will interact together and the final economic impact will differ depending on the particular situation.

The main aim of this paper is to research the hypothesis that expects a negative relationship between economic growth and military expenditures in relatively poorer countries, and a positive relationship in relatively richer countries. The Feder-Ram model is used and compared with the common regression analysis which includes different independent variables. The model is implemented for the developed EU countries and the results are compared between them and with other papers. It might come as a surprise that there is a significant lack of published articles concerning this topic for the EU, despite the continuous discussion regarding a Common European Defence Policy that would require an assessment of the economic effects of defence in this region, there is a significant lack of published articles concerning this topic for the EU.

2. Review of Literature

Benoit (1978), with his pioneering work, is considered to be the first who proposed the thesis that military expenditures are not necessarily detrimental to national growth. He calculated simple correlation coefficients using a sample of 44 countries between 1950 and 1965. The dependent variable was the average annual growth rate; the independent variables were private investment as a proportion of GDP, net economic assistance, and defence spending. All have a positive impact on growth. In other words, there was a strong positive association between military expenditures and the economic growth of civilian output per capita. Benoit's conclusions were confirmed by Knight, Loyaza and Villanueva (1996), whose research dealt with a large number of countries and concluded that the GDP growth rate of each country did not seem to have been influenced by their defence allocation.

Frederisken and Looney (1985) used a growth equation that had investment and military outlay as regressors, but they made a distinction between relatively resource-constrained and resource-rich developed countries. They used large cross-sectional data in a 28 year period at the end of the1980s. The results showed that increased military expenditures supported economic growth in the relatively richer countries, but not in relatively poorer ones. Thus, they concluded that there is a negative relationship between military expenditures and economic growth in relatively poorer countries, and a positive relationship in the case of richer ones.

Hewitt (1991), in his paper under the IMF, dealt with an econometric analysis of political and economic influences in 125 countries during the period 1972 – 1988. He examined the trends in world military expenditures by analysing the shares of different country groups and the ratio to the GDP of individual nations.

This work also compared military expenditures as a proportion of central government expenditures and examined the budgetary trade-offs among military, social, and development expenditures. Hewitt did not find any positive trend.

Mehhanna (2004) examined the parsimonious New Growth model to investigate the link between military spending and economic growth in the United States over the period 1959 – 2001 by adopting a more robust estimate technique. It followed the Johansen co-integration and error correction methodology, coupled with vector auto-regression (VAR) and innovation accounting techniques. The findings were robustly substantiated and revealed that military spending and growth have neither statistical nor economic impact on one another.

Kollias, Manolas and Paleologou (2004), and Kollias, Mylonidis and Paleologou (2007), focusing on the EU-15, investigated the causal relationship between growth and military expenditures over the period 1961 – 2000. By using panel data methods, the researchers found evidence of a positive bi-directional causality in the long-run and a positive effect from defence spending to growth in the short-run. Given these results, the authors argued that increases in defence may promote growth in this region.

Subsequently, Hatzinikolaou (2007) focused only on the contribution of Kollias, Manolas and Paleologou (2004). He noted that according to standard growth-accounting equations, the GDP depends on the growth rate of the following variables – capital stock, labour force, and total factor productivity. Its conclusions report similar results

Aizenman and Glic (2006), in their contribution, discovered that the impact of military expenditures is frequently found to be non-significant or negative, yet most countries spend a large proportion of GDP on their defence and military.

Bernauer and Koubi (2009) introduced a study whereby their findings showed that although military expenditures have had a positive effect on the rate of economic growth, the distributions of defence spending across cantons has not contributed to the dispersion of cantonal growth rates.

As noted by Heo (2010), military expenditures can both help hinder economic growth, while under certain conditions. One of the reasons for a positive relationship is job opportunity. Since the average wage of the military sector is lower than that of the private sector, military expenditure is economically more effective than other expenditures. In addition, army contracts generate job opportunities for military industries, thus leading to multiplier effects on unemployment, which can boost aggregate demand in the economy.

The other authors dealing with this topic examined different types of models as possible reasons for differing results and subsequent inconsistencies, e.g. Dunne, Smith and Willenbockel (2005), who employed a Feder-Ram and Solow model;

Cuaresma and Reitschuler (2006), who used the Feder-Ram model; Mylonidis (2008), who examined the EU-14 and employed a Barro-type model; Dunne and Nikolaidou (2012), who employed an augmented Solow-Swan model; and Wijeweera and Webb (2012), who studied the Feder-Ram and military Keynesian model.

