

## **THE DEMAND FOR MILITARY EXPENDITURE: EVIDENCE FROM THE EU15 (1961-2005)**

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### **Abstract**

Given the discussions in recent years towards the development of a Common European Security and Defence Policy (CESDP) in the European Union (EU), it is of great importance to investigate the determinants of military expenditure in this region. This paper employs the Autoregressive Distributed Lag (ARDL) approach to cointegration to estimate a general model of aggregate defence spending for each of the 15 core EU countries over the period 1961-2005. The findings indicate that there is very little uniformity in the factors that determine each country's demand for military expenditure, something that needs to be considered by policy makers.

### **1. Introduction**

In the defence economics empirical literature, an issue that has attracted a lot of research interest over the years has been the investigation of the demand for military expenditure. There are a wide variety of models of the demand for military expenditure based on different theories about the decision-making process and the influence of various military, political and economic factors (see Smith, 1977, 1989, 1995, 2007; Hartley and Sandler, 1990 and Sandler and Hartley, 2007 for a comprehensive review of the demand for military expenditure). Military factors (i.e. military spending of potential enemies, or of allies) are considered to be external influences on the demand for military expenditure, in which case it is represented by arms-race models or models of alliances. Internal influences include economic factors (income and prices, or even the need to stabilise demand and control public expenditure), political factors (lobbying by the Military Industrial Complex and other interest groups, or even the ideology of the government) and bureaucratic factors (bargaining over the budget starting from the status quo). As such, the demand for military expenditure is represented by public choice models, models of bureaucratic behaviour, or general models of aggregate defence spending in which all the above can be either incorporated or seen as special cases (Dunne, 1996).

There is a bulk of empirical work trying to investigate the factors that determine the demand for military spending. Some studies focus on individual countries while others focus on a group of countries and provide cross-sectional results or panel data estimates. And although panel data methods have been a trendy approach in recent years, there is a lot of criticism regarding the conclusions that arise from such methodologies – especially if the group of countries under consideration is not such homogeneous.

This paper extends the work undertaken by Dunne et al. (2003) on the demand for military expenditure in Greece, Spain and Portugal over the period 1961-2000 by focusing on the 15 core EU countries over the period 1961-2005. The aim is to provide empirical evidence for each of the 15 countries by estimating an aggregate model for the demand of military expenditure within an Autoregressive Distributed Lag framework (ARDL) where the data are allowed to determine the particular short-run dynamics. Knowledge of the specific economic, political and strategic features of each country will be taken into account when the empirical estimation takes place. In this way, the empirical analysis can be particularly valuable and informative, as it does not miss out important structural changes, as is usually the case with cross-sectional studies of large groups of countries. The 15 EU countries under consideration present a lot of diversity both in terms of their economic indicators and in terms of the pattern of their military spending, which points to the importance of individual estimates. We follow the ‘general to specific’ methodology in an attempt to end up with the best specification for each country but we also present the estimates of the general model.

The next section provides a brief background analysis of the 15 EU countries’ economies, defence spending and security considerations, followed by a discussion of the way demand for military expenditure can be modeled and the specification of a general model for the demand of military expenditure for the 15 countries. The fourth section then presents the data and the empirical results to end up with the final section presenting some conclusions.

## **2. Economic and Security Issues for the 15 EU Countries.**

The 1960s and early 1970s was a period of continuous growth and economic prosperity for the entire industrialised West. In the 1960s, the average growth rate of GDP for the 15 EU countries per annum was 5.48% with Greece enjoying the highest growth (9.31%) followed by Spain (7.91%) and Portugal (7%) while the UK experienced the lowest growth (3.02%) during the same period (see Table 1). The 1970s brought developments on the economic front for all countries given the world energy crisis and the subsequent international recession during 1974-75. In the 1970s the average growth rate of GDP for the 15 countries fell to 3.52% from 5.48% in the previous decade. The only country that managed to increase the growth rate during the 1970s was Ireland (5.02% in comparison to a 4.43% in the previous decade). The recession led most of the countries to negative growth

rates during 1974-75. The only countries that avoided the “below zero” growth during those years were Belgium, Spain, Ireland, the Netherlands, Finland and Sweden. The recession coincided with the collapse of the dictatorships in three countries, namely Greece, Spain and Portugal and in the case of Greece, 1974 was the year of the conflict with Turkey over Cyprus. After 1974 the Greek military burden has seen tremendous increases (reaching an average of 6.5% of GDP during the fifteen years following the conflict). But even after the end of the Cold War the Greek military burden has remained high in comparison to other EU countries because of the perceived threat from Turkey.

