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Analysis of Relationship between Military Expenditures and Economic Growth

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Declaration

I hereby, declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material which has been accepted or submitted for the award of any other degree or diploma.

I also declare that, to the best of my knowledge and belief, this thesis contains no material previously published or written by any other person except where due reference is made in the text of the thesis.

In Prague, 1st May 2016

Tomáš Daněk

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List of Abbreviations

ACE	the Allied Command Europe
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
AID	Receipts of Bilateral Aid
ARDL	Autoregressive Distributed Lag
ARRC	the Allied Rapid Reaction Corps
CAGR	Compound Annual Growth Rate
CES	Constant Elasticity Function
CGPD (**CIVGDP**)	Real Growth in Gross Domestic Product
CORRUP	Corruption
COW	Country of War Project
CSIS	Centre for Strategic and International Studies
D-W	Durbin-Watson
ELG	Employed Labour Growth
EU	European Union
EXP	Exports
GDP	Gross Domestic Product
GFSY	Government Financial Statistic Yearbook
ICRG	International Country Risk Guide
IISS	International Institute for Strategic Studies
IMF	International Monetary Fund
IMP	Imports
INV	Investments
LM	Lagrange Multiplier
MLTEX	Military Expenditures
NATO	North Atlantic Treaty Organization
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
O&M	Operations and Maintenance
PUBEX	Public Expenditures
RAB	Resource Account Budgeting
RAF	the Royal Air Force

R&D	Research and Development
SBIC	Schwartz Bayes Information Criterion
SIPRI	Stockholm International Peace Research Institute
THR	Threat
UECM	Unrestricted Correction Error Models
UK	the United Kingdom
UN	United Nations
US / U.S./ USA	the United States of America
VAR	Vector Auto-regression
V4	Visegrad Four
WB	World Bank
WTO	World Trade Organization
WW1	the World War First
WW2	the World War Second

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Summary

The dissertation thesis is aimed to examine the relationship between military expenditures (independent variable) and economic growth (dependent variable). Fixed effects balanced panel data regression models are used to analyse the relationship. This thesis hopes to contribute to the existing pool of literature by examining the relationship between military expenditures and economic growth in European countries, because there is an obvious lack of studies in this area.

The first section of the thesis deals with the different definitions of military expenditures used by international organisations; characterizes the "guns vs. butter" trade-off issue and introduces the overall global and European situation of defence economy. The second part comes with the theoretical approaches, individual effects and determinants of military expenditures and models the relationship between military expenditures and economic growth. Subsequently, the methodology section follows and the last part is an own empirical research that includes new conclusions in the area of defence economics.

There are three growth models with different variations used in the thesis (the Feder-Ram model, the Augmented Solow-Swan model and the Barro model). The data from 28 + 3 (Switzerland, Norway and Island) European countries are examined between 1993 and 2012. All together there are 620 observations. To reach the defined aim, the main hypothesis has been set and it says that there is a relationship between military expenditures and economic growth. Subsequently, the secondary hypothesis says that the relationship is positive in case of relatively richer countries and negative for relatively poorer countries. It has been also defined a research question that asks which model better describes the relationship (if it exists) between military expenditures and economic growth. The data are mostly collected from the SIPRI, NATO and OECD database.

According to the results, the final conclusion is that the relationship between military expenditures and economic growth in European countries does exist. The positive character in relatively richer countries and negative character in relatively poorer countries was rather verified. The Feder-Ram model seems to be the most appropriate way in order to analyze the relationship between military expenditures and economic growth.

Shrnutí

Předložená dizertační práce si klade za cíl analyzovat vztah mezi vojenskými výdaji jako nezávisle proměnnou a ekonomickým růstem jako závisle proměnnou. K tomu poslouží statistická metoda regresní analýzy, kdy jsou pozorována panelová data vyvážených modelů s fixními efekty. Na základě rešerše bylo zjištěno, že publikovaných prací, které se zabývají vlivem vojenských výdajů na ekonomický růst v evropských státech, je nedostatek a právě v tom, že se analyzují data evropských států, spočívá přínos dizertační práce.

První část práce se zabývá rozdílnými definicemi vojenských výdajů používanými jednotlivými mezinárodními organizacemi. Dále je rozebírána problematika „trade-off" mezi „zbraněmi a máslem" a z globálního pohledu představena celková situace ekonomiky obrany ve světě. Druhá část dizertační práce přichází s jednotlivými teoretickými přístupy, efekty a determinanty vojenských výdajů a formulují se zde jednotlivé modely. Následuje popis použitých metod a dat a samotná empirická část, která obsahuje nové závěry v oblasti ekonomiky obrany vyvozené z výsledků vlastní analýzy.

Zvoleny byly tři růstové modely (Feder-Ramův, rozšířený Solow-Swanův a Barroův model) a jejich následné variace. V časovém období let 1993 až 2012 se sleduje 28 zemí EU + Švýcarsko, Norsko a Island. Celkem se tak jedná o 620 pozorování. Data jsou sbírána především z databází Stockholmského mezinárodního institutu pro výzkum míru (SIPRI), Severoatlantické aliance (NATO) a Organizace pro hospodářskou spolupráci a rozvoj (OECD). Na základě rešerše byla stanovena primární hypotéza, která tvrdí, že existuje vztah mezi vojenskými výdaji a ekonomickým růstem. Dále byla formulována sekundární hypotéza, která říká, že existuje pozitivní vztah mezi vojenskými výdaji a ekonomickým růstem u relativně zdrojově bohatších států a negativní vztah mezi sledovanými proměnnými u relativně zdrojově chudších států. Položena byla výzkumná otázka se záměrem zjistit, který z použitých růstových modelů se jeví jako nejvhodnější pro odhadování vztahu mezi sledovanými proměnnými.

Na základě dosažených výsledků kvantitativní analýzy je možné konstatovat, že primární hypotéza byla potvrzena a vztah mezi vojenskými výdaji a ekonomickým růstem existuje. Sekundární hypotéza, a tedy pozitivní charakter tohoto vztahu u relativně zdrojově bohatších států a negativní charakter u relativně zdrojově chudších států byl spíše prokázán. Jako nejvhodnější se jeví použití Feder-Ramova modelu.

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 adverse effect on economic growth as it displaces investment on productive sectors of the economy, while others are of the view that military spending improves economic performance as it tends to expand aggregate demand. Furthermore, the defence sector could have a spill-over effect on the economy through technological progress, infrastructure, and human capital formation. Finally, 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.

Comparing to other parts of public sector, defence economics is relatively new area. In the literature many different topics dealing with the defence economics are examined by individual researchers as for example: Abbott et al. (2006), Bellais and Guichard (2006), Castille et al (2001), Guyot and Vranceanu (2001), Hartcup (2000), Hodzic (2014), James (2005) Mallik (2004), Molas-Gallart (2001), Setter and Tishler (2006), Schofield (2006), Sköns (2004), Stone (2004), Terriff (2010), Välivehmas (2010) etc. One of the first scholars who began with this discipline were probably Hitch and McKean (1960). They introduced some overview of the achievements and challenges for defence economics. According to Hartley (2010), defence economics was defined differently during and after the Cold War. During the Cold War it was a definition of economic study of defence, disarmament, conversion and peace. After this period, it has been focusing on the economics of war and peace. He added that modern definitions include the analysis of wars and conflicts both conventional and non-conventional. An examination of civil wars, revolutions or terrorism was mentioned (Brauer, 2003; Barros and Sandler, 2003; Hartley 2007).

At the beginning there were quite a lot of American scholars and according to them, it is possible to divide defence economics into these main parts:

a) Models of arms races (Richardson, 1960 or Brito and Intriligator, 1974),
b) Economic theories of alliances (Olson and Zeckhauser, 1966 or Sandler and Forbes, 1980),
c) The demand for military expenditures (Smith, 1980),

d) Defence, growth and development (Benoit, 1978),
e) The economics of military personnel (Hansen, Burton and Weisbrod, 1967),
f) Procurement and contracting (Peck and Scherer, 1962).

Since the end of the Cold War and in the post-Cold War environment there were some new developments appeared in the defence economics. These especially characterize a new expression of globalization and new security threats in the form of international terrorism. They include:

a) Economic analysis of disarmament and the peace dividend (Hartley et al., 1993; Hartley and Sandler 2000),
b) The arms trade (Levine et al., 2000),
c) Terrorism (Sandler, 1992),
d) Economic studies of conflict (Hartley and Sandler, 2003),
e) Economic of peace-keeping (Solomon and Berkok, 2006).

The above mentioned authors might be considered to be the pioneering researchers in each area. Turning to Hartley (2010) contribution with his research, from 1990 to 2000 the following top 10 topics were found across the research and examination:

1) Defence expenditures studies
2) Procurement processes and policies
3) Economics of alliances
4) Conversion
5) Defence industries and industrial base
6) Military manpower
7) Country surveys
8) Terrorism
9) Defence spending and growth
10) Defence and public choice

From the year 2000 further, some progress and changing trends were found in many publications. A big jump to the leading position was found in case of papers dealing with the defence spending-growth analysis as well as with the personnel and military production function. There are also some new topics that include arms trade, arms races, conflicts or peacekeeping.

The main attention of this thesis is focused right on the defence spending-growth relationship. The main hypothesis is formulated:

"The relationship between military expenditures and economic growth does exist."

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 (1983) 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 that there is a negative relationship between military expenditures and economic growth in relatively more resource constrained (hereafter "relatively poorer" to simplify) countries and a positive relationship in relatively more resource abundant (hereafter "relatively richer" to simplify) countries. In investigating the relationship between defence spending and economic growth 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, socio-political effects etc. Therefore, many relatively poorer countries try to save as much as they can. Consequently, they spend much less on military expenditures 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 secondary hypothesis was adopted and this claims that:

"There is 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 main aim of the thesis is to examine these two hypotheses using the sample of chosen European countries. A cluster analysis is used to divide the countries into individual groups with the similar characteristic. Consequently, a fixed effect balanced panel data regression model is used to analyse the above mentioned relationship.

The additional research question is set and it asks which of the three models was better for estimating the relationship between military expenditures and economic growth – if one of the two neoclassical models, i.e. – the Feder-Ram or the augmented

Solow-Swan model or the endogenous Barro model. The augmented Solow-Swan model is also examined with and without including dummy variables ("dummies"). The other task is to use the autoregressive distributed lag (ARDL)-bound test for examining the cointegration between military expenditures and economic growth as well as the Toda-Yamamoto test in order to analyse the Granger causality. The presence of long-run coefficients is tested at the end. The simple reason why the following thesis comes with many statistical and econometric methods (that sometimes might seem to be similar) is that the author's aim is to have a stronger certainty of results and to find potential discrepancies between the used methods. Likewise, the author finds important to explicitly present the theoretical base and characteristic of each method in order to have a comprehensive homogenous research material.

The first section of the thesis deals with the different definitions of military expenditures used by international organisations; characterizes the "guns vs. butter" issue and introduces the overall global and European situation of defence economy. The second part comes with the theoretical approaches, individual effects and determinants of military expenditures as well as with the review of literature. Subsequently, the methodology section follows and the last part is an own empirical research that includes new conclusions in the area of defence economics. For the purpose of the thesis, data from 28 + 3 European countries are examined between 1993 and 2012. This time range was chosen because of the availability of data from 1993 to keep the balanced model. In the year of analyzing the data of this thesis (2015) there was no complete data set for the years 2013 and 2014. The data are collected from the Stockholm International Peace Research Institute (SIPRI), Centre for Strategic and International Studies (CSIS), North Atlantic Treaty Organization (NATO) and Organization for Economic Co-Operation and Development (OECD) database. For the purpose of gathering data for the Barro model, the International Country Risk Guide (ICRG) and Country of War Project (COW) database have to be used.

This thesis hopes to contribute to the existing pool of literature by examining the relationship between military expenditures and economic growth among European countries, because there is an obvious lack of studies in this area. Moreover, the motivation is much bigger 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.

1 Current Practice

1.1 Military-Growth Nexus

Military expenditures are characterized by many definitions. It is generally understood that military spending represents an economic or financial burden of any country. There is, however, a rather substantial difficulty related to its definition since every single country may characterize military expenditures according to its own needs. There will be consequently a significant discrepancy within the world-wide comparison. Due to this reason, some international organisations acceded to a unification of definitions. The NATO, SIPRI or IMF definitions are the most frequently mentioned. However they still use some characteristics that differ.

NATO defines military expenditures as the total measure of financial burden caused by military operations. Generally speaking it is the amount of spending by NATO on their military forces in order to keep the international military dominance. But NATO prioritises use of this classification only for its internal needs. Defence expenditures are calculated on the basis of the revised NATO definition agreed to in 2004 which excludes expenditures on paramilitary forces – even those with a national defence function during the time of war. It means expenditures on other forces that are structured, equipped and trained to support defence forces. However, there are differences between this and national characteristics of military expenditures. There may be a considerable divergence from those which are quoted by national authorities or given in national budgets (NATO, 2015).

SIPRI has got rather similar definition. They state there is no generally accepted world-wide definition of military expenditures. SIPRI seeks to include all costs incurred as a result of the current military activities. According to them, these factors and activities include:

- armed forces (including peacekeeping forces),
- defence ministries and other government agencies engaged in defence projects,
- paramilitary forces, when judged to be trained and equipped for military operations,
- military space activities that include all current and capital expenditure,
- military and civil personnel (including retirement pensions of military personnel and social services for personnel),

- operations and maintenance,
- procurement,
- military research and development,
- military aid (in military expenditures of the donor country, excluding civil defence and current expenditures for past military activities, such as for veteran's benefits, demobilisation, conversion and weapon decommission).

As mentioned above, the SIPRI definition is very close to that of NATO. The main difference is the exclusion of expenditures on paramilitary forces by NATO.

The IMF collects the expenditure data for its Government Financial Statistic Yearbook (GFSY) according to the functional classification and typically categorises military pensions within the social security function. The IMF data are also widely used by the World Bank (WB). Other organisations and countries make use of various definitions. Media reports on military expenditures, including specialist publications, tend to report simply on the defence budget of the given country, although many countries have significant military expenditures in other budget lines as well. For example, the United Kingdom (UK) along with a number of other governments has moved to a system of Resource Account Budgeting (RAB) across all the areas of government budgeting that involves accounting for expenditures on an accrual rather than cash basis and includes items such as a charge for the capital employed based on the assumed return that could have been obtained in case the capital was deployed otherwise (SIPRI, 2015).

It is obvious that all results and findings must be interpreted carefully because of many problems with questionable data. A lot of problems appear when analysing different data – definitions, characteristic, accuracy or coverage. There are many difficulties if it is needed to compare across country, or to aggregate it to larger groups. These different characteristics are mostly essential when conducting cross section analysis of nations but not when analyzing time series data.

1.1.1 Military Expenditures

After the Cold War defence spending generally fell from the highest numbers of the late 80s by approximately the third. In the mid-1990s most of the aspiring EU members were facing financial constraints and could realistically expect to do very little on their own to make their military systems compatible with NATO's systems.

Nevertheless, overall defence spending in EU countries is nowadays higher than in 2001. According to SIPRI (2015) military expenditures grew from this year in the highest level since the World War 2 (WW2). As it is seen from table 3 the EU countries hold worldwide 5th, 6th, 7th and 11th position thanks to France, UK, Germany and Italy. Their combined spending was almost $200 billion in 2010 and the numbers have been still growing. However, the European defence spending has fallen from 29 % of the world military total to 20 % since 2001. Compared to countries out of European borders that are growing strong in both population and economic way, it seems to be as an objective finding. See Table 1 for defence spending for EU 28 countries in two decades – firstly from 1993 – 2000, then from 2001 – 2012. There is mostly an obvious decrease in the second decade. But, the real amount of military expenditure was growing. The largest drop has been noticed by Croatia, Romania or Cyprus. Poland or Portugal holds almost the same level, Estonia enjoyed the increase.

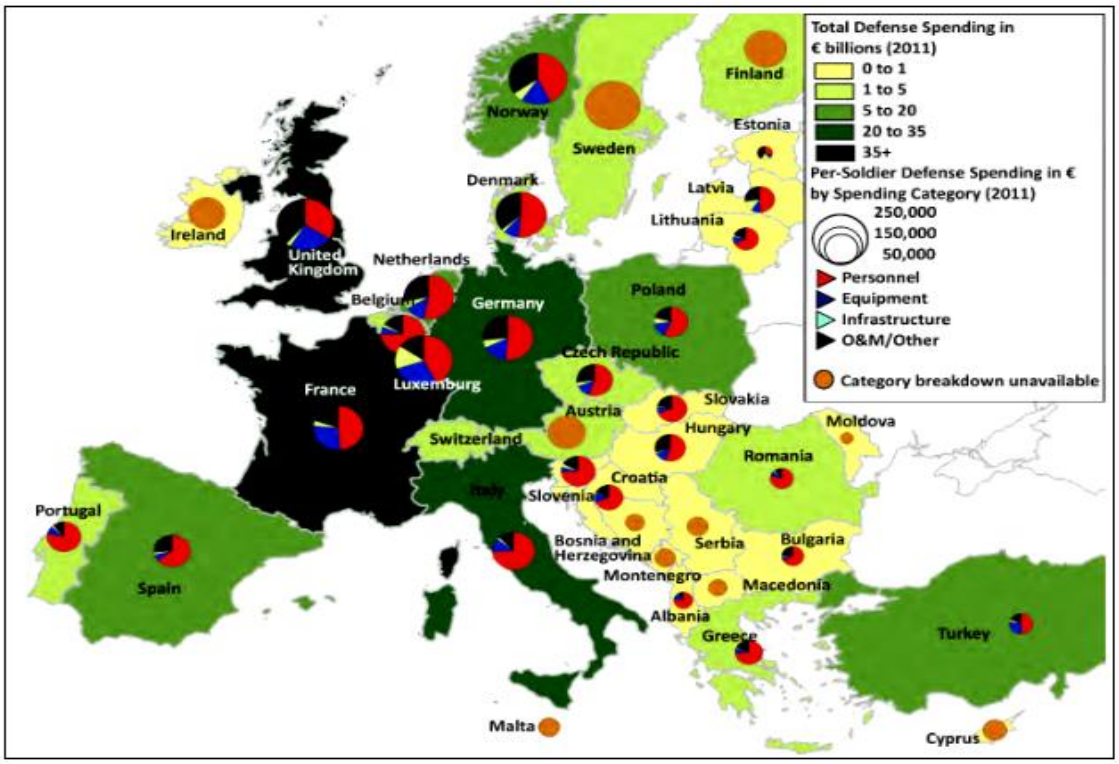
Table 1 Military expenditures as a % of GDP for the EU 28 + 3 (1993 – 2012)

Country	**1993-2000**	**2001-2012**	**Country**	**1993-2000**	**2002-2012**
Germany	1.55	1.35	Czech Rep.	1.80	1.45
France	2.80	2.30	Romania	2.55	1.60
UK	2.75	2.45	Hungary	1.70	1.25
Italy	1.90	1.70	Slovakia	2.05	1.35
Spain	1.25	1.15	Luxembourg	0.70	0.60
Netherlands	1.75	1.40	Croatia	4.50	1.70
Sweden	1.85	1.35	Bulgaria	2.55	1.85
Poland	1.95	1.90	Lithuania	1.40	1.30
Belgium	1.35	1.15	Slovenia	1.50	1.40
Austria	1.00	0.85	Latvia	0.90	1.35
Denmark	1.60	1.35	Estonia	1.30	1.90
Finland	1.45	1.40	Cyprus	3.80	2.05
Greece	3.30	2.60	Malta	0.80	0.65
Portugal	2.05	2.00	Ireland	0.80	0.55
Norway *Switzerland* *Iceland*	*2.1* *1.25* -	*1.55* *0.85* *1.15*	**EU 28** **EU 28 + 3**	1.89 1.87	1.50 1.47

Source: SIPRI, 2015

Figure 1 shows a nation-by-nation comparison of total military expenditures in Europe, and also spending per soldier. Because of the SIPRI database the constant (2011) US dollar (US$) currency is used in all calculations, if needed. However, the thesis includes both US dollar and Euro (€) currency. Then the exchange rate is approx. 1 Euro = 1.35 US dollars.

Figure 1 European military expenditures

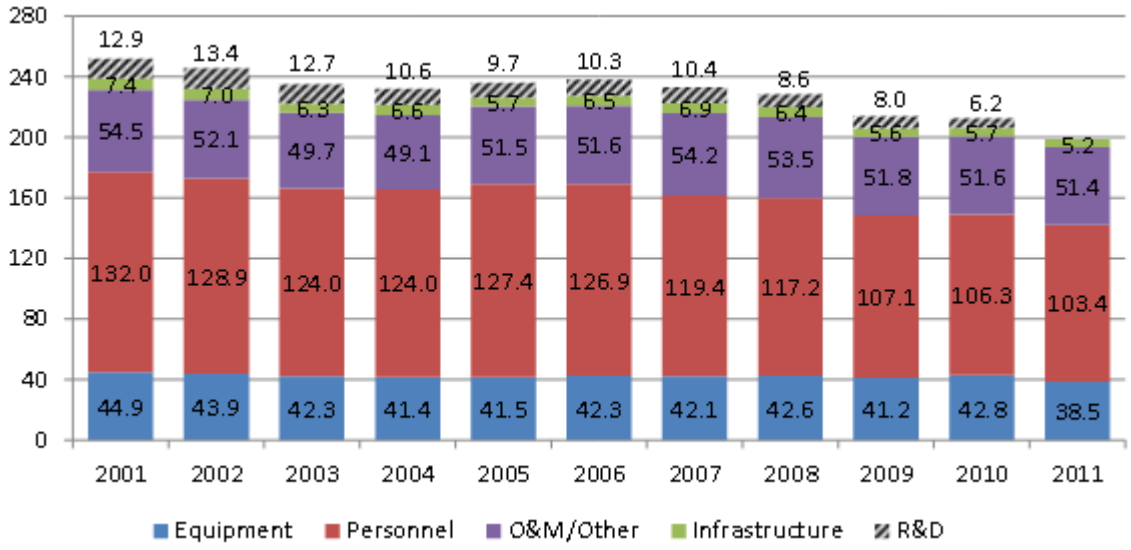


Source: NATO; SIPRI, 2015; own modification

From the total defence spending point of view the main military leaders are again – UK and France followed by Germany and Italy. The one of the largest army represented by Poland comes next, also Spain and Netherlands or non-EU countries such as Norway or Turkey. In the next group there are the rest of Scandinavian countries (Sweden, Finland and Denmark), Portugal, Austria, Belgium, Romania, the Czech Republic, Greece or non-EU Switzerland. Finally, the last yellow group is represented by Baltic countries (Latvia, Lithuania and Estonia), Slovakia, Hungary, the rest of countries that were part of the Soviet Union, Ireland, Malta and Cyprus.

Military expenditures are divided into special functional military spending categories – Personnel, Equipment, Infrastructure and Operation with Maintenance plus other. Because of unavailable data for each nation it is not possible to present all shown countries with these characteristics. See Figure 2 for more accuracy in breaking down spending showed by functional military expenditure categories. Military spending are displayed in million dollars. R&D means research and development.

Figure 2 European total military expenditures by functional categories (2001 – 2011)



Source: NATO, 2015; own modification

The data reveal that all the categories enjoyed some increase in absolute terms during the middle of chosen time range. The expenditure trend in each military functional category diminished during the time-range while spending per soldier diminished during this time.

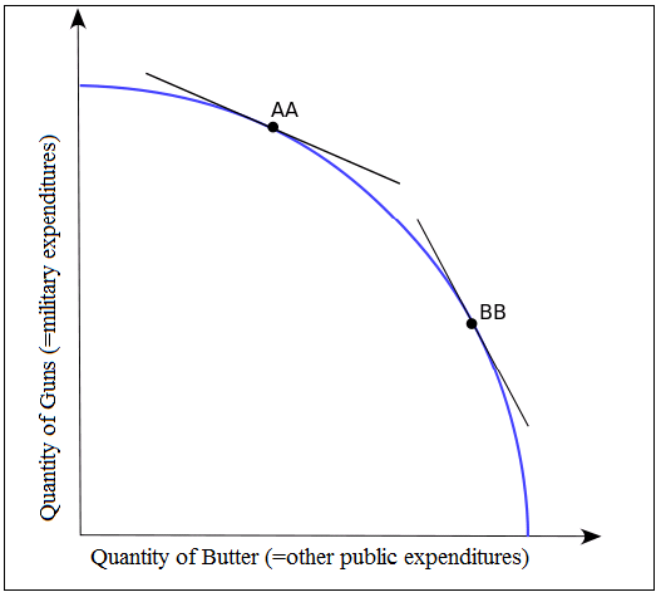
1.1.2 Guns vs. Butter

A lot of research papers have tried to examine the military expenditures and its influence on economic growth - but also the influence on other macroeconomic aggregates as for example – inflation, unemployment, or on education, etc. There is generally a significant inconsistency in the view of a society on whether military expenditures have a positive or a negative impact on the economic growth. And there is also a controversy in modern macroeconomics on the subject, as different schools of economics thought differ on how households and financial markets would react to more government spending under various circumstances.

