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DISSERTAÇÃO

MODELLING THE DEMAND FOR MILITARY EXPENDITURE IN PORTUGAL

LUÍS FILIPE NUNES PARDAL ESTEVES TORRES

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ORIENTAÇÃO:

PROFESSOR DOUTOR CARLOS BARROS

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Abstract

Throughout history, countries from all over the world have devoted a considerable amount of resources to produce security. This evidence has motivated a growing number of studies that examine the determinants of the demand for military expenditure. Albeit the difficulty to develop a general theoretical framework and the inexistence of a standard empirical approach to model the demand for military expenditure, it is an important issue to understand which factors may influence the military expenditure demand function of a country.

The aim of this dissertation is to find out the main variables affecting the Portuguese military expenditure taking into account a comprehensive set of economic, strategic and political determinants. For this goal, a military expenditures demand model is constructed for the period 1960–2010 employing the Autoregressive Distributed Lag (ARDL) bound testing cointegration approach.

The results suggest that the Portuguese defence spending is determined by the country´s economic performance, allies' defence speeding and security considerations. As far as the domestic political environment is concerned, the dominant ideology of the party in power seems to be insignificant, while the transition to a democratic regime is considered a relevant determinant with a negative effect on the military expenditure.

JEL Classification: H56, H41

Keywords: Portugal; Military expenditure; Demand model, Autoregressive distributed lag model

Resumo

Ao longo da história, países de todo o mundo têm empenhado uma quantidade considerável de recursos para produzir segurança. Esta constatação tem motivado um número crescente de estudos sobre as possíveis variáveis explicativas da despesa militar. Apesar da dificuldade em estabelecer um quadro teórico de referência e da inexistência de uma abordagem empírica padronizada para determinar a procura de despesa militar, revela-se importante compreender quais as variáveis que influenciam a despesa militar de um país.

O objetivo deste trabalho é aferir quais as principais fatores que poderão determinar a despesa militar de Portugal, tendo em conta um amplo conjunto de variáveis de natureza económica, estratégica e política. A prossecução deste objetivo assenta na construção de uma equação de procura para a despesa militar portuguesa, para o período compreendido entre 1960 e 2010, através de um modelo uniequacional ARDL.

Os resultados obtidos sugerem que a despesa militar em Portugal é determinada pelo desempenho económico, pelo gasto militar de países aliados e por considerações relativas à perceção das condições de segurança. No que respeita à influência do ambiente político, a ideologia dominante do partido em funções no Governo surge como não significante, ao passo que a transição para um regime democrático é considerada uma variável relevante, com um efeito negativo sobre as despesas militares.

Classificação JEL: H56, H41

Palavras-chave: Portugal; Despesa militar; Modelo de Procura; modelo uniequacional ARDL

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1. Introduction

What drives the demand for military expenditure in Portugal? How is the military expenditure affected by economic, strategic and political factors?

To answer those questions, this dissertation provides an empirical analysis of the Portuguese demand for military expenditure from 1960 to 2010 employing the Autoregressive Distributed Lag (ARDL) bounds testing cointegration approach

Given the contemporary crisis scenario in Europe, and particularly in the Euro Zone, the Portuguese government has been applying a range of strategies to manage with the impact of the financial and economic crisis. The correction of imbalances in the public sector involves a fiscal consolidation process that requires the adoption of a comprehensive program of public spending cuts. Public expenditure reform motivates an important debate on the size and functions of the state. According to the National Defence Strategy Concept (Portuguese Government, 2013), security and national defence functions are not immune to fiscal consolidation measures. Therefore, a very important issue is how to cope the pressure on the defence budget. The present work, rather than focusing on particular consolidation measures and on the consequences of military cuts, aims to shed some light on the matter by providing a clear understanding of the Portuguese demand for defence.

Economic Theory has been providing useful insights into the study of conflicts and peace. Thus, Defence Economics became a fertile ground for academic research motivating economists to explore researched fields such as the determinants and consequences of violent conflicts, the relationship between military expenditure, growth and development, the arms production and trade or the determinants of military

spending. As the majority of the countries all over the world devote a considerable amount of resources to produce security, it is well founded the interest of academic researchers and policy makers in determining the factors that influence the demand for military expenditure.

There have been few previous studies on the determinants of the Portuguese military expenditure and the existing ones do not provide a satisfactory and comprehensive analysis, as they do not take into account the country´s historical and political specificities when modelling the demand for military expenditure.

The estimation of a demand model exclusively for Portugal using a comprehensive set of economic, strategic and domestic political determinants is a new addition to the literature and is the main purpose of this dissertation.

With the information obtained, we are able to identify the factors that may be understood as determinants of the Portuguese military expenditures. Thus, it would be possible to find a better alignment between the public resources allocated to the military and the economic, political and security environments.

This dissertation is organized as follows. The next section reviews the relevant literature. Section 3 briefly traces the history of Portuguese defence policy and the involvement in multilateral security initiatives. Section 4 presents the data collected and used in the empirical analysis. The econometric methodology and the main empirical results are presented in sections 5 and 6. Finally, Section 7 concludes.

2. Literature review

2.1. Theoretical background

There is a wide range of literature examining the determinants of military expenditure. Albeit sharing the same starting question – what drive the military expenditure? – studies do vary in several aspects such as the theoretical framework considered, the empirical methodology used, the sample of countries under analysis and the time period covered.[1]

Generally, the empirical works on the determinants of military expenditure can be grouped into four different conceptual approaches: Organizational Politics and Bureaucratic models, Military Alliances Theory Models, Arms Race Models and General Models of aggregate defence spending.

The literature on Organizational Politics and Bureaucratic Models[2] are supported in the notion that the military budget is used by decision makers to respond to the political environment and so the level of military expenditure is understood as the result of a complex struggle for power. Therefore, the models developed focus on the military budgetary process where interest groups (such as bureaucrats, politicians, the military institution and the arms industry) compete in order to optimize their own objectives. One main features of this approach, as suggested by Smith (1989) and Neira and Gonzalez (2008), is the "incrementalism", so that, the complexity of the military budgetary process, together with the agent´s limited rationality, lead to inertia and to an incrementing behaviour of military expenditures.

[1] Studies on the determinants of military expenditure are reviewed by Hartley and Sandler (1990), Smith (1995) and, more recently, by Neira and Gonzalez (2008)

[2] See Ostrom (1978); Cusack and Michael Don (1981); Majeski (1983) and Rattinger (1975)

A second class of models, the Military Alliance Theory Models[3], sought to analyse the economic dynamics of military alliances addressing issues such as the alliance size, the burden sharing and the sub-optimality of the military expenditure level. Since the seminal work of Olson and Zeckhauser (1966), where the security and deterrence provided by the North Atlantic Treaty Organization (NATO) is considered as a pure public good from the perspective of an individual ally, this strand of literature have been extensively studied. Although the study of military alliances is closely related to the theory of public goods, the intense debate over the public good nature of military expenditure has motivated the incorporation of additional theoretical extensions.

Another strand of literature, the Arms Race Models[4], accounts for the effect of a rival country´s military expenditure as the major determinant of one country military spending. The arms race models reference work is Richardson (1960) who developed, in a Game Theory framework, a mathematical model defined by a set of differential equations. The key feature of this approach is that the level of military expenditure is determined by an action-reaction process. As pointed out by Dunne, Perlo-Freeman, and Smith (2008), these models are best suited to analyse situations in which countries are in conflict.

Recent literature has focused on a more general approach based on the development of a comprehensive demand model for military expenditure taking into account a range of economic, political and geostrategic variables. Despite some works turn to *ad hoc* variables, the theoretical background for military expenditure demand

[3] Sandler (1993) review the literature about Military Alliance models

[4] Isard and Anderton (1985) and Brito and Intriligator (1995) review the literature about Arms Race models

models adapts the standard microeconomic formulation of utility maximization subject to a budget constrain so that this approach is also known as the Neoclassical Approach. Smith (1980) is a reference work for this approach and its model is the theoretical background of the present dissertation. The author assumed that a country maximizes an aggregate welfare function, W, depending on the civilian output, C, and on the level of security, S, i.e.:

$$\mathrm{W} = \mathrm{W}(\mathrm{C}, S). \tag{1}$$

Security can be understood as a subjective confidence based on perception of threat of attack. In order to quantify the variable, the level of security is assumed to depend upon the level of military expenditure, M, conditioned on political and strategic factors Z:

$$\mathrm{S} = (\mathrm{M}, \mathrm{Z}). \tag{2}$$

The social welfare function maximization is subject to the security function and to a budget constraint as follows:

$$\mathrm{Y} = P_c \mathrm{C} + P_m M \tag{3}$$

where Y is nominal aggregate income, $\mathrm{P_c}$ and $\mathrm{P_m}$ are the prices of real military expenditure M and output C.