In the 1980s, the economic growth declined further for most of the countries (the average growth rate for the 15 countries during the 1980s was 2.64% in comparison to 3.52% in the previous decade). The only exceptions were Luxembourg (the most noticeable exception with the highest growth rate of 4.87% for the decade), Sweden (that had a slight increase in the growth rate from 1.98% to 2.02%) and the UK that experienced an average of 2.8% growth in comparison to 2.09% in the 1970s.

**Table 1. GDP growth for the EU Countries (%)**

	<b>1961-70</b>	<b>1971-80</b>	<b>1981-90</b>	<b>1991-2000</b>	<b>2001-2005</b>
<b>Austria</b>	4.96	3.83	2.39	2.47	1.53
<b>Belgium</b>	5.19	3.56	1.92	2.17	1.47
<b>Denmark</b>	4.76	2.38	2.03	2.51	1.41
<b>Finland</b>	5.11	3.71	3.21	2.25	2.32
<b>France</b>	5.93	3.49	2.40	2.00	1.53
<b>Germany</b>	4.73	2.86	2.35	2.07	0.75
<b>Greece</b>	9.31	5.17	0.76	2.45	4.63
<b>Ireland</b>	4.43	5.02	3.78	7.84	5.47
<b>Italy</b>	6.06	3.82	2.29	1.63	0.65
<b>Luxembourg</b>	3.78	2.87	4.87	6.22	3.38
<b>Portugal</b>	7.00	5.22	3.38	3.03	0.63
<b>Spain</b>	7.91	3.77	3.14	2.84	3.24
<b>Sweden</b>	4.65	1.98	2.02	1.92	2.24
<b>The Netherlands</b>	5.39	3.10	2.28	3.19	0.96
<b>UK</b>	3.02	2.09	2.80	2.51	2.38
<b>EU15 (average)</b>	<b>5.48</b>	<b>3.52</b>	<b>2.64</b>	<b>3.00</b>	<b>2.17</b>

*Source: Eurostat*

In the 1990s the average growth rate of GDP for the 15 countries was slightly improved reaching 3% in comparison to 2.64% of the previous decade. But among the 15 countries only seven (Austria, Belgium, Denmark, Greece, Ireland, Luxembourg and The Netherlands) managed to enjoy higher growth rates to those

of the previous decade. The most noticeable improvements in GDP growth during the 1990s have occurred in Ireland and Luxembourg (with an average growth rate in the 1990s of 7.84% and 6.22% respectively).

The average growth rate of GDP for the 15 EU countries over the years 2001-2005 has seen a slight decline (2.17% in comparison to 3% of the previous decade) with only four countries (Finland, Greece, Spain and Sweden) experiencing higher rates of growth in comparison to the previous decade.

If we consider each country's GDP per capita, given that it is considered to be a better indicator for the prosperity or level of development of a country, we observe that Luxemburg, Denmark, The Netherlands, Sweden and Austria are at the top end throughout the period examined while Greece, Spain and Portugal at the bottom end during the same period. Among the 15 countries, Ireland has managed to move from the bottom end of the EU prosperity rankings to the top end during the last two decades. It becomes obvious that there is a big discrepancy among the 15 countries as far as the level of development is concerned. Looking at each country's military burden (Table 2), we observe a similar situation. What is more interesting is that we cannot generalize saying that poorer countries dedicate less of their resources on defence or rich countries dedicate more resources on defence. There are poor countries that dedicate a significant percentage out of GDP for defence (Greece, Portugal) and rich countries with a very small defence burden (Luxembourg, Austria).