3. Methodology

3.1. Feder-Ram Model

For the past twenty five years, the Feder-Ram has been the most commonly used model for explaining defence-growth nexus. It is a supply-side model that was originally created to examine the effects of export on economic growth in developing countries (Biswas and Ram, 1986). Thus, this model employs a supply-side explanation for aggregate output with changes in labour and capital. For the purpose of the defence-growth nexus, it allows the defence sector to be treated as one sector in the economy, and its externality and differential productivity effects to be identified within a single equation model. There have been a number of authors (Atesoglu and Mueller, 1990; Mintz and Huang, 1990; etc.) who believed in its potential because of its important contribution to the area of researching the relationship between military expenditures and economic growth. The reason is that the model was created from a consistent theoretical structure based on the neoclassical production function framework.

The real origin was given by Feder (1983) who divided the aggregate output of the economy into two sectors – exports and non-exports. On the basis of this division of the economy, Biswas and Ram (1986) suggested a two-sector model to explain growth as inclusive of a government and a private sector. A very interesting idea came from Mintz and Huang's (1990) contribution in which they tried to propose a defence sector as a third sector based on the thought that military expenditures can also vary from that of other (non-military) government expenditures due to different kinds of stimulation.

Assuming the economy is simply composed of two sectors, with the output being from the military (M) and civilian (C) sector, and where the input is allocated between homogenous capital (K) and labour (L), then we should also consider the defence production which influences civilian production operation and the θ that represents the elasticity of C with respect to M:

$$M = M\left(L_m + K_m\right);\ C = C\left(L_c + K_c\right) = M^{\theta} c\left(L_c + K_c\right) \tag{1}$$

The equation including constraints is given by:

$$L = \sum_{i \in S} L_i;\ K = \sum_{i \in S} K_i;\ S = \{m, c\} \tag{2}$$

And the domestic product is given by:

$$Y = C + M \tag{3}$$

Turning to capital and labour, this model accepts that marginal product values differ across sectors by a constant uniform proportion as it is shown in the following equation:

$$\frac{M_L}{C_L} = \frac{M_K}{C_K} = \frac{P_m Mr_L}{P_c Cr_L} = \frac{P_m Mr_K}{P_c Cr_K} = 1 + \mu \tag{4}$$

where *Pm* and *Pc* denote the unitary money prices associated with real output quantities *Mr* and *Cr*. Allowance is given for this by considering that the marginal productivity of factors used in the military sector is equal to (1 + μ) times to the corresponding marginal factor productivity in the civilian sector. The marginal productivities of capital (M_K, C_K) and labour (M_L, C_L) in the military sector may not be the same as in the civilian sector. Obviously, military production is not physically divided from civilian production because a significant amount of military supplies and amenities is used by the civilian sector. It may be said that the only difference between the military and civilian sectors is based on theoretical grounds. From empirical studies, the civilian output or expenditure is simply the difference between real output and military expenditure.

Taking the proportional differentiation of economic output (3) with the total differentiation of relation (1) and (2) leads to the following growth equation:

$$\hat{Y} = \frac{C_L L}{Y}\hat{L} + C_K \frac{I}{Y} + \left(\frac{\mu}{1+\mu} + C_M\right)\frac{M}{Y}\widehat{M} \tag{5}$$

where *I* is equal to the derivative capital *K* and represents net investment. The hat symbol is used to indicate proportional rates of change; θ is used to denote the externality effects of the military and non-military sectors, and the constant elasticity of *C* with respect to *M*, can be rewritten in the following form:

$$\hat{Y} = \frac{C_L L}{Y}\hat{L} + C_K \frac{I}{Y} + \left(\frac{\mu}{1+\mu} - \theta\right)\frac{M}{Y}\widehat{M} + \theta\widehat{M} \tag{6}$$

This allows the divided identification of the externality effect and the marginal factor productivity differential effect. As introduced by Dunne, Smith and Willenbockel (2005), the aspect of a marginal factor productivity differential between sectors in the model often causes interpretational mistakes.