By solving the maximization problem the derived demand function for the level of military expenditure can be written as:

$$\mathrm{M} = \mathrm{D}\ (\mathrm{Y}, P_m, P_c, Z). \tag{4}$$

The general models of aggregate defence spending popularity is essentially due to three features: first, it takes a comprehensive approach where, in a single equation, the

military expenditures is defined as a function of economic, political and geostrategic factors; second, this strands of research brought together some of the issues considered in the other approaches mentioned above by incorporating specific variables that allow a more wide-ranging understand of military expenditures; third, it provides a satisfactory empirical analyses (Dunne et al., 2008).

Depending on the author´s purpose and on the data availability, studies do differ in the sample of countries and in the time period covered. Some studies focus on a group of countries, employing cross-sectional or panel data techniques, in order to find out a common pattern or to explain the differences in military expenditures across them[5]. Alternatively, there are studies that focus on individual countries performing a time-series analysis, generally taking into account the country´s historical and institutional information[6]. The time period under analysis is commonly determined by the data availability and, in some cases, is by itself a prominent variable under analysis as some events are well delimited in a specific time period[7].

[5] For Less Developed Countries see Dunne, Nikolaidou, and Mylonidis (2003); Dunne and Perlo-Freeman (2003b); Dunne et al. (2008). For European countries see Dunne et al. (2003); Nikolaidou (2008)

[6] Examples of case-study works are: Solomon (2005) for Canada; Abdelfattah, Abu-Qarn, Dunne, and Zaher (2013) for Egypt; Kollias and Paleologou (2003) for Greece; Batchelor, Dunne, and Lamb (2002) for South Africa; Sezgin and Yildirim (2002) for Turkey; Smith (1980) and Hartley and MacDonald (2010) for United Kingdom.

[7] Dunne and Perlo-Freeman (2003), for instance, attempts to evaluate the driving forces behind military spending in developing countries by comparing a period during the Cold War with the period afterwards.

2.2. Literature on the determinants of military expenditure

In the Defence Economics literature several factors have been put forward as potential explanatory variables for military expenditures. Nevertheless, there is little consensus amongst the majority of empirical studies regarding the definition, significance and direction of the effect of those variables. Table VI (see the appendix) provides a summary of the empirical evidence on the determinants of military expenditure.

The variables considered in most studies as key factors for determining the level of military expenditure can be broadly grouped into three categories: economic, strategic and political variables. In this section, the empirical literature on military expenditure will be reviewed following the above categories. Variables can also be grouped into internal and external according to the country´s influence on them. As suggested in Figure 1, the variables categorization is not straightforward.

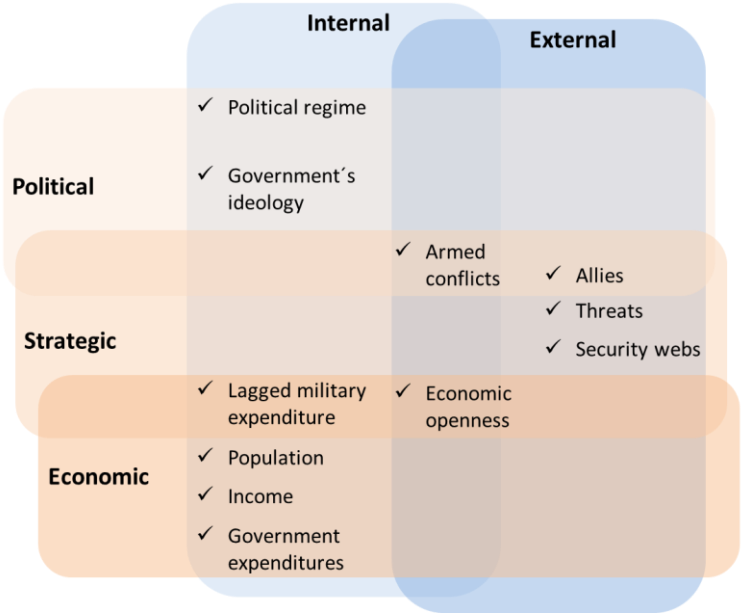

Figure 1: Summary of the determinants of military expenditure

2.2.1. Economic determinants

Income

The causality nexus between income and military expenditure has been extensively studied in the Defence Economics literature. The impact of defence spending on economic growth is a controversial issue, beyond the scope of this work, that has stimulated an intense debate among economists since the seminal work Benoit (1978). On the other side, income is commonly considered as a key explanatory variable as it is included in practically all the models of demand for defence expenditures, although there is a lack of unanimity on its significance.

Under the light of Public Finance Theory, national defence is considered a standard public good and the level of military spending is expected to be positively related to income. In other words, higher income levels tend to generate higher military spending so that income can be easily understood as a country´s ability to pay for security.

Most studies use either GDP or GNP as a proxy for income. Batchelor et al. (2002), investigating the demand for South Africa defence expenditure, Kollias and Paleologou (2003), for Greece, and Nikolaidou (2008), for 15 EU member states, evidence the important role of income in determining military expenditure. Controversy, Dunne et al. (2003), for Spain and Greece, and Solomon (2005), for Canada , reported income as insignificant at least in the long-run, while Dunne et al. (2008), studying a sample of Less Developed Countries, and Hartley and MacDonald (2010), for United Kingdom, found it to have a significant and negative effect on military expenditure.

Population

Population is introduced into the demand function in order to capture a possible size effect. Regarding the non-rivalry of defence, military expenditure is unlikely to increase as population increases. This idea is supported by studies that evidence the insignificance of population as explanatory variable such as Solomon (2005) and Kollias and Paleologou (2003). Additionally, Dunne and Perlo-Freeman (2003a, 2003b) and Dunne et al. (2008) found that population has a significant and negative impact on military expenditure suggesting that a large population provide intrinsic security by itself, so that small countries, who cannot rely on a large army, have to spend more on high technology armaments.

Openness of the economy

Rosh (1988) is the first author to address the possible relationship between a country's incorporation into the world economy and its degree of militarization. The author starts by hypothesizing that countries highly integrated in the global economy would find it easier to obtain financial support to arms purchase, leading to a higher military expenditure. However, in a time series model, he finds out a negative relationship between share of trade (exports plus imports over GDP) and military expenditure stating that "the negative relationship exhibited within countries has overwhelmed the positive relationship exhibited across countries" (Rosh, 1988, p. 691), thus concluding that, controversy to the initial hypothesis, as a countries become more involved in the world economy their policymakers begin to perceive greater benefits from not engaging in military conflicts .

The economic openness ambiguity as explanatory variable for military expenditure demand is illustrated in Dunne and Perlo-Freeman (2003b), where trade has a positive and significant effect in a dynamic panel specification, although in the static fixed effects model it is also significant but presents a negative sign.

Government expenditures

The impact of government expenditures on military expenditure can be analysed in two perspectives. By one hand, the share of government expenditure as a percentage of GDP may be used to account for the fact that the military will likely benefit from high government expenditure by itself. By another hand, researchers often use non-military government expenditures as an explanatory variable to account for the opportunity cost of military expenditure. Dunne et al. (2003), for instance, found a negative trade-off between non-military and military expenditure.

Lagged military expenditure

Many studies include a lagged military expenditure variable among the explanatory variables in order to capture the incremental inertia effect which is, as stated above, the main characteristic of Organizational Politics and Bureaucratic Models. The autoregressive nature of military expenditure is revealed in several studies, such as Abdelfattah et al. (2013), Solomon (2005) and Sezgin and Yildirim (2002), and besides being explained in terms of bureaucratic inertia it may be associated with intangible reasons, such as tradition or national pride (Markowski & Tani, 2005), or may be due to hangover from previous expenditures or commitments to programmes (Dunne and Mohammed, 1995).

2.2.2. Strategic determinants

Armed Conflicts

The existence of an armed conflict is a relevant determinant of military expenditure. To capture a country's participation in a conflict, either external or internal, dummy variables are commonly used in order to identify the years when it occur. It is unanimously accepted the positive significance of conflict variables as explanatory variables. Batchelor et al. (2002) reveal a positive impact of the involvement in Angola War on South Africa´s military burden, and Dunne et al. (2008), using a sample of 98 LDC, find out a positive effect from external and civil wars on the military burden.

Allies

As a member of a military alliance, a country is committed to cooperate with allies on defence and security issues and, consequently, will get benefits resulting from the collective production of a public good such as defence. Therefore, and despite the existence of a specific approach that focus on alliance issues (the previously mentioned Military Alliance Theory Models), several works include alliance's military burden as a potential determinant in order to account for the spill-in effect.

Hartley and MacDonald (2010) and Solomon (2005) show, for UK and Canada respectively, positive spill-ins from NATO, concluding that each country under analysis adopted a 'follower' response to the alliance, thus not acting as a 'free rider'.