Table 2 provides data on the military burden for each of the 15 countries over the period 1961-2005. We attempt to categorize these countries in two groups: high defence spenders and low defence spenders based on whether their average burden over the period 1961-2005 is above or below 2.67% which is the average military burden for the 15 EU countries over the same period.

Given this we can classify the 15 EU countries as follows:

**High defence spenders:** Greece (5.05%), UK (4.39%), Portugal (4.11%), France (3.83%), Germany (2.93%), The Netherlands (2.89%), Sweden (2.86%).

**Low defence spenders:** Belgium (2.55%), Italy (2.42%), Denmark (2.17%), Spain (1.93%), Finland (1.63%), Luxembourg (0.97%), Austria (1.08%), Ireland (1.26%).

Among the big defence spenders, the UK and France are the only countries of the European NATO with the status of nuclear powers. Since becoming a nuclear power in 1960, France has placed a particular emphasis on its nuclear capabilities trying to modernizing them. Germany is also among the big defence spenders with a developed defence industry. Portugal had a high military burden for the years prior to 1974 and after that a dramatically decreased one. The reduction of the Portuguese military burden after 1974 is attributed to the end of the dictatorship but most importantly to the end of the Colonial Empire. As Barros (2002) mentions during the period 1960-1974 the Portuguese armed forces were engaged in various wars against liberationist forces in the African colonies. At that time the domestic defence industry was supplying arms and munition to the

army. However, the Portuguese defence industry (like the Greek defence industry) is small, inefficient and underdeveloped.

Exactly the opposite pattern is observed for Greece. The Turkish invasion of Cyprus in 1974 marked a huge increase in military burden which has remained high since then due to continuous disagreements and conflicts with the neighbouring country. So, Greece's military burden is the highest because of the security concerns. Since 1974, the Hellenic forces' primary mission has been to maintain a balance of power with Turkey, specifically deterring the infringement of Greek national interests and sovereignty and preventing a Turkish attack on the Greek-Cypriot part of Cyprus. In the 1990s there was a deep concern over the events in the Balkans (Yugoslavia's disintegration, the treatment of the Greek minority in Albania, etc). Initially these events seemed to add to the security concerns for Greece, but since none of these countries possessed large military establishments Greek defence policy and military planning was not affected.

**Table 2. Defence Spending as share of GDP (%)**

	<b>1961-70</b>	<b>1971-80</b>	<b>1981-90</b>	<b>1991-2000</b>	<b>2001-2005</b>	<b>1961-2005</b>
<b>Austria</b>	1.22	1.15	1.17	0.91	0.80	<i>1.08</i>
<b>Belgium</b>	3.20	3.05	2.95	1.62	1.30	<i>2.55</i>
<b>Denmark</b>	2.73	2.30	2.22	1.74	1.54	<i>2.17</i>
<b>Finland</b>	1.73	1.56	1.85	1.61	1.20	<i>1.63</i>
<b>France</b>	5.15	3.87	3.90	3.05	2.56	<i>3.83</i>
<b>Germany</b>	4.18	3.42	3.14	1.73	1.44	<i>2.93</i>
<b>Greece</b>	4.14	5.83	6.11	4.54	4.24	<i>5.05</i>
<b>Ireland</b>	1.32	1.52	1.47	0.99	0.72	<i>1.26</i>
<b>Italy</b>	3.11	2.52	2.25	1.99	2.04	<i>2.42</i>
<b>Luxembourg</b>	1.18	0.92	1.04	0.80	0.86	<i>0.97</i>
<b>Portugal</b>	6.76	5.09	3.13	2.42	2.18	<i>4.11</i>
<b>Spain</b>	1.94	2.03	2.66	1.48	1.14	<i>1.93</i>
<b>Sweden</b>	3.93	3.29	2.62	2.16	1.74	<i>2.86</i>
<b>The Netherlands</b>	4.00	3.24	2.99	1.97	1.64	<i>2.89</i>
<b>UK</b>	5.74	4.85	4.77	3.09	2.64	<i>4.39</i>
<b>EU15 (average)</b>	<b>3.36</b>	<b>2.98</b>	<b>2.82</b>	<b>2.01</b>	<b>1.74</b>	<b>2.67</b>
<b>NATO Europe</b>	<b>3.86</b>	<b>3.48</b>	<b>3.26</b>	<b>2.39</b>	<b>2.1</b>	<b>3.1</b>
<b>US</b>	<b>8.61</b>	<b>6.15</b>	<b>6.35</b>	<b>3.79</b>	<b>3.66</b>	<b>3.7</b>
<b>NATO</b>	<b>5.22</b>	<b>3.85</b>	<b>3.89</b>	<b>2.56</b>	<b>2.30</b>	<b>3.7</b>