People have to choose between two options – either to buy guns (invest in military or defence) or to buy a butter (invest in the production of other goods), or do both. The amount of military expenditures realised for ensuring security is obviously determined by political decisions. Public spending related to this purpose is associated with a reduction in expenditures on other public goods. In some economy where there are two goods, an option has to be done between how big portion of each one

manufacture. Because the economy produces more guns (defence expenditures) it must reduces its production of butter (other public expenditures), and vice versa. The "guns and butter" model is a typical example of the production possibility frontier (see Figure 3).

Figure 3: Guns vs. Butter model



Source: SIPRI, 2015; own modification

As it is shown in Figure 1 the main curve represents all possibilities of production for the economy. Two curves displayed by Figure 3 shows two possible options of product. The main idea is that every single option has an opportunity cost. It is impossible to realize the output out of the curve. If yes, there has to be some boost in productivity.

The more resources are given for military spending the less are available for other parts of public spending. In this case we talk about "crowding out effect". One way of crowding out is a reduction in private investment that occurs because of an increase in government borrowing. If an increase in government spending and/or decrease in tax revenues leads to a deficit that is financed by increased borrowing, then the borrowing can increase interest rates, leading to a reduction in private investment.

1.1.3 Economic Growth

Economic growth introduces an increase in production and consumption of goods and services. With using other words, it is a process by which a country's wealth raises over time. This growth is usually indicated by increasing GDP which values will be used in the whole thesis.

As a single economy the EU has the largest economy in the world. The EU economy consists of an internal market and the EU is represented as a unified entity in the World Trade Organization (WTO). The EU's internal market is a single or common market and it guarantees the free movement of goods, services, capital and people. It is also known as the EU's four freedoms. The internal market should be helpful for all the members to increasing competition and improving efficiency of the allocation of resources. It should also direct economies to build a common integration area. However, the internal market is still open to non-EU countries.

See Table 2 for GDP as a percentage for 28 EU countries. It is divided into two periods and the significant decrease between the periods is obvious in case of almost all countries. The largest drop has been noticed for Ireland, Spain, Greece or Portugal. Very stable and high values are in case of Estonia. The countries from the Eastern Europe and Baltic countries enjoyed a significant increase (Romania, Bulgaria, Latvia and Lithuania). However, the main leaders and European major economies are still Germany, France and UK. Also Italy and Spain must be mentioned but these countries were strongly influenced by financial crisis. A special case introduces Greece and also Ireland had significant difficulties with its economy.

Table 2 GDP growth rate (in %) for the EU 28 + 3 (1993 - 2012)

Country	**1993-2000**	**2001-2012**	**Country**	**1993-2000**	**2001-2013**
Germany	1.3	1.1	Czech Rep.	1.8	2.6
France	2.0	1.0	Romania	-0.9	3.6
UK	2.9	1.5	Hungary	0.3	1.5
Italy	1.7	-0.2	Slovakia	3.5	4.5
Spain	3.2	1.2	Luxembourg	4.9	2.3
Netherlands	3.2	0.9	Croatia	1.7	1.5
Sweden	1.9	2.2	Bulgaria	-1.3	3.4
Poland	3.3	3.8	Lithuania	-1.6	4.4
Belgium	2.2	1.3	Slovenia	2.1	1.8
Austria	2.7	1.5	Latvia	-1.6	4.0
Denmark	2.4	0.6	Estonia	3.8	3.8
Finland	2.0	1.3	Cyprus	4.4	1.4
Greece	2.3	-0.1	Malta	4.5	1.9
Portugal	2.8	-0.1	Ireland	7.4	1.9
Norway	*3.4*	*1.5*	**EU 28**	**2.2**	**1.9**
Switzerland	*1.3*	*1.8*	**EU 28 + 3**	**2.3**	**1.9**
Iceland	*2.6*	*2.2*			

Source: SIPRI, 2015; own modification

1.2 Overall Situation in the World

All countries in the world must ensure internal and external security of their inhabitants and that is why politicians have to make a decision on how much money they spend on military expenditures. Military spending is an integral part of the national spending and most of the countries spend about 2 – 3 % of GDP. However we have to abstract from the major military players such as the United States. Table 3 shows 15 world's top military spenders in 2012. It is based on current market exchange rates. The first column includes expenditures in billion dollars, the second one a percentage of GDP and the third one a world share as a percentage.

Table 3 Top world military spenders in 2012

Position	Country	Military Expenditures ($ bill.)	Percentage of GDP	World share (in %)
1.	USA	640.0	3.8	36.6
2.	China	188.0	2.0	10.8
3.	Russia	87.8	4.1	5.0
4.	Saudi Arabia	67.0	9.3	3.8
5.	France	61.2	2.2	3.5
6.	United Kingdom	57.9	2.3	3.3
7.	Germany	48.8	1.4	2.8
8.	Japan	48.6	1.0	2.8
9.	India	47.4	2.5	2.7
10.	South Korea	33.9	2.8	1.9
11.	Italy	32.7	1.6	1.9
12.	Brazil	31.5	1.4	1.8
13.	Australia	24.0	1.6	1.4
14.	Turkey	19.1	2.3	1.1
15.	United Arab Emirates	19.0	4.7	1.1
TOTAL	**World**	**1747.0**	**2.4**	**100**

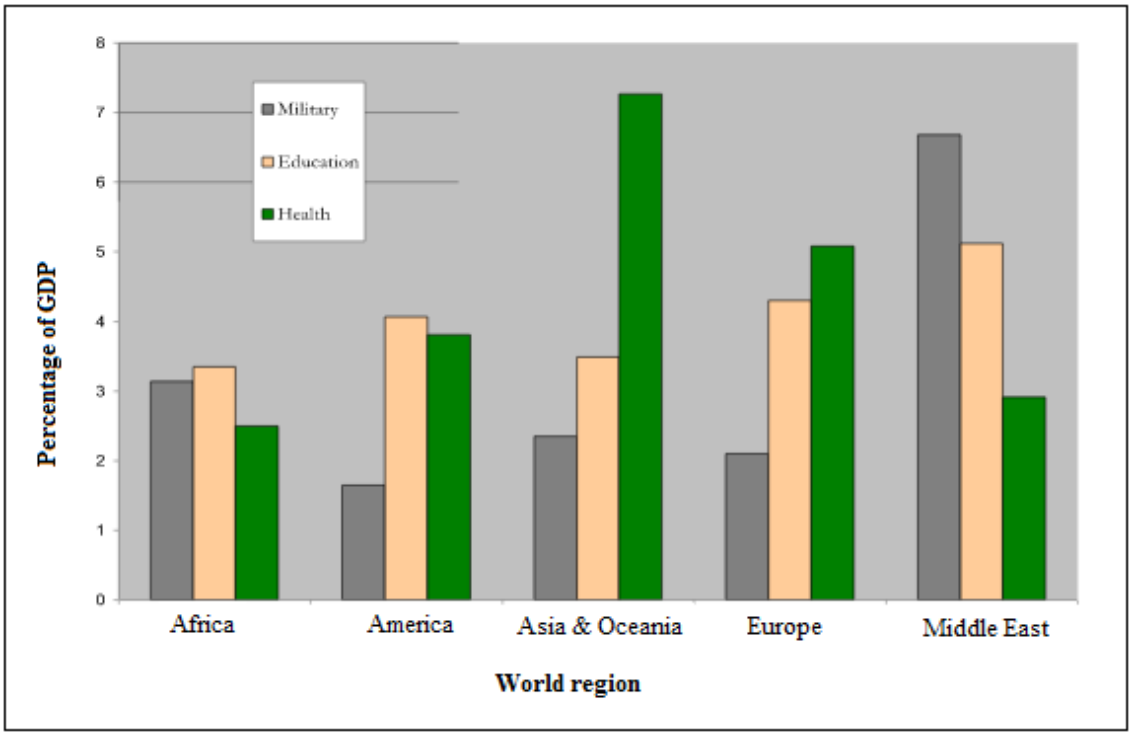
Source: SIPRI, 2015; own modification

To compare expenditures with the following year 2013 the world spending was lower in 2013 than in 2012. It was $1.75 trillion in 2013 which means the fall by 1.9 %. It is very interesting that the North America and the countries from the West and Middle Europe spent less money in 2013. For example the United Kingdom (UK) defence expenditures have been the lowest from the WW2. In the EU countries where military spending fell by 2.8 %, governments began to address soaring budget deficit having

previously enacted stimulus packages in 2009. Cuts were particularly substantial in the smaller economies (SIPRI, 2015).

On the other hand all the countries from other world regions increased their defence expenditures. Moreover, 23 of them have doubled their spending between 2004 and 2013. Russia plans to alter and modernize up to 70 % of its arsenal until 2020 and they estimate the expenditures to be more than $700 billion. It is also pointed out that the increase of military expenditures in developing countries still continues. The experts suggest that this might be a result of economic growth or kind of response to defence needs. As another reason it is mentioned the autocratic system dominance, resource wasting or the beginning of arms competition in some of these countries. Another increasing of military spending has been noticed in Saudi Arabia or China (SIPRI, 2015). The following Figure 4 reveals the average military expenditures comparing with spending on health and education in each world region.

Figure 4 World region public expenditures (average values)



Source: SIPRI, 2015; own modification

After the collapse of the Soviet Union new hopes for a stable world peace have globally raised. Suddenly, the world no longer appears to be divided into two arms camps, occasionally teetering at the brink of nuclear annihilation. There is a widespread

belief that the new military and geopolitical realities provide the unprecedented opportunities for the West to reap the peace dividends. There is a strong desire in many countries to decrease military expenditures and this desire has been growing stronger in face of the unprecedented budget deficit and the need to spend on infrastructure and other neglected domestic programs of each country. As the possibility for a significant increase in government revenues through taxes appears rather remote, defence cuts appear to be an obvious option.

However, reductions in military spending may have some serious implications. If the decrease in military expenditures is not matched with the increased private sector or government spending, there would be a decline in output and employment, due to a decline in aggregate demand. This adverse outcome, however, is not inevitable if the level of demand is maintained. In fact, if the level of aggregate demand is maintained, GDP actually increases due in large part to increases in investment and private capital. Nevertheless, while the overall economy may not be adversely affected, if the level of aggregate demand is maintained, this does not have to be true for certain regions of the economy that are heavily dependent on the defence industry (NATO, 2015).

1.3 Military Expenditures Trends in European Countries

The end of the Cold War promised a more secure European environment. This had prompted considerable speculation about the possibility of major cuts in military expenditures and the distribution of a peace dividend as the resources currently absorbed by defence among other uses such as higher consumption, investment or net exports. While the unilateral actions of a number of countries in cutting their military budgets reflect an understanding that military expenditures impose a substantial burden on economic development, there is still considerable debate between researchers dealing with the military expenditures and its level. The need for continued development of advanced weapons systems in order to deal with future threats and the importance of military production to the economy is obvious. Of course, these arguments meet opposition. Apart from the damaging social effects of militarism there is significant evidence which suggests that military expenditures are an economic burden across the European Union and that reducing military expenditures might be an opportunity rather than a cost.

The Western and Central Europe has been affected by the decreasing trend since 2010 continued to 2012. The largest diminishing was noticed in the Central Europe. Since approximately 2008, twenty countries reduced defence spending by more than 10 % in real terms. For example UK cut spending by 5.2 %, France by 3.8 %. On the other side, Germany increased military spending by 2.6 % (SIPRI, 2015).

As Guyot and Vranceanu (2013) pointed out, the impacts of continuous high defence spending has not been examined, even though it has led to fiscal difficulties, especially in nations as for example Greece, Ireland, Spain or Portugal. The nations with the toughest issues of the crisis had to lower the military expenditures most of all. However it was after a long time of surplus spending. On the other side, less-hit and more military stable countries show cuts of defence budgets rather than cuts in the other public expenditures sector such as health or education.

The political and military crisis in Ukraine has led to a major reassessment of great perceptions and military strategies in many European countries. Increased threat perceptions have led to calls for higher military spending in Europe and, in particular, a renewed commitment by NATO members to spend at least 2 % of their GDP on the military (NATO, 2015).

The following chapters characterize the military expenditures trends in EU countries. The countries are intuitively divided into individual groups and for each country a separate figure with the military expenditures in million dollars and as a percentage of GDP is presented. The sample of described countries has informative character (not all countries are mentioned to save the space – the rest might be reached upon request) and should serve as an example to better see the real trend. That is why the shorter time range (i.e. 2001 – 2012) was chosen. According to Frey et al. (2004) in the whole examined time range the year 2001 is so-called milestone because of the terrorist attacks that significantly changed the structure of defence budgets in all countries. The chapters 1.3.1 – 1.3.4, among others, are all described based on data from SIPRI (2015), NATO (2015) and CSIS (2015).

1.3.1 EU Leaders

Most of the nations in Western Europe went on to cut back defence spending as saving measure policies were obtained mostly everywhere. The drops in Western Europe since the financial crisis started in 2008 are no more limited to Western Europe.

Falls of more than 9 % since 2008 were noted for example in Austria, Italy, the Netherlands, Spain or the UK. On the other hand, defence spending of Germany were by almost 3 % higher. France importantly kept up its defence expenditures during the financial crisis with the total amount that was for five years after 2008 just by 5 % lower. And it goes on so far, accepting the special program for the period 2014 – 2019. The law sets the total defence budget, excluding military pensions, at $252 billion over 6 years. The budgets for 2014–16 are planned to be $41.7 billion each year in current prices, implying a slight fall in real terms. Long-term plans for the period to 2025 laid out in the April 2013 Defence and Security White Paper, suggest a subsequent stabilization in real terms.

A country-by-country analysis of Personnel spending reveals a significant gap between the United Kingdom, France, Germany, and Italy and the rest of Europe. However, despite high levels of overall spending in absolute terms, Personnel spending in these four countries decreased with compound annual growth rates of between -0.5 and -5 %. In addition, the top four defence spenders shifted spending, in relative terms, from the Personnel to the Equipment accounts. In fact, Equipment spending in both France and Germany experienced a positive growth while Personnel spending declined at a faster rate than did total defence spending (the latter trend was also true for the United Kingdom). The relative prioritization of Equipment over Personnel spending by the top spenders might be suggestive of a conscious decision to protect force modernization funds in an era of fiscal austerity.

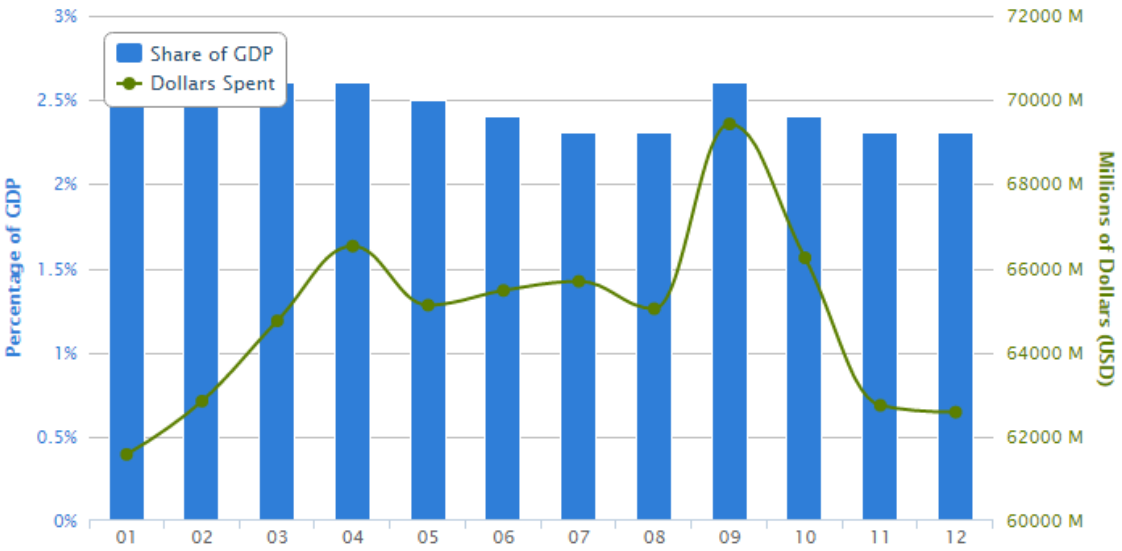
1.3.1.1 France

Military expenditures in France have evolved since 1980 and the French military budget might be divided into 3 decades - the first period takes from 1980 to 1990, the second one (also called peace dividend period) from 1990 to 2002 and the third one (known as a military reinvestment) from 2002 to 2010. It might be very interesting that the military budget in real terms at the beginning (1980) was almost the same like the budget accepted in 2010. Defence spending had been increased substantially since 2002, with the objective of reaching 2.5% of GDP. This increase has been enshrined in the Military Planning Act for 2003-2008, which calls for spending of $16.55 billion each year to maintain and improve capabilities through delivery of new equipment. This represented an average increase of 6.8 % over the whole period compared to the previous Military Planning Act for 1997-2002. In fiscal year 2007, France's defence

budget reached $65 billion, a modest dollar increase from 2006 that represented 1.4 % of GDP. A declining share of France's defence budget goes toward its nuclear force. For comparison with France's military expenditures, the U.S. defence budget in 2007 was about 3.2 % of GDP and dollar figures that dwarf the spending of the NATO partners (SIPRI, 2015).

Turning to the structure of French military expenditures this topic has become important from 1998. The reason is that in this year the amount of equipment expenditures caught up the O&M level. This fact implicated the real French model of defence spending which is based on personnel expenditures which are three-times higher than equipment expenditures (see Figure 2). However, the ratio of these two variables was not always so close. For example, 10 years ago more than $15 was spent on equipment for every $10 spent on personnel structure. The expectancy of defence productivity shows that high-tech equipment has not been followed by productivity gains in human resources. Figure 5 comes with the overview of French military spending between 2001 and 2012.

Figure 5 Military spending of France (2001 – 2012)



Source: SIPRI, 2015; own modification

French military budget is the fifth largest in the world in the long term but the country is nowadays confronted with a difficult question. Whether either to let the military spending diminish in the absence of adequate credits or to increase these expenditures at the time of government being under pressure to keep public expenditures. Using other words, the state will have to make a decision whether to

reorient military equipment spending in order to maintain the current military structure, or to cut back the capacities. Everything also depends on international relations and participating in world organizations and alliances.

The case of relationship between military expenditures and economic growth of France is rather difficult to explain. That is because, for example, in 2010 the French Ministry of Defence disposed of almost 70 % of total state investment costs. Thus, it has more special position in the French national economy. Bellais and Guichard (2006) illustrated in their work that in case of France even military capital expenditures include almost 20 % of research and development expenditures with more than $1.6 billion for military technology research. This spending has positive effects on civil research and contributes to maintaining the military industry which gave more than 160 000 direct job opportunities in 2010 and at least as many indirect job opportunities with incomes of around $16 billion where about 30 % is derived from exports (NATO, 2015).

While the financial crisis might push some countries to lower their guard, France continued to devote a major financial effort to its defence. According to the April 2013 Defence and Security White Paper this will amount to $364 billion for the period 2014-2025, including $179 billion for the years 2014 to 2019. This commitment will allow the realization of an army model responding to the strategic needs and adaptation to the requirements of the French defence and national security, while meeting the French government's goal of restoring equilibrium of public finances and thus preserving its sovereignty and strategic autonomy (SIPRI, 2015).

1.3.1.2 United Kingdom

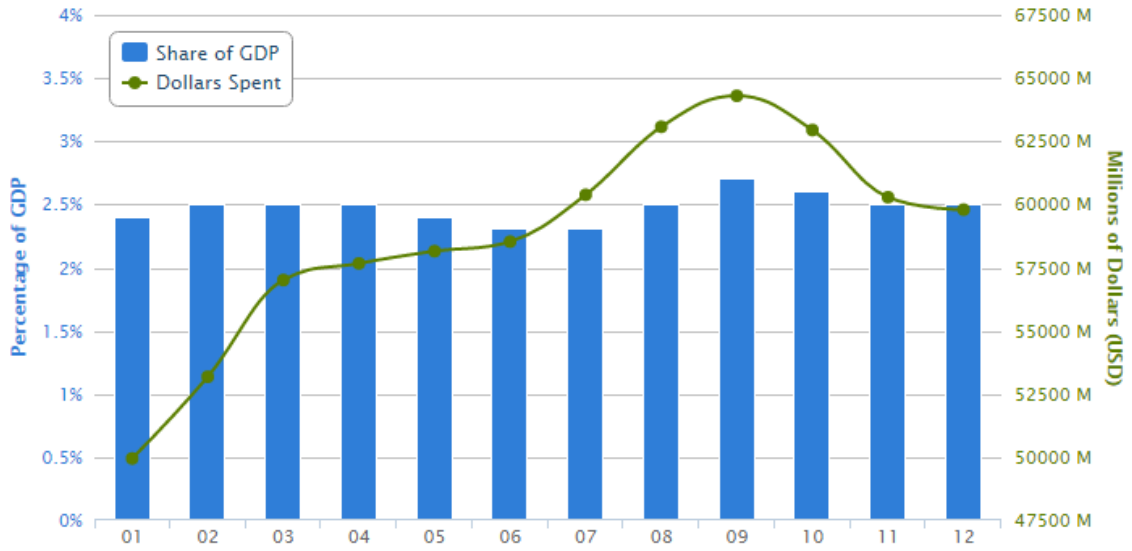
From the historic point of view UK’s defence (and foreign affairs generally) policy has been under Churchill’s leadership (1940s and 1950s) and there were three overlapping positions known - UK’s position as a post-imperial leader with a lot of responsibilities and very close relationships to Commonwealth nations; UK’s very specific relationship to USA through which they could behave as a small super leader; finally, UK’s position as an European nation with relations to the future EU.

Historically UK’s military expenditure rose in the early 1950s when it was approximately 8 % of GDP. After that defence spending fell during 1960s and then there was a significant increase in 1980s under Thatcher’s government military expenditures rose and the state supported all the activities dealing with the deployment of cruise missiles and went ahead with the purchase of USA missiles. After the Cold

War the British government announced a plan with many options for changes including strong cuts, especially in the British Army. Since 1985 military expenditures diminished in real terms and fell as a share of GDP from 5 % to 3.5 % in 1990s. Today, UK spends around $60 billion on defence every year. It represents from 2 to 3.5 % of GDP and more than 15 % of total public expenditures (see Figure 6 for more details).

From 2001 UK changed the cash based accounting system to a resource based system. Thus, Figure 6 is based on the "Net Cash Requirement" figures given in the Annual UK Defence Statistics that are closest to the old cash definition. The Net Cash Definition differs slightly from the cash definition used up to 2000. However the effect on the figures for UK military expenditures is unknown. The significant mileposts are indicated such as Falklands War in 1982, First Gulf War in 1991 up to Libyan Conflict in 2011 etc. In 2012/13 military expenditures were estimated to be the fourth highest area of public expenditures right behind Work and Pensions, Health and Education. The British Ministry of Defence spent in this year over $60 billion with UK industry. See Figure 6 for more details.

Figure 6 Military spending of United Kingdom (2001 – 2012)



Source: SIPRI, 2015; own modification

The UK plans are to cut more than 28 000 armed forces personnel by 2020, leaving almost 150 000. Under the government's proposal, the British Army should lose almost 20 000 soldiers by 2020, the Royal Navy more than 5000 personnel which is the same as the Royal Air Force (RAF). On the other hand there are some plans to increase the amount of reservists in each structure.

In the recent years on of the main defence spending category represents personnel area with total expenditures of more than $20 billion. The highest amount for capital military expenditures represents single use military equipment with more than $9 billion while total estimated equipment expenditures were over $19 billion. The equipment support took its highest percentage in 2011/12 and the capital expenditures on equipment seem to be diminished since the financial crisis in 2008 (CSIS, 2015). There is an obvious constant decline in spending money for research and development.

According to International Institute for Strategic Studies (IISS) and SIPRI the newest statistical charts say that Britain military expenditures have dropped from the third to fifth, respectively sixth place. UK is worldwide behind Russia and Saudi Arabia. The reason might be both Russian's and Saudi's innovations and modernizations of their military equipment while British efforts have been falling. Moreover, UK implemented few steps for cutting its military expenditure and the mentioned drop in the world ranking can also be because of exchange rate effects.

While the UK's defence budget declined by a marginal 0.6 % in real terms during 2011, the UK's defence spending relative to GDP (2.6 % in 2011) was the fifth highest in NATO. The UK devoted the second highest percentage of defence spending (29 %) to NATO modernization programs (i.e., procurement, and research and development). The UK provides substantial host nation support for U.S. forces (over $133 million), almost entirely in the form of indirect contributions (i.e., waived taxes, rents and other forgone revenues). British forces form the backbone of the Allied Command Europe (ACE) and Allied Rapid Reaction Corps (ARRC), and provide the second largest shares of total NATO naval combat and mine countermeasures tonnage, combat aircraft capability, naval supply, tender and transport tonnage, military transport aircraft capacity and tanker aircraft fuel offload capacity.