Threats

Threats may be understood in a similar way to spill-in effects. Typically, a threat is represented by the military expenditure of a country considered as an enemy, or a potencial enemy, for the country under analisys. As an example, Sezgin and Yildirim (2002) find evidence that Turkish defence spending is positively influenced by Greek military expenditure, while Kollias and Paleologou (2003), by its turn, find the same evidence to Greece regarding the Turkish military expenditure.

Security Web

The security web idea was develop by Rosh (1988) as an attempt to look beyond the arms race models by establishing a broader concept comprising external security issues. A country´s security web is then defined as all the countries (allies, enemies or neutrals) that are able to affect significantly its security. Rosh emphasizes the geographic proximity and, calculating the degree of militarisation of a nation's security web by averaging the military burdens of neighbour countries, finds a significant and positive effect of security web on military expenditure. Following Rosh´s definition, Dunne and Perlo-Freeman (2003b) also find out a significant and positive effect associated with the security web variable.

2.2.3. Political determinants

Political regime

Some authors have studied the effect of political regimes on military spending. It is widely found that democratic countries spend less on the military than non-

democracies. On the contrary, autocracies or states with a military government are more likely to allocate more resources to military purposes.

Many studies include a measure for democracy when they run military spending regressions with most of them revealing that a more democratic regime has a significant negative effect on military spending (Dunne & Perlo-Freeman, 2003a; Dunne et al., 2008; Sezgin & Yildirim, 2002). A recent paper of Albalate, Bel, and Elias (2012), emphasizing the institutional determinants of military expenditure, show that presidential democracies spend more than parliamentary systems on defence, whereas its interaction with a majoritarian electoral rule reduces the defence burden.

Ideology of the government

In many countries the domestic political environment depends on the party in power, so that it´s political agenda may act as an influent determinant of military expenditures. In a case study for the United Kingdom, Hartley and MacDonald (2010) found that, albeit the lack of significance, the variable representing the party in power hints at higher defence spending by the Conservative governments than Labour governments.

Kollias and Paleologou (2003), emphasizing the incorporation of variables that reflect the domestic political changes in Greece, show evidence that changes in the political colour of governments have a positive and significant effect on military expenditures.

2.3. Literature on the determinants of Portuguese military expenditure

There have been few previous studies on the determinants of the Portuguese military expenditure. Probably, the first study on this subject was done by Barros and Santos (1997) who carry out an empirical investigation in order to assess the economic effects and the determinants of military expenditure in Portugal from 1950 to 1990. As far as the military expenditure determinants are concerned, the authors regressed the military expenditures on five variables: lagged military expenditures, GDP, population, a dummy variable representing the party in power (0=left wing party; 1=right wing party) and a dummy variable assuming 1 in a war situation. It was found that only the GDP and the trend variable coefficients were significant both with a negative sign. One limitation of this work, as noted by the authors, is the fact that it was not included in the model a strategic variable such as the military expenditure of NATO.

Using a cointegration Autoregressive Distributed Lag (ARDL) approach, Dunne et al. (2003) estimate military demand equations for Greece, Portugal and Spain over the period 1960-2000. Results showed that output has a positive and significant influence on the Portuguese military expenditures. On the other hand, non-military expenditures and a dummy variable representing democracy have a negative and significant influence, both on the short and long run. NATO military spending has a positive effect that is only significant in the short-run and there is a positive effect of trade balance that is only significant in the long-run. Population is revealed as not significant variable.

Following the previous work, a study conducted by Nikolaidou (2008) brings evidence on the determinants of military expenditure for each one of the 15 core

European Union countries over the period 1961-2005. The author find evidence supporting that Portugal is a follower of the United States and of the European NATO countries. Moreover, income shows a positive and significant effect on military expenditure. Population reveal a negative and significant effect suggesting, according to the author, that the public good effect of defence is verified. The non-military expenditures and the economic openness variable reveal no significance. This work, as the previous one, simply did not include variables regarding the domestic political environment.

3. Contextual setting: Portuguese defence policy and military expenditure trends

The present section briefly traces the history of Portuguese defence policy and the involvement in multilateral security initiatives.

In a general and summary way, as indicated by Telo (1998b), along its history Portugal has had four essential security concerns: (i) the defence of land frontiers in order to maintenance its sovereignty on the Iberian Peninsula, (ii) the participation effort in military alliances, (iii) the protection of its colonial empire and its communities all over the World and (iv) the support of the regime in power. Thus, the Portuguese military policy definition was always a combination of those security concerns with each one of them being more stressed according to the specific historical context.

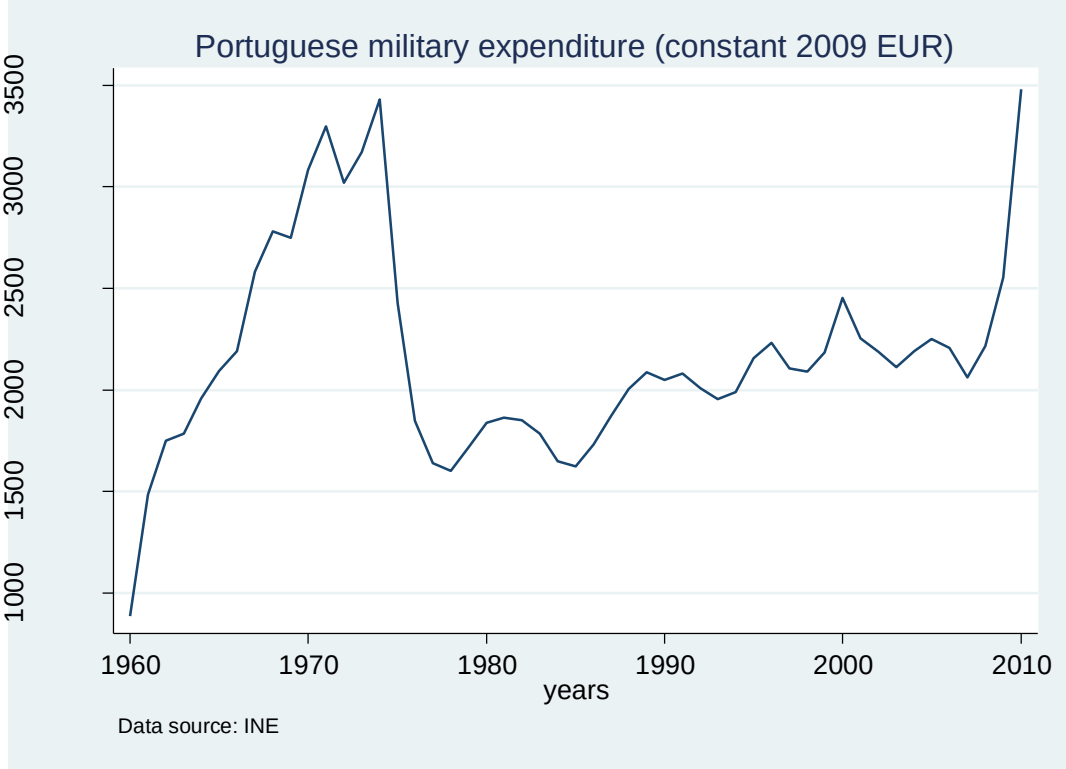

Figure 2: Portuguese military expenditure (constant 2009 EUR), 1960-2010

Despite being a founding member of NATO, since 1949, the contribution to the alliance was secondary and only marginal for more than two decades. After 1959, the defence of the colonial empire became the main topic in the Portuguese foreign and military policy agenda. Portugal had been the first European power to establish a colony in Africa and was one of the last to leave the African continent. From 1961 to 1974 the Portuguese Armed Forces conducted a counterinsurgency campaign to retain control over its African colonies. The conflict is known as the Portuguese Colonial War or the Overseas War. In April 1961 starts the insurrection in the northwest of Angola, in December of the same year Portugal lost its Indian possessions, in 1963 a new war front was opened in the former Portuguese Guinea (known as Guinea-Bissau since 1974) and in 1964 a third battlefront starts in Mozambique.

The war effort was tremendous, especially considering the territorial dimension, the population[8] and the poor economic development of Portugal. The Portuguese Colonial War was characterized by (i) its long duration (ii) the far distance between the mother country and the three theatres of operations (Angola, Guinea and Mozambique); (iii) the increasing civil mobilization and (iv) the substantial military expenditure growth. In 1968, the military burden (military expenditures as a percentage of GDP) was around 6%, the ratio of military spending to total central government spending was more than 40% and, according to Ramos, Sousa, and Monteiro (2009), the military personnel accounts for more than 150.000 soldiers.