*Source: SIPRI*

Spain's transition from a long period of dictatorship (the Franco regime) to parliamentary democracy (monarchy) took place in 1975, after Franco's death. The international isolation, autarky and stagnation that characterised Spain during the dictatorship dramatically changed after Spain acceded to the EC in 1986 (Story, 1995). One of Spain's major foreign policy objectives since the advent of democracy has been to increase its influence in Latin America. Spain has a special interest in this area because of historical ties and a common linguistic, cultural and religious heritage. In the post-Franco years, economic investment and diplomatic initiatives were added to the more nostalgic links between Spain and its former colonies (Solsten & Meditz, 1998).

When war broke out between Britain and Argentina over the Falkland islands (Malvinas) in the spring 1982, Spain supported Argentina's claim to the islands. Also, Spain took active part in the Contadora group, an association of Latin American republics seeking peaceful solutions to the bloody struggles in El Salvador, Guatemala and Nicaragua. Spain's long-established policy of neutrality ended with its conditional accession to NATO in 1982 which was confirmed by referendum in 1986. Defence spending remained well below the average for the alliance since then. In the early 1980s, Spanish defence industries were very successful in arms exports mainly because of the relatively small scale of Spain's own military orders. By 1987, it had risen to eighth rank as a world exporter with a number of clients in the Middle East and Latin America. But this changed after the changes in Eastern Europe in the late 1980s. After 1988, Spain enforced sales embargoes against countries accused of human rights violations (S.Africa, Chile, Paraguay), Warsaw Pact and other communist countries as well as active belligerents (Iran, Iraq), (Mollas-Gallard, 1992). For the period 1995-1999, Spain was twelfth in the ranking of countries with exports of major conventional weapons (SIPRI, 2000). As Castro (2001) claims the main demand for Spanish defence companies is the home market that's why the modernization of the armed forces is very important for them.

As far as the rest of the countries, they didn't have any serious strategic considerations during the period of examination, apart from some economic crises that are captured with dummies.

### **3. Modelling the Demand for Military Expenditure**

It becomes obvious that there are important differences among the 15 countries both as far as their military burden and their economic situation are concerned. There are countries that are economically weak and spend a lot on defence, countries that are economically strong that spend a lot on defence but also among the rich countries we identify those that spend a small percentage out of their GDP on defence and those that have a high military burden. This heterogeneity points to individual country analysis or grouping of similar countries.

The simple demand model developed in this section draws upon the neoclassical principle of maximising the social welfare function given security and budget constraints (see Smith (1980, 1989) for further details). It follows that the demand for a country's military expenditure can be modeled as:

$$\mathbf{M} = \mathbf{D} (\mathbf{Y}, \mathbf{Z}, \mathbf{P}_m, \mathbf{P}_c) \quad (1)$$

Where M is the military expenditure of a country and it is a function of economic variables (Y), political and strategic factors (Z), military price deflator ( $P_m$ ) and civilian price deflator ( $P_c$ ).