The UK provided nearly $5.5 billion on foreign assistance in 2001 and also further on (0.3 % of GDP). Furthermore, the UK works closely with the United States on countering the proliferation of weapons of mass destruction, focusing especially on compliance issues. It has pledged to contribute about $750 million to the G-8 Global Partnership Initiative, and, during 2002, established a comprehensive project implementation framework for a wide range of Soviet nuclear legacy issues, including: nuclear submarine dismantlement and management of spent fuel, re-employment of proliferation-sensitive skills in closed 'nuclear cities,' improving the operational safety of nuclear power plants, addressing the social consequences of nuclear power plant

closure, and physical security of facilities containing sensitive material of interest to terrorists (SIRPI, 2015).

1.3.1.3 Germany

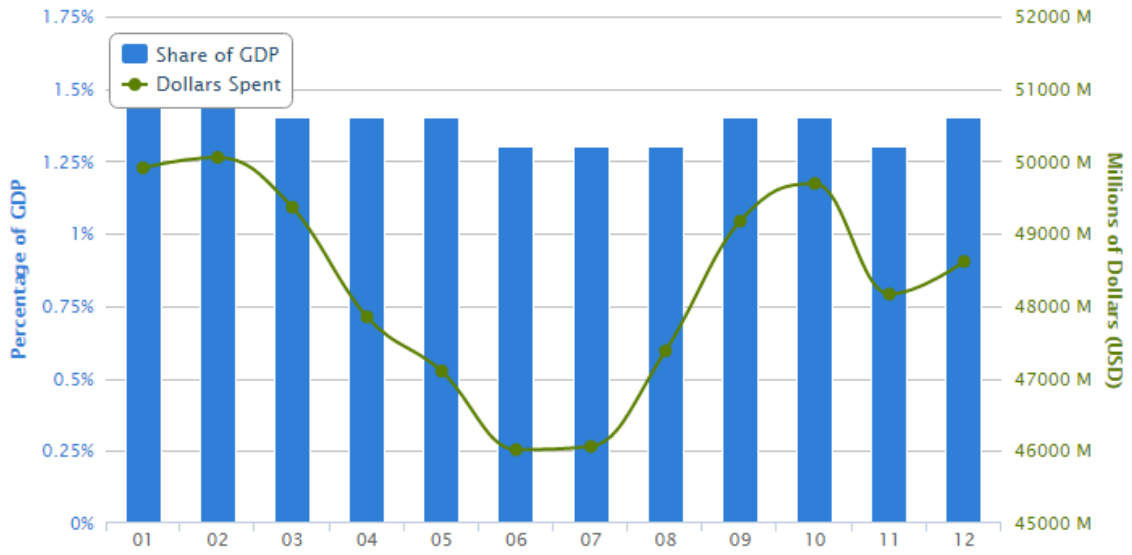
Germany has the largest and most powerful economy in Europe and one of the biggest in the world. Nevertheless, German defence economy stands, measured by military expenditures, just behind France and UK. Germany's position is worldwide still very strong and the ranking in top 10 belongs to Germany for sure. Since the end of WW2, Germany has rarely sent soldiers to combat zones but compared to France and UK, German exports of arms and weapons are much higher. From this sector more than $1.2 billion flows to national economy every year. Military transport industry, logistics or protective equipment has a very high level. The German military industry makes almost 75 % of its profit outside the country with the significant portion outside of Europe, for example in countries from Persian Gulf where Saudi Arabia plays the main role (then also Qatar, Bahrain, United Arab Emirates or Oman). Turning to Europe, the most important "customer" for Germany has been Greece and Portugal (CSIS, 2015).

The German military budget comprises expenditures in the total amount of approximately $48 billion every year. This is more than 10 % of the whole federal budget. Basically, the military budget is divided into four spending groups. Firstly, the operating costs which make up the largest share of the budget (approx. 57 %) and more than half is earmarked to cover personnel costs followed by material maintenance. Secondly, there are the capital military expenditures with almost 25 % where research and development, military procurements, facilities and other investments are included. The following and remaining shares are allocated to pension and benefit payments for former military career personnel and civil servants (15 %). With 5 % there are also the private operator models for the further development.

Germany's defence spending has been relatively low over the past half-century compared with the size of its economy, the biggest in Europe. Its military is also constrained by the constitution from taking on overseas combat missions without parliamentary consent, though the air force and army have been involved in a number of recent foreign operations. Nowadays, Germany spends less than 1.0 % of its GDP on defence (see Figure 7), well below the 2% target recommended for NATO countries to signify their willingness to contribute financially to the alliance. This reflects the German public's reticence to get involved in foreign military engagements.

But after balancing its budget for the first time in almost 50 years, the German government has more leeway to increase spending. The government approved the 2016 budget and financial planning cycle until 2019 on 1 July. As a result, it is expected to allocate additional funds to plans to modernise the army and finance the growing engagement of German forces with NATO, as the alliance seeks to increase the number of exercises and manoeuvres in response to Russia's aggression in Ukraine. Germany is to increase its defence spending, aiming to support NATO guidelines of spending 2% of GDP on national defence (SIPRI, 2015).

Figure 7 Military spending of Germany (2001 – 2012)



Source: SIPRI, 2015; own modification

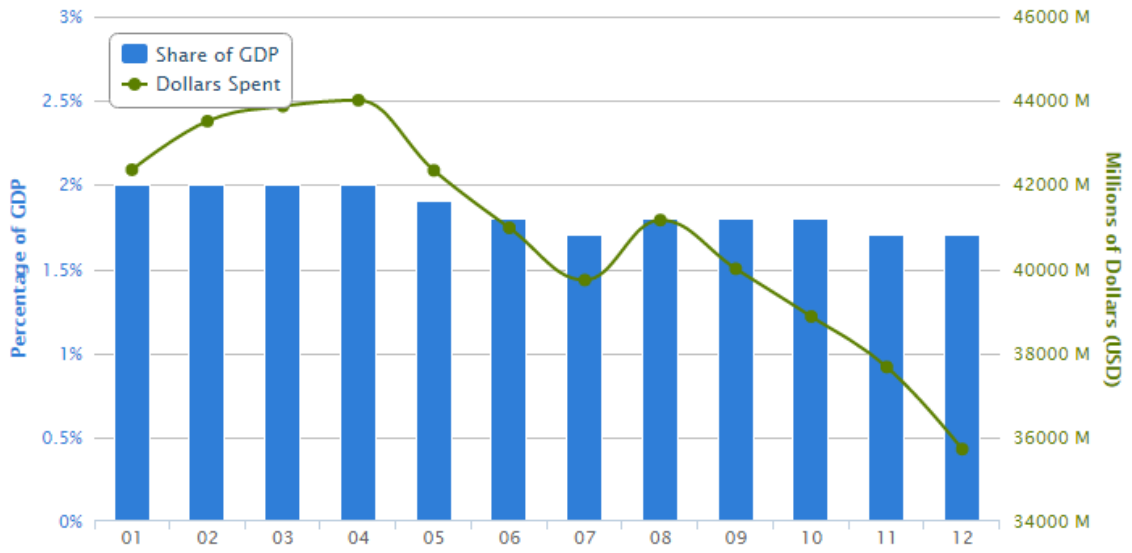
1.3.1.4 Italy

Although Italy assumed a heavy burden of defence spending in the years immediately after joining NATO in 1949, it had been unwilling to do so since the mid 1950s. In the mid 1960s the Italians opposed moves with NATO to increase military expenditures for member states. In the 1970s military appropriations were approved only after long, contentious parliamentary debates. A series of 10 year modernization programs were approved, but much of the funding was delayed because of domestic inflation. Public and political concern about defence issues seemed to diminish in the face of a growing economic crisis. In 1985 it was uncertain whether the Italian government was fully prepared to provide the armed forces with budgetary increases that would be essential to the completion of modernization programs. Nevertheless, any sharp reductions in defence spending seemed unlikely because of domestic political

constraints. The armed forces were a source of jobs in a country with chronic unemployment, and cuts in defence spending would adversely affect the domestic aerospace, shipbuilding, and electronics industries. According to the 1985 White Paper, a new 10 year budget plan would be retroactively implemented, lasting from 1982 to 1991, and would contain a projected annual increase in the defence budget of 3 %, in line with NATO guidelines for an annual increase in defence spending.

During the 10-year period from 1974 to 1984 the Italian defence budget accounted for 5 % of state expenditures and 2.7 % of GDP. According to NATO calculations, this represented a net drop in defence spending of 0.6 point as a percentage of GDP. This still represented, however, an increase in defence spending of 21.3 % since 1974. From 1991 to 2001 Italy's defence budget, in real terms, declined steadily. This led to decreases in R&D and delays in nine major armaments programs. Available funding was concentrated on programs that were more advanced or for which there were international obligations. Total defence expenditure as a percentage of GDP was expected in 2011 to decrease from an average of 1.3%, to 1.1% by 2016 due to cuts in the budget. The defence function budget was also expected to decline from 0.9% of GDP in 2011 to 0.8% by 2016. See Figure 8 for military expenditures and GDP growth rate between 2001 and 2012.

Figure 8 Military spending of Italy (2001 – 2012)



Source: SIPRI, 2015; own modification

The Italian government is keen to continue to modernize its military and equip its forces with the latest technology. The government efforts to restore the competency

of its forces lost during the period of lower spending will support the national military budget. Furthermore, the Italian government had awarded high priority to the peacekeeping operations of its armed forces, including UN and NATO missions. Italy was one of the leading contributors to global peacekeeping operations, and is the sixth largest contributor to the UN peacekeeping budget (CSIS, 2015).

1.3.2 Baltic Countries

Latvia, Lithuania and Estonia are among the smallest members of NATO in terms of population, GDP and military spending, but, given their geographic location and history of Russian rule, have long sought to establish themselves as serious contributors to NATO. Events in Ukraine as well as numerous incidents involving Russian forces (from airspace violations to the abduction of an Estonian intelligence officer by Russia in September 2014) have heightened their traditional fears. Both Lithuania and Latvia also discussed the possibility of creating a mid-range missile defence system along with Estonia.

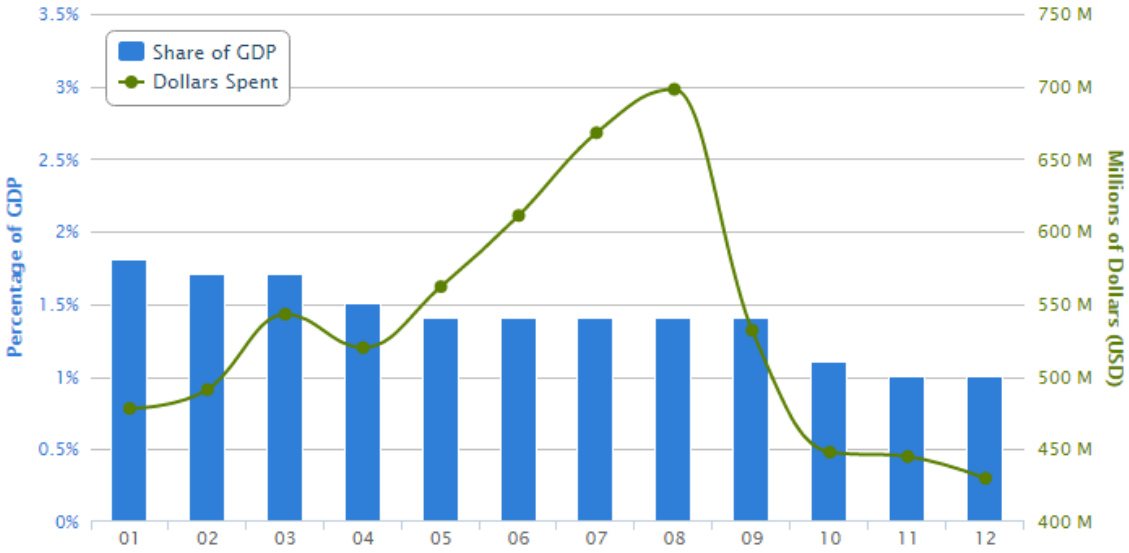
All three countries increased military expenditure sharply in the years leading up to and following NATO membership in 2004. In the last 2–3 years spending has been increasing once again, and the Ukraine crisis is further spurring this trend. Although, Latvia, Lithuania and Estonia are planning dramatic increases to arms spending, but they remain vulnerable to economic pressures. The same increase is planned by Poland and some other Eastern Europe countries (SIPRI, 2015).

1.3.2.1 Lithuania

In 2012, Lithuania spent just 0.3 % of GDP on defence, i.e. the second smallest share of NATO countries after Luxemburg (see Figure 9 for Lithuanian 12-year period of military expenditures).

Nevertheless, Lithuania should spend more on defence. Its economy is growing the national debts is low and the budget deficit well under the EU's threshold of 3%. The Lithuanian Ministry of Defence proposed the raise of military spending by $169 million to $596 million, or about 1.46 % of the economy in 2016.

Figure 9 Military spending of Lithuania (2001 – 2012)



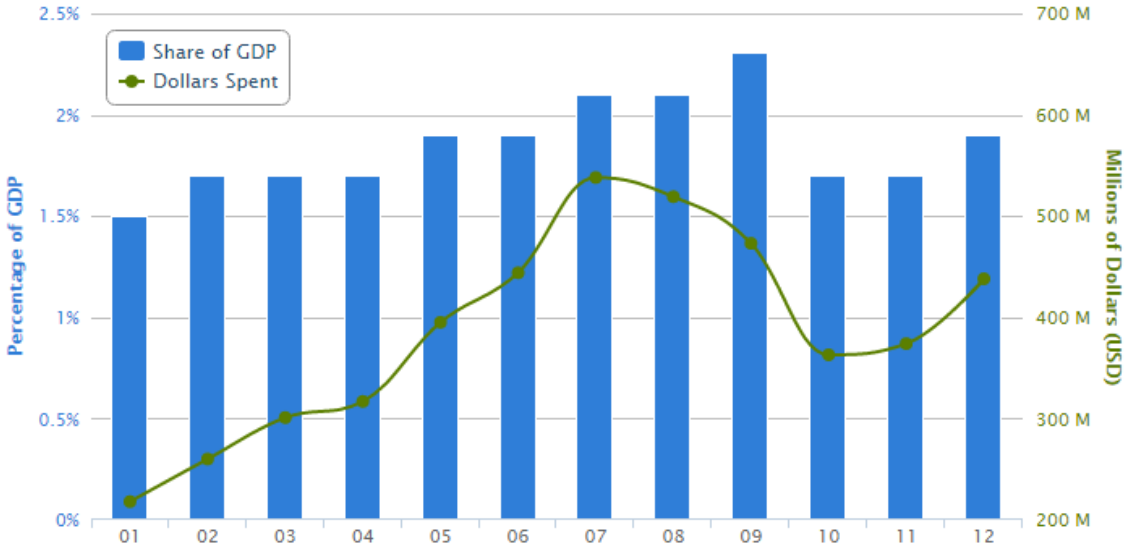
Source: SIPRI, 2015; own modification

Lithuania already upped defence spending in 2014 and 2015, and its government has promised to reach the 2 % of GDP goal no later than in 2020 (CSIS, 2015).

1.3.2.2 Estonia

Estonia's defence budget exceeded $400 million in 2012, i.e. more than 1.7 % of its GDP to mainly cover costs associated with providing infrastructure and accommodation for incoming NATO troops and equipment. See Figure 10 for Estonian military spending and its ratio to GDP. Compared to the Baltic neighbours Estonia realized the less severe cuts in military spending, approx. by 30 % from 2006 to 2012, compared to more than 50 % for Latvia from 2008 – 11, and 40 % for Lithuania from 2006 to 2012. From 2012 further the budgets have been planned for the boost in defence expenditures both in Estonia and other two Baltic states as well. Estonia proudly meets the NATO requirements in spending 2 % of GDP on defence between 2007 and 2009.

Figure 10 Military spending of Estonia (2001 – 2012)



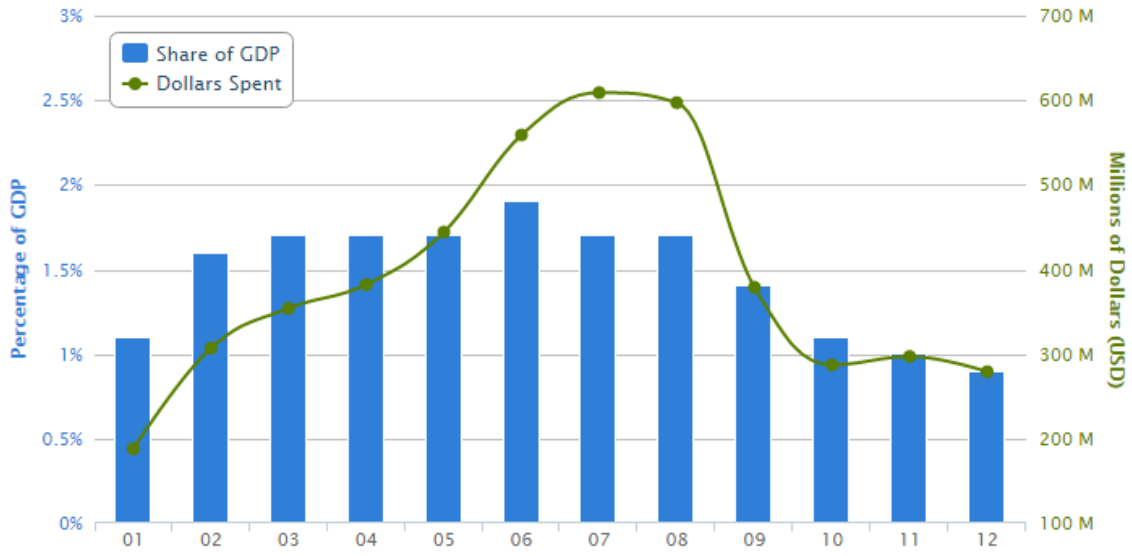
Source: SIPRI, 2015; own modification

1.3.2.3 Latvia

Latvia's defence budget surpassed $285 million in 2015, rising by 12 % compared with 2014, and to a record 1 % of GDP. Latvia's increase to 2 % between 2006 and 2009 represented a 100% increase in defence spending and was expected to cost around $210 million, compared to Lithuania's more modest amount of $330 million. After joining NATO, the foundation of the Latvian defence system has shifted from total territorial defence to collective defence. Latvia has acquired small but highly professional troop units that have been fully integrated into NATO structures (SIPRI, 2015). Figure 11 shows the linkage of military spending and GDP between 2001 and 2012.

Latvia uses an old Czech model, which cannot even fire standard NATO ammunition. Now if the three nations agreed to merge their procurement and agreed on a common brigade structure, then they could acquire a modern and much more capable artillery system together. As together the three nations would buy up to 72 systems, all sellers would be very open to produce the system in the Baltic States, thus giving the three nations a chance to develop their own defence industries and thus spend their money on their soil.

Figure 11 Military spending of Latvia (2001 – 2012)



Source: SIPRI, 2015; own modification

Both Latvia and Lithuania have a very small amount of active and reserve troops they field. To compare this, for example Israel fields 2142 active soldiers per 100000 citizens, Greece 1,008 and the most serious Baltic nation Estonia 418 active troops per 100,000 citizens. That is actually an exceptional high number compared to Lithuania's 269 troops and Latvia's 232 troops (SIPRI, 2015).

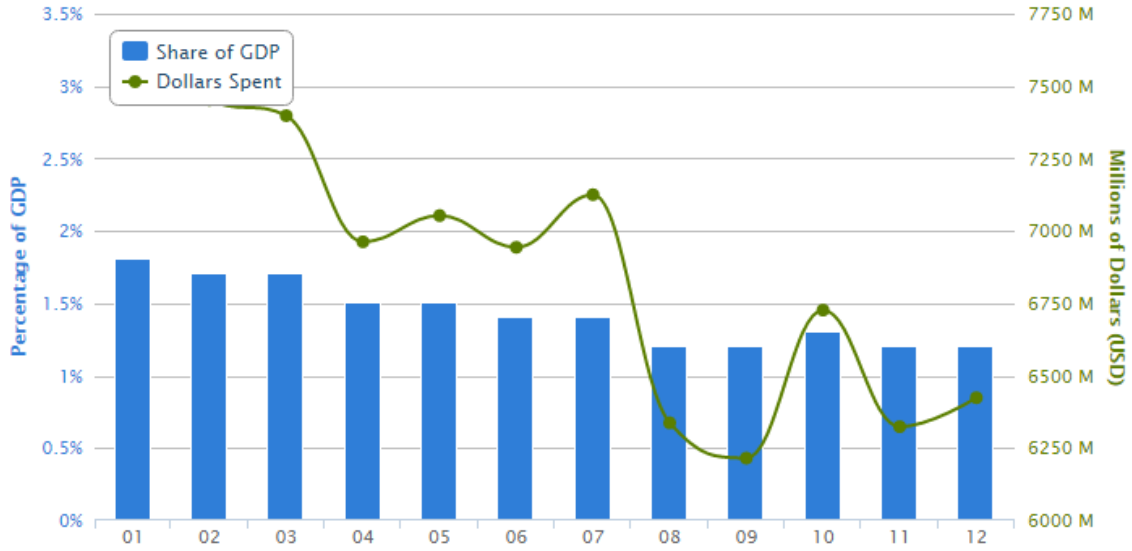
1.3.3 Scandinavian Countries

1.3.3.1 Sweden

The armed forces budget for 2012 amounts to $6.4 billion. See Figure 12 for military spending and its relationship to GDP percentage between 2001 and 2012.

The Swedish government has proposed a $182 million reduction in defence spending in 2015, according to budget documentation released in the middle of April 2014. However, Sweden will raise defence spending by $1.18 billion for the period 2016 to 2020 because of crucial situation between Russia and Ukraine. A large share of the money is to be spent modernizing ships that can detect and intercept submarines, and bringing troops back to the strategically-located Baltic island of Gotland for the first time in 10 years.

Figure 12 Military spending of Sweden (2001 – 2012)



Source: SIPRI, 2015; own modification

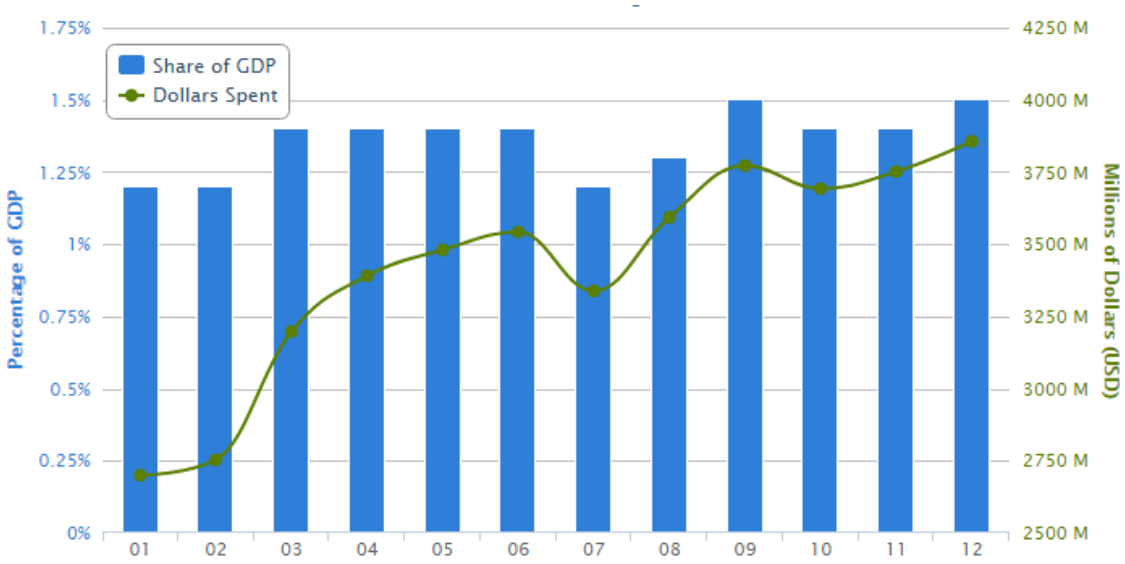
The Swedish government's promised to bolster defence expenditure and send enough capital into equipment to refresh the military expenditures. The government said that military expenditures will boost by $210 - 230 million in 2014 – 2017. The increase will be between $50 - 60 million a year.

1.3.3.2 Finland

Finland has the lowest defence budget from the Nordic countries, with its annual military budget allocation now less than half of the budget spent by Norway. Spending on Finnish defence has been in short decline since 2006, when the military budget represented 1.1 % of GDP. Efforts by government to bolster spending on defence since 2008 were hampered by a faltering economy that was seriously impaired by falling international demand for Finnish export products following the global financial crisis. The GDP to defence spending ratio was 1.35 % in 2012, and has began to drop (Figure 13 shows how much Finland spent on their military between 2001 and 2012).