The Revolution of the Carnations, on the 25th of April 1974, put an end to the war in Africa and to the *Estado Novo* right-wing authoritarian regime heralding the

[8] By the early 1970s some 8% of the Portuguese labor force were in the military (Graham, 1979)

installation of a democratic regime. After 1974, a major structural reorganization began in the Portuguese military structure. The two main outcomes of that reform were the considerable military down-sizing, performing the transition to a smaller peacetime force, and the strategic commitment to support the NATO effort in the defence of the West in response to the perceived threat represented by the Soviet Union and the Warsaw Pact.

As pictured in Figure 2, Portugal had a high military burden for the years prior to 1974. Since then, and after a dramatically decrease in the following years (the military expenditure was reduced by 29% in 1975 and 24% in 1976), the military burden has been kept at relatively low levels (less that 2% of the GDP).

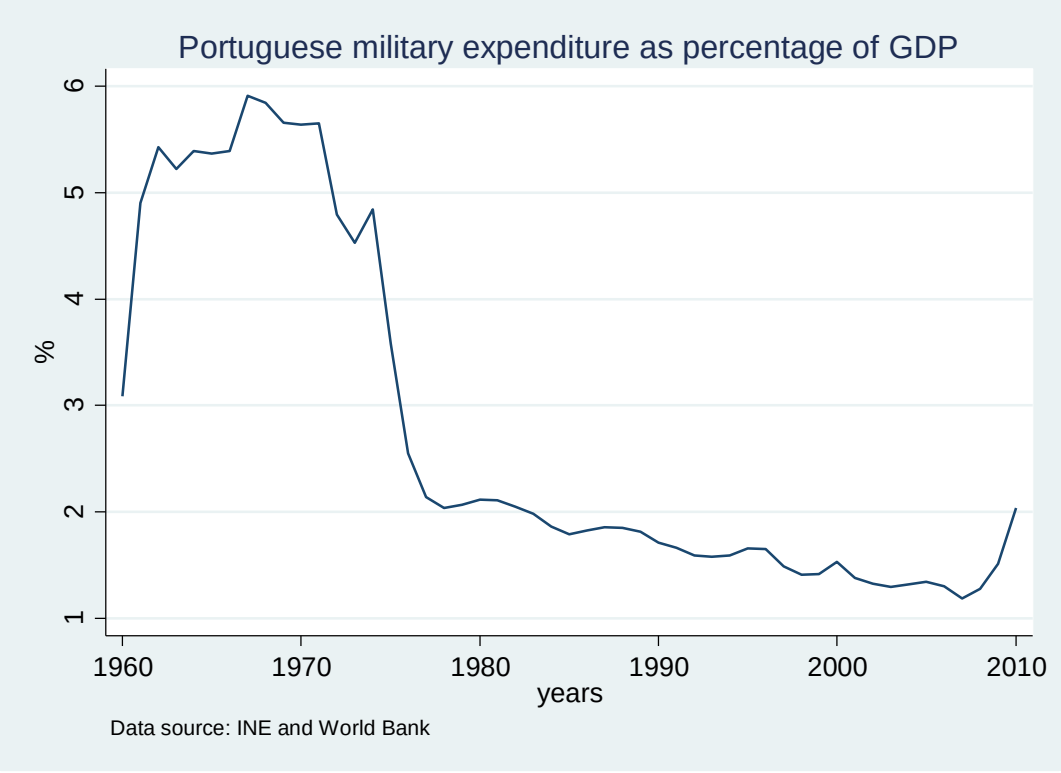

Figure 3: Military expenditure as percentage of GDP, 1960-2010

The end of the Cold War induced, during the 1990´s, a reform process in the Portuguese armed forces in order to adapt the military to a new international strategic environment (Telo, 1998a). That reform led to the professionalization of the military[9] and to the progressive military downsizing, with the reduction of both the military personnel and the military burden. According to Duque (1998), the personnel reduction was from 72.000 soldiers in 1989 to 46.000 in 1997, the military expenditure as a GDP share was reduced from 2,2% in 1990 to 1,4% in 1997 and the military expenditure share in the central government expenditure was reduced from 6,1% in 1990 to 3,3% in 1997.

From 1988 to 2009, the defence budget was increased by an annual average of approximately 1% in real terms despite presenting a variable pattern between 2 and 2.5 million euro (2009 EUR). Considering the military expenditure time series under analysis it is important to notice that the military expenditure reached a high level in 2010 (an increase of 36.21% when compared to 2009) because the Portuguese Navy sub-surface fleet has seen a considerable improvement with the acquisition of two new submarines.

Nowadays, the objectives of the Portuguese defence policy are to guarantee the national independence, the integrity of the territory, the freedom and security of the citizens and the safeguard of national interests, as well as, in the scope of a cooperative security, the active participation in providing international security, in particular, in international crisis management missions of Humanitarian and Peace-keeping nature.

[9] Over the 1990s a series of laws reduced the age of conscription and reduced the duration of service. In 2005, peacetime conscription ended and the Portuguese military became an all-volunteer force open to both men and women (Card & Cardoso, 2012)

4. Data sources and descriptions

The data used in this dissertation are annual observations from 1960 to 2010 and come from several sources. The economic evaluation was conducted in 2009 constant prices.

Data on the Portuguese military and non-military expenditure were collected from Instituto Nacional de Estatística (INE). The expressed military expenditure corresponds to the defence function expenditure according to the Classification of the Functions of Government. The non-military expenditures were obtained by subtracting the military expenditures to the total central government expenditures.

The allies' countries military expenditure data were obtained on request from Stockholm International Peace Research Institute (SIPRI) and all the series in 2009 million USD were converted to 2009 million EUR by the relevant 2009 exchange rate. NATO founding members military expenditure excludes the military expenditure of Portugal and United States of America. Thus, the countries considered are Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, Netherlands, Norway and United Kingdom.

Data on population, trade, GDP (in current EUR), GDP deflators and exchange rates were collected from the World Development Indicators 2012 database from the World Bank.

To obtain a characterization of the government´s ideology it was used the Database of Political Institutions from the World Bank. Therefore, Right (right=1) stands for parties that are defined as conservative, Christian democratic or right-wing,

while Left (left=0) stands for parties that are defined as communist, socialist, social democratic, or left-wing

The variables used in the estimation are summarized in Table I.

Table I: Data summary

Variable	Description		Mean	Std.Dev.	Min.	Max.	Data source
ME	Portuguese military expenditure	10^6€	2169.52	514.28	886.35	3480.66	*Conta Geral do Estado* Instituto Nacional de Estatística
NME	Non-military central government expenditures	10^6€	27108.28	19867.74	2686.79	62792.37	
GDP	Real GDP	10^6€	101971.20	47258.22	28687.64	173565.80	*World Development Indicators Database* World Bank
POP	Total population	hab	9709004	649930	8630430	10600000	
TRADE	Share of imports plus exports over GDP	%	55.55	10.95	33.48	74.97	
NATO	NATO founding members military expenditure	10^6€	127241.10	20570.29	86409.10	152941.10	*SIPRI Military Expenditure Database* Stockholm International Peace Research Institute
USA	Unites States military expenditure	10^6€	318797.80	64051.82	236823.50	494607.70	
PARTY	Ideology of the party in power	*dummy*	0.27	0.45	0	1	*Database of Political Institutions* World Bank
WAR	Portuguese Colonial War (1961-1974)	*dummy*	0.61	0.49	0	1	-
D2010	Year 2010	*dummy*	0.02	0.14	0	1	-

5. Econometric methodology

5.1. Model specification

The demand model developed in this section draws upon the Neoclassical framework as defined in Smith (1980). As mentioned in Section 2, a country is represented as a rational decision-maker maximizing a national welfare function, depending on security and economic variables, subject to a security function and a budget constrain. As it is assumed that the security function depends, among other factors, on military expenditure, by solving the maximization problem the demand function for military expenditure is then derived. It follows that the demand for a country's military expenditure can be modelled as expressed in equation (4).

The lack of data on civilian and military prices is a serious difficulty for the estimation of a conventional demand function. Indeed, under the light of the neoclassical theoretical framework, the exclusion of the relative price variable may cause a serious specification error. However, it is important to notice that GDP deflator is easily assumed to include price variation in the military sector. Therefore, most empirical studies exclude the civilian and military relative prices from the demand equation and simply use the overall deflator.

Given the previous considerations, the equation that best describes the determinants of Portuguese military expenditure should incorporate economic, strategic and political effects. For the purpose of this study, it is assumed that the demand for military expenditure in Portugal is modelled as follows:

$$\mathrm{ME}_t = \beta_0 + \beta_1 ME_{t-1} + \beta_2 \mathrm{GDP}_t + \beta_3 \mathrm{NME}_t + \beta_4 TRADE_t + \beta_4 \mathrm{POP}_t +$$
$$\beta_5 \mathrm{NATO}_t + \beta_6 \mathrm{USA}_t + \beta_7 \mathrm{WAR}_t + \beta_8 PARTY_t + \beta_9 D2010_t + \varepsilon_t \,. \qquad (5)$$

The variables were selected in such a way that diverse dimensions of the determinants of military expenditure could be analysed.