In empirical work, prices are usually dropped from the equation because either there is not a separate price deflator for military goods or because the two deflators move together. This practice has been recently criticized by Solomon (2004) who used the relative prices to estimate the demand for military expenditure in Canada. However, when there is no separate deflator for military goods (and this is the case for most of the countries in our sample) there is not much one can do. Based on the above considerations, the equation that best describes the determinants of military expenditures should incorporate economic, political and strategic effects all of which need to be specified and quantified. This leads to the following specification:

$$\mathbf{M} = \mathbf{M} (\mathbf{Y}, \mathbf{P}, \mathbf{G}, \mathbf{TB}, \mathbf{N}, \mathbf{Z}) \quad (2)$$

where:

M: military expenditure in constant 1998 mn US \$

Y: GDP in constant 1998 mn US \$

P: population (in '000s)

G: government expenditure (excluding military) in constant 1998 mn US \$

TB: share of trade balance (exports - imports of goods and services) in GDP

N: average military burden of NATO's European member states

US: US military burden

Z: Country-specific dummies and variables

Defence is considered a public good and conventional public finance theory suggests that the levels of military spending should be positively related to income. This should be captured by the positive coefficient of real GDP (Y). Population (P) is also introduced as a proxy variable to capture any scale public good effect<sup>1</sup> of military spending. If security is a public good it is unlikely to increase as population increases, or at least not in the same proportion. The inclusion of non-military government expenditure (G) in the model represents the economic burden of defence and is expected to enter the equation with a negative sign to account for the opportunity cost of defence. The share of the trade balance in GDP (TB) reflects the openness of the economy and its sign is ambiguous. For

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<sup>1</sup> Given the non-rivalness characteristic of defence, an increase in population need not lead to an increase in the quantity of defence supplied. There may nevertheless, be an increase in demand for a pure public good (like defence) if it has a high income elasticity of demand and if rising population reduces the tax cost faced by the median voter.

those countries that are members of the NATO alliance<sup>2</sup>, the inclusion of the alliance's military burden seemed reasonable in order to account for the spill-in effect. If the sign on the NATO variable (N) is positive, the country is a "follower", otherwise a "free-rider". For non-NATO members (Austria, Finland, Ireland, Sweden) the NATO variable was not included. Finally, the lagged value of the dependent (M) is introduced to account for inertia, such as hangover from previous expenditures or commitments to programmes (Dunne and Mohammed, 1995).

To account for the strategic and political factors that played an important role in military spending during 1961-2005 for all countries, a number of country specific dummies and variables are included. These dummies either capture strategic/political events that affected military spending positively or negatively or economic crises that led to reductions in defence spending. Specifically, one dummy variable is introduced for Greece to capture the perceived threat after the Turkish invasion in Cyprus in 1974. The dummy for the Turkish invasion of Cyprus is expected to be statistically significant with a positive sign, given the dramatic increase in the Greek military spending that year. For the case of Greece, also Turkey's military expenditures are introduced to see whether Greece's military expenditure depends on the "enemy's" military spending. A single dummy is introduced for Portugal to encapsulate the increased military burden prior to the collapse of the dictatorship and the end of the colonial wars. The dummy for Spain accounts for the increase in its military expenditure due to the war over the Malvinas (in 1982) and the export-led growth of the Spanish defence industry since the early 1980s. The year 1982 also coincided with Spain's membership of the NATO alliance.

#### **4. Data and Empirical Estimation**

Data on the military expenditures (both in levels and in shares of GDP) for the 15 EU countries, for the European NATO countries and for the US come from various SIPRI Yearbooks (1975, 1981, 1988, 1992, 2001 volumes), while the data on government expenditure, trade balance, population and GDP (in 1998 mn US \$) are from the EUROSTAT database. The non-military government expenditure variable was constructed by deducting the SIPRI military expenditure figure from the EUROSTAT general government expenditure figure.