It is important to mention that there are also some econometric issues which arise when estimating the Feder-Ram model. It has been widely used and in a number of different ways, for example when assessing the effects of military expenditures by using data for individual countries (Mintz and Huang, 1990;

Ward, Davis and Lofdahl, 1995, etc.), cross-country data (Heo and DeRouen Jr, 1998), or time-series and cross-sectional data (Murdoch, Pi and Sandler, 1997). The main criticism came from Dunne, Smith and Willenbockel (2005) when they argued over the problem of multicollinearity in the case of cross-sectional data. This issue was found between the last two terms in the estimating equation and provoked a concern over applying an obviously insignificant coefficient to measure the externality effects. Moreover, when the model was estimated using time-series data, the multicollinearity problem still appeared and other complications followed. Alexander and Hansen (2004) discussed the impossibility of dividing the economy into a series of two sectors in reality. These theoretical misunderstandings have forced the mainstream literature to more advanced models of economic growth. The criticism showed the sectors should be separated from other residual sectors within the growth equation. Ram (1995) argued that because of the variation of the models and the high possibility of bias, a minimum of four sectors are necessary. However, most of the analyses in the military-growth nexus area are done with only two sectors. Dunne, Smith and Willenbockel (2005) added that the model is also specified in growth rates which limit the dynamics to a single lag. Thus, they offered the other possibility that should not limit the results and interpretation of empirical papers as seriously as the Feder-Ram model. The substitute approach is the augmented Solow growth model, which can be abundantly used for cross-country analysis (p.a. Mankiw, Romer and Weil, 1992; Knight, Loyaza and Villanueva, 1996, etc.).

3.2. Cluster Analysis and Variables

First of all, a cluster analysis was employed. Seven variables were selected based on SIPRI data – exports, imports, deficit, private savings, private consumption (all as a % of the GDP), investment GDP ratio, and military strength. A cluster analysis was performed using these seven variables for 28 EU countries between 1993 and 2014. It was expected that each variable would have an effect on the defence burden-growth relationship. One additional variable called Military Strength (MLS) was artificially added. It was used on over 40 factors to determine each nation's military power. From this score, the finalized ranking was generated. The factors were set within the algorithm, which provided a fair canvas and allowed smaller, technologically advanced nations to compete with larger, lesser-developed ones. Additionally, various bonuses and penalties were added for refinement. The MLS variable is especially important for grouping the countries. All the current currency was converted to a constant value using the implicit price deflator, after which the multiple regression equation with the following variables was estimated:

$$RGDP = f (EXP, INV, MLTEX, IMP) \quad (7)$$

RGDP is the real growth in GDP minus real growth in military expenditures expressed as a cumulative rate of annual growth between the first and last years of the available series. EXP and IMP are the exports and imports as a percentage of GDP; INV is the gross capital formulation as a percentage of GDP; and MLTEX is military expenditures as a percentage of GDP. The signs of the coefficient are all assumed to be positive except for imports. In the model, economic growth is a dependent variable; the others are independent variables. Cuaresma and Reitschuler (2006) discussed the Feder-Ram model's popularity which can be clarified by its ability to handle the externality effects of military expenditures on economic growth. Thus, the Feder-Ram model incorporates four new independent variables to potentially find some changes: Public expenditure PUBEX (meaning non-military expenditures), public expenditure externality PUBEX ext, military expenditure externality MLTEX ext, and as described in paragraph three – employed labour growth ELG.

Considering the data set is a time series, there were two methodological concerns: The stationarity of the variables and autocorrelation. Dunne, Smith and Willenbockel (2005) also mentioned that if any variable in a regression equation is not stationary, the results of the analysis might be distorted. That is why each variable was tested for the presence of a unit root using the augmented Dickey--Fuller (D-F) test. If there was, in the case of any variable, the presence of a unit root, a 1st difference would be used to solve this problem. This happened in the case of exports, imports, and investment. To find some issues dealing with autocorrelation, the Durbin-Watson (D-W) statistic was performed. The D-W statistic indicated that there was no autocorrelation, either in the Feder-Ram model, or in the multiple regression analysis. A Granger causal analysis was employed for testing exogeneity, to allow for the simultaneity bias issues between economic growth and military expenditures and between investment and public expenditures in the Feder-Ram model. As Table 1 denotes, the Granger causal analysis findings indicate that there were no issues with simultaneity bias. Neither relationship showed a statistically significant causal effect in either direction.