This model considers five key economic variables. GDP is the real gross domestic product and evaluates the effect of income, so that a positive coefficient may be understood as military expenditure being a normal good while, on the contrary, a negative coefficient may be understood as military expenditure being an inferior good. ME_{t-1} is the lagged military expenditure and is introduced to account for any bureaucratic inertia. NME is non-military expenditure and allows evaluating the existence of opportunity costs if a negative sign is observed. TRADE is defined as the ratio of imports plus exports over GDP and estimate the effect of the economic openness. POP is the total population and is used to measure the public good effect, so that a negative coefficient can be associated with the public good effect of defence.

This model considers the role of strategic determinants by distinguishing between the response to the military expenditure of USA and the response to the military expenditure of others NATO allies. There are two reasons to consider the specific effect of USA military expenditure. First, the USA is the world's largest military spender and remains the only NATO member capable of sustaining a large-scale military operation. Second, as suggested by Markowski and Tani (2005), the US military expenditure can be understood as a proxy to measure the index of global instability.

The NATO variable aggregates the military expenditure of NATO allies. It must be noticed that not all the members of NATO were used so that only the founding

members are considered with the exclusion of Portugal, the country under analysis, and the USA, treated in a separate variable. The member countries that joined the coalition later than 1960 were excluded in order to avoid the military expenditure increase due to enlargements. Greece and Turkey, despite the first two nations to be part of NATO's first enlargement in 1952, are not considered because their particular security issues that may distort their respective military spending. Germany is not included because, although the Federal Republic of Germany joined NATO in 1955, only in 1990, with the reunification of Germany, NATO grew to include the former country of German Democratic Republic.

Additionally to the strategic variables mentioned, the WAR dummy variable is introduced in order to capture the effect of the Portuguese Colonial War from 1961 to 1974, taking the value of one during the conflict. Having in mind that, in 1974, the Revolution of the Carnations heralded the installation of a democratic regime, it is straightforward to understand the WAR variable with an additionally political meaning as it incorporate the effect of the previous authoritarian regime.

In an attempt to capture the effects of domestic political considerations a dummy variable for the ideology of the political party in power is included. The PARTY variable takes the value one when the government is formed by parties that are defined as right-wing and takes the value 0 when formed by parties that are defined as left-wing.

As stated in chapter 4, the Portuguese military expenditure in 2010 increased by 36.21% when compared to the previous year. Considering this outlying observation the dummy variable D2010 is included to account for the observed fact.

5.2. Estimation method

The present work follows the most recent literature on the determinants of military expenditure and estimate the demand model by employing the bounds testing approach to cointegration within an Autoregressive Distributed Lag (ARDL) framework as develop by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001).

It is important to note that there is no standard methodology for conducting the analysis on military expenditure demand function. Thus, several alternative methods have been applied in empirical studies. Nevertheless, the ARDL approach has gained popularity over recent years and its adoption for empirical analysis can be found, not only in the field of Economic Defence, but rather in a wide spectrum of economic works.

In order to understand the popularity of the ARDL approach it is important to bear in mind the limitations commonly associated with alternative modelling methodologies. For instance, some studies have used simultaneous-equation estimation procedures, especially in Arms Race models and in Military Alliances Theory Models, where the military spending of countries are jointly determined. However, simultaneous equation methods have shortcomings that have been widely criticized, such as the division between endogenous and exogenous variables that are not always clear in many empirical models. In other instances, studies have applied single equation estimation procedures for the demand for military spending and have employed different cointegration techniques such as the Engle–Granger two-step procedure (see Dolores Gadea, Pardos, and Pérez-Forniés (2004) for NATO countries) or the Johansen maximum likelihood approach to cointegration (see Solomon (2005) for Canada). These

approaches to cointegration assume that the variables under analysis must be stationary and, therefore, require testing for unit roots and the use of differenced variables in case of non-stationarity. However, the first differences of the level variables may remove long-term information. Additionally, the cointegration estimation based on vector autoregressive (VAR) modelling is problematic when the number of variables considered is large due to the degrees of freedom considerations.

The ARDL approach is more suitable for this study than the above alternative approaches and the main reasons for using this procedure are as follows.

First, the ARDL procedure can be applied regardless of the stationary properties of the variables in the model. As shown by Pesaran et al. (2001), this methodology yields consistent estimates of the long-run coefficients that are asymptotically normal irrespective of the underlying regressors are I(0) or I(1).

Second, according to Pesaran et al. (2001) the use of the ARDL model for the estimation of level relationships suggests that, once the order of the ARDL has been recognised, the relationship can be estimated by OLS.

Third, ARDL allows to describe the existence of a relationship in terms of long-run and short-run dynamics without losing long-run information. Contrary to the VAR frameworks, the number of variables in the regression model can be large.

Finally, as demonstrated by Pesaran and Shin (1999), the small sample properties of the ARDL bounds testing approach are superior to that of the traditional Johansen cointegration approach, which typically requires a large sample size for the results to be valid. In particular, Pesaran and Shin (1999) show that the ARDL approach has better properties in sample sizes up to 150 observations.

A general ARDL(p, q_i) model, with $i = 1,2, \dots k$, takes the following form:

$$\emptyset(L,p)y_t = \sum_{i=1}^{k} \beta_i(L,q_i)\, x_{it} + \delta' w_t + \varepsilon_t \quad (6)$$

where $\emptyset(L,p)$ and $\beta_i(L,q_i)$ are polynomial lag operators, with maximum lag of p and q_i respectively

$$\emptyset(L,p) = 1 - \emptyset_1 L - \emptyset_2 L^2 - \cdots - \emptyset_p L^p \quad (7)$$

$$\beta_i(L,q_i) = \beta_{i0} + \beta_{i1} L + \beta_{i2} L^2 + \cdots + \beta_{iq_i} L^{q_i} \quad (8)$$

and y_t is the dependent variable, x_{it} are exogenous variables, w_t is a $s \times 1$ vector of deterministic variables (such as the intercept term, the deterministic time trend, dummy variables or exogenous variables with fixed lags), L is the lag operator and ε_t is a white noise error.

An ARDL model can be rewritten in an error correction form as follows:

$$\Delta y_t = -\emptyset(1,\hat{p})\mathrm{EC}_{t-1} + \sum_{i=1}^{k} \beta_{i0} \Delta x_{it} + \gamma' \Delta w_t + \sum_{j=1}^{\hat{p}-1} \emptyset_j \Delta y_{t-j} + \sum_{i=1}^{k} \sum_{j=1}^{\hat{q}_i - 1} \beta_{ij} \Delta x_{i,t-j} + \varepsilon_t \quad (9)$$

where Δ is the first differences operator and the error correction term is defined as:

$$\mathrm{EC}_t = y_t - \sum_{i=1}^{k} \hat{\theta}_i x_{it} - \hat{\delta}' w_t \ . \quad (10)$$

According to Pesaran and Shin (1999) and Pesaran et al. (2001), the ARDL procedure involves two stages.

The first stage is to test the existence of a long-run relationship among the variables and consists in testing the cointegration between y_t and x_{it}. It is tested through the OLS estimation of equation (9) and by computing the F-statistic for the joint significance of the coefficients of the lagged levels variables (i.e. to test if the

coefficients of y_{t-1} and x_{it-1} do not equal zero jointly). The F-test has a non-standard distribution which depends upon; (i) whether variables included in the ARDL model are I(0) or I(1); (ii) the number of regressors; and (iii) whether the ARDL model contains an intercept and/or a trend. The two sets of critical values, reported in Pesaran et al. (2001), provide critical value bounds for all classification of the regressors into purely I(1), purely I(0) or mutually cointegrated. If the F-statistic exceeds the upper critical value, we can conclude that a long-run relationship exists. If the F-statistic falls below the lower critical value, we cannot reject the null hypothesis of no cointegration. A value of the F-statistic that lies within the bounds makes the test inconclusive.

In a second stage, once a long-run relationship has been established, a further two-step procedure to estimate the model is carried out. First, the orders of the lags in the ARDL model are selected using an appropriate lag selection criterion, such as the Akaike information criterion (AIC) or the Schwarz Bayesian Criterion (SBC), and the second step involves the estimation of the long-run relationship and the short-run dynamics of the variables with the ECM representation of the ARDL model.

6. Estimation results

While the ARDL approach allows the estimation of a cointegrating vector with both I(1) and I(0) series, it is still important to exclude the possibility that any of the series are I(2). For this purpose, the standard Augmented Dickey-Fuller (ADF) unit root test was employed to identify the order of integration of the variables.