The negative impact flowing from rising national debt and weakening central finances are reflected in the military's budget for 2015. Spending on defence fell around to $2.9 billion. The military's budget allocation had been cut, in real terms, in 2013 and 2014. Both Sweden and Finland were planning zero to negative growth in their defence budgets in 2014-2015.

Figure 13 Military spending of Finland (2001 – 2012)



Source: SIPRI, 2015; own modification

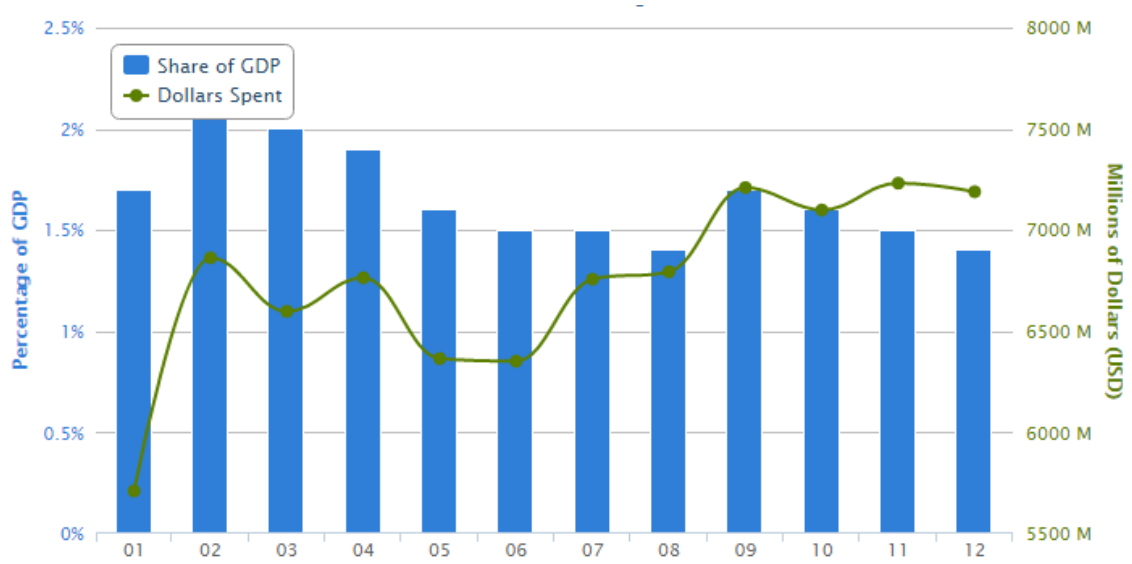
This budgetary picture changed in the light of unresolved tensions over Ukraine and elevated activity by Russian air, land and naval forces in the Baltic Sea and High North regions (NATO, 2015). Although some politician parties disagreed on the size of the spending increase, the government estimates that the defence budget may need to be raised by 5 % to 15 % from 2016 to 2024 in order to cover future procurements.

1.3.3.3 Norway

Figure 14 shows the Norwegian military expenditures between 2001 and 2012. As it is seen Norway has not met the NATO's 2% target at any way till this date (except of 2002 and 2003). Norway earlier announced that to spend 2 % of GDP would be easily reachable but government would have to give the priority to it first.

Norway has decided to invest $500 million in two new programs intended to strengthen its military capability in the High North. The High North Programme supports collaboration between higher education institutions in Norway and institutions in Canada, China, Japan, Russia, the Republic of Korea and the United States in order to increase knowledge about the High North. The capital investment, which was being financed within the framework of the 2015 defence budget, happened against a backdrop where Russia continues to reinforce its air, naval and land capabilities in the neighbouring High North.

Figure 14 Military spending of Norway (2001 – 2012)



Source: SIPRI, 2015; own modification

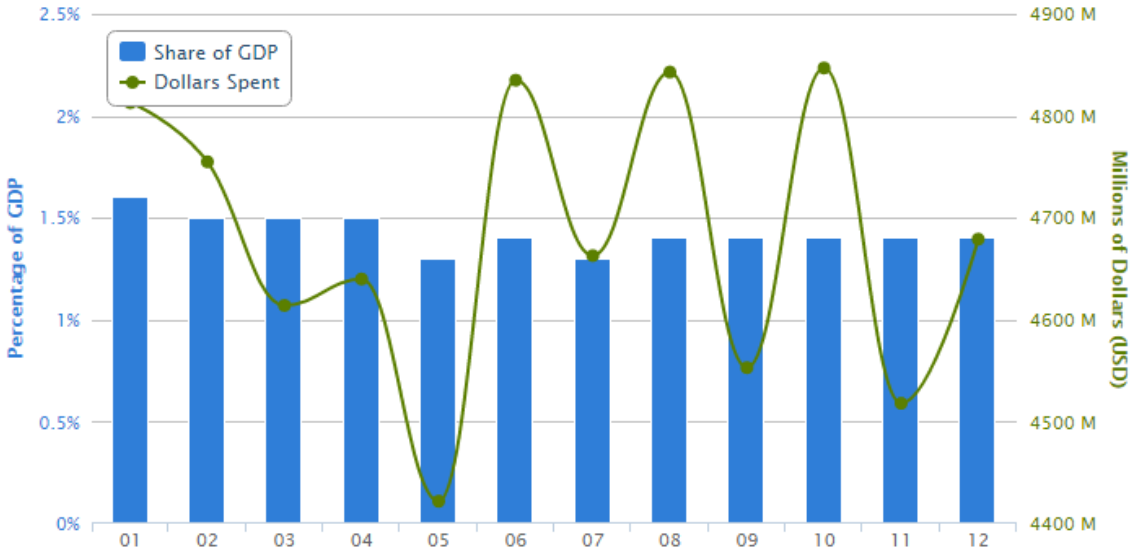
The Norwegian government earlier set spending on the core defence budget at $5.6 billion for 2015, a 3.4 % increase compared with the core military budget for 2014 (SIPRI, 2015).

1.3.3.4 Denmark

Military expenditures in Denmark were measured at 1.4 % of GDP in 2012. As it is shown in Figure 15 Danish military expenditures have probably the most interesting curve trend. From 2003 the curve went up and down each year. Moreover from 2005 the expenditure ratio did not exceed 1.5 % of GDP. There is no special reason found as the explanation of these changing trends. It might possibly be different politician priorities.

The focus of future international capabilities for the Danish defence will be the ability to react quickly in relation to international deployments in a UN, NATO or EU. At the same time it is crucial that Denmark continues to have an effective and usable defence that can flexibly and speedily solve the tasks decided upon by the government. In the light of this, there is agreement that the annual defence spending is to be reduced by $355 million in 2015, $368 million in 2016 and $382 million in 2017.

Figure 15 Military spending of Denmark (2001 – 2012)



Source: SIPRI, 2015; own modification

The defence budget is reduced correspondingly, and the released funds are used according to a separate agreement in the Ministry of Finance between the Parties to the Defence Agreement (CSIS, 2015).

1.3.4 Visegrad Group Countries

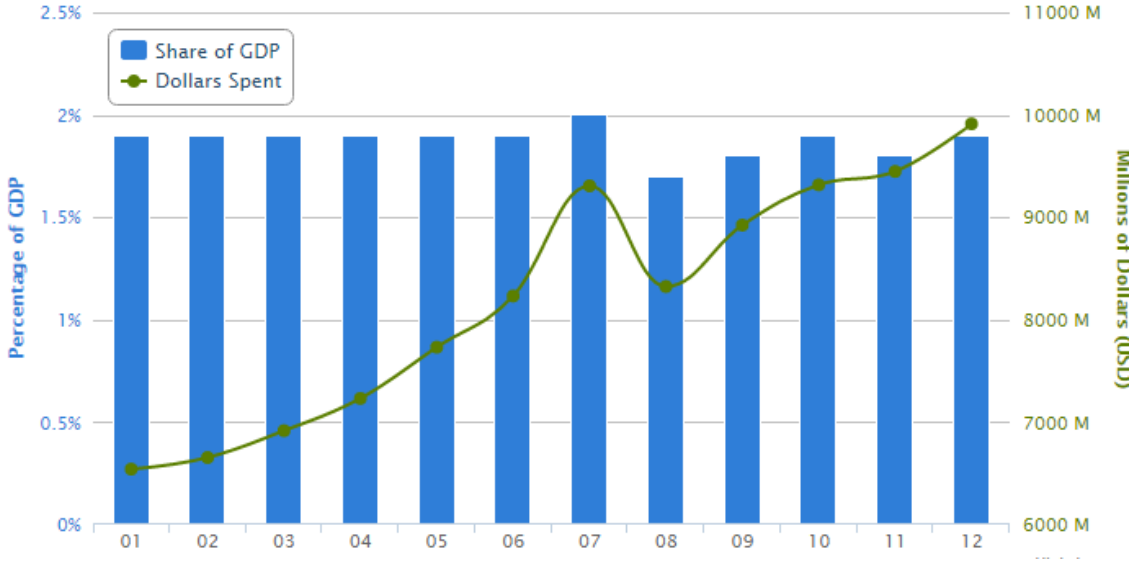
The Visegrad Group, also called the Visegrad Four, or V4 is an alliance of four Central European states – Czech Republic, Hungary, Poland and Slovakia. The V4 countries are united not only through their common neighbourhood and similar geopolitical situation, but also through their joint history, traditions, culture and values. The main aim of the group is to strengthen their military, economic and energy cooperation. All the activities of the Visegrad Group are aimed at improving stability in the Central European region. Thus, it was not created against European integration efforts. Turning to military expenditures, the internal dynamism of the V4 group has significantly shifted as a result of different defence expenditure trends. One country that literally stands out is Poland. Comparison of GDP, population, territory and military expenditure shows that Poland represents more than 50 % of the Group's total in each category, effectively dominating the rest of the partners combined. Poland contributes 72 % of V4's total defence expenditures, the Czech Republic with 14 % takes the

second place. Thus, the growing gap between Poland and the rest of the group is significant (SIPRI, 2015).

1.3.4.1 Poland

Poland has the region's largest economy with the total GDP of more than $980 billion. It is a high-income country with the sixth largest economy in the EU and one of the fastest growing economies in Europe, with a yearly growth rate of over 3 %. Poland is among the very few European countries that have been increasing its military spending, as part of a shift away from the rest of modern world (see Figure 16 for the last 12-year trend).

Figure 16 Military spending of Poland (2001 – 2012)



Source: SIPRI, 2015; own modification

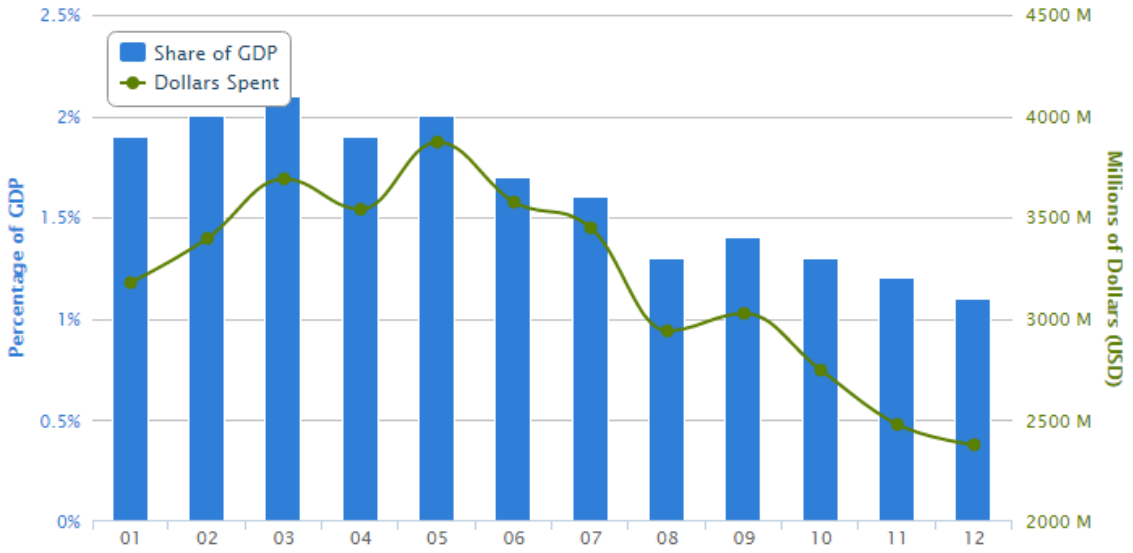
The country will increase its military spending by 18%, marking the biggest increase in military spending of any country in Europe. From the total allocation of almost $60 billion, $37 billion will be spent on fourteen modernization programs. The rest will be allocated to weapon systems and military equipment that aren't covered by the mentioned modernization programs. The Polish government will meet NATO's targets by increasing defence expenditure to 2 % of GDP, adding about $290 million to defence modernization in 2016, and $2.35 billion by 2022 (SIPRI, 2015).

1.3.4.2 Czech Republic

Military expenditures declined sharply in the transition from the large Soviet-era defence force to the post-Cold War era force. The cuts in the Czech military budget

were slowing the pace of military reform and inhibiting the relocation of troops to Slovak Republic. The Czech defence budget in 1993 was almost $1 billion, representing 2.6 % of GDP. In 1998, based on NATO's definition of military expenditures, the Czech Republic spent an estimated 2 % of its GDP. The Czech Republic pledged continued military expenditures increases until it reached the NATO-Europe goal of 2.1 % of GDP of defence spending and military expenditures increased to almost 2.2 % of GDP in 2003 with the amount of more than $4 billion. See Figure 17 for the next progress.

Figure 17 Military spending of the Czech Republic (2001 – 2012)



Source: SIPRI, 2015; own modification

The Czech Republic had planned to increase military spending during 1999-2003 to modernize their forces and meet NATO requirements. The transformation has not been entirely successful. The main reason can be seen in the diminishing financial framework and postponement of individual modernisation projects in the Czech Armed Forces. At the end of 2005 Czech defence budget was 2 % of GDP where 49 % covered personnel expenditure, 12 % equipment expenditure, 10 % infrastructure expenditure, and 29 % of other expenditure.

The decrease in the percentage of GDP allocated for defence was significant since 2006. Despite of the fact that Czech defence spending had been gradually decreasing, the process of renewal of main weapon and technical systems which form the basis of the armed forces capabilities, is yet to be completed. The difference

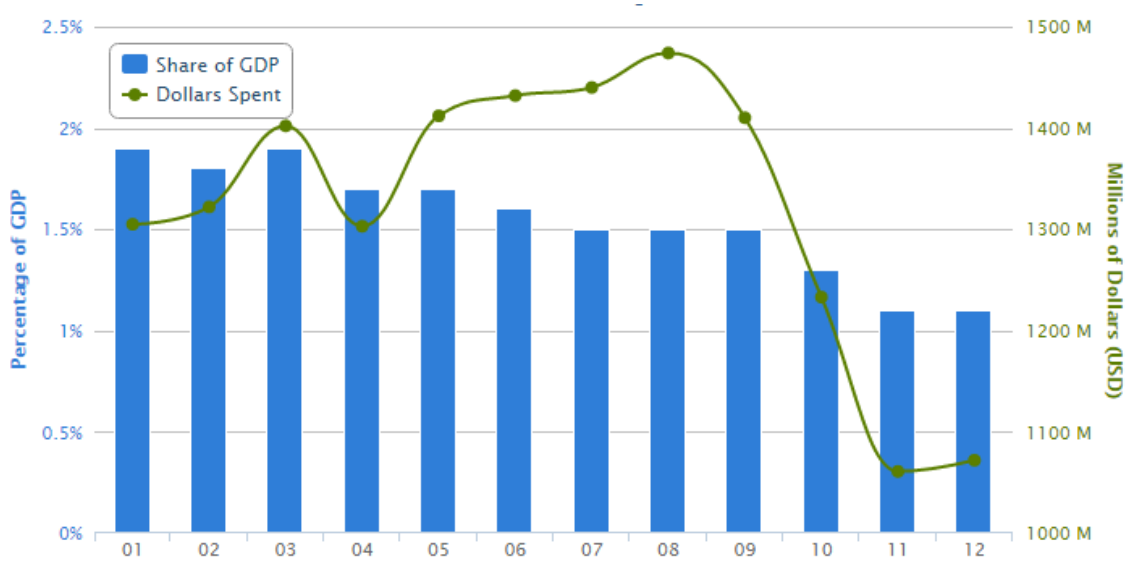
between growing requirements and diminishing resources is not sustainable in the long run. These trends increase the risk that the set of capabilities, indispensable for ensuring all current functions of the armed forces and fulfilling the political military ambitions, will become unachievable. Moreover, the demand for huge investments into the renewal and modernisation of technical aspects of many crucial military capabilities will be concentrated within two relatively short periods around the years 2015 and 2020 (SIPRI, 2015).

1.3.4.3 Slovak Republic

It might be said that not only from the view of military expenditures the turning point occurred in 1998. There was a civil campaign where coalition government came to power and real democratic environment began.

The main problem in Slovak defence was that before the dissolution of Czechoslovakia in 1993 the most of armed forces was situated in the Czech part. The Slovak military started to transform from the concept of large armed forces to smaller ones which are more effective and ready to defend the country. From the political and defence point of view Slovakia constitutes an integral part of the NATO space. From the year 2000 further, the government of the Slovak Republic has claimed in its program declaration to allocate at least 2 % of the country's GDP to the military. And this is probably one the reasons why the given goal has never been fulfilled in the new century. Figure 18 shows the military spending between 2001 and 2012.

Figure 18 Military spending of the Slovak Republic (2001 – 2012)



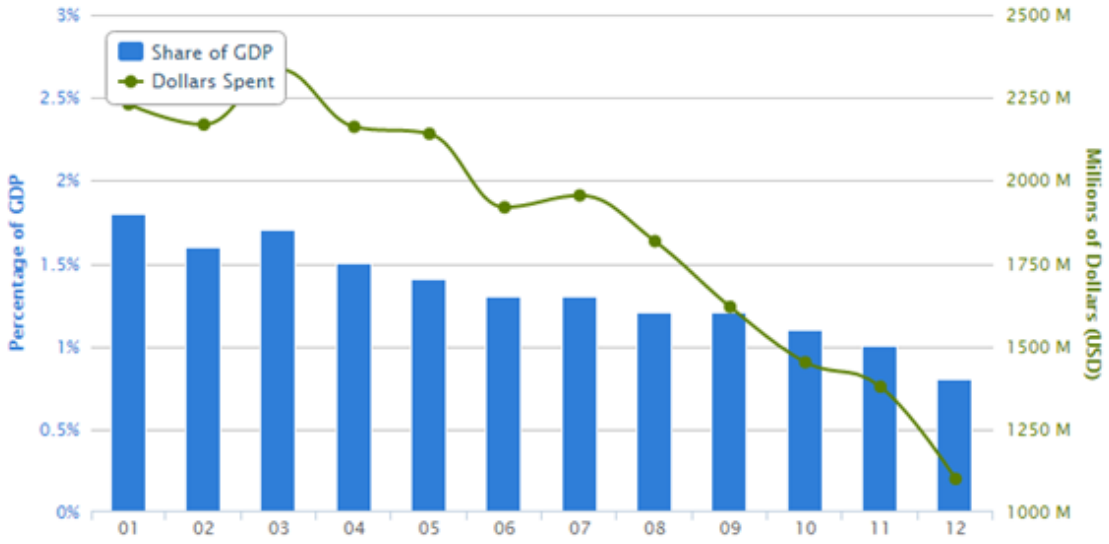
Source: SIPRI, 2015; own modification

It is obvious that especially after the financial crisis in 2008 there is a big jump caused mainly by increasing debt of the public finance and resulting in cuts that continue up to now. Nevertheless, before 2011 the government decided that some reorganization has to begin because of insufficient funding of asset management and other related parts of defence. Thus, the total amount of funds allocated for the defence in 2011 reached 55 % of the real financial limit estimated in the Directive for the defence policy of the Slovak Republic. However, Figure 18 shows, and it is really alarming, that still less money come to defence from the national budget. For 2013 the government projected to decrease the resources from the national budget to less than 1 % of GDP. A financially unsustainable support of the government, alongside with an ongoing decrease in asset allocation prevent Slovakia's armed forces from meeting the tasks of national defence (SIPRI, 2015).

1.3.4.4 Hungary

Except for the short-lived neutrality declared in 1956, Hungary's foreign policy generally followed the Soviet lead from 1947 to 1989. During the communist period, Hungary maintained treaties of cooperation with the Soviet Union, Poland, Czechoslovakia, the German Democratic Republic, Romania, and Bulgaria. Since 1990, Hungary's top foreign policy goal has been to achieve integration into Western economic and security organizations.

Figure 19 Military spending of Hungary (2001 – 2012)



Source: SIPRI, 2015; own modification

2 Review of Theoretical and Empirical Research

2.1 Individual Theoretical Approaches

Each analytical part of an individual thesis also needs to have a theoretical part which is very important to interpret the findings of an analysis. As Dunne et al. (2005) said, it is not so easy to describe effects of defence spending on economic growth. The reason is that a lot of economic theories do not have an explicit role for military expenditures as a distinctive economic activity. Nevertheless, three basic theories were developed and adopted in the literature for both developed and developing countries. It is always talked about the Marxist theory which basically seeks to explain the sustained economic growth, mostly amongst developed nations. Then it is mentioned the Keynesian version which is usually called the Military Keynesianism. Finally, it is the Neoclassical approach that understands the nation as a rational player which balances the opportunity costs and security benefits of defence spending in order to maximize a well defined national interest reflected in a societal social welfare function.

However, none of these schools of thought provide an understanding of the role of military expenditures and militarism in economic development that is other than a partial understanding in a comparative static framework or the phenomena which has an impact on the economy to knock it away from some well-defined ideal. While they can provide valuable insights, they provide little basis for examining the relation between military expenditures and economic development as a historic and dynamic process. The significance of military expenditures does not provide a measure of its overall importance to the global economy. It is necessary to consider its impact on the pace and character of economic development. This requires an understanding of the specific role of military expenditures in the economy and in society and this can differ depending on the theoretical approach used. While it is difficult to draw the boundaries between the approaches of different schools of thought, they do have certain characteristics which distinguish them (Dunne, 1990).

The Neoclassical approach to military expenditures is based upon the notion of a state, reflecting some form of social democratic consensus, recognizing some well-defined national interest, and threatened by some potential enemy. Given the potential enemy it is necessary to deter aggression and this is done by developing a particular level of military capability which is derived from some optimization procedure. Game

theoretic models reflecting in a limited way, inter-state behaviour have become more prevalent. High military spending is then the result of technology, rising costs and arms races and the industrial effects of military expenditures are simply the impact of moving the industries from the same competitive ideal. Military spending is also seen as important for New Classical economics, in a dynamic context, in that it provides shocks to the system. These shocks are exogenous rather than endogenous.

The critical liberal approach hinges on the nature of the military industrial complex with its conflicting interest groups which lead to internal pressures for military expenditures. External threats are simply the way to justify these pressures. For this approach there is still some national interest but it is distorted by vested interests. In contrast the Marxist approach sees the role of military expenditure in the development of capitalism as much wider and pervasive process, with the military industrial complex constrained by the laws of motion of the capitalist system. Within the Marxist approach there is a number of strands which differ in their treatment of crisis and in the extent to which they see military expenditures as necessary for capital accumulation. Defence spending may act as a countervailing tendency to the falling rate of profit by slowing the increase in the organic composition of capital by diverting capital from accumulation. Defence spending can cheapen constant capital and increase relative surplus value through spin-off. The military can be used to coerce workers and military spending can be used to overcome crises either caused by overproduction or under consumption. Defence spending may lead to a search for control of raw materials sources and the development of international hegemony. This tendency for the expansion capitalism via imperialism has stirred debate since Lenin time (Riddel, 1986).

2.1.1 Marxist Theory

Marxists developed the theory when they proposed a stagnation of capitalism which did not appear before the World War First (WW1). When post-WW2 economic growth finished with the oil crisis and let get a new period of deepening stagnation started, Marxists viewed this as a classic developing of capitalism. After WW1 military spending was lower because of peace, after WW2 military spending became very high because of the beginning Cold War. This was the reason for the large increase up to 1970s. In case of USA, defence expenditures were at the amount of more than 15 % of GDP. This number presented a slow decrease since the end of WW2 and in the 1990s it

was only at about 3 %. During the Vietnam War it was around 10 % and in 2002 it was around 5 %. This decrease in defence expenditures between the 1960s and 1970s brought the end of the permanent military economy and came back with the capitalist crisis.

Another adaptation of the theory diverges in the fact how to make clear the real process how military spending did fix the capitalist economy. Firstly, it focuses on a society where there is an insufficient consumption. Here military expenditures are proposed within the groundwork recession and economic crisis coming from the capitalism. This is why the defence spending is found by this approach as an important in some conflict (Riddell, 1986). The accumulation of capital gets clear with the aim of profit but accumulation continuously diminishes profitability. As a result of diminishing profitability when capitalists cut back investment spending, some of merchantable products stay not bought. That is why the depression seems to be generated insufficient demand and overall consumption.