Following Dunne et al. (2003), the proposed equation of the demand for military expenditure that is estimated over the period 1961-2005 for each of the 15 EU countries is:

$$M_t = M(M_{t-1}, Y, P, G, N, TB, Z) \quad (3)$$

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<sup>2</sup> Spain joined the alliance in 1982

Where:

$M_t$  is the lagged value of military expenditure;

Y is real GDP;

P is population;

G is government expenditure excluding military;

N is the share of military expenditure in GDP for the European NATO countries;

TB is the share of trade balance in GDP;

Z is the dummy for political or strategic changes

TUR is the Turkish military burden (relevant only for the case of Greece)

This model was estimated within the ARDL framework to cointegration over the period 1961-2005. The ARDL approach to cointegration allows for inferences on long-run estimates regardless of the stationarity properties of the series<sup>3</sup>. It is quite unclear whether one should use the levels, logarithms or shares of the variables (see Brauer (2003), Solomon (2004)). And although it is true that the use of shares allows us to avoid conversion problems, the interpretation of such results is not always clear. Furthermore, as Hartley and Sandler (1995) claim, the nature of the demand for military expenditure is better explained by the level variable. The present study estimated the aforementioned model for each country under three specifications, in levels, logarithms and shares of the variables. Non-nested tests suggested that the logarithmic transformation of the variables was preferred over the levels and shares specifications for all countries, and as such, these results are presented.

Before we follow the ‘general to specific’ methodology, we present the estimated long-run coefficients of the full model for each of the 15 countries on Table 3. As expected, the results show some variation across the countries. Specifically, the income variable appears to have a positive and significant effect on the demand for military expenditure in Greece, Portugal, The Netherlands, UK, Italy, Spain and Austria and an insignificant effect for the case of France, Germany, Sweden, Belgium, Denmark, Finland, Luxembourg and Ireland. Among the last set of countries where income appears to be insignificant as a determinant of military expenditure we find mostly resource-unconstrained countries. This may imply that once the countries have reached a certain level of defence spending further increases in income will leave defence spending unaffected.

As far as the public good effect of defence (captured by the negative coefficient of the population variable) is concerned, it is only verified in the case of Germany, Portugal and Finland. In Ireland, Luxembourg and Sweden the coefficient of the population variable is significantly positive suggesting that increases in population leads to increases in military spending.

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<sup>3</sup> See Pesaran and Shin (1999)