Table II: Augmented Dickey-Fuller unit root results

Variable	ADF test statistic (levels)	ADF test statistic (first differences)	I(d)
LME	-1.565	-5.280***	I(1)
LGPD	-1.341	-4.552 *** (b)	I(1)
LNME	-0.083	-5.380 *** (b)	I(1)
LTRADE	-3.298 * (b)		I(0)
LPOP	-3.856 ** (b)		I(0)
LNATO	-1.323	-4.913 *** (a)	I(1)
LUSA	-2.156 (a)	-4.253 ***	I(1)

Notes:
Significance at the 10%, 5% and 1% level is represented by *, ** and ***, respectively.
(a) denotes the presence of a significant drift component but no trend term
(b) indicates that both drift and trend components are significant
Results obtained from EViews 5

According to the results reported in Table II, there is evidence that the variables LME, LGDP, LNME, LNATO and LUSA are I(1), while the variables LTRADE and LPOP are I(0). It comes out of these results that the conditions for applying the ARDL cointegration approach are satisfied, i.e., none of the variables considered is I(2) or of greater order. It is worthwhile to mention that the mixture of both I(1) and I(0) variables would not be possible under the Johansen procedure. This gives a good reason for using the ARDL bounds test approach as proposed by Pesaran et al. (2001).

The specified military expenditure demand function of equation can be written as the unrestricted error correction version of the ARDL model:

$$\Delta LME_t = \alpha + \theta_1 LME_{t-1} + \beta_1 LGDP_{t-1} + \beta_2 LNME_{t-1} + \beta_3 LTRADE_{t-1} +$$
$$\beta 4 \mathrm{L} POPt-1+\beta 5 LNATOt-1+\beta 6 LUSAt-1+i=1n\gamma 1i\Delta LMEt-i+i=1n$$
$$\gamma 2i\Delta LGDPt-i+i=1n\gamma 3i\Delta LNMEt-i+i=1n\gamma 4i\Delta LTRADEt-i+i=1n\gamma 5i$$
$$\Delta LPOPt-i+i=1n\gamma 6i\Delta LNATOt-i+i=1n\gamma 7i\Delta LUSAt-i$$
$$+\delta_1 \mathrm{WAR} + \delta_2 PARTY + \delta_3 D2010 + \mu_t \qquad (11)$$

In order to tests the long-run significance of the dependent variables the F-statistic test is computed. It tests the null hypothesis of non-existence of the long-run relationship through a joint testing of the lagged level variables in the unrestricted error correction version of the ARDL specification. Given the few observations available, because the series in the sample are annual and the sample size is small, the maximum order of lag in the ARDL models is chosen to be 2. The bounds test for the existence of a level relationship is presented in Table III.

Table III: Bounds test for the existence of a level relationship

Calculated F-statistic	*k*	Critical values bounds					
		10%		5%		1%	
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F(7, 23) = 3.32	7	2.03	3.13	2.32	3.5	2.96	4.26

Notes:
Critical values are obtained from Pesaran et al. (2001, p. 300) table CI case III
k is the number of regressors
Results obtained from Stata 12

Using the asymptotic critical value bounds computed by Pesaran et al. (2001), the obtained F-statistic F(7, 23) = 3.32 is significant at the 10% level, regardless the order of integration (I(0) or I(1)). Therefore, the null hypotheses of no cointegration is

rejected implying the existence of a long run relationship between the variables. In other words, the vector of explanatory variables is relevant to explain the long-run dynamic of the Portuguese military expenditure.

Having found a long-run relationship amongst the variables, the estimation of the long-run coefficients and the associated error correction model is carried out using the econometric software Microfit 4.0 developed by M.H. Pesaran and B. Pesaran. The optimal lag length for each variable is determined empirically by maximizing the Schwarz Bayesian criterion[10]. The selected ARDL regression based on SBC take the form of ARDL(2,0,1,0,0,0,0).

Table IV: Estimated long-run coefficients

Dependent variable LME		
	Coefficients	t statistic
Constant	55.229	3.854
LGPD	0.787***	4.485
LNME	-0.115	-0.848
LTRADE	0.315***	2.565
LPOP	-3.358***	-4.287
LNATO	-0.562*	-1.792
LUSA	0.302***	2.949
WAR	0.199**	1.916
PARTY	0.021	0.934
D2010	0.452***	5.824

Notes:
Significance levels: * at 10%, ** at 5%, *** at 1%
Results obtained from Microfit 4.0

[10] Although the ARDL-AIC and the ARDL-SC estimators have very similar small-sample performances, there is a "slight superiority of the ARDL-SC over the ARDL-AIC procedure" according to Pesaran and Shin (1999, p. 404)

The long run coefficients of the regression in the ARDL approach are presented in Table IV and the short-run estimates of the error correction model (ECM) representation are given in Table V.

Table V: Error correction representation (short-run estimates)

Dependent variable ΔLME		
	Coefficients	t statistic
ΔLME(-1)	0.208***	3.090
ΔLGPD	0.610***	3.955
ΔLNME	0.224	1.449
ΔLTRADE	0.244**	2.463
ΔLPOP	-2.602***	-3.502
ΔLNATO	-0.435*	-1.676
ΔLUSA	0.234**	2.644
ΔWAR	0.155**	2.064
ΔPARTY	0.016	0.941
ΔD2010	0.350***	6.771
Δconstant	42.794***	3.218
ECM(-1)	-0.775***	-8.672
R-Squared	0.86705	
F-Statistic	F(11, 37) = 21.3429 [.000]	
DW-Statistic	2.0133	
Residual sum of squares	0.067112	

Notes:
Significance levels: * at 10%, ** at 5%, *** at 1%
Δ denotes the first difference
ECM is the error correction term.

The results suggest that the sign of the coefficient associated with each variable do not differ in the long and in the short-run, when the same is statistically significant.

The economic growth plays a positive role on military expenditure so that the GDP coefficient comes out as statistically significant, giving support to the evidence that defence behaves as a normal good.

Albeit presenting contradictory signs in the long and in the short-run, the effects of non-military expenditure (NME) are non-significant. Thus there is no evidence, as a negative coefficient would suggest, of a clear opportunity cost between the resources allocated to defence and the resources allocated to other functions of the state.

The population variable POP presents a significant and negative coefficient suggesting that the public good effect of defence is verified.

The impact of the economic openness variable TRADE on military expenditure is positive and statistically significant, although less significant in the long-run. This result is in agreement with the relationship hypothesised by Rosh (1988) that it is easier to an open country to access finance and markets for arms purchase.

As far as the allies' military expenditure is concerned, rather surprising results are obtained. By one hand, the effect of the NATO founding members military expenditure is negative and significant (although only at a 10% level) suggesting that Portugal may behave as a free-rider relatively to the NATO founding members excluding the United States. By another hand, the spill-in from the USA is positive and significant revealing that Portugal behaves as a United States follower. Moreover, and considering the US military expenditure as a proxy to measure the index of global instability, the observed impact of this variable may be understood as an active awareness of Portugal towards international security instability.

As expected, the dummy variable for the Portuguese Colonial War has a positive and significant effect on the Portuguese military expenditure. For Portugal, as stated before, this variable presents an additional meaning since it incorporate the effect of the *Estado Novo* regime. Therefore, it is arguably to assume that the authoritarian regime

had a positive effect on military expenditure when compared to the democratic period established since 1974.

The positive coefficient of PARTY, although not significant, hints at higher military spending by the right-wing governments than left-wing governments. The dummy variable D2010 presents, as expected, a positive and highly significant coefficient.

Considering specifically the short run dynamics, it is shown that military expenditure is positively influenced by the previous year spending. This result is in agreement with the literature supporting the existence of an inertia effect in the military expenditure determination. In addition, the estimated coefficient of the error correction term is highly significant, thus confirming the previous results that there is a long-run relationship between the variables. Furthermore, the magnitude of the estimated coefficient of the error correction term suggests a relatively high speed of adjustment to any disequilibrium in the short run.

7. Conclusions

This dissertation contributes to the literature about the determinants of military expenditure in Portugal by estimating a comprehensive demand model that take into account the effect of economic, strategic and political environments. Using yearly data from 1960 to 2010 and employing an autoregressive distributed lag (ARDL) approach to cointegration, the results obtained yield a number of insights about variables that may affect the Portuguese military expenditure.

The empirical results suggest that income is a prominent determinant with a positive effect on military expenditure. This result deserves particular attention as it contains important policy implications. Thus, since the economic growth seems to plays an important role in determining the level of military expenditure, it is arguable that the present difficult economic situation of Portugal may pressure the defence budget and, therefore, constrain the country´s military capabilities.

Moreover, there is no evidence of a clear opportunity cost between the resources allocated to defence and the resources allocated to other functions of the state. The public good effect of defence is evidenced by the significant and negative effect of population and there is strong evidence that economic openness has a significant positive effect.