The main idea of the approach with insufficient consumption presents that the wealthier the capitalist subject or economy is, the higher the existing extra production becomes. And that is more than it is necessary for consumption and investment. As defence spending brings the same economic function as consumption spending, a boost in defence spending will keep up effective demand and make the economic surplus. There is a positive relationship between the welfare level and the relative amount of defence spending in each country's income. That is why it is assumed that nation with a high amount of defence spending has a low level of unemployment but not low level of capacity use. Defence spending is profitable for the capitalist class to the extent this spending make use of the inactive labour force and inactive means of production. Influenced by the analysis of Griffin et al. (1982), Gottheil (1986) argues in his contribution that capitalism enters into stagnation in case of lack of external factors (e.g. defence spending).

Secondly it is said that defence spending is both important itself and as an integral component. The thought sees defence spending as important in overcoming realisation crises, allowing the absorption of surplus without increasing wages and so maintaining profits. No other form of government spending can fulfil this role. While this theory was very influential in the general economic development literature, empirical findings within this opinion tended to be limited for developed nations (Smith, 1977).

2.1.2 Military Keynesianism

Keynesian theory considers a proactive state using defence spending to increase the output through multiplier effects in the presence of ineffective aggregate demand (Faini et al., 1984; Fine, 2001). More radical Keynesian perspectives have focused on the way in which high military spending can lead to industrial inefficiencies and to the development of a powerful interest group composed of individuals, firms and organisations that benefits from defence spending, usually referred to as the military industrial complex. This may increase military expenditure through inter-pressure within the state even when there is no threat to justify such expenditures (Dunne and Sköns, 2010).

With using more general words, Keynes wanted to obtain full employment in capitalism where there was not enough demand. Nevertheless, the consumption as a part of demand might be considered as stable, it is opposite for investments. When the investment demand will not exceed the employment level, the economy can fall to spiral. Investments for profit in a capitalist economy are independent on decisions of savings. Potential profits of investments depend on the demand for the final product of that investment. To beat the economic depression, Keynes recommended the state to boost the investment demand and public expenditures to support the aggregate demand. During the war-time, the technological innovations depend on the current needs (Cypher, 2007).

The other possible factor that causes the increase of investments is the change of the overall demand structure. This change might rise or diminish the final demand. Because the expected level of manufacturing and industries output affected by the change in production differ, the impact of this issue on investments might vary even if the manufacturing change is balanced. Such boost by changing the demand for investment in this way may be assured by defence spending.

The lack of the investment demand may be explained by defence spending in different ways. Firstly, a growth may be made in defence spending. Secondly, the structure of defence demand might be changed. Then, by enhancing employment, the increase in defence spending motivates for individual demands and for boosting investments to meet this demand. Last, defence spending which is considered to be the main factor of growth, has an innovative impact. The impact of defence spending on

non-military sectors as for example other public expenditures and different technological innovations might be considered within this structure (Foster et al., 2008).

Habermas (2006) mentioned that a lot of government impact might disadvantage for capitalism. The individuals will have more needs. The capitalism will not be protected as a system. The politicians will create in-natural laws and capitalism will be deformed. The balance of rights between the blue-collars and white-collars will be changed in favour of the blue-collars if there is a lot of expenditures on public welfare. The military Keynesianism came to an end with the end of the WW2.

Today's situation looks as following. The theory says that during peacetime, any raise of military expenditures will lead to crowding-out effect with respect to allocating other forms of public expenditures, expecting a null impact on economic growth. Custers (2010) presented this theory based on the economic model used by Europe and the USA, declaring that European governments have been seen as relying on public expenditures to promote the regulation of their business cycle. US governments during the Cold War frequently relied on expanded defence allocations to ensure an adequate level of aggregate demand for commodities.

2.1.3 Neoclassical Theory

Generally, classical economists say that military expenditures are not effective and they decrease the productivity of each nation's economy. Classical and neoclassical economists give a very important role to the laissez-faire. As the welfare state increases the burden of military will become insignificant. The all financial transactions are more globalized and this causes that the motives that lead to war will decrease. Globalized financial and economic environment ensures worldwide security. This environment is ultimate in the way of growth but there are also some breakdowns when the economic environment cannot ensure enough resources for each country's security and interventions of government are necessary. The reason is that the state security is supported by public services and goods which the private sector has no chance to assure. That is why there is no connection with the laissez-faire. Military expenditures are considered to be exogenous. The finances spent on military expenditures might cause the technological changes, increasing costs and the economic competition in the defence sector (Smith, 1980). Traditional optimization tools are adopted in identification of military spending. There are so called alternative costs to the

contribution of sources assigned to defence spending. The share assigned to defence spending is determined by individual public preferences. In the area of defence technology, it is required to generate the security with the lowest cost. (Attar, 2010).

The Neoclassical theory was criticized a lot because of the metaphysical reasons and even because of the fact that the approach allegedly did not respect the historical values (Smith, 1977; Dunne, 1990). It was argued that here was an issue between setting an effective policy and announced government goals. As the example it might be a special strategy which has to be just in the war-time planned. There is an obvious inconsistency among different groups of individuals in society, foreign relations and defence issues. It is almost impossible to reach some consensus.

The general approach says that army manufacturing is enlarged under technology and the army composition of each country is very important. On the other hand, Left Keynesians argue that military institutionalism is not accepted because of outside danger but because of internal tensions, and individual interests in making of defence decisions. They say that profits of expenditures primarily direct to private interest parties and the decision making process has nothing to do with the public interests. It is often talked about military or defence industry complex which means that the important decisions regarding defence spending are made on behalf of powerful interest groups. However, the interests of government or the public still have some place but they are continuously destroyed by higher interests (Dunne, 1990).

To demonstrate the criticism of neoclassical theory, Left Keynesians also claim that increasing defence expenditures will not eliminate the rising in capacity utilization and the rate of unemployment. Conversely, spending money for non-military programs will provide the same employment boost and expenditure multiplier effect. These non-military public expenditures have to be chosen based on the positive effects and it will bring the boost of the long-term capital base of each country (Abell, 1990).

2.2 Determinants of Military Expenditures

There are two groups of empirical studies which focus on determinants of defence spending. The arms race model that has been developed in many different ways and there are still some difficulties with its application, mostly in case of developing countries. Dunne (2010) argues that these ways are mainly applicable for countries with some kind of military conflict. Some analyses contain a complete theory, joining all the

economic and political impacts. Econometric analysis of the determinants of military spending requires some theoretical framework to allow for a specification of causality, functional form, relevant variables and the testing of implied restrictions. A formal model also allows hypotheses to be well defined and tested, assumptions to become explicit, and the number of parameters to be reduced through tests of restrictions. This approach is most consistently applied within a neoclassical framework using a model of the state as a rational actor maximising social welfare subject to a resource constraints. The social welfare function can be determined by the state and is based on individual preferences or on some voting rule such as the median voter. Military expenditure is then determined by balancing its opportunity cost and the security benefits it provides. Determinants of military expenditure are of four broad types: security-related; technological; economic and industrial; and more broadly political.

Dunne (2010) also added that GDP per capita is often used to reflect the income effect. Higher income is likely to lead to higher military spending, which may or may not translate into a higher military burden. Also, higher income can lead to structural changes, inequalities and hence conflict requiring higher military spending to maintain internal control (Maizels and Nissanke, 1986). The share of total government expenditure on GDP is used to account for the fact that the military will likely benefit from high government expenditure per se (McNamara, 1991). The effect of incorporation of a country into the world economy is measured by the share of trade (exports plus imports as a percentage of GDP) (Rosh, 1988).

In addition, there are attempts to model the dynamics of the government spending process allowing for inertia due to some hangover from previous expenditures, commitments to programs, or simply a ratchet effect. The ratchet effect can be incorporated by estimating a dynamic model where the lagged dependent variable will pick up such effects. There are also many attempts to introduce political factors within the countries. The type of government can effect military spending, with military governments to be most likely higher spenders, though there is no simple dichotomy between military and non-military governments. The situation in developing countries is a bit different than in developed countries as there is less likely to be arms production. There will, however, still be a ‘military industrial complex’, comprising the civil servants, industrialists, officials, and workers involved with arms imports, with vested interests in maintaining or increasing military spending.

2.3 Military Expenditures Effects

Generally said, defence spending can either stimulate the economy of each country or it may cause an increasing deficit of public budget and debt used to finance the costs of defence spending. These effects can be direct or indirect. For example, defence spending can stimulate economic growth directly by spin-off from defence to other sectors in economy. Nevertheless, defence spending might diminish economic growth by depressing the savings ratio.

For example, in case of the USA the increased defence expenditures following the year 2001 were financed almost entirely by borrowing. The macroeconomic view says that the increasing deficit leads to raising debt and raising interest rates. Of course, there are many other factors that may influence the debt or the ratio of debt to GDP as for example tax cuts, higher government spending of other parts of public sector etc. Furthermore, the government of each country has always many options how to finance the military – the borrowing, raising taxes or reducing other public spending. Some of them are more popular across the society, some of them less. However, the hidden and increasing interest on defence spending is very dangerous for nation's economy. It is very difficult to define exactly how would each national debt, GDP ratios or interest look without military spending. It is a task of researchers to make sophisticated and relevant empirical analysis.

The general effect on economic growth or GDP is an interaction of many different factors. Recent military project may push GDP high, improve the rate of unemployment or inflation and increase the aggregate demand. On the other hand, spending financed by the deficit crowds out investment spending which decreases each country's stock of productive capital. The impacts of military processes as for example deaths also reduce the human capital. Both these cases ultimately reduce GDP.

In addition to these direct effects of military expenditures upon economic growth there are several indirect effects that should be mentioned. Military expenditures could generate negative externalities with respect to the environment, lead to the militarization of society, as well as create an arms race mentality for threatened countries. On the other side, positive externalities from the defence to the civilian sector can exist in the form of advancing technology, human capital formation, or infrastructure.

2.3.1 Positive Effects

Both positive and negative effects of defence spending were examined by many authors. Some of them notice that the positive impact on economic growth claim that military expenditures improve efficiency and protection of industry because of new technological progress. Other researchers talk about increasing human capital as an improvement of managing and organizing skills in decision making process. For example, Gurr (1974) says that at the end of some military circumstance redirecting resources to peacetime industries that were marginalized during the wartime leads to economic growth. The other arguments mention a positive impact on employment. Many people can find a new job because of increasing military expenditures. Big companies in military industry need to increase their investments and it can help to lower the rate of unemployment. Consequently, the aggregate demand is strengthen. The economy can also enjoy a technological improvement in this military area. A lot of researchers (Heo, 2010; Sandler and Hartley, 1995) talk about a positive spin-off effect on the private sector. It is joined with a big contribution to education and already mentioned increasing human capital which positively influences economic growth (Barro, 1990). Defence spending has even non-negligible positive impact on each nation's security which is generally very important for the whole economic productivity. It is essential for every country to have a safe economic environment to be attractive for international investors. Another view brings Smith (1980) who explains that defence spending can support economic growth by influencing of resource mobilization, modernizing of infrastructure and utility.

2.3.2 Negative Effects

On the contrary to mentioned positives, some important difficulties of each country's economic development can appear while financing military. It is often argued by low savings ratio, severe balance of payment deficit and lack of public expenditures on health, education, culture etc. It is generally said that defence spending cannot be productive or effective. Many authors found out that too high military expenditures can negatively influence economic growth. They usually argue that there are significant differences in individual nation's borrowing capacities. According to them, it can lead to a decline in savings relative to income that retarded growth. The growth rate of

output is also affected by changing export conditions, changing population, capital inflows and capital stocks. Benoit (1978) talked in his pioneering article about impact of modernization which negatively resulted in an income shift. Thus, the civilian GDP is consequently diminished. Finally, crowding-out effects of military expenditures on civilian consumptions and investments were observed by Benoit. Many scholars followed Chan (1985) with his contribution when he said that defence spending may turn to chronic and severe removal of capital and brains from the most progressive parts of civilian sector to military sector. Moreover, the research and development resources in military area can negatively influence the state's technological base. Frederiksen and Looney (1983) added that military expenditures are mostly focused on import. But it depends on if the country is more developing or developed. They say that in case of paying for imports with using external borrowing, the foreign debt increases. In case of using earnings from export, funds are absorbed and they cannot be used alternatively.

2.3.3 Supply-side Effects

The supply-side considerations are based in the opportunity costs of scarce resources. In this case, military expenditures divert resources from more productive uses. Private consumption could be reduced if military expenditures are devoted to the production of non-consumption items such as weapons. Also, private consumption could be harmed if the social value attached to military expenditures is smaller than the social value of consumption that is displaced. Depending on the resource constraints that a country faces, military expenditures could either crowd-out or crowd-in private investment and savings. Moreover, public expenditures on health, education, research or development may be adversely influenced by increase in military expenditures. For example, arms imports may affect especially less developed countries' balance of payment by using scarce foreign exchange reserves that could be used for the import of capital and necessary intermediate goods.

2.3.4 Demand-side Effects

In addition to affecting economic growth from the supply-side, military expenditures could have effects on the demand-side. In the absence of capacity constraints, increase in military expenditures may increase aggregate demand thereby enhancing real output and economic growth. If capacity constraints are binding then

increases in military expenditures could generate inflationary pressures. The positive or negative effects of military expenditures on economic growth are largely an empirical question tailored to the specifics of the country under inquiry (Dunne, 2004).

2.4 Review of Literature – General Findings

There are many specified opportunities through which military expenditures could influence the economic growth. It depends whether we consider a theoretical or rather empirical approach. Neoclassical models are generally based on the supply side with a focus on the trade-off between the aforementioned "guns and butter". Keynesian models view military expenditures as one part of public spending and focus on the demand side, although when used in econometric models, the aggregate production function gives them a neoclassical flavour (Dunne, 2002). Some authors found a positive impact on technological innovation and it has promoted growth through a spin-off effect on the private sector (Chan 1995, Gold 1990). The military expenditures have also a positive effect on education and human capital at all. Finally, it significantly supports maintaining of both internal and external security (Sandler and Hartley 2007). A secure environment may also attract better foreign direct investment and international economic exchanges which both support the economic growth (Heo and DeRouen 1998). It cannot be forgotten that especially in poorer countries military expenditures may support a civilian growth by clothing, feeding, providing medical care as well as vocational and technical training, engaging in a variety of public works – public roads, dams, river improvements, airports, communication networks, etc. And also engaging in scientific and specialties which otherwise would have to be performed by civilian personnel (Atesoglu et al. 1990).

Another question arises as to what type of model is more efficient to use while examining the relationship between military expenditures and economic growth. According to Dunne et al. (2005), the potential reason why previous studies resulted in positive or negative influence is because they used various versions of the Feder-Ram based 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). Although, it might be said there is a wide variety of reasons that may lead to different results such as different theoretical underpinnings,

different estimation methods, different groups of countries etc. Dunne et al. (2005) argue 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, Dunne et al. (2005) recommend the augmented Solow model which was presented by Mankiw et al. (1992). They noted that such a model fit the data extremely well. But on the other side, it is necessary to mention Heo's (2010) conclusions. He argued that the benefits of the augmented Solow model are achieved through the loss of the Feder-Ram's benefits as far as testing the economic effects of non-military expenditures compared with those of military expenditures and the externality effects of both public expenditures. Moreover, the augmented Solow model may also have multicollinearity issues because of the inclusion of both current and lagged military expenditures. Nevertheless, an early cross-country correlation analyses by Benoit (1978) gave way to a variety of econometric models, reflecting different theoretical prospective. Keynesian, neoclassical and structuralist models provide a variety of specifications for different samples of countries. The diversity of results led to arguments for case studies of individual countries and relatively homogenous groups of countries. Thus, there are different results with different conclusions among researchers and some of the most important are further described.

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 et al. (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 negatively influenced by their defence allocation.

Frederiksen and Looney (1983) 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 for the 28-year period. The results showed that increased military expenditures

supported economic growth in the relatively richer countries, but not in relatively poorer ones. 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, conducted 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. 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 each other.

Dunne et al. (2005) published a paper that evaluates some of the statistical issues including the estimating of growth models involving military expenditures. They found that the newest authors did usually not concluded that there is some effect of military expenditures, however, on the other side, a lot of older authors dealing with military found a some significant impact. The authors suggest that this is mostly because of some characteristics of the Feder-Ram model that was widely used in the past but it is not nowadays. The paper argued that the commonly used Feder-Ram model has a number of weaknesses and misinterpretations and should not really be the main tool of such an analysis. They recommend a simple neoclassical growth model as a helpful alternative approach and introduced an impact of military expenditures through their effects on technology. Another issue considered is use of panels of data 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 the Swamy random coefficient estimator. They produced poor results for the Feder-Ram model but much more promising results for the new growth model.

Aizenman and Glic (2006) 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.

Cuaresma and Reitschuler (2006) presented a positive externality effect in their paper but the overall effect turns out to be negative due to the size of the military effect. Using a cross-country growth regression and the Feder-Ram model, the partial correlation between defence spending and the economic growth appears to be robust and significantly negative only for countries with a relatively low military expenditure ratio. They say that military expenditures can be unproductive although they provide insurance against war. Then the budgetary trade-off may occur because government expenditures are generally financed through taxes, budget deficit, the "guns and butter" trade-off or monetary policy. Every additional increase of military spending brings a heavier tax burden, inflation, increasing government deficit and on the other side a decline of social welfare spending, such as finances on education, medical care, concluded Ward et al. (1995). In the past, it was also argued by Aschauer (1989) that military expenditures adversely affect growth because the government sector generally exhibits negligible rates of measurable productivity increase.

Bernauer and Koubi (2009) introduced a study whereby they showed that although military expenditures have had a positive effect on the rate of economic growth, the distribution 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 and 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.

Alptekin and Levine (2010) in their article reviewed 32 empirical studies with 169 estimates to find the combined overall effect of military expenditures on the economic growth. It needs to be said that meta–analysis is mostly used in statistics and refers to methods that focus on contrasting and combining results from different studies in a hope to identify patterns among study results. In their paper they used meta–fixed and random effects and regression analysis and the results showed that there exists a net

effect of military expenditures on the economic growth. The net combined effect is according to their study positive although its magnitude is rather small.

Wijeweera and Webb (2012) studied the use of the Feder-Ram and military Keynesian model to examine the nexus between defence spending and the economic growth in Sri Lanka. They found that the Keynesian aggregate demand model is better suited to analyse the link than the Feder-Ram model for the case of Sri Lanka. Based on their results they expected a higher economic growth rate in Sri Lanka provided more public resources were diverted from the defence to civilian sectors of the economy. The conclusions of their paper are that the optimistic predictions of their economic analysis are entirely dependent upon the political decision.

2.5 Review of Literature – the EU

Not too many authors examine the defence-growth nexus in the European Union (EU). The EU has one of the biggest military budgets in the world. It is a kind of federal budget that is divided into each country's Department of Defence and part of the budget finances any military-related expenditure. The military budget pays for the maintenance of arms, equipment and facilities, salaries, funds operations, training, health care of uniformed and civilian personnel, and develops and buys new equipment. The budget funds all branches of the particular military – the Army, Navy, Air Force, Marine Corps and Coast Guard. Defence spending is close to its historic lows now. Moreover, the European Commission proposed five-year budget plan in 2010 that would further reduce the defence spending to the levels unprecedented during wartime. Between 2010 and 2015 the total defence spending was set to fall as a percentage of the gross domestic product, even though the Europeans have assigned more military missions over the past two decades (Mackenzie, 2010).

Turning to research in this area, Cappelen et al. (1984) tried to verify a hypothesis that countries with a high defence burden tend to have a lower rates of economic growth than countries with a low defence burden. His sample included 17 OECD countries for the period 1960 – 1980 but his results also touched the European countries, although it could not be an analysis dealing with EU countries. Nevertheless, he found a positive effect of defence spending on manufacturing output but a negative effect on investment. These two effects had an opposite impact on economic growth. The net effect was that military spending had an overall negative effect on economic

growth for the whole sample of countries except the European ones, especially Mediterranean countries.

Kollias et al. (2004, 2007) focusing on the EU15 investigated the causal relationship between growth and military expenditures over the period 1961-2000. Using panel data methods the researchers found a proof of a positive directional causality in both directions in the long term and a positive effect from military expenditures to growth in the short term. With these findings the researchers contended that boosts in military could results in growth in this area.

Subsequently, Hatzinikolaou (2007) focused only on the contribution of Kollias et al. (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. His conclusions reported the similar results.

Mylonidis (2008) examined the EU14 and employed the Barro model to explore the impacts of defence spending using of methods adopting cross-section and panel data. The findings from this paper focused on a significant negative effect of defence spending on the economic growth. Thus, there are no similar results and conclusion in case of the mentioned researchers.

Dunne and Nikolaidou (2012) employed the augmented Solow-Swan model and estimated it both with panel data and time series to find some proof of military expenditures effects in the EU15 countries over the period 1961 – 2007. Their results showed that both panel data and time series methods are consistent and suggested that defence spending does not contribute to the economic growth in this area.

3 Own Empirical Research

3.1 Methodology and Data

As stated above, the main hypothesis of the thesis is that there is a relationship between military expenditures and economic growth. A secondary hypothesis says that the relationship is positive in case of relatively richer countries and negative for relatively poorer countries.

Consequently, a basic regression model with the modified variables, the Feder-Ram model, the augmented Solow-Swan model (both with panel data and time series with and without dummies) and the Barro model are used. The dependent variable is always economic growth rate expressed as a percentage. The main independent variable is always military expenditure expressed as a percentage. In individual models new different independent variables are added to test the growth-expenditure relationship. After that, the ARDL-bound test for cointegration and the Toda-Yamamoto as a modified Granger causality test are used. The presence of long-run coefficients is also tested at the end.

For all the models a fixed effect (proved by the Hausman test) balanced panel data regression model is used. The data for 28 + 3 European countries are examined between 1993 and 2012. This time range was chosen because of the availability of data from 1993 to keep the balanced model (there is always 620 observations). In 2015 (the year of analysis) there was no complete data set for the years 2013 and 2014. The data are collected from the SIPRI, NATO, OECD, CSIS (and for the Barro model from ICRG and COW) database.

3.1.1 Cluster Analysis

Clustering is the task of grouping objects in such a way that objects in one group (called a cluster) are more similar to each other and simultaneously different from objects in the other groups. Of course, there might be some characteristics that do not fit all the objects in the group perfectly. Nevertheless, there is no reason to doubt if the objects are grouped correctly. This technique was used by Frederiksen and Looney (1983) in order to identify countries as relatively poorer and relatively richer ones and it is also adopted in this thesis.

As an inspiration by Frederiksen and Looney (1983), six variables were selected for the cluster analysis – export, import, deficit (of a state budget), private savings, private consumption (all as a % of the GDP) and investment to GDP ratio. It is expected that each variable has an effect on the defence burden-growth relationship as shown in Table 4. Each variable either strengthens or weakens the relationship. A cluster analysis was performed using these six variables for 28 + 3 EU countries in the sample.

Table 4 Cluster Analysis Variables

Description of Variables Used in Cluster Analysis	
Variable Description	*Impact on Defence-Growth Nexus*
Export (EXP) as a % of GDP, Average 1993 – 2012	(+) Openness of the economy reflecting the ability to transform and to achieve economic efficiency in production
----------	----------
Import (IMP) as a % of GDP, Average 1993 – 2012	(+) Ability of foreign resources for military expenditures
----------	----------
Deficit (of a state budget) (DEF) as a % of GDP, Average 1993 – 2012	(+) Ability of the government to have attracted foreign capital in the past to supplement domestic resources
----------	----------
Private Consumption (CONS) as a % of GDP Average 1993 – 2012	(-) May reflect a scarcity of savings for development or (+) a high multiplier effect on economic growth
----------	----------
Private Savings (SAV) as a % of GDP Average 1993 – 2012	(-) A proxy indicator of the government's inability to finance expenditures through tax revenues
----------	----------
Investment (INV) to GDP Ratio, Average 1993 – 2012	(-) No or low productivity of investment reflecting bottlenecks or government inefficiency in allocation

Source: NATO, 2015; SIPRI 2015; own modification

3.1.2 Models of Military Expenditures-Growth Relationship

As stated above, the additional research question of this thesis is to find which model better describes the relationship (if it exists) between military expenditures and economic growth. The models are tested using the new data sample. It is necessary to find some suitable or proper model in the field of military expenditure and its effects on economic growth and other macroeconomic aggregates. Generally, the economic theories deal with how to achieve the highest level of real GDP, especially in the long-time period. Using different words, it is talked about full employment production. The main theory is classical – which is a mix of Adam Smith, David Ricardo and Thomas Malthus research. It says that there is a steady state GDP and any change is just temporary. Neo-classical theory is presented by Robert Solow and Trevor Swan's model called the Solow-Swan model. The model assumes that increasing capital leads to diminishing returns. Basically, the theory employs capital, labour and technology and the economy tends to the point at which there is no more technological progress, capital is constant and economic growth does not continues. This is a steady state moment in the economy. Last but not least, there is a new economic growth theory from the 1980's and 1990's called endogenous growth theory presented by Robert Lucas and Paul Romer. They say that capital increase does not have to necessarily cause diminishing returns as reaction on the neo-classical theory. The economists literally made a technological progress endogenous. A human capital and innovation have been included and the type of capital investment is now more decisive (Helpman, 2004).