T a b l e 1

Granger Causal Analysis

Military expenditures to Economic growth	$X^2 = 0.582$ (probability > $X^2 = 0.723$)
Economic growth to Military expenditures	$X^2 = 1.426$ (probability > $X^2 = 2.042$)
Public expenditures to Investment	$X^2 = 3.212$ (probability > $X^2 = 2.665$)
Investment to Public expenditures	$X^2 = 2.114$ (probability > $X^2 = 1.083$)

Source: Own calculation based on data from SIPRI (2015).

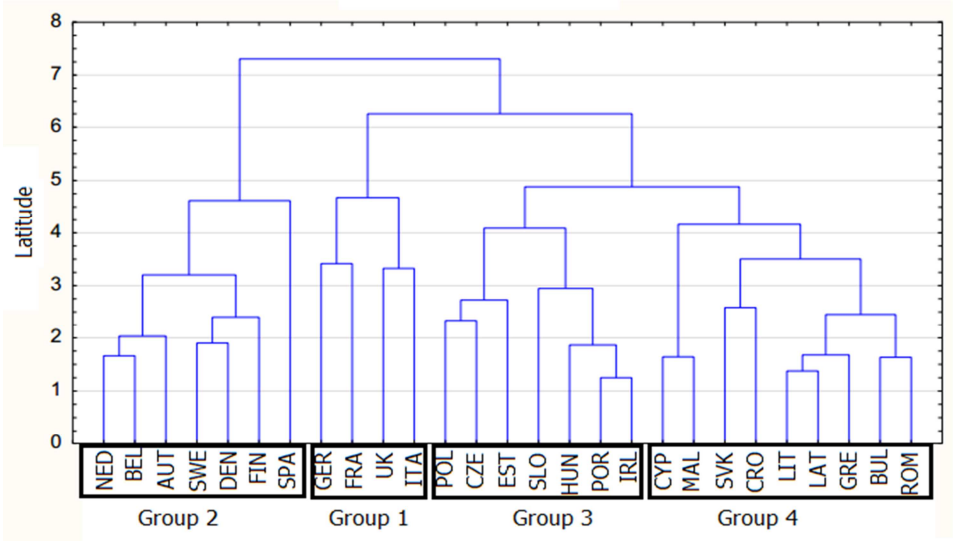
4. Results

4.1. Cluster Analysis

Clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar to each other than to those in other groups. Of course, there might be some characteristics that do not fit all the members of a group. See Figure 1 for more details.

F i g u r e 1

Cluster Analysis – Euclidean Distances



Source: Own adaptation based on data from SIPRI (2015).

Group 1 (Germany, France, the United Kingdom, and Italy) – the resource-abundant group and the richest nations in the EU – was characterized by a high growth in foreign exchange earnings, a low debt-service ratio (except for Italy), a low incremental capital-output ratio, a high GDP ratio, and a very good balance between private savings and consumption. This group also had a very high government expenditure multiplier and a very good ranking in the final score of the special variable, military strength.

Group 2 (Spain, Belgium, the Netherlands, Austria, Sweden, Denmark, and Finland) includes countries which are very similar to Group 1; we can also call them resource-abundant nations, but the results were not as strong in most variables as they were in Group 1. Spain was balanced between Groups 1 and 2, but was finally located in Group 2.

Group 3 and Group 4 are called resource-constrained groups. In the case of Group 3 (Poland, the Czech Republic, Estonia, Slovenia, Hungary, Portugal, and Ireland), the results were not as strict as in Group 4. These nations were characterized by lower growth in foreign exchange countries, a higher debt-service ratio, a lower government expenditure multiplier, a lower incremental capital-output ratio, and a flawed balance between private savings and consumption. The ranking in the final score of military strength was deficient with the exception of Poland, which has one of the best military strengths in Europe.

Each nation was classified at the 100% probability level, except for Spain which had a probability of 81% correct placement, and Poland, which had a probability of 87% correct placement. In Poland's case, the reason might be the last additional variable – Military Strength, because Poland belongs to the strongest countries. Spain should probably belong to Group 1 because of its well-known economic similarity to these countries, but the paper respects the cluster analysis result. Moreover, Italy had a correct placement probability of 74%.

4.2. Regression Analysis and the Feder-Ram Model

Table 2 presents the findings with the regression equation of a multiple regression analysis containing four independent variables, and Table 2 shows the results of the Feder-Ram model where four more independent variables were added – military expenditures externality (MLTEX ext), public expenditures (PUBEX), public expenditures externality (PUBEX ext), and employed labour growth (ELG).