Considering the strategic and security environment, an interesting result was obtained relatively to the impact of the allies' military expenditure. It seems that Portugal behave as a 'free-rider' regarding the effort of the NATO allies and as a 'follower' of the United States. Unsurprisingly, the Portuguese Colonial War presents a very significant and positive effect.

As far as the domestic political environment is concerned, the transition to a democratic regime is considered a relevant determinant, with a negative effect, while the effect of the political ideology of the party in power appears to be insignificant.

Apart from the sign of the coefficient associated with the allies' military expenditure, all the results are aligned with the few previous studies considering the Portuguese case.

As a time series analysis using yearly data from 1960 to 2010, this empirical work presents as a major limitation the small sample under analysis (t=51). By one hand, it is obvious that a small sample compromise the results statistical significance. However, by another hand, it must be noticed that this study uses a larger sample when compared to the existing literature on the determinants of the Portuguese military expenditure.

For a future research I would like to suggest two topics. First, considering the results obtained regarding the effect of allies' military expenditure on the Portuguese military expenditure, a further research would be important to understand the role of Portugal as an international security producer.

A second research topic is about a matter that is in line with the theme of this dissertation. As the present work finds evidence about a significant impact from economic growth on military expenditure, it would be interesting to explore in future works the causality nexus between these two variables. Such a study could give especial attention to the period that become known as the 'golden age' of the Portuguese economic growth, during the 1960´s and early 1970´s, in order to better understand the relationship between the tremendous war effort, due to the Portuguese Colonial War, and the accelerated economic growth experienced by the Portuguese economy.

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Appendix

Figure 4: Military expenditure as percentage of total central government expenditure, 1960-2010

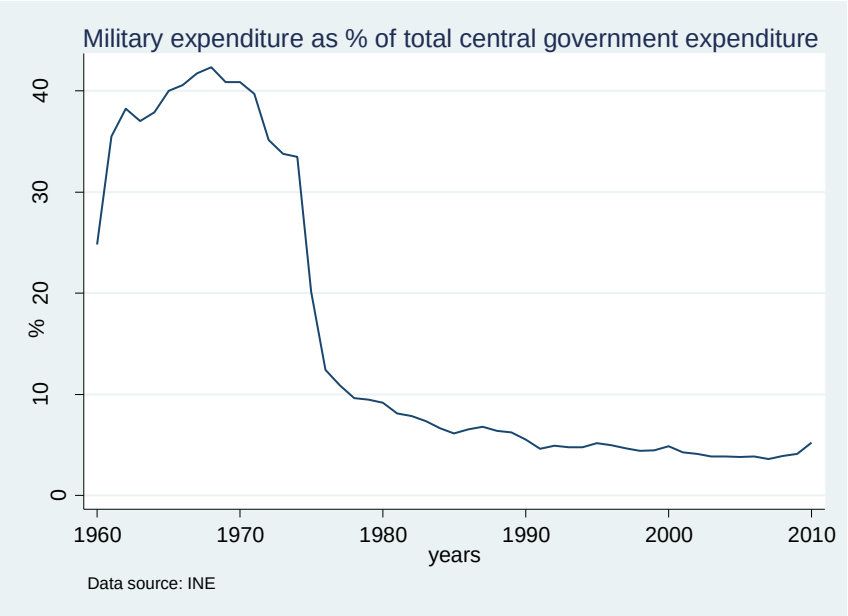

Figure 5: Allies military expenditure (constant 2009 EUR), 1960-2010

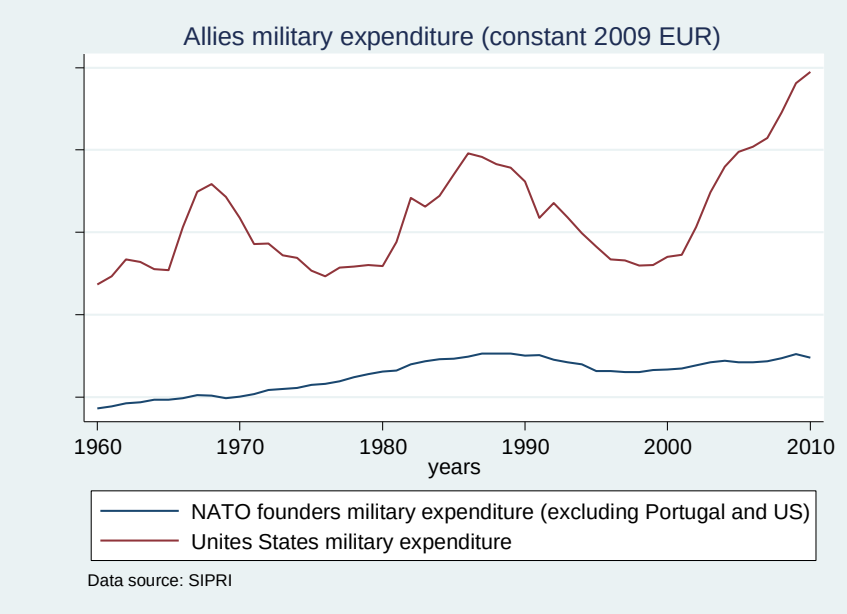

Figure 6: Stata output for data summary

```
. sum
```

Variable	Obs	Mean	Std. Dev.	Min	Max
YEAR	51	1985	14.86607	1960	2010
ME	51	2169.524	514.2848	886.3522	3480.66
GDP	51	101971.2	47258.22	28687.64	173565.8
POP	51	9709004	649930	8630430	1.06e+07
NME	51	27108.28	19867.74	2686.794	62792.37
TRADE	51	55.55306	10.94834	33.478	74.965
NATO	51	127241.1	20570.29	86409.1	152941.1
USA	51	318797.8	64051.82	236823.5	494607.7
WAR	51	.2745098	.4507075	0	1
PARTY	51	.6078431	.4930895	0	1
D2010	51	.0196078	.140028	0	1

Figure 7: Stata output for the bounds test for the existence of a level relationship

```
. regress DLME  l.LME l.LGDP l.LPOP l.LNME l.LTRADE l.LNATO l.LUSA WAR PARTY D2010
>  l.DLME l.DLGDP l.DLPOP l.DLNME l.DLTRADE l.DLNATO l.DLUSA l2.DLME l2.DLGDP l2.D
> LPOP l2.DLNME l2.DLTRADE l2.DLNATO l2.DLUSA
```

Source	SS	df	MS		
Model	.429522638	24	.017896777	Number of obs	= 48
Residual	.052901639	23	.002300071	F(24, 23)	= 7.78
				Prob > F	= 0.0000
				R-squared	= 0.8903
				Adj R-squared	= 0.7759
Total	.482424276	47	.010264346	Root MSE	= .04796

DLME	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LME						
L1.	-1.112694	.3138156	-3.55	0.002	-1.761871	-.463517
LGDP						
L1.	1.166581	.5081421	2.30	0.031	.1154085	2.217753
LPOP						
L1.	-1.435153	1.847908	-0.78	0.445	-5.257841	2.387535
LNME						
L1.	-.4575214	.3464165	-1.32	0.200	-1.174138	.2590957
LTRADE						
L1.	.1467677	.2669247	0.55	0.588	-.4054081	.6989434
LNATO						
L1.	.0229057	.6085741	0.04	0.970	-1.236026	1.281837
LUSA						
L1.	.0513739	.2190241	0.23	0.817	-.4017119	.5044598
WAR	.2723747	.1108071	2.46	0.022	.0431529	.5015966
PARTY	.0139408	.0272785	0.51	0.614	-.0424892	.0703707
D2010	.4160433	.093005	4.47	0.000	.2236479	.6084387
DLME						
L1.	.3582795	.2019995	1.77	0.089	-.0595884	.7761473
DLGDP						
L1.	-.1884957	.6056867	-0.31	0.758	-1.441454	1.064463
DLPOP						
L1.	-1.476365	4.467042	-0.33	0.744	-10.71714	7.764415

DLNME L1.	.472415	.2737286	1.73	0.098	-.0938358	1.038666
DLTRADE L1.	-.0821104	.1730364	-0.47	0.640	-.4400635	.2758428
DLNATO L1.	-.8124836	.6494158	-1.25	0.223	-2.155902	.5309353
DLUSA L1.	.1182528	.2101001	0.56	0.579	-.3163724	.552878
DLME L2.	-.0709114	.1536832	-0.46	0.649	-.3888294	.2470066
DLGDP L2.	-.2142882	.5323101	-0.40	0.691	-1.315456	.8868791
DLPOP L2.	-2.088098	3.816945	-0.55	0.590	-9.98405	5.807853
DLNME L2.	-.0997582	.2667181	-0.37	0.712	-.6515066	.4519902
DLTRADE L2.	-.0924324	.1570759	-0.59	0.562	-.4173687	.2325039
DLNATO L2.	-.3610834	.7163398	-0.50	0.619	-1.842945	1.120778
DLUSA L2.	-.052983	.1895809	-0.28	0.782	-.4451611	.3391951
_cons	21.21181	32.97988	0.64	0.526	-47.01227	89.4359

```
. test l.LME l.LGDP l.LPOP l.LNME l.LTRADE l.LNATO l.LUSA

 ( 1)  L.LME = 0
 ( 2)  L.LGDP = 0
 ( 3)  L.LPOP = 0
 ( 4)  L.LNME = 0
 ( 5)  L.LTRADE = 0
 ( 6)  L.LNATO = 0
 ( 7)  L.LUSA = 0

       F(  7,    23) =    3.32
            Prob > F =    0.0136
```