Empirical studies give us a plenty of examples varying from applied econometrics to more institutional focused case study papers. Most of them are generally based on the neoclassical approaches. Cuaresma and Reitschuler (2003) talk about the Feder-Ram model which popularity can be clarified by its ability to handle the externality effects of military expenditures on economic growth. However, Dunne et al. (2005) argue with the severe deficiencies found in their article. As an appropriate alternative seems to be the augmented Solow model or some endogenous growth model as for example Barro model. From the other authors, it is for example Mylonidis (2008) who examined the 14 EU countries and employed the Barro-type model; Dunne and Nikolaidou (2012) who employed the augmented Solow-Swan model; or Wijeweera and Webb (2012) who studied the Feder-Ram and military Keynesian model.

The main issue in estimating growth models was the shortage of independent exogenous variation in the data. To deal with it, using of pooling cross section and time series data for a relatively homogenous group of countries was recommended (Murdoch et al., 1997). There is a problem that the cross section and time series parameters may measure different variables. The former could pick up the long run effects and the latter the short run ones. The pooled relation is then a weighted average of the two. Growth equations have been most successful in the cross sections because of the difficulties in distinguishing the cyclical demand side effects from medium term supply side growth effects. More recently the growing length of the data series and the availability of reliable cross country data and developments in panel data estimation methods have led to a marked increase in the analysis of economic growth and its relation to military spending (Dunne et al., 2005).

3.1.2.1 Feder-Ram Model

For the past twenty five years, the Feder-Ram has been the most commonly used model for explaining the 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. The defence sector externality and differential productivity effects are identified within a single equation model. There was a number of authors (Atesoglu et al., 1990; Mintz and Huang, 1990; Sandler and Hartley, 1995 etc.) who believed in its potential because of its important contribution to the area of research of the relationship between military expenditures and economic growth. The reason was 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, Ram (1986) suggested a two-sector model as inclusive of a government and a private sector to explain growth. 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 of the other (non-military) government expenditures due to different kinds of stimulation.

Assuming the economy as 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* (Sandler and Hartley, 1990):

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

The equation including constraints is given by:

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

And the domestic product *Y* is given by:

$$Y = C + M \quad (3)$$

Turning to capital and labour, this model accepts that marginal product values differ across sectors by a constant uniform proportion as:

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

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 $1+\mu$ times the corresponding marginal factor productivity in the civilian sector. The marginal productivities of capital *MK*, *CK* and labour *ML*, *CL* 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:

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

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*. The relation (5) can be rewritten in the following form:

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

This allows the divided identification of the externality effect and the marginal factor productivity differential effect. As introduced by Dunne et al. (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. The model 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 (Huang and Mintz, 1991; Ward et al, 1995 etc.), cross-country data (Heo and DeRouen Jr, 1998), or time-series and cross-sectional data together (Murdoch et al, 1997). The main criticism came from Dunne (1996) and Dunne et al. (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 (6) and provoked a concern over 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 two sectors in reality. 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 is necessary. However, most of the analyses in the military-growth nexus area have been done with only two sectors. Dunne et al. (2005) added that the Feder-Ram 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 (e.g. Mankiw et al., 1992; Knight et al., 1996 etc.).

3.1.2.2 Augmented Solow-Swan Model

The Solow growth model is rooted in Solow (1956) and Swan (1956) who described the supply-side changes to aggregate output that explained the growth. The model was modified by Mankiw et al. (1992) and the augmented Solow growth model was developed. The modification was realized in a characteristic of growth using the accumulation of economy-wide human and physical capital. Generally, this model is very simple and clear in identifying economic growth. On the other side it is considered to be a very contributive for its capability to represent an authentic characteristic of economic growth. This approach can explain more than three quarters of cross-country variation in growth which is more than the Feder-Ram model that can explain about 60% (Mintz and Huang, 1990).

There are few basic conditions that have to be fulfilled in case of this model. The causality of military expenditure and its impacts on economic growth holds on other economic growth models comparing to Feder-Ram, and mainly, this model suggests that the part of economic growth and military expenditures influences a total factor productivity of individual country. It should happen thanks to a balancing effect on the efficiency value that directs labour-modifying technological change. It is useful to remind the assumptions of basic Solow model such as constant savings rate *s*; constant labour force growth *n*; constant rate of capital depreciation *d*.

The first step of the model is the aggregate neoclassical production function that features labour-augmenting technological change demonstrated as:

$$Y(t) = K(t)^{\alpha}[A(t)L(t)]^{1-\alpha} \tag{7}$$

where the notation *Y* is aggregate real income, *K* is the real capital output, *L* is labour and *A* is the technology level. It is expected that technology and labour growth is exogenous at the rates *n* and *g*, as it shown on the two following equations:

$$L(t) = L_0 e^{nt} \tag{8}$$

$$A(t) = A_0 e^{gt} m(t)^{\theta} \tag{9}$$

It is also possible define the rate *g* as the exogenous Harrod-neutral technical progress and *m* introduces an index of defence spending as the part of GDP that grows at rate θ. The characteristic of technology expects a permanent change in *m* that will not influence a long-term steady state growth. With defined assumptions mentioned above, the dynamics of capital accumulation $\dot{k}_e$ is given as:

$$\dot{k}_e = sk_e^{\alpha} - (g + n + d)k_e \Leftrightarrow \frac{\delta \ln k_e}{\delta t} = se^{(\alpha-1)\ln k_e} - (g + n + d) \tag{10}$$

In this relation α denotes the constant capital output elasticity, *k* denotes the effective capital output per labourer ($k=K/AL$; $k_e=K/[AL]$), analogically *y* denotes per capita income ($y=Y/AL$). This implies the steady-state level of k_e which is given by:

$$k_e^* = \left[\frac{s}{g+n+d}\right]^{1/(1-\alpha)} \tag{11}$$

The linearly adjusting of (10) using a simplified Maclaurin series around the steady-state and using (11) is described as:

$$\frac{\delta \ln k_e}{\delta t} = (\alpha - 1)(g + n + d)[\ln k_e(t) - \ln k_e^*] \tag{12}$$

Then the steady-state level of output per effective labour gives (13) including (14):

$$y_e^* = \left[\frac{s}{g+n+d}\right]^{\alpha/(1-\alpha)} \tag{13}$$

$$\frac{\delta \ln y_e}{\delta t} = (\alpha - 1)(g + n + d)[\ln y_e(t) - \ln y_e^*] \tag{14}$$

For better empirical using (14) the relation is forwarded from *t-1* to *t* and it gives:

$$\ln y_e\,(t) = e^z \ln y_e\,(t-1) + (1 - e^z) \ln y_e^*\,; \quad z \equiv (\alpha - 1)(g + n + d) \tag{15}$$

After linearly adjusting around the steady-state and approximating the transition dynamics of output per labourer and with using (12), (13) and (15), the model relates y_e to the observed *y=Y/AL* through:

$$\ln y\,(t) = e^{z} \ln y\,(t-1) + (1-e^{z})\left\{\ln A_0 + \frac{\alpha}{1-\alpha}[\ln s - \ln(g+n+d)]\right\} + \theta \ln m(t) - e^{z}\theta \ln m(t-1) + (t-(t-1)e^{z})g \quad (16)$$

The rate θ gives the elasticity of income with respect to the long-run military expenditure share of GDP. The relation (16) expects the dynamic panel data model. The final effect of military expenditures on economic growth using the augmented Solow growth model is stated as:

$$\Delta \ln y\,(t) = \beta_0 + \beta_1 \ln y\,(t-1) + \beta_2 \ln s(t) + \beta_3 \ln\big(g(t)+n(t)+d(t)\big) + + \beta_4 \ln m(t) + \beta_5 \ln m(t-1) + \varepsilon \quad (17)$$

More details and a full derivation of the model can be found at Knight et al. (1996). It is possible to retype (17) in truncated form as:

$$\ln y_{i,t} = \beta_0 \ln y_{i,t-1} + \sum_{j=1}^{4} \beta_j \ln x_{j,i,t} + \eta_t + \mu_i + \nu \quad (18)$$

With conjunction of the equation (17) and (18) together, $x_1 = s =$ gross investment/GDP; $x_2 = n + g + d =$ labour force growth rate + 0.05; $x_3 = m =$ military expenditures/GDP; $x_4 = m_{t-1}$. The variables s and n are treated as changeable across nations and time and g and d are considered to be uniform time-invariant constants. Rate A_0 is nation-specific but, when constructing, also time-invariant. The equations (17) and (18) denote the augmented Solow-Swan growth model with the Harrod-neutral technical progress. Equation (17) leads to an estimated model of the form of equation (18).

Thus, the augmented Solow growth model offers some kind of enhancement compared to the Feder-Ram model. Dunne et al (2005) talk about main advantages of this improved model. The augmented Solow model is dynamic and it gives an opportunity to explore the effects of military expenditures on economic growth during the time. Then, the elimination of non-military government expenditures and

changeable externality effects abates the probability of multicollinearity presented in other models. And finally, the human capital rate covers both capital depreciation and total factor productivity. The augmented Solow model is considered to be more theoretically specified than the Feder-Ram model and its incorporation of the labour force's growth rate. Generally, the augmented Solow growth model should provide more consistent specification with testable hypothesis for coefficients and it is easier to interpret when estimated.

On the other hand, there is also some critique when implementing these exogenous growth models. Although the exogenous models offer a valuable explanation of convergence in growth between nations, these are criticised for failing to explain the observed growth in living standards. For this purpose the endogenous growth models were developed.

3.1.2.3 Barro Model

This endogenous model firstly developed by Barro (1990) is commonly used as the alternative model for examining the relationship between military expenditures and economic growth. Generally, the model offers a more common framework for examining. Moreover, the model clearly allows for forms of government spending that might affect product through the production function and has an explicit utility function for a representative agent which the government boosts. The government spending then has a non-linear effect on growth produced by the interaction between the productivity improving. As a small disadvantage might be considered that a more general framework is available at the cost of increasing complexity and not so easy interpretation of results.

The basic model starts by assuming that the representative agent produces a single commodity expressed as:

$$y = Af\left(\frac{g}{k}\right) \tag{19}$$

It uses a generic production function given by the amount k – private capital and g – total public expenditures. Symbol A is the exogenous rate of technology and f is a generic function formalized as a constant elasticity function (CES), Cobb-Douglas or a logarithmic function. The growth of private capital is modelled as:

$$k^{\&} = (1-\tau)y - c \tag{20}$$

In which $k^{\&}$ is growth rate of private capital, τ is the flat rate of income tax and *c* is private consumption. The agent chooses the amount of private consumption to maximize the flow of future utility functions:

$$U(c) = e^{-\rho t}u(c) \tag{21}$$

where ρ is the rate of time preferences. If the utility function is specified as a CES function, then:

$$u(c) = \frac{e^{1-\sigma}-1}{1-\sigma} \tag{22}$$

Since σ > 0, the marginal elasticity is −σ . Government expenditure *G* is determined by the amount of collected taxes from the private sector:

$$G = \tau y \tag{23}$$

The agent then maximizes the utility function (22) subject to the private capital accumulation constraint (20) and the government budget constraint (23) to choose the optimal growth rate, giving:

$$\gamma = \frac{1}{\sigma}\left((1-\tau)f'\left(\frac{g}{k}\right) - \rho\right) \tag{24}$$

This can be written as:

$$\gamma = \frac{1}{\sigma}\left((1-\tau)f\left(\frac{g}{k}\right)(1-\eta) - \rho\right) \tag{25}$$

where η is the elasticity of γ with respect to g (for given values of k), so that 0< η < 1. Government spending can have two effects on the growth rate. First, an increase in τ can reduce γ and second an increase of g / y can raise $\partial y\ k / \partial$, which raises γ. The first effect typically dominates when government spending is large and the second one when the government spending in GDP is small.

Now let's consider the production function of Cobb-Douglas rather than the CES form. The elasticity of *y* with respect to *g* is constant and η = α, so that the conditions τ = *g / y* and *g / k = (g / y) ϕ (g / k)* imply that the derivative of γ with respect to *g / y* is:

$$\frac{d\gamma}{d(\frac{g}{y})} = \frac{1}{\sigma}\phi\left(\frac{g}{k}\right)(\phi' - 1) \tag{26}$$

In the Cobb-Douglas technology, the optimal size of government that maximises the growth rate corresponds to the condition for productive efficiency, that is φ ' =1 . Since α = η = φ '(g / y), it follows that α = g / y = τ. This implies that there will exist an inverse hump-shaped relationship between government spending and the growth rate and so an optimal level of government spending.

For the purpose of this thesis the approach of Aizenman and Glick (2006) is used. Originally, they evaluated a non-linear interaction between defence spending, external threats and corruption. As the growth fell with increasing military expenditures, they assumed either negative or insignificant effect. According to them, it resulted from non-linearities. The model begins with the reduced product *y* expressed as:

$$y = A(k)^{1-\alpha}(g)^{\alpha} f \tag{27}$$

where *A* is an exogenous productivity factor, *k* is the capital/labour ratio, *g* is the infrastructure/labour ratio, and *1-f* in the relation (29) measures the product cost of the threat posed by foreign rival's hostile actions. There is the assumption that these costs depends negatively on defence spending and positively on the magnitude of the threat. Then a simple functional equation is adopted:

$$f(g_m, z) = \frac{g_m}{g_m + z} \tag{28}$$

where g_m is military expenditures and *z* is the external level of threat. It is important that the threat is measured in units commensurate with military expenditures. That is why both variables might by aggregated. This indicates that the level of threat might be displaced by the level of military expenditures more likely than a presence of the conflict between home and foreign country.

Finally, the corruption variable is incorporated into the model. It works as a kind of activity that taxes fiscal expenditures on military and non-military expenditures. The rate is t_c and the equation is following:

$$y = A(k)^{1-\alpha}(g[1-t_c])^{\alpha}\frac{g_m(1-t_c)}{g_m(1-t_c)+z} \tag{29}$$

The ratio between military and non-military expenditures is expressed by ϕ, then:

$$g_m = \phi g \tag{30}$$

Subsequently, the overall fiscal outlay on military and non-military spending is *(1+ϕ)*g*. From this point, the deducing is equivalent to the usual Barro model. The fiscal outlay is financed by a proportional tax τ as:

$$(1+\phi)g = \tau y \tag{31}$$

The representative agent's preferences are then:

$$U = \int_0^{\infty}\frac{c^{1-\sigma}-1}{1-\sigma}\exp(-\rho t)\,dt \tag{32}$$

After that the product growth rate is expressed by:

$$\gamma = \frac{\dot{y}}{y} = \frac{1}{\sigma}\left[(1-\tau)\frac{\partial y}{\partial k} - \rho\right] \tag{33}$$

The ideal formula of taxes and expenditures expressed by $\tilde{\tau}$ and $\tilde{\phi}$ which determine the size of defence sector and boost the growth rate is following:

$$\tilde{\tau} = \alpha(1+\tilde{\phi}) \tag{34}$$

This formula equates the tax rate and government spending ($\tau = (g+g_m)/y$) rate to the product elasticity with respect to the marginal product of non-military expenditures (α), augmented at the rate ϕ. Because of military expenditures absence,

the formula (34) reduces the standard production efficiency condition to $\tau = \alpha$. However, the equation (35) includes military expenditure ratio expressed as ϕ:

$$\frac{z}{k} = (\tilde{\phi})^2 \alpha [\alpha (1 - t_c]^{\frac{1}{1-\alpha}} \left[1 - \alpha \tilde{\phi}\right]^{\frac{\alpha}{1-\alpha}} A^{\frac{1}{1-\alpha}} \quad (35)$$

From this equation it is obvious that military expenditures ratio ϕ depends positively on external threat and corruption level and negatively on productivity level. Subsequently, to define optimal tax and expenditure rates, the following equation is adopted:

$$\alpha \tilde{\phi} = 1 - f = \frac{z}{\tilde{g}_m (1 - t_c) + z} \quad (36)$$

where $\tilde{g}_m = \frac{\tilde{\phi} \tilde{\tau} \tilde{y}}{1 + \tilde{\phi}}$ and the ideal ratio of military to non-military expenditure ($\tilde{\phi}$) times the product share of normality expenditures (α) equals the product cost of foreign threat ($1 - f$) that in turn equals the magnitude of the external threat (z) relative to the aggregate effective military expenditures by the home country and its foreign rival ($\tilde{g}_m = (1 - t_c) + z$) where the expression "effective" indicates net of corruption tax. Subsequently, an exogenous increase in the external level of threat (z) boosts the ideal expenditure and tax rate ($\tilde{\phi}$ and $\tilde{\tau}$). At the end, it should be concluded that higher corruption (t_c) and lower productivity (A) may increase military expenditures and the ideal tax rate and reduce growth.

Thus, the model says that defence spending induced by foreign threats should increase product, by increasing security; while defence spending induced by rent seeking and corruption should reduce growth, by displacing productive activities.

3.1.3 Cointegration Test – the ARDL-bound Test

Cointegration can be defined simply as the long-term, or equilibrium, relationship between two variables. This makes cointegration an ideal analysis technique to ascertain the existence of a long-term relationship between the observed variables.

The ARDL-bound test is quite a new method which tests the existence of a long-run level relationship between a dependent variable and a set of regressors, when it is

not known with certainty whether the underlying regressors are trend or first-difference stationary. The proposed tests are based on standard F-statistics and t-statistics used to test the significance of the lagged levels of the variables in a first-difference regression. The ARDL test is used in two unrestricted correction error models (UECM) as introduced below (see Model 1 and 2 with equations (37), (38), (39) and (40) below).

This method has a lot of advantages. Mainly, the ARDL method is able to analyse the presence of short run as well as long run relationship between the independent variables and the dependent variable. It also takes a sufficient numbers of lags to capture the data generating process in a general to specific modelling framework. The ARDL model was firstly employed by Pesaran and Shin (1999) and two years later developed by Pesaran and Smith (2001). Basically it is a dynamic model that uses the lags of dependent variable and the lagged and contemporaneous values of the independent variables through which the short-run effects can be directly estimated, and the long-run equilibrium relationship can be indirectly estimated.

As mentioned above, this approach has many advantages compared to other cointegration methods as for example Johansen cointegration test which introduces the system-based reduced rank regression. Or the Granger test that presents a two-step residual based technique for testing the null of no cointegration. The ARDL test does not levy a restrictive assumption that all the variables must be integrated in the same order. It might be used irrespective of whether the underlying regressors are integrated of order one I(1), order zero I(0) or fractionally integrated. Using other words, there are two sets of asymptotic critical values provided. The first one assumes that all the regressors are I(1), and the another set assumes that they are all I(0). These two sets of critical values provide a band covering all the possible classifications of the regressors into I(0), I(1) or mutually cointegrated. While other cointegration tests are sensitive to the size of the sample, the ARDL methods are suitable even if the sample size is small. The other advantage is that ARDL test generally provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous (Narayan and Smyth, 2009).

With using ADF unit root test the determination of variable integration is done and analysing of variables cointegration by using ARDL bound testing follows. This bound test involves the comparison of the critical value and F-statistic.

Two models and four equations together are set (see below). The following variables are used: MLTEX is the ratio of military expenditures to GDP, GDP is real

gross domestic product, and GDPpc is real GDP per capita. All variables are transformed into natural logarithm.

Model 1

Equation 1 (37)

$$\Delta logMLTEX_t = \alpha_0 + \alpha_1 logMLTEX_{t-1} + \alpha_2 logGDP_{t-1} \sum_{i=1}^{m} \alpha_{3,i} \Delta logMLTEX_{t-1} + \sum_{i=1}^{n} \alpha_{4,i} \Delta logGDP_{t-1} + \varepsilon_t$$

Equation 2 (38)

$$\Delta logGDP_t = \beta_0 + \beta_1 logGDP_{t-1} + \beta_2 logMLTEX_{t-1} \sum_{i=1}^{m} \beta_{3,i} \Delta logMLTEX_{t-1} + \sum_{i=1}^{n} \beta_{4,i} \Delta logGDP_{t-1} + \mu_t$$

Model 2

Equation 3 (39)

$$\Delta logMLTEX_t = \theta_0 + \theta_1 logMLTEX_{t-1} + \theta_2 logGDPpc_{t-1} \sum_{i=1}^{m} \theta_{3,i} \Delta logMLTEX_{t-1} + \sum_{i=1}^{n} \theta_{4,i} \Delta logGDPpc_{t-1} + \gamma_t$$

Equation 4 (40)

$$\Delta logGDPpc_t = \delta_0 + \delta_1 logGDPpc_{t-1} + \delta_2 logMLTEX_{t-1} \sum_{i=1}^{m} \delta_{3,i} \Delta logMLTEX_{t-1} + \sum_{i=1}^{n} \delta_{4,i} \Delta logGDPpc_{t-1} + \omega_t$$

In case of the first model in equation (37) logMLTEX is a dependent variable and logGDP is an independent variable. In equation (38) logGDP is a dependent variable and logMLTEX is independent. The second model denotes two equations as well. Equations (39) and (40) are similar to the equations (37) and (38), however variable logGDPpc is employed instead of logGDP.

3.1.4 Causality Test – the Toda-Yamamoto Test

The Toda and Yamamoto (1995) causality test is a modified Granger causality test and it is based on VAR system and a Wald test statistic. In contrast to other tests, this method might be used without the order of integration, non-cointegrated or cointegration properties of the variables.

The test requires the estimation of a VAR in levels which minimizes the risks associated with incorrectly identified order of integration and the cointegration properties among the variables. Specifically the Toda–Yamamoto long-run causality test artificially augments the correct order of the VAR, *k*, by the maximum order of integration, *dmax*, and ensures that the usual test statistics for the Granger-causality have the standard asymptotic distribution.

The optimal lag length based on Akaike Information Criteria (AIC) and Bayes Information Criterion also known as Schwartz Information Criterion (SBIC) is firstly determined. After determining lag length (*k*), (*k* + *dmax*) the order VAR is estimated where *dmax* is the maximum order of integration.

3.1.5 Panel Data Analysis

When a regression analysis is undertaken, a regression model with panel data is set as:

$$y_{i,t} = \alpha + \beta x_{i,t} + \varepsilon_{i,t} \qquad (41)$$

where *y* denotes a dependent variable, *x* denotes and independent variable, *i* and *t* are markers for subject and time, α and β denote coefficients. The fixed and random effects are chosen while checking the error ε_{it}. A random effect model supposes ε_{it} to be differed stochastically in respect to *i* and *t*. Then it is necessary to

adopt an appropriate treatment of the error matrix. On the other hand, a fixed effect model supposes ε_{it} to be differed non-stochastically in respect to *i* and *t*. This makes the fixed effects similar to a dummy variable. Panel data analysis has three more-or-less independent approaches:

- independently pooled panels;
- random effects models;
- fixed effects models or first differenced models.

Panel data models in macroeconomics have become popular since last decades. The idea of a panel data set is that a cross-section of observational units, typically individuals or economic entities, is selected and a response and explanatory variables are observed for each unit. So panel data set contains observations on multiple phenomena observed over multiple time periods.

Panel data sets generally include chronological blocks or cross-sections of data. Panel data are of two types; balanced panel data which has equal number of observations for each individual (cross-section), and unbalanced panel data which does not contain equal number of observations for each individual.

Primary reason for increased utilization of panel data is that it offers opportunity for controlling unobserved individual and/ or time specific heterogeneity, which maybe correlated with the included explanatory variables. Both time series and cross-section when combined, enhance the quality and quantity of data in the ways that would be impossible using only one of these two dimensions (Gujarati, 2003). Klevmoarken (1989), Hsiao (2003, 2005), Woolridge (2002), Baltagi (2005), Greene (2005), etc. listed several benefits of using panel data, such as it increases the precision of parameter estimates, allows to sort out model temporal effects without aggregation bias, gives more informative data, less collinearity among variables, more efficiency, etc.

3.1.6 Model Assumptions

To fulfil the assumptions of individual models several tests were adopted, as for example the Jarque-Bera test for the normal distribution, the White test for heteroskedasticity, the Breusch-Godfrey and the Durbin-Watson test for autocorrelation, or the Farrar-Glauber test for multicollinearity.

3.1.6.1 Normal distribution – Jarque-Bera Test

The Jarque-Bera statistic is a test where it is examined if the observed data have the skewness and kurtosis identical with a normal distribution. Of course, when the data sample has more than 100 observations, the normality test is more or less redundant, however, the author decided to add this test as well because of being sure and having precisely verified results.