T a b l e 2

Regression Analysis Results

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group x**
Dependent Var.: **RGDP**	Coefficient (Standard Error)				
EXP	1.284**	1.452*	2.241*	2.111**	2.754
INV	2.951**	2.248**	2.214*	1.794**	2.201**
MLTEX	0.332**	0.840	0.625	–0.045**	–0.154
IMP	–2.810**	–2.021*	–1.514**	–2.875**	–2.985*
Constant	0.021 (0.095)	0.052 (0.147)	0.101 (0.154)	0.084 (0.111)	0.102 (0.144)
Adjusted R^2	0.58	0.67	0.49	0.66	0.52
D-W stat.	1.67	1.75	1.74	1.82	1.76

Note: * p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01.

Source: Own calculation based on data from SIPRI (2015).

Adjusted R^2 indicates that both models perform quite well. The resultant value oscillates around 0.6. As expected in both models, imports show a significant negative effect on economic growth and exports, as well as a significant positive effect on investment.

The results of the regression analysis in Table 2 imply that military expenditures have a significant effect on economic growth in Group 1 (positive) and Group 4 (negative). This verifies the examined hypothesis of Frederiksen and Looney (1985). In their equations (below), RGDP is the real growth in GDP; INV is the gross capital formulation as a percentage of GDP; and AID is the receipts of bilateral aid as a percentage of GDP. The variable AID is different because of the analysis of developing countries. The results show a positive and significant coefficient in richer nations (Group 1) and a negative but also significant coefficient in poorer nations. Adjusted R^2 signifies very strong results. Group 1 shows that a 1% increase in military expenditures tends to a 0.22% increase in the economic growth rate. On the other hand, Group 2 shows that a 1% increase in military expenditures brings a 1.22% decrease in the economic growth rate.

(Group 1) RGDP = 1.77 + 0.16 INVEST + 0.12 AID + 0.22 DEFN (8)
(R^2 = 0.89) (6.11)** (3.07)** (3.77)**

(Group 2) RGDP = 4.72 + 0.15 INVEST + 0.19 AID + –1.22 DEFN (9)
(R^2 = 0.76) (1.92) (1.46) (–3.52)**

Nevertheless, the results of this paper deviate greatly from Benoit's (1978) original finding of no significant relationship between military expenditure and economic growth.

As shown in Table 3, the Feder-Ram model brings quite diverse results. The new variables PUBEX, PUBEX ext, INV, and ELG, unsurprisingly demonstrate a significant positive impact on economic growth (of varying strengths) for all groups. In the case of military expenditures, there are no significant effects for Groups 1, 2 and x, but Groups 3 and 4 show a significant negative effect. However, the last new variable, MLTEX ext, brings some significant changes. All groups show a significant positive impact. The author expects that it might be due to offsetting negative effects. The highest value of Group 1 shows that a 1% increase in military expenditures implies a 0.341% increase in economic growth. In Luxembourg's case (Group x), there is only a 0.028% increase. Atesoglu and Mueller (1990), Cuaresma and Reitschuler (2006), and Heo (2010) all show similar findings. Conversely, externalities showed an insignificant effect as noted by Mintz and Huang (1990) and War, Davis and Lofdahl (1995). Turning to offsets, as found by Heo and Eger (2005) or Dunne, Smith and Willenbockel (2005), the significant effects (either positive or negative) of military expenditures on economic growth become meaningful over two years because of the offset by the delayed effects. However, this is often seen by some as protectionist and distortion of competition, which is also why results might be distorted. Offset agreements often involve trade in military goods and services; this is an agreement

between two parties whereby a supplier agrees to buy products from the party to whom it is selling in order to win the buyer as a customer and offset the buyer's outlay. While each country uses its own, there is no formal offset policy. Usually MoD functions as a governing body for offsets. Ungaro (2012) mentioned that the value of global offset obligations is estimated to increase in the future thanks to the ambitious defence procurement programmes of countries such as Brazil, India, Indonesia, Saudi Arabia, Taiwan, and the United Arab Emirates. It seems evident that the defence offset market presents strong dynamics that could negatively affect European defence companies' competitiveness and, above all, the European defence technological edge as a whole.