Figure 8: Microfit 4.0 output for the estimated long-run coefficients

```
           Estimated Long Run Coefficients using the ARDL Approach
       ARDL(2,0,1,0,0,0,0) selected based on Schwarz Bayesian Criterion
*****************************************************************************
 Dependent variable is LME
 49 observations used for estimation from 1962 to 2010
*****************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 LGDP                       .78705             .17554             4.4836[.000]
 LNME                      -.11462             .13509            -.84848[.402]
 LTRADE                     .31454             .12262             2.5651[.015]
 LPOP                      -3.3576             .78329            -4.2865[.000]
 LNATO                     -.56172             .31353            -1.7916[.082]
 LUSA                       .30237             .10255             2.9486[.006]
 WAR                        .19987             .10431             1.9161[.063]
 PARTY                     .021159            .022662             .93368[.357]
 D2010                      .45181            .077575             5.8242[.000]
 C                         55.2289            14.3299             3.8541[.000]
*****************************************************************************
```

Figure 9: Microfit 4.0 output for the estimated error correction representation

```
         Error Correction Representation for the Selected ARDL Model
       ARDL(2,0,1,0,0,0,0) selected based on Schwarz Bayesian Criterion
*****************************************************************************
 Dependent variable is dLME
 49 observations used for estimation from 1962 to 2010
*****************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 dLME1                      .20760             .067183             3.0901[.004]
 dLGDP                      .60983              .15419             3.9550[.000]
 dLNME                      .22406              .15461             1.4492[.156]
 dLTRADE                    .24372             .098950             2.4630[.019]
 dLPOP                     -2.6016              .74295            -3.5017[.001]
 dLNATO                    -.43524              .25972            -1.6758[.102]
 dLUSA                      .23429             .088629             2.6435[.012]
 dWAR                       .15487             .075035             2.0639[.046]
 dPARTY                    .016395             .017430              .94063[.353]
 dD2010                     .35008             .051707             6.7705[.000]
 dC                        42.7935            13.2996             3.2177[.003]
 ecm(-1)                   -.77484             .089352            -8.6717[.000]
*****************************************************************************
 List of additional temporary variables created:
 dLME = LME-LME(-1)
 dLME1 = LME(-1)-LME(-2)
 dLGDP = LGDP-LGDP(-1)
 dLNME = LNME-LNME(-1)
 dLTRADE = LTRADE-LTRADE(-1)
 dLPOP = LPOP-LPOP(-1)
 dLNATO = LNATO-LNATO(-1)
 dLUSA = LUSA-LUSA(-1)
 dWAR = WAR-WAR(-1)
 dPARTY = PARTY-PARTY(-1)
 dD2010 = D2010-D2010(-1)
 dC = C-C(-1)
 ecm = LME   -.78705*LGDP +   .11462*LNME   -.31454*LTRADE +   3.3576*LPOP +
 .56172*LNATO   -.30237*LUSA   -.19987*WAR  -.021159*PARTY   -.45181*D2010  -5
5.2289*C
*****************************************************************************
 R-Squared                      .86705   R-Bar-Squared                  .82273
 S.E. of Regression            .043177   F-stat.    F( 11,  37)   21.3429[.000]
 Mean of Dependent Variable    .017391   S.D. of Dependent Variable      .10255
 Residual Sum of Squares       .067112   Equation Log-likelihood        92.0057
 Akaike Info. Criterion        79.0057   Schwarz Bayesian Criterion     66.7089
 DW-statistic                   2.0133
*****************************************************************************
 R-Squared and R-Bar-Squared measures refer to the dependent variable
 dLME and in cases where the error correction model is highly
 restricted, these measures could become negative.
```

Table VI: Summary of the empirical literature on the determinants of military expenditure

Authors	Sample	Estimation method	Observations		Determinants													
					Economic						Geostrategic					Political		
					Income	Population	Economic openness	Government expediture	Price ratio	Lagged military expenditure	Security web	Allies	Threats	External conflict	Civil war	Ideology of the government	Democracy	Political regime	Election date
Hartley, K. and P. MacDonald (2010)	United Kingdom 1970-2008	Time series ARDL	Model 1 - Variables in levels	LR	(-)*			(+)*				(+)*		(+)*		(+)			
Dunne, J. P., S. Perlo-Freeman, et al. (2008)	98 LDC 1981-1997	Panel data regressions			(-)*	(-)*	(+)*				(-)*		(+)*	(+)*	(+)*		(-)*		
Nikolaidou, E. (2008)	EU15 1961-2005	Time series ARDL	SR		(+)*	(-)*						(+)*		(+)*					
			LR		(+)*	(-)*	(+)	(-)				(+)*		(+)*					
Solomon, B. (2005)	Canada 1952-2001	Time series ARDL	SR					(-)	(-)*	(+)*		(+)*							
			LR					(-)*	(-)*	(+)*		(+)*							

Table VI: Summary of the empirical literature on the determinants of military expenditure (cont.)

Authors	Sample	Estimation method	Observations	Determinants													
				Economic						Geostrategic					Political		
				Income	Population	Economic openness	Government expediture	Price ratio	Lagged military expenditure	Security web	Allies	Threats	External conflict	Civil war	Ideology of the government	Democracy	Political regime	Election date
Kollias, C. and S.-M. Paleologou (2003)	Greece 1960-1998	Time series ARDL	Model 1 SR	(+)	(+)						(+)*	(+)*	(+)*					
			Model 1 LR	(+)	(+)						(+)*	(+)*	(+)*					
			Model 2 SR	(+)*	(-)						(+)*	(+)*	(+)*		(+)*			(-)
			Model 2 LR	(+)*	(-)						(+)*	(+)*	(+)*		(+)*			(-)
Dunne, P. and S. Perlo-Freeman (2003)	LDCs 1981-1989 1990-1997	Static and dynamic panel data analysis	Fixed effects model	(0)	(-)*	(-)*				(-)		(+)*	(+)*	(+)*		(-)*		
			Dynamic effects model	(-)	(-)	(+)*			(+)*	(+)*		(+)*	(-)*	(0)		(0)		
Dunne, P. and S. Perlo-Freeman (2003)	LDCs 1981-1989 1990-1997	Cross section regression	Cold War 1981-1989	(-)	(-)*					(+)*		(+)*	(+)*	(+)*		(-)*		
			Post Cold War 1990-1997	(-)	(-)*					(+)*		(+)*	(+)	(+)*		(-)*		

Table VI: Summary of the empirical literature on the determinants of military expenditure (cont.)

Authors	Sample	Estimation method	Observations	Determinants														
				Economic						Geostrategic					Political			
				Income	Population	Economic openness	Government expediture	Price ratio	Lagged military expenditure	Security web	Allies	Threats	External conflict	Civil war	Ideology of the government	Democracy	Political regime	Election date
Dunne, J. P., E. Nikolaidou, et al. (2003)	Greece, Portugal and Spain 1960–2000	Time series ARDL	SR	(+)*	(-)	(+)*	(-)*				(+)					(-)*		
			LR	(+)*	(-)	(+)	(-)*				(+)*					(-)*		
Sezgin, S. and J. Yildirim (2002)	Turkey 1951-1998	Time series ARDL	SR	(-)*	(-)	(-)*	(+)		(+)*		(+)*	(+)*	(+)					
			LR	(-)*	(+)*	(-)*	(+)				(+)*	(+)	(+)					
Batchelor, P., P. Dunne, et al. (2002)	South Africa 1963-1997	Time series OLS		(+)*					(+)*				(+)*			(-)*	(+)*	
Barros, C. and J. G. Santos (1997)	Portugal 1950-1990	Time series OLS		(-)*	(-)				(+)				(+)		(+)			

Notes:
The signs (+) or (−) indicate a positive or negative impact on military expenditure and the asterisk (*) marks the statistically significant variables.
For the cases of ARDL estimations: LR = Estimated long-run coefficients and SR = Error correction representation (short-run estimates)
The results of Nikolaidou, E. (2008) and Dunne, J. P., E. Nikolaidou, et al. (2003) here presented are exclusively for Portugal