When the data have a normal distribution, the Jarque-Bera statistic has a chi-squared distribution with 2 degrees of freedom. The common zero hypothesis analyzes a skewness and kurtosis. It is expected a normal distribution when skewness and kurtosis results at 0. As it was mentioned above, when there is a small number of observations, the chi-square is typically very sensitive. The Jarque-Bera test looks as:

$$JB = \frac{n-k+1}{6}\left(S^2 + \frac{1}{4}(C-3)^2\right) \tag{42}$$

Where *n* denotes the size of sample (number), *S* denotes the skewness, *C* denotes the kurtosis and *k* denotes how many regressors are there. According to Hall et al. (1995), in case of multiple regression, the equation should be as:

$$JB = \frac{n-k}{6}\left(S^2 + \frac{1}{4}(C-3)^2\right) \tag{43}$$

3.1.6.2 Heteroskedasticity – White Test

The White test establishes whether the residual variance of a variable in a regression model is constant. It is to test homoskedasticity. When the White test is significant, heteroskedasticity does not have to be the reason. It might be a specification error. Thus, the White test might be a test of specification error or heteroskedasticity or both of them. Another opportunity is to use the Breusch-Pagan test which is the equivalent.

To analyze the constant variance a supplementary regression analysis could be done. It regress the residuals from the authentic regression model onto a set of regressors that involve the original regressors along with their squares. The Lagrange multiplier test is now the output of the R^2value and the following equation comes as:

$$LM = n * R^2 \tag{44}$$

3.1.6.3 Autocorrelation – Breusch-Godfrey (or Durbin-Watson) Test

The Breusch-Godfrey test is adopted to analyze the validity of the observed data series. It examines the existence of serial dependence that is not involved in a observed model. It is used in cases when lagged dependent variables are considered to be as independent variables in further observations. A similar assessment can be also carried out with the Durbin–Watson (D-W) test. However, the D-W statistic is the traditional test for the presence of the first-order autocorrelation, while the Breush-Godfrey statistic is a more flexible test, covering autocorrelation of higher orders and applicable whether or not the regressors include lags of the dependent variable.

Because the test is based on the idea of the Lagrange multiplier testing, it is sometimes referred to as LM test for serial correlation. The Breusch–Godfrey serial correlation LM test is a test for autocorrelation in the errors in a regression model. It makes use of the residuals from the model being considered in a regression analysis, and a test statistic is derived from these. The null hypothesis is that there is no serial correlation of any order up to *p*-value.

3.1.6.4 Multicollinearity – Farrar-Glauber Test

One of the assumptions of regression analysis is that the explanatory variables are independent of each other, that is, two or more explanatory variables do not tend to move together in the same pattern. When this assumption fails, it is said there is multicollinearity among the independent variables. Therefore, a crucial condition for the application of the ordinary least squares method is that the predictor variables are not perfectly linearly related. The term multicollinearity is used to denote the presence of linear relationships among explanatory variables. If the explanatory variables are perfectly linearly correlated, that is if the correlation coefficient for these variables is equal to unity, the parameters become indeterminate; it is impossible to obtain numerical values for each parameter separately and the method of least squares breaks down.

Using other words, if the variables are found to be orthogonal, there is no multicollinearity; if the variables are not orthogonal, then multicollinearity is present. In statistics the multicollinearity (also collinearity) is a phenomenon when two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a substantial degree of accuracy. In

this situation the coefficient estimates of the multiple regression may change erratically in response to small changes in the model or the data. Multicollinearity does not reduce the predictive power or reliability of the model as a whole, at least within the sample data set; it only affects calculations regarding individual predictors.

Farrar and Glauber (1967) proposed a procedure for detecting multicollinearity comprised of three tests. The first one examines whether collinearity is present (Chi-square test), the second one determines which regressors are collinear (F-test) and the third one determines the form of multicollinearity (t-test). Only the first test is conducted in this thesis. The chi-square test for the presence and severity of multicollinearity in a function with several explanatory variables is outlined as follows:

$$B = -\left[(n-1) - \frac{1}{6}(2p+5)\right] ln|R| \tag{45}$$

where *n* is a sample size, *p* is the number of independent variables added to the model, *R* is a determinant of correlation matrix. After the placement a null hypothesis is tested. It says that independent variables are not intercorrelated between each other. For this purpose, the following relation is defined:

$$B \geq \chi^{2}_{1-\alpha}[p(p-1)/2]^{21} \tag{46}$$

3.1.7 Estimating Techniques

Dunne (2010) mentioned in his contribution that the main difficulty in estimating growth models has been found out as an insufficient independent exogenous variation in the data. One form of getting over this has been by collecting cross section data and time series data for the approximately same group of countries (Murdoch et al., 1997). However, it appears as an issue that both time series and cross section parameter can measure different variables. The former can show the long run effects and the latter the short-run effects and the pooled relation is then weighted average of both. Economic growth and development relations and equations seemed to be the most used in the cross section analysis because of many problems with recognizing the cyclical demand side effects from medium term supply side effects. More accurately, the growing length of the data series and the reachability of suitable cross country data and development of

panel data estimations methods directed to a marked increase in the examination of economic growth in panels (Smith, 2000) and its relation to military expenditures.

3.1.7.1 Single Equation Method

In a number of empirical analyses of the economic impacts or effects of military expenditures a lot of different econometric methods have been used. For example, single equation methods deal with economic growth as the dependent variable and military expenditures as the (or one of the) independent variables based on structural model. There are a plenty of methods used in econometrics that try to estimate models consisting of a single equation. The oldest and still the most commonly used is the ordinary least square (OLS) method used to estimate linear regression. On the other hand, there are many methods available to estimate non-linear models. A particularly essential group of non-linear models is that estimating relationships where the dependent variable is discrete. The single equation method is applied to time-series, cross section or panel data.

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful for forecasting the other ones. Ordinarily, regressions reflect mere correlations but it was argued by Granger that causality in economics could be reflected by some sort of tests. Econometricians assert that the Granger test finds only predictive causality. In this case, very important is a sentence saying that correlation does not imply causation. Using other words, a correlation between two variables does not necessarily imply that one causes the other. Then, there is no structural approach included. This kind of dynamic regression or vector autoregressive models is suitable for using because of its dynamic specifications which does not depend on economic assumptions taken in advance. Many studies have especially used Johansen's cointegration method and a lot of contributions dealing with cross-country and case studies have been written (Kollias et al., 2004; Smith, 2010 etc.). Some of them did include a structural model when determining the vector autoregressive, some of them did not. Dunne (2010) added in his paper that it is very helpful to have a structural model because of determining the direction of causality.

3.1.7.2 Simultaneous Equation Method

Next to the single equation method some of the papers use also simultaneous equation methods that mainly highlight military expenditures being independent on

economic growth or other variables. They include either structural or reduced form. After some inferences a simple general linear model is given and this can be estimated for example by OLS. In case of reduced form, unfortunately, the way of decomposing the estimated matrix into the individual factors is too complicated and that is why the reduced form is more suitable for prediction but not for inference. Thus, this model is not so common these days. It was more widespread in the past and nowadays it is worth to mention Dunne and Nikolaidou (2001) or Atesoglu (2009).

3.1.7.3 OLS Method

The different methods and approaches introduce a variety of possibilities to deal with some of the mentioned examples. The OLS method (47) assumes all parameters are the same for each nation and invariant across time.

$$y_{it} = a + bx_{it} + u_{it} \tag{47}$$

However, the fixed effects estimator (48) allows the intercept to differ across nations which ignores all the information in the cross sectional relation.

$$y_{it} = a_i + bx_{it} + u_{it} \tag{48}$$

Time fixed effects might also be available separately or together with nation fixed effects in a two-way fixed effect model. See the following model (49) and dynamic model (50) where the fixed effect estimator is not efficient because of lagged dependent variable bias which biases the OLS estimator of λ downwards.

$$y_{jt} = a_t + a_i + bx_{it} + u_{it} \tag{49}$$

The dynamic model (50) is, however, consistent in the limit when the number of time periods goes to infinity, and for samples of the size used here the bias is small.

$$y_{it} = a_i + bx_{it} + l_{it-1} + u_{it} \tag{50}$$

Thus, a dynamic fixed effects specification may give the author a helpful beginning point. If the parameters differ over groups there is a further heterogeneity

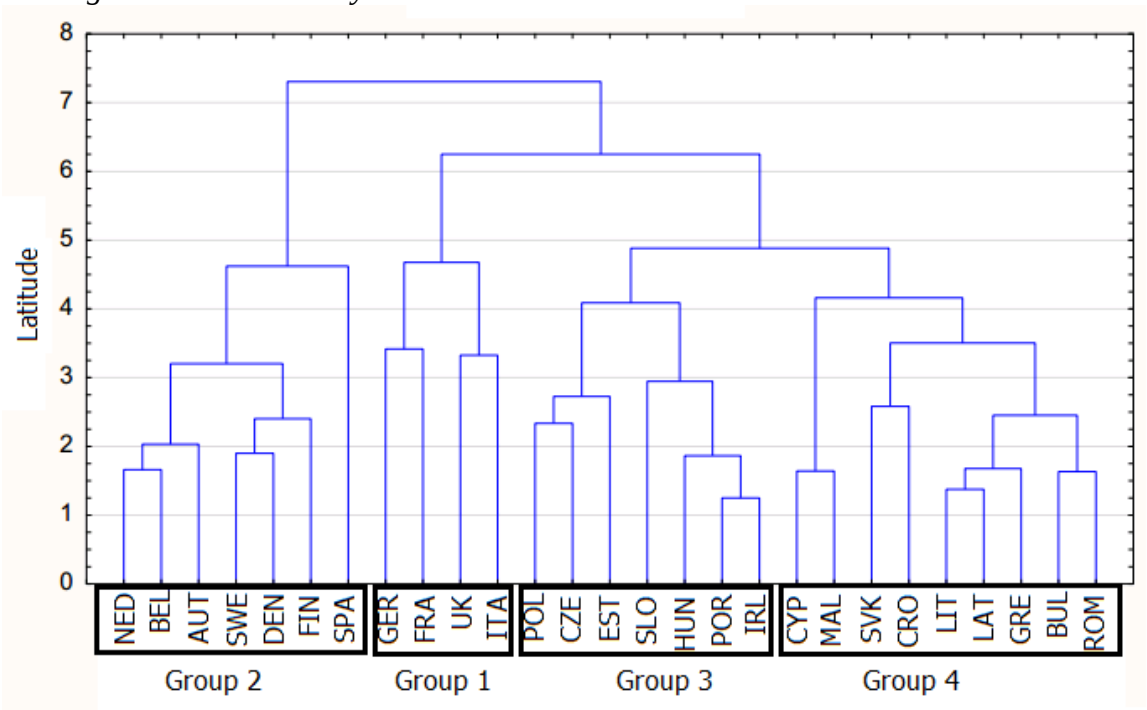
bias which can be dealt with by estimating each equation individually and taking an average of the individual estimates (Smith, 2010).

3.2 Findings

3.2.1 Cluster Analysis

As it can be seen from Figure 20, there are four bigger groups that have been identified. One special group has also been identified - Group 5 - this includes only one country – Luxembourg. Three non EU countries (Island, Norway and Switzerland) were artificially added to this group to complete the sample of all EU countries. The author decided for this step because of similar characteristics. The cluster procedure isolated Luxembourg since the country had a lot of extreme values for the chosen variables. With the above mentioned non EU countries it is considered to be a special case and that is why this group should be carefully interpreted.

Figure 20 Cluster analysis – Euclidean Distances



Source: SIPRI (2015); own modification

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.

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

Group 3 and Group 4 are called resource-constrained (i.e. relatively poorer) 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 (Cyprus, Malta, Slovakia, Croatia, Lithuania, Latvia, Greece, Bulgaria and Romania). These nations were characterized by lower growth in foreign exchange earnings, 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.

Each nation was classified at the 100% probability level, except of Spain which had a probability of 81% correct placement, and Poland, which had a probability of 87% correct placement. Spain should probably belong to Group 1 because of its well-known economic similarity to these countries but this thesis respects the cluster analysis result. Moreover, Italy had a correct placement probability of 74 %.

3.2.2 Basic Regression Model

Table 5 presents the findings of the basic regression analysis. This basic regression model contains freely chosen variables (by author of this thesis) that were modified from the other different well-known models as for example the Feder-Ram model which results are described further. CGDP 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 same works for all the following models). CGDP is always a dependent variable. MLTEX and other added variables are always independent variables. The signs of the coefficient are all assumed to be positive except for imports. The data came from the SIPRI, NATO and OECD database in case of all the models.

Table 5 Basic regression model

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Dependent Var.: **CGDP**	Fixed effects / One way error				
EXP	1,284** (3,21)	1,452* (3.85)	2,241* (5,11)	2,111** (5,47)	2,754 (6,08)
INV	2,951** (6,54)	2,248** (6,27)	2,214* (5,96)	1,794** (3,95)	2,201** (4,24)
MLTEX	0,332** (2,12)	0,840 (1,32)	0,625 (2,24)	-0,045** (-1,80)	-0,154 (-2,82)
IMP	-2,810** (-7,23)	-2,021* (-6,54)	-1,514** (-4,72)	-2,875** (-7,02)	-2,985* (-9,23)
Adjusted R^2	0,58	0,67	0,49	0,66	0,52
F-test (6,42)	14,21	20,15	10,84	8,82	11,02
Jarque-Bera	0,16	0,15	0,18	0,14	0,11
White	0,19	0,26	0,20	0,15	0,02
Farrar-Glauber	0,21	0,18	0,25	0,24	0,19
Breusch-Godfrey	0,17	0,15	0,19	0,09	0,01
D-W stat.	1,67	1,75	1,74	1,82	1,76

**p-value <0,10; **p-value< 0,05; ***p-value<0,01*
Note: t-stat. in parenthesis
Source: own calculation based on SIPRI (2015)

Adjusted R^2 indicates that the model performs quite well. The resultant value oscillates around 0,6. As expected, imports showed a significant negative effect on economic growth and exports as well as investment showed a significant positive effect.

The results of the regression analysis in Table 5 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 (1983). In their equations (below), CIVGDP is the real growth in GDP; INVEST is the gross capital formulation as a percentage of GDP; AID is the receipts of bilateral aid as a percentage of GDP; and DEFN is the military expenditure. The variable AID is different because they analysed the developing countries. The results show a positive and significant coefficient in relatively richer nations (Group 1) and a negative but also significant coefficient in case of relatively 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) CIVGDP = 1,77 + 0,16 INVEST + 0,12 AID + 0,22 DEFN (51)
(R^2 = 0,89) (6,11)** (3,07)** (3,77)**

(Group 2) CIVGDP = 4,72 + 0,15 INVEST + 0,19 AID - 1,22 DEFN (52)
(R^2 = 0,76) (1,92) (1,46) (-3,52)**

The results of Frederiksen and Looney (1983) deviated greatly from Benoit's (1978) original finding of no significant relationship between military expenditure and economic growth

3.2.3 Feder-Ram Model

Firstly the 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. The Granger causal analysis findings (see Table 6) indicate that there were no issues of simultaneity bias. No relationship showed a statistically significant causal effect in either direction. Thus, there is no simultaneity bias in the direction from military expenditures to economic growth as well as in the opposite direction. Some issue was found in case of public expenditures and investment but it is not the objective of this thesis.

Table 6 Granger causal analysis

Military expenditures -> Economic growth	X^2 = 0,582 (probability > X^2 = 0,723)
Economic growth -> Military expenditures	X^2 = 1,426 (probability > X^2 = 2,042)
Public expenditures -> Investment	X^2 = 3,212 (probability > X^2 = 2,665)
Investment -> Public expenditures	X^2 = 2,114 (probability > X^2 = 1,083)

Source: own calculation based on SIPRI (2015)

Table 7 presents the Feder-Ram model that brings quite diverse results from the basic regression model. However, for both models the *F*-statistics values denote that R^2 are significant as well as the models have a normal distribution (see Jarque-Bera test) and there is no heteroskedasticity (see White test). The autocorrelation of higher orders was detected for Group 2 and 5 (at 5% significance level) in case of the Feder-Ram model and for Group 5 for basic regression. The Farrar-Glauber test did not prove any multicollinearity between independent variables. The new variables PUBEX (public and non-military expenditures), PUBEX ext (public and non-military expenditures externality), ELG (employed labour growth), and MLTEX ext (military expenditures externality), unsurprisingly demonstrate a significant positive impact on economic growth (of varying strengths) for all groups.

Table 7 Feder-Ram model

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Dependent Var.: **CGDP**	Fixed effects / One way error				
ELG	0,242** (1,10)	0,023* (0,21)	0,134** (0,82)	0,098* (0,30)	0,324* (2,03)
INV	0,085* (0,94)	0,623** (2,57)	0,035* (1,75)	0,061** (1,02)	1,008** (3,33)
MLTEX	0,232 (1,46)	0,198 (1,19)	-0,049* (-0,89)	-0,386* (-2,41)	0,054 (0,77)
MLTEX ext	0,341* (2,22)	0,224** (1,84)	0,121* (1,89)	0,041** (0,57)	0,028* (0,25)
PUBEX	1,094*** (3,38)	2,084** (5,41)	1,078*** (4,74)	1,099** (5,23)	1,415*** (7,74)
PUBEX ext	1,235*** (6,16)	2,854*** (9,21)	2,124** (7,58)	1,277*** (5,84)	1,889*** (6,27)
Adjusted R^2	0,54	0,66	0,42	0,71	0,78
F-test (6,12)	15,29	18,47	12,20	10,54	12,78
Jarque-Bera	0,11	0,17	0,12	0,10	0,12
White	0,25	0,15	0,32	0,19	0,26
Farrar-Glauber	0,12	0,14	0,18	0,10	0,16
Breusch-Godfrey	0,14	0,03	0,08	0,11	0,04
D-W stat.	1,81	1,80	1,67	2,14	1,89

**p-value <0,10; **p-value< 0,05; ***p-value<0,01*
Note: t-stat. in parenthesis
Source: own calculation based on SIPRI (2015)

In case of military expenditures, there are no significant effects (although with positive signs) for Groups 1, 2 and 5, but Groups 3 and 4 show a significant negative effect. The highest value is presented by Group 4 where 1% increase in military expenditures implies a 0,386% decrease in economic growth. However, the last new variable, MLTEX ext, brings some significant changes. It represents the amount of MLTEX covering the externality effect signed as θ. All groups show a significant positive impact. The author expects that it might be due to offsetting negative effects. Atesoglu and Mueller (1990), Cuaresma and Reitschuler (2006), and Heo (2010) proved similar findings. Conversely, Mintz and Huang (1990) and Ward et al. (1995) noted that externality effects became insignificant.

These real negative 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 (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.

3.2.4 Augmented Solow-Swan Model

The results of the Augmented Solow-Swan model are presented in Table 8. As in case of the previously used Feder-Ram model, the new variables were used as the table demonstrates. The dependent variable is the same again – CGDP. Also the independent variables are the same – ELG, INV and MLTEX. However, there are two new independent variables used – $CGDP_{t-1}$ (it displays the economic growth in GDP in the previous year) and $MLTEX_{t-1}$ (the share of military expenditures in GDP in the previous year). All the variables are expressed as the log of the particular sum. On the face of it, there is a clear majority of the significant coefficients.

Table 8 Augmented Solow-Swan model

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Dependent Var.: **CGDP**	Coefficient (Standard Error)				
$CGDP_{t-1}$	-0,142** (-0,66)	-0,274*** (-1,97)	-0,085** (-0,23)	-0,133*** (-0,68)	-0,345*** (-2,78)
ELG	0,228** (1,64)	0,375*** (2,55)	0,201** (2,45)	0,108*** (1,06)	0,127** (1,14)
INV	0,394*** (2,42)	0,222** (1,87)	0,255** (2,15)	0,021** (0,49)	0,408*** (3,88)
MLTEX	-0,137** (-0,89)	-0,183** (-0,62)	-0,291** (-2,12)	-0,357** (-3,73)	-0,132* (-1,17)
$MLTEX_{t-1}$	0,094*** (0,37)	0,104** (1,54)	-0,078*** (-0,12)	-0,088* (-0,37)	-0,116 (0,26)
Adjusted R^2	0,74	0,68	0,81	0,54	0,42
F-test (4,21)	21,41	14,54	18,24	11,58	9,26
Jarque-Bera	0,15	0,17	0,19	0,18	0,11
White	0,41	0,27	0,26	0,16	0,14
Farrar-Glauber	0,08	0,11	0,10	0,15	0,07
Breusch-Godfrey	0,09	0,14	0,12	0,04	0,02

**p-value <0,10; **p-value< 0,05; ***p-value<0,01*
Note: t-stat. in parenthesis
Source: own calculation based on SIPRI (2015)

All values of adjusted R^2 indicate that the models perform well. All *F*-statistics verify the significance of R^2 values. At 5% significance level the models do not indicate any heteroskedasticity (White test) or autocorrelation of higher orders (Breusch-Godfrey test) except Group 4 and 5. The normal distribution (Jarque-Bera test) and no multicollinearity between independent variables (Farrar-Glauber test) were detected. Also in case of the Augmented Solow-Swan model the variables ELG and INV show a significant positive impact on economic growth. As Heo (2010) argued, this is apparently due to the capital depreciation and technological innovations with changes in multifactor productivity of the private business sector.

When focused on the variable MTLEX which is the most important for the purpose of this thesis, it is obvious that the effects of both current and lagged MLTEX bring quite a high significance. The case of current MLTEX does not verify the secondary hypothesis because all the coefficients have a negative sign. This means an adverse impact of military expenditures on economic growth. However, the lagged variable $MLTEX_{t-1}$ brought some improvement. Group 1 and 2 show a significant positive impact. The values of both coefficients are not too high. For Group 1, a 1% increase in military expenditures implies a 0,094% increase in economic growth. In case of Group 2, a 1% increase in military expenditures implies a 0,104% increase in economic growth. The similar findings (but for USA) were found by Ward and Davis (1992), Atesoglu (2002) or Heo (2010). Current effect of military expenditures was negative and when using lagged variable, the effect was positive. On the other hand, Dunne et al. (2005) found in their analysis a negative but insignificant effect of military expenditures. They argued that significant effect of military expenditures become insignificant over two years because of the offset by the delayed effects. This was also approved by Heo (2000). The same conclusion was also found by Heo and Eger (2005) or Dunne et al. (2005).

3.2.5 Barro Model

As described in chapter 3.1.2.3 the Barro model includes two new variables – the first one is a corruption (CORRUP). To be able to measure this variable, a special index developed by Tanzi and Davoodi (1997) was used. This index is based on data coming from the International Country Risk Guide (ICRG). In this thesis the measured values were used vice-versa, meaning from 0 (least corrupted) to 10 (most corrupted). The

variable is then described as the average level of this value over the period 1993 – 2012. The second new independent variable – THR is an external threat. This is little more complicated because the original paper (Tanzi and Davoodi, 1997) counted with the older period and included a number of years at war for individual countries. For the purpose of this thesis, THR is described as the number of months at any military conflict. It also includes terrorist attacks of any kind when always one month is counted. That is because of the severe economic influence for the country. These data were collected from the database developed by the Correlates of War Projects (COW).

As it shown in Table 9 the statistical assumptions of the model expressed by Jarque-Bera, White, Farrar-Glauber and Breusch-Godfrey test are very good. These indicate a normal distribution, no heteroskedasticity, no multicollinearity between independent variables and even no autocorrelation of higher orders. The same comes for the D-W test and no first-order autocorrelation. *F*-statistic shows that R^2 is significant in all cases. When focused on results the variable CORRUP has a negative effect on economic growth in case of all groups. It is significant only for Groups 3 and 4 (in case of this thesis – relatively poorer countries). The second variable THR denotes the negative and insignificant effect on economic growth for all groups. It means that a higher level of external threat diminishes economic growth. Very interesting for this thesis are results of the main variable MLTEX. All groups have a very high negative and significant coefficient. The main results of military expenditures having negative impact on economic growth are verified in the findings of Mauro (1995), Aizenman and Glick (2006).

Table 9 Barro model

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Dependent Var.: **CGDP**	Coefficient (Standard Error)				
$CGDP_{t-1}$	-0,212** (-1,78)	-0,325*** (-2,66)	-0,137** (-0,94)	-0,204*** (-1,82)	-0,301*** (2,80)
INV	0,099*** (0,44)	0,118** (0,41)	0,074** (0,29)	0,068** (0,34)	0,106*** (0,52)
THR	-0,235 (-1,83)	-0,348 (-3,94)	-0,218 (-2,02)	-0,192 (-2,17)	-0,204 (-2,10)
CORRUP	-0,321 (-3,37)	-0,285 (-2,99)	-0,589** (-7,74)	-0,624** (-9,09)	-0,214 (-2,77)
MLTEX	-0,756** (-11,34)	-0,607** (-9,55)	-1,184** (-15,41)	-1,234** (-17,83)	-0,945* (-12,12)
Adjusted R^2	0,53	0,47	0,61	0,59	0,51
F-test (6,47)	18,20	11,58	9,33	10,01	21,30
Jarque-Bera	0,21	0,16	0,20	0,12	0,18
White	0,41	0,27	0,26	0,16	0,14

Farrar-Glauber	0,14	0,17	0,08	0,15	0,09
Breusch-Godfrey	0,18	0,19	0,09	0,10	0,14

**p-value <0,10; **p-value< 0,05; ***p-value<0,01*
Note: t-stat. in parenthesis
Source: own calculation based on SIPRI (2015)

The correlation between MLTEX and CORRUP was also counted (but not shown in the table) with the value of -0,37. This means that military expenditures share of GDP tends to increase with lower corruption and diminish with higher corruption.