T a b l e 3

Feder-Ram Model

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group x**
Dependent Var.: **RGDP**	Coefficient (Standard Error)				
ELG	0.242**	0.023*	0.134**	0.098*	0.324*
INV	0.085*	0.623**	0.035*	0.061**	1.008**
MLTEX	0.232	0.198	–0.049*	–0.386*	0.054
MLTEX ext	0.341*	0.224**	0.121*	0.041**	0.028*
PUBEX	1.094***	2.084**	1.078***	1.099**	1.415***
PUBEX ext	1.235***	2.854***	2.124**	1.277***	1.889***
Constant	0.010 (0.107)	0.008 (0.245)	–0.015 (0.022)	–0.006 (0.007)	0.001 (0.012)
Adjusted R^2	0.54	0.66	0.42	0.71	0.78
D-W stat.	1.81	1.80	1.67	2.14	1.89

Note: * p-value < 0.10; ** p-value < 0.05; *** p-value < 0.01.

Source: Own calculation based on data from SIPRI (2015).

These real effects of military expenditures may not be direct because the aforementioned delay might arise through indirect channels, such as investment, consumption, employment, international competitiveness, national debt, and budgetary trade-offs through cutbacks on public expenditures on health or education. According to Dunne, Nikolaidou and Smith (2002), those effects likely reduce demand in the given economy, potentially leading to reduced output and unemployment, though resources will also be freed for alternative uses. It may also reduce the role of the army in the non-military sector, meaning that any training, infrastructure, or national cohesion it may have provided so far will need to be replaced. Or finally, it may cause a reduction in the imports of arms which will free scarce foreign exchange reserves, but will also lead to a reduction in the employment of bureaucrats and employees involved in trade.

According to Dunne, Smith and Willenbockel (2005), the potential reason previous studies recorded a positive or negative influence is because the various versions of the Feder-Ram used were based on a defence-growth model. It was

pointed out that this model is not commonly used in the mainstream literature in economics and that is why the body of literature has found an insignificant relationship between military expenditures and economic growth (Collier and Hoeffler, 2004). However, there are several factors which could have led to a different result, such as different theoretical underpinnings, different estimation methods, different groups of countries etc. Dunne, Smith and Willenbockel (2005) argues that the Feder-Ram model should not be used in defence economics research because of simultaneity bias, multicollinearity between independent variables, and its statistic nature stemming from the lack of lagged regressors. To address these issues, they recommend the augmented Solow model which was presented by Mankiw, Romer and Weil (1992).

Dunne, Smith and Willenbockel (2005) published a paper that evaluates some of the theoretical and econometric issues involved in estimating the growth models which also include military expenditures. They hold that while the mainstream growth literature has not found military expenditures to represent a significant determinant of growth, much of the defence economics literature has found significant effects. The paper argues that this is largely a product of a particular specification, the Feder-Ram model, which has been used in defence economics but not mainstream literature. The paper suggests that the commonly used Feder--Ram model has a number of weaknesses and misinterpretations and should not really be the main tool for such analyses. They recommend a simple neoclassical growth model as a helpful alternative approach and introduce the impact of military expenditures through its effects on technology. Another issue considered is the use of data panels, rather than simple cross sections on averages. Their estimates were made of both the Feder-Ram and the new growth model using one and two-way fixed-effects models and a Swamy random coefficient estimator. It produced poor results for the Feder-Ram model, but much more promising results for the new growth model.

Conclusion

Based on a review of the previous research, this paper examined the possible impacts of military expenditures on economic growth in EU countries – a relevant and timely topic which has heralded relatively little research interest thus far. After reviewing the available literature and contributions, the following hypothesis was examined: There should be a negative relationship between military expenditures and economic growth in relatively poorer countries of the EU and a positive relationship in more affluent ones. A multiple regression analysis with the Feder-Ram model was subsequently employed for all groups. The real civilian

growth in GDP was considered to be a dependent variable and the remaining choices were independent variables. The first multiple regression analysis with chosen variables found a statistical significance for Groups 1 and 4, when focused on the results of military expenditure values. This means for the most resource--abundant countries (the most affluent) and for the most resource-constrained countries (the most deprived). Generally speaking, the results verified the hypothesis that was laid down for the purpose of this article which states that military expenditures in relatively richer countries tend to have a positive impact on economic growth. These countries can be less concerned by scarce finances and as a result of their other positive parts (linkage with industry, research, education, etc.) military expenditures can have a significant and positive impact on economic growth. On the other hand, there are relatively poorer countries that may have insufficient government resources or a lack of foreign exchange. In the case of these nations, military expenditures obviously drain finances away from more productive investments with a consequent binding impact on economic growth. Thus, it is necessary to recognise the determinants of military expenditures as well as the interdependence of the supply and demand side. However, the Feder-Ram model showed almost no relevance to the hypothesis. Only Groups 3 and 4 demonstrated a significant negative effect which verifies the statement. Nevertheless, testing externality effects resulted in a significant positive impact of military expenditures on economic growth. Moreover, both public spending and its externality effect denoted a very strong positive effect which might not be surprising, as in the case of defence spending. Finally, it must be noted that the findings of this study might be very sensitive to the chosen time period, individual variables, or adopted methodology. Thus, this could open a new space for future research using diverse methods, countries, or time periods.

References

AIZENMANN, J. – GLICK, R. (2006): Military Expenditure, Threats, and Growth: Journal of International Trade & Economic Development. Taylor and Francis Journal, *15*, No. 2, pp. 129 – 155.

ALEXANDER, W. R. – HANSEN, P. (2004): Military Spending and Economic Growth. Applied Econometrics and International Development, *4 – 2*, No. 1, pp. 35 – 54.

ALPTEKIN, A. – LEVINE, P. (2010): Military Expenditure and Economic Growth: A Meta-analysis. European Journal of Political Economy, Elsevier, *28*, No. 4, pp. 636 – 650.

ATESOGLU, S. – MUELLER, M. (1990): Defence Spending and Economic Growth: Defence and Peace Economics, *33*, No. 1, pp. 19 – 27.

BENOIT, E. (1978): Growth and Defence in Developing Countries. Economic: Development and Cultural Change, *26*, No. 2, pp. 271 – 280.

BERNAUER, T. – KOUBI, V. (2009): National and Regional Economic Consequences of Swiss Defence Spending. Journal of Peace Research, *46*, No. 1, pp. 467 – 484.

BISWAS, B. – RAM, R. (1986): Military Expenditures and Economic Growth in Less Developed Countries: An Augmented Model and Further Evidence: Economic Development and Cultural Change. University of Chicago Press, *34*, No. 22, pp. 361 – 372.

COLLIER, P. – HOEFFLER, A. (2004): Greed and Grievance in Civil War. [Oxford Economic Papers.] Oxford University Press, *56*, No. 4, pp. 563 – 595.

CUARESMA, J. C. – REITSCHULER, G. (2006): Guns or Butter? Robustness and Nonlinearity Issues in the Defence Growth Nexus, Scottish Journal of Political Economy. Scotch Economic Society, *8*, No. 4, pp. 523 – 541.

DUNNE, J. P. – NIKOLAIDOU, E. – SMITH, R. (2002): Military Spending, Investment and Economic Growth in Small Industrializing Economies. The South African Journal of Economics, Economic Society of South Africa, *70*, No. 5, pp. 789 – 790.

DUNNE, J. P. – SMITH, R. – WILLENBOCKEL, D. (2005): Models of Military Expenditure and Growth: A Critical Review: Defence and Peace Economics. Taylor and Francis Journals, *16*, No. 6, pp. 449 – 461.

DUNNE, J. P. – NIKOLAIDOU, E. (2012). Defence Spending and Economic Growth in the EU-15. Defence and Peace Economics, Taylor and Francis Journals, *23*, No. 6, pp. 537 – 548.

FEDER, G. (1983): On Exports and Economic Growth. Journal of Development Economics, Elsevier, *12*, No. 1 – 2, pp. 59 – 73.

FREDERIKSEN, P. – LOONEY, R. (1985): Defence Expenditures and Economic Growth in Developing Countries. Armed Forces and Society, *11*, No. 2, pp. 298 – 301.

GOLD, D. (1990): The Impact of Defence Spending on Investment, Productivity and Economic Growth: Political and Military Sociology. Washington, DC: Defence Budget Project, *7*, No. 1, pp. 78 – 84.

HARTLEY, K. (2007): Defence Economics: Achievements and Challenges: Economics of Peace and Security Journal, *2*, No. 1, pp. 45 – 50.