3.2.6 Cointegration Test (ARDL-bound)

It is necessary to preferentially test the order of integration of military expenditures and economic growth. If any variable in a regression equation is not stationary, the results of the analysis might be distorted. For this purpose some unit root test must be adopted. As expected, the Augmented Dickey-Fuller (ADF) test is employed (Dickey, Fuller 1979). The ADF test results are reported in Table 10. The null hypothesis of unit root cannot be rejected at the 5 % level of significance for the series in levels, while for series in first difference, the null hypothesis of *I(1)* can be rejected at the 5 % level of significance. The following hypotheses for ADF unit root test are verified:

- H_0: non-stationary
- H_a: stationary

Table 10 ADF Unit Root test

Country	**Variable**	**ADF (series in level)**			**ADF (1st difference)**		
		t-stat.	critical value	lag	t-stat.	critical value	lag
Group 1	logMLTEX	-4.22	-3.21	1	-	-	-
	logGDP	-6.14	-5.35	0	-	-	-
	logGDPpc	-2.24	-1.84	0	-	-	-
Group 2	logMLTEX	-3.32	-3.66	3	-3.86	-2.54	1
	logGDP	-1.24	-4.02	1	-2.21	-2.05	0
	logGDPpc	-0.94	-2.14	1	-3.47	-3.12	0
Group 3	logMLTEX	-5.32	-4.99	1	-	-	-
	logGDP	-0.85	-2.08	1	-1.55	-0.90	0
	logGDPpc	-2.45	-3.33	0	-4.14	-3.87	0
Group 4	logMLTEX	-3.47	-3.98	0	-2.36	-2.11	0
	logGDP	-5.23	-6.84	1	-1.74	-1.10	0
	logGDPpc	-1.21	-3.42	1	-2.78	-2.41	0

Group 5	logMLTEX	-1.57	-3.25	0	-3.42	-3.01	0
	logGDP	-4.44	-2.96	1	-	-	-
	logGDPpc	-5.84	-5.15	0	-	-	-

Source: own calculation based on SIPRI (2015)

The null hypothesis of unit root cannot be rejected at 5% level of significance, if absolute t-statistic value is less than absolute critical value. Both in levels of series and in first difference it is run with constant for non-stationary series. As it can be seen from Table 10, these variables are stationary in levels of series: all three for Group 1, logMLTEX for Group 3, logGDP and logGDPpc for Group 5. The other variables among groups are non-stationary in levels of series and become stationary in first difference.

When all series of variables are integrated of *I(1)*, it is the ARDL-bound method's turn to test cointegration. The results are shown in Tables 11 – 14. When resulting *F*-statistics is below the lower critical value, the null hypothesis of no cointegration cannot be rejected. Conversely, when *F*-statistic exceeds the upper critical value, then the evidence of long-run relationship is shown. The last option is when the critical value lies between these two bounds. Then, the inference is inconclusive.

It is shown in Table 11 that when logMLTEX is dependent variable and logGDP is independent variable, there is a significant relationship in case of Group 1 and 4 because *F*-statistic is higher than upper bound. The results of Groups 2, 3 and 5 did not bring any significant relationship. In Table 12 logGDP is dependent variable and logMLTEX is independent one. In this case there is only one significant relationship for Group 1. In the rest of the groups no significant relationship is detected. Table 13 comes with logMLTEX as dependent variable and logGDPpc as independent variable. The same situation as in previous example follows. Only Group 1 shows a significant relationship. Also Table 14 denotes a cointegration just in case of Group 1 when logGDPpc is dependent variable and logMLTEX in independent one.

Table 11 Bound testing for cointegration 1

	Country	F-stat.
Depend. Var. : logMLTEX Independ. Var.: logGDP	Group 1	11.235**
	Group 2	4.771
	Group 3	4.241
	Group 4	8.524**
	Group 5	0.785

**p-value< 0,05; lower bound value = 5.825, upper bound level = 6.696
Source: own calculation based on SIPRI (2015)

Table 12 Bound testing for cointegration 2

	Country	F-stat.
Depend. Var. : logGDP Independ. Var.: logMLTEX	Group 1	8.231**
	Group 2	0.954
	Group 3	1.427
	Group 4	3.255
	Group 5	1.118

***p-value< 0,05; lower bound value = 5.825, upper bound level = 6.696*
Source: own calculation based on SIPRI (2015)

Table 13 Bound testing for cointegration 3

	Country	F-stat.
Depend. Var. : logMLTEX Independ. Var.: logGDPpc	Group 1	15.736**
	Group 2	4.458
	Group 3	4.543
	Group 4	5.524
	Group 5	3.878

***p-value< 0,05; lower bound value = 5.825, upper bound level = 6.696*
Source: own calculation based on SIPRI (2015)

Table 14 Bound testing for cointegration 4

	Country	F-stat.
Depend. Var. : logGDPpc Independ. Var.: logMLTEX	Group 1	7.241**
	Group 2	2.441
	Group 3	1.742
	Group 4	1.254
	Group 5	0.425

***p-value< 0,05; lower bound value = 5.825, upper bound level = 6.696*
Source: own calculation based on SIPRI (2015)

The general finding of this test is that only Group 1 proves a bidirectional causal effect because military expenditures causes real economic growth, real economic growth per capita and vice versa. Only Group 4 has a unidirectional relationship from logGDP to logMLTEX. Groups 2, 3 and 5 have no significant relationship between the examined variables.

3.2.7 Causality Test (Toda-Yamamoto)

According to AIC and SBIC, the optimal lag length is 2 ($k = 2$) for Group 1 to 4, if unit root test $dmax = 1$, therefore the order of VAR is 3. But in Group 5 the optimal lag length is one, therefore the order of VAR is 2. The results of Toda and Yamamoto causality (see Table 15) show that Groups 1, 2, 3 and 4 have a Granger causality from

logGDP and logGDPpc to logMLTEX. For Group 5 there is a Granger causality running from logGDP and logGDPpc to logMLTEX and vice versa.

Thus, there is a unidirectional relationship between military expenditures and economic growth in case of the first four countries and a bidirectional relationship between military expenditure and economic growth for Group 5.

Table 15 Toda and Yamamoto causality test

	Causality direction		Wald test (χ^2)	*p*-value
	From	To		
Group 1	logMLTEX	logGDP	11,49	0,32
	logGDP	logMLTEX	0,92	0,09
	logMLTEX	logGDPpc	10,12	0,21
	logGDPpc	logMLTEX	3,74	0,04
Group 2	logMLTEX	logGDP	9,23	0,28
	logGDP	logMLTEX	3,34	0,11
	logMLTEX	logGDPpc	8,88	0,32
	logGDPpc	logMLTEX	2,92	0,01
Group 3	logMLTEX	logGDP	0,55	0,20
	logGDP	logMLTEX	4,12	0,02
	logMLTEX	logGDPpc	0,71	0,54
	logGDPpc	logMLTEX	5,93	0,24
Group 4	logMLTEX	logGDP	13,21	0,26
	logGDP	logMLTEX	5,59	0,03
	logMLTEX	logGDPpc	13,19	0,69
	logGDPpc	logMLTEX	5,23	0,11
Group 5	logMLTEX	logGDP	7,83	0,44
	logGDP	logMLTEX	2,14	0,04
	logMLTEX	logGDPpc	8,45	0,28
	logGDPpc	logMLTEX	1,66	0,01

Source: own calculation based on SIPRI (2015)

3.2.8 Time Series Analysis

Table 16 shows the long-run coefficients estimation for each group separately. The employed 20 year period (1993 – 2012) is long enough and that is why the estimation of the model might be done for each group. As the attention is mainly focused on logMLTEX, a positive effect is reported in case of Group 1 and Group 2 (relatively richer countries) and a negative effect is reported in case of Group 3 and 4 (relatively poorer countries) and Group 5. Some issues with the significance of the individual coefficients were found, however, only with Group 3 and Group 4 having significant (at 5% significance level) negative long-run coefficients in the sense of both the lagged output per capita and military burden having significant negative coefficients

(at 5% significance level). All coefficients on the change in military burden are significant, first two groups positive, Groups 3, 4 and 5 negative. Regarding the labour force variable the estimates are negative and significant for all groups except Group 2 and 4. The investment variable is positive and significant for all of the groups except Group 3 and 4.

Table 16 Long-run coefficient estimation (1993 – 2012)

	logINV	logMLTEX	logELG	tr
Group 1	3.60**	0.29**	-0.64**	0.01
Group 2	0.18**	0.14**	0.82	-0.02
Group 3	-1.40	-0.61**	-2.7**	0.001
Group 4	-0.65	-0.37**	0.58	0.01
Group 5	0.92**	-0.21**	-0.24**	-0.002

***p-value< 0,05*
Source: own calculation based on SIPRI (2015)

Table 17 reports the values for mean group estimator, the mean coefficient and the estimated standard error. The variable logINV has the assumed sign. Important for this thesis, variable logMLTEX shows the value -0.15. It is a negative and not so high number in absolute value. The reason might be that the mean group estimator is sensitive to outliers, particularly when N is relatively small as in this study.

Table 17 Long-run coefficient estimation for all groups (1993 – 2012)

	logINV	logMLTEX	logELG	tr
mean	0.53**	-0.15	-0.44	-0.0002
sd	1.92	0.37	1.40	0.012

***p-value< 0,05*
Source: own calculation based on SIPRI (2015)

Even if a fixed effects model is employed, some issues or events such as financial crisis might appear and such problems do not have to be fully resolved by this simple model. That is why the model was estimated again, now with using dummies as displayed in Table 18. A dummy variable is an artificial variable used in to demonstrate subgroups of the sample. It is used the value 0 or 1 to indicate the absence or presence of some categorical effect. The results brought some changes compared to the results in Table 16, with only Group 1 having a positive long run coefficient estimates for the variable logMLTEX. Group 2, 3 and 4 have significant negative long run coefficients in the sense of both the lagged output per capita and military expenditures.

Table 18 Long-run coefficient estimation + dummies (1993 – 2012)

	logINV	logMLTEX	logELG	tr	D
Group 1	4.82**	0.32**	2.42	0.005	-2.74
Group 2	-2.95	-2.94**	0.98	0.01	-0.98
Group 3	0.86	-4.14**	-6.21	-0.02	-1.18
Group 4	-0.41	-1.25**	-4.22	-0.001	-0.47
Group 5	9.15**	-7.56	4.55	0.10	-0.23

***p-value< 0,05*
Source: own calculation based on SIPRI (2015)

The means of the coefficients in Table 19 show a value of -3.11 for logMLTEX, which is larger in absolute terms than the value for the model without dummies, but remains insignificant. The results show some tendency to verify the secondary hypothesis saying that there is a positive effect of military expenditures on economic growth in case of relatively richer countries and vice versa which is displayed in values both of the short- and long-run coefficients. However, not all coefficients are significant.

Table 19 Long-run coefficient estimation for all groups + dummies (1993 – 2012)

	logINV	logMLTEX	logELG	tr	D
mean	2.29	-3.11	-0.50	0.02	-1.12
sd	4.75	3.00	4.55	0.05	0.98

***p-value< 0,05*
Source: own calculation based on SIPRI (2015)

The findings are contrary to those from Mylonidis (2008) and Dunne and Nikolaidou (2011) who both found rather a negative impact of defence spending in their contributions. Mylonidis (2008) used the Barro growth model, Dunne and Nikolaidou used an augmented Solow-Swan model and estimated it with panel and time-series method. They did not find any evidence that military expenditures positively support economic growth. However, there was either negative or no effect. There is also no consensus with two Granger causality studies by Kollias et al. (2004; 2007) that were made for EU countries.

It should be concluded that there were some insignificant coefficients among some groups and it means that the results have to be carefully interpreted. After applying the dummy variables into the equations, some group results were changed.

3.3 Summarising of Military Expenditures Results

At this point, all the proposed models and tests are done. The results are given and it is necessary to summarise them all together and compare among each other. Table 20 brings the coefficients of the MLTEX variable from every single model that was used in this thesis.

Table 20 Summarising of MLTEX results

		Military Expenditures effect on Economic Growth				
MODEL USED		Group 1	Group 2	Group 3	Group 4	Group 5
Basic regression		0,332**	0,840	0,625	-0,045**	-0,154
Feder-Ram		0,232	0,198	-0,049*	-0,386*	0,054
Solow-Swan basic (MLTEX)		-0,137**	-0,183**	-0,291**	-0,357**	-0,132*
Solow-Swan ($MLTEX_{t-1}$)		0,094***	0,104**	-0,078***	-0,088*	-0,116
Solow-Swan without dummies		0.29**	0.14**	-0.61**	-0.37**	-0.21**
Solow-Swan with dummies		0.32**	-2.94**	-4.14**	-1.25**	-7.56
Barro		-0,756**	-0,607**	-1,184**	-1,234**	-0,945*
ARDL-bound cointegration (*F*-stat.)	logMLTEX/ logGDP	11.235**	4.771	4.241	8.524**	0.785
	logGDP/ logMLTEX	8.231**	0.954	1.427	3.255	1.118
	logMLTEX/ logGDPpc	15.736**	4.458	4.543	5.524	3.878
	logGDPpc /logMLTEX	7.241**	2.441	1.742	1.254	0.425

**p-value <0,1; **p-value< 0,05; ***p-value<0,01*
Note for the ARDL-bound test coefficient is the F-stat. compared with upper and lower bound

Groups 1 and 2 (as relatively richer countries) will be commented together for each model. Similarly, Groups 3 and 4 (as relatively poorer countries) will also be commented together.

Group 5 can already be commented now. It is shown that all coefficients have a negative sign except the coefficients from the Feder-Ram model (borders on zero, moreover). The highest negative and significant coefficient was indicated in case of the Barro model expressing that a 1% increase in military expenditures tends to a 0,945% decrease in the economic growth rate (at 1% significance level). Very interesting value denotes the long run coefficient from the Solow-Swan model with dummies (-7.56). However, more than 7.5% decrease remained insignificant.

The secondary hypothesis is rather verified in case of the basic regression model with the modified variables. First three groups showed a positive effect however only in case of Group 1 was significant. Group 4 showed a negative and also significant effect. In relatively richer countries military expenditures have a positive effect on economic growth, in relatively poorer countries there is a negative effect. Almost the same finding was obtained in case of the Feder-Ram model. Groups 3 and 4 presented a negative and significant effect. Groups 1 and 2 showed a positive but insignificant effect. The hypothesis thus cannot be rejected.

As mentioned for the basic regression and the Feder-Ram model, the augmented Solow-Swan but with the lagged variable $MLTEX_{t-1}$ cannot reject a hypothesis. A positive and significant effect is indicated for Groups 1 and 2 and a negative and also significant effect is indicated for Groups 3 and 4.

The augmented Solow-Swan model was examined without the lagged variable $MLTEX_{t-1}$. Moreover, it was analysed with and without dummies for long run coefficients. The hypothesis cannot be rejected in the model without dummies. All coefficients are significant, for Groups 1 and 2 are positive, for Groups 3 and 4 are negative. However, in case of the model with dummies the hypothesis is rather rejected. Only Group 1 showed a positive and significant but very low coefficient. Group 2 showed a very high negative and also significant coefficient. That is why the hypothesis has to be rejected. Nevertheless, Groups 3 and 4 strongly verified the hypothesis with high negative and significant effect. But it still remains questionable if only two groups might verify the defined hypothesis.

At this point, also the Barro-type and the (basic) augmented Solow-Swan model might be conclusively commented. The reason is that just in case of these models a negative and significant coefficient was detected for all the groups. This may be because of extra variables (corruption and threat) that were added in the Barro model. In the Solow-Swan model no extra variable was added except $MLTEX_{t-1}$. Groups 3 and 4 showed more than 1% decrease in the economic growth when military expenditures increase by 1 % in the Barro model. The hypothesis in this case has to be rejected.

Overall, seven individual models and test for cointegration between variables were tested. The main hypothesis was definitely verified because there is a relationship between military expenditures and economic growth. Subsequently, there is the secondary hypothesis which says about the positive effects of military expenditures on economic growth in relatively richer countries and negative effects in relatively poorer

countries. Here the hypothesis was conclusively not rejected for the basic regression model, the Feder-Ram model and the augmented Solow-Swan model (with the lagged variable $MLTEX_{t-1}$). In case of the Solow-Swan model without dummies the hypothesis was rather not rejected, in case of the Solow-Swan model with dummies the hypothesis was rather rejected. For the last two (the Barro model and the (basic) Solow-Swan model) model the hypothesis was rejected. A special case – Group 5 belongs rather to the relatively richer countries but mostly negative signs do not support the secondary hypothesis.

Conclusion

The thesis aimed to examine the relationship between military expenditures (as an independent variable) and economic growth (as a dependent variable). Based on the review of the previous research, the main hypothesis has been formulated – it says that there is the relationship between the above mentioned variables. Subsequently, the secondary hypothesis has been adopted. It is more specific statement which expects a negative relationship in relatively poorer countries and a positive relationship in relatively richer ones. This hypothesis has been inspired by Frederiksen and Looney (1983). The observed sample contained 31 European countries (28 EU countries and Island, Norway and Switzerland), data covered the period 1993 - 2012. It is undoubtedly that this is a relevant and timely topic which has attracted little research interest thus far.

The thesis examined the following growth models: the basic regression model with the modified variables (unofficially termed by the author in order to observe the changes between models), the Feder-Ram model, the augmented Solow-Swan model with Harrod-neutral technical progress (separately analyzed with and without dummy and lagged variables) and the Barro model. A cluster analysis was employed to divide countries into individual groups, i.e. to identify the relatively poorer and richer countries. The fixed effect balanced panel data regression model with the panel-corrected standard errors and ordinary least square were also used in the thesis. In addition, for examining the long-run relationship between military expenditures and economic growth the ARDL-bounds testing was employed as well as the Toda-Yamamoto test to analyze the causality.

Each examined model normally includes more basic independent variables besides the military expenditures. They were: investments (INV) in all cases; exports (EXP) and imports (IMP) in case of the basic regression; non-military expenditures (PUBEX), non-military expenditures with the externality effect (PUBEXext) and military expenditures with the externality effect (MLTEXext) for the Feder-Ram model; employed labour growth (ELG) for the Feder-Ram model and the augmented Solow-Swan model which also includes the lagged military expenditures ($MLTEX_{t-1}$) as well as the lagged GDP ($CGDP_{t-1}$); threat (THR), corruption (CORRUP) and $CGDP_{t-1}$ for the Barro model. Although it is not essential for the purpose of the thesis, the variables INV, EXP, PUBEX, PUBEXext and ELG had, as expected, quite highly significant and

positive coefficients for all observed groups (it means a positive effect on economic growth) while IMP and $CGDP_{t-1}$ had negative but also significant coefficients (this means a negative effect on economic growth. The variables THR and CORRUP had negative coefficients but in case of THR the coefficient remained insignificant. On the other hand the coefficient for CORRUP proved to be significant for the relatively poorer countries. A 1% increase in the corruption ratio leads approximately to a 0.6% decrease in the economic growth. To be more effective with interpretation, it might be concluded that the adjusted coefficient of determination oscillated around the value of 0.6 in all the models.

Turning to the military expenditures, it is very important that the main hypothesis was verified. In all cases there was the significance between military expenditures and economic growth.

Concerning the secondary hypothesis, one thing is that relatively richer countries can be less concerned with scarce finances and as a result of their other positive areas (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 impact on economic growth. Another thing is that there are undoubtedly some interesting variations in defence spending and economic growth between the EU countries (see Table 1, 2 and SIPRI (2015) for more details). There are four main cases - nations that are relatively poorer and invest quite a lot on defence (Portugal or Greece), and then the same group of states with a very low military burden (e.g. Ireland). There are also countries that are relatively rich and spend a lot on defence (UK, France, Germany or Sweden), and then the same group of countries with a very low military burden (Austria, Luxembourg, Denmark or Belgium). Of course, the countries in the brackets are displayed for better illustration (on a long term basis) and do not have to reflect the actual situation.

The basic regression showed two significant groups – a positive relationship in case of relatively richer countries (Group 1) and a negative relationship in case of relatively poorer countries (Group 4). This conclusion rather verified the secondary hypothesis. Both Groups 2 and 3 showed a positive but insignificant effect, Group 5 a negative but also insignificant effect. The Feder-Ram model definitely verified the

secondary hypothesis. Groups 1, 2 and 5 (relatively richer countries) brought a positive effect, although insignificant. Moreover, Groups 3 and 4 showed a negative and significant effect.

For the augmented Solow-Swan model there are four individual cases – since the model became dynamic. Firstly, there is a basic augmented Solow-Swan model. The secondary hypothesis was fully rejected because the effect was negative and significant in all cases. The same hypothesis was nevertheless verified when the variable $MLTEX_{t-1}$ has been added. The model has only one year delayed variable because as found by Heo (2000) and verified by Dunne et al. (2005) the significant effect of military expenditures on economic growth starts to be insignificant over two years due to the offsetting of delayed effects. Subsequently, the augmented Solow-Swan model was estimated with time series method to verify the meaningfulness of dummy variables. The model without dummies brought a verification of the secondary hypothesis. All coefficients were significant and for relatively richer countries (Groups 1 and 2) showed a positive effect and for relatively poorer countries (Groups 3 and 4) showed a negative effect. In case of Group 5 the coefficient was negative and significant. The same group had an insignificant coefficient for the model with dummies. A negative and significant effect was proved for Groups 2, 3 and 4. A positive and significant coefficient was shown by Group 1. Thus, the secondary hypothesis is also rather verified by the augmented Solow-Swan model with dummies. For the endogenous Barro model the secondary hypothesis is fully rejected because of all the coefficients are highly significant and negative for both relatively richer and poorer countries.

The ARDL-bound test examines the long run and short run relationship between the observed variables. Before ARDL-bound testing the augmented Dickey-Fuller unit root test had to be done. Those variables that were non-stationary in levels of series became stationary in the first differences. When all the series were integrated in *I(1)*, the ARDL-bound testing could start to test the cointegration. Only two significant conclusions were found. Group 1 (relatively richer countries) proved the bidirectional causal effect between military expenditures and economic growth and Group 4 (relatively poorer countries) had the unidirectional relationship from economic growth to military expenditures in the long term. These results explicitly support the main hypothesis that the relationship does exist and it is also partially in accordance with Kollias et al. (2004, 2007) who proved a positive directional causality in both directions

in the long term and a positive effect from military expenditures to growth in the short term.

When discussing the empirical findings and answering the question which model is better for estimating the relationship between military expenditures and economic growth, it should be stated that there are several different situation. The Barro-model is used as an alternative in the defence-growth nexus and it is true that the model allows taking advantage of a more common framework and government expenditures that could influence the output through the production function. However, the model does not offer so easy way for interpretation of results. In the thesis, using of the Barro model is obviously affected by the presence of chosen variables. The Barro model results brought a negative effect (similarly as the basic augmented Solow-Swan model) of military expenditures for all the groups and this is the same result as in Mylonidis (2008) who found a negative impact and it is also in accordance with Aizenman and Glic (2006) and Dunne and Nikolaidou (2012) who did not find any positive contribution to the economic growth. As it was done in this thesis, using the basic augmented Solow-Swan model brought a negative effect. Thus, both of them rejected the secondary hypothesis.

On the other hand, the adding of the lagged or dummy variable in the Solow-Swan model caused some changes in Groups 1 and 2 - relatively richer countries (meaning the positive effect of military expenditures) and it is in accordance with the secondary hypothesis. The undisputed advantage of the augmented Solow-Swan model is that it is rather dynamic because of the lagged military expenditure variable and possibility to test the delayed effects.

Although the Feder-Ram model is static in case of this survey, its results verify the secondary hypothesis. This is in accordance with Benoit (1978), Frederiksen and Looney (1983), Knight et al. (1996) or Bernauer and Koubi (2009) and Alptekin and Levine (2010). The most critical opponents of the Feder Ram model are Dunne et al. (2005) or Wijeweera and Webb (2012) who are strictly against the using of the Feder-Ram model. To defend this model, the multicollinearity might appear because of the two terms as military expenditures usually have a trend over time. Next, there are no non-military variables and variables with externality effects that might cause the multicollinearity in the augmented Solow-Swan model. The labour input might be better specified by covering technological progress and capital depreciation instead of a simple growth rate of employed labour.

According to the results, the final conclusion is that the relationship between military expenditures and economic growth in European countries does exist. The positive character in relatively richer countries and negative character in relatively poorer countries was rather verified. Of course, it must be noted that the findings of this thesis might be very sensitive to the chosen time period, individual variables, or adopted methodology. That is why the results should be interpreted carefully. At the same time, this could open a new space for future research using different methods, countries, or time periods.

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USED DATABASE:

SIPRI database

CSIS – Centre for Strategic and International Studies

OECD data – Domestic Product

NATO – Information on Defence Expenditures

ICRG and COW database