HATZINIKOLAU, D. (2007): A Panel Data Analysis of the Nexus between Defence Spending and Growth in the European Union: A Comment. Defence and Peace Economics, *18*, No. 6, pp. 577 – 579.

HEO, U. – DeROUEN Jr., K. (1998): Military Expenditures, Technological Change and Economic Growth in the East Asian NIC., Journal of Politics, *60*, No. 3, pp. 830 – 846.

HEO, U. – EGER, R. (2005): Paying for Security: The Security-Prosperity Dilemma in the United States. Journal of Conflict Resolution, *49*, No. 5, pp. 792 – 817.

HEO, U. (2010): The Relationship between Defence Spending and Economic Growth in the United States. Political Research Quarterly, *63*, No. 4, pp. 760 – 770.

HEWITT, D. (1991): Military Expenditure: International Comparison of Trends. [IMF Working Paper, No. 1, pp. 1 – 52.] Washington, DC: International Monetary Fund.

CHAN, S. (1995): Grasping the Peace Dividend: Some Propositions on the Conversion of Swords into Low Shares. Mershon International Studies Review, *39*, No. 1, pp. 53 – 95.

KNIGHT, M. – LOYAZA, N. – VILLANUEVA, D. (1996): The Peace Dividend: Military Spending Cuts and Economic Growth. IMF Staff Papers, *43*, No. 1, pp. 1 – 44.

KOLLIAS, Ch. – MANOLAS, G. – PALEOLOGOU, S. M. (2004): Defence Expenditure and Economic Growth in the European Union: A Causality Analysis. Journal of Policy Modelling, Elsevier, *26*, No. 5, pp. 553 – 569.

KOLLIAS, Ch. – MYLONIDIS, N. – PALEOLOGOU, S. M. (2007): A Panel Data Analysis of the Nexus between Defence Spending and Growth in the European Union. Defence and Peace Economics, *18*, No. 1, pp. 75 – 85.

KOLLIAS, Ch. – PALEOLOGOU, S.-M. (2010): Growth, Investment and Military Expenditure in the European Union-15. Journal of Economic Studies, *37*, No. 2, pp. 228 – 240.

MacKENZIE, E. (2010): U. S. Defence Spending: The Mismatch between Plans and Resources. National Security and Defence, No. 2, pp. 1 – 15.

MANKIW, G. – ROMER, D. – WEIL, D. (1992): A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics, *107*, No. 2, pp. 407 – 437.

MEHANNA, R. A. (2004): An Econometric Contribution to the U.S. Defence-Growth Nexus: Evidence from Error Correction Model. Conflict Management and Peace Science, *21*, No. 1, pp. 121 – 131.

MINTZ, A. – HUANG, Ch. (1990): Defence Expenditures, Economic Growth and the "Peace Dividend". American Political Science Review, *84*, No. 2, pp. 1283 – 1293.

MURDOCH, J. C. – PI, C. R. – SANDLER, T. (1997): The Impact of Defence and Non-defence Public Spending on Growth in Asia and Latin America. Defence and Peace Economics, *8*, No. 2, pp. 205 – 224.

MYLONIDIS, N. (2008): Revisiting the Nexus between Military Spending and Growth in the EU. Defence and Peace Economics, *19*, No. 4, pp. 265 – 272.

RAM, R. (1986): Government Size and Economic Growth: A New Framework and Some Evidence from Cross-Section and Time-series Data. The American Economic Review, *76*, No. 1, pp. 191 – 203.

SIPRI (2015): Defining Military Expenditure. [Online.] SIPRI Military Expenditure Database. Available at: <http://www.sipri.org/research/armaments/milex/milex_database>.

UNGARO, A. R. (2012): Trends in the Defence Offset Market. 17th Annual ICES. [Online.] Available at: <http://www.sipri.org/research/armaments/milex/ICES2013/papers/archive/ungaro-trends-in-the-defence-offsets-market>.

WARD, M. – DAVIS, D. – LOFDAHL, C. (1995): A Century of Trade-offs: Defence and Growth in Japan and the United States. International Studies Quarterly, *39*, No. 2, pp. 27 – 50.

WIJEWEERA, A. – WEBB, M. (2012: Using the Feder-Ram and Military Keynesian Models to Examine the Link between Defence Spending and Economic Growth. Defence and Peace Economics, *23*, No. 3, pp. 303 – 311.