**Table 3. Estimated long-run coefficients**

Dependent variable LM										
	constant	LGDP	LPOP	LG	TB	NATO	US	DUM1	DUM2	T
<b>Austria (D64,D9305)</b>	10.41 (0.72)	<b>0.82</b> <b>(2.31)</b>	-1.46 (0.85)	0.04 (0.16)	<b>-0.03</b> <b>(2.25)</b>	N/A	N/A	<b>0.26</b> <b>(3.11)</b>	<b>-0.17</b> <b>(2.63)</b>	N/A
<b>Belgium (D92)</b>	-46.85 (0.57)	1.61 (0.87)	3.63 (0.37)	-0.06 (0.07)	-0.01 (0.65)	<b>1.04</b> <b>(2.49)</b>	-0.03 (0.57)	<b>-0.76</b> <b>(1.84)</b>	----	N/A
<b>Denmark</b>	-3.78 (0.63)	-0.02 (0.09)	0.86 (0.98)	<b>0.36</b> <b>(4.75)</b>	0.002 (0.44)	<b>0.11</b> <b>(2.63)</b>	<b>0.02</b> <b>(1.85)</b>	<b>-0.10</b> <b>(2.65)</b>	----	N/A
<b>Finland (D87, D9599)</b>	<b>235.53</b> <b>(2.18)</b>	0.30 (0.39)	<b>-30.00</b> <b>(2.15)</b>	<b>2.21</b> <b>(2.88)</b>	0.06 (1.68)	N/A	N/A	<b>-0.55</b> <b>(1.88)</b>	<b>-0.93</b> <b>(2.11)</b>	N/A
<b>France (D69,D00)</b>	1.99 (0.11)	<b>1.21</b> <b>(1.70)</b>	-0.66 (0.38)	-0.14 (0.29)	-0.02 (1.15)	0.28 (1.65)	0.01 (0.47)	<b>-0.35(D69)</b> <b>(2.61)</b>	<b>-0.22(D00)</b> <b>(2.18)</b>	N/A
<b>Germany (D91)</b>	<b>20.64</b> <b>(3.96)</b>	0.75 (1.62)	<b>-1.83</b> <b>(6.56)</b>	-0.06 (0.23)	-0.001 (0.17)	<b>0.21</b> <b>(1.91)</b>	<b>-0.04</b> <b>(2.23)</b>	<b>-0.24</b> <b>(2.52)</b>	---	N/A
<b>Greece (D74)</b>	-6.63 (0.72)	<b>1.43</b> <b>(12.39)</b>	-0.81 (0.73)	<b>0.39</b> <b>(2.40)</b>	<b>0.03</b> <b>(2.02)</b>	<b>0.41</b> <b>(3.80)</b>	<b>0.06</b> <b>(1.98)</b>	<b>0.43</b> <b>(3.61)</b>	---	<b>0.16</b> <b>(4.47)</b>
<b>Ireland</b>	<b>-33.9</b> <b>(3.74)</b>	-0.13 (0.86)	<b>4.83</b> <b>(3.55)</b>	0.23 (0.85)	<b>-0.02</b> <b>(4.55)</b>	N/A	N/A	<b>-0.30</b> <b>(4.44)</b>	---	N/A
<b>Italy (D80, D95)</b>	40.88 (1.57)	<b>1.4</b> <b>(2.42)</b>	-4.43 (1.50)	-0.17 (0.99)	0.005 (0.53)	0.12 (0.86)	0.007 (0.34)	<b>-0.21</b> <b>(2.12)</b>	<b>-0.19</b> <b>(2.02)</b>	N/A
<b>Luxembourg</b>	<b>-49.99</b> <b>(4.02)</b>	<b>2.82</b> <b>(3.85)</b>	<b>5.51</b> <b>(2.27)</b>	<b>-0.97</b> <b>(3.38)</b>	<b>-0.02</b> <b>(2.88)</b>	<b>1.80</b> <b>(3.38)</b>	<b>-0.11</b> <b>(1.75)</b>	-----	----	N/A
<b>Portugal (D6175)</b>	<b>18.49</b> <b>(2.71)</b>	<b>1.41</b> <b>(5.55)</b>	<b>-3.00</b> <b>(4.31)</b>	-0.02 (0.16)	0.004 (0.11)	<b>0.22</b> <b>(2.58)</b>	<b>0.07</b> <b>(3.43)</b>	<b>0.46</b> <b>(3.74)</b>	----	N/A
<b>Spain (D7805)</b>	-2.68 (0.12)	<b>1.42</b> <b>(2.45)</b>	-0.52 (0.17)	-0.33 (1.50)	0.003 (0.34)	<b>0.72</b> <b>(6.46)</b>	-0.02 (0.68)	<b>0.80</b> <b>(5.32)</b>	---	N/A
<b>Sweden (D96, D7678)</b>	<b>-53.36</b> <b>(4.29)</b>	-0.07 (0.42)	<b>7.71</b> <b>(4.75)</b>	<b>-0.62</b> <b>(4.99)</b>	<b>-0.02</b> <b>(5.78)</b>	N/A	N/A	<b>-0.34</b> <b>(5.59)</b>	<b>0.15</b> <b>(4.34)</b>	N/A
<b>The Netherlands</b>	29.90 (1.04)	<b>1.90</b> <b>(2.31)</b>	-5.13 (1.29)	0.25 (0.59)	0.005 (0.40)	<b>0.33</b> <b>(1.78)</b>	<b>0.06</b> <b>(2.10)</b>	----	----	N/A
<b>UK(D81,D91)</b>	-16.69 (0.49)	<b>0.89</b> <b>(2.19)</b>	0.91 (0.28)	0.27 (0.80)	-0.008 (0.86)	<b>0.57</b> <b>(4.29)</b>	0.03 (1.19)	<b>-0.20(D81)</b> <b>(2.09)</b>	<b>0.31(D91)</b> <b>(3.54)</b>	N/A

Surprisingly, the ‘crowding-out’ effect of defence (captured by the negative coefficient of the non-defence government expenditures) applies only to the case of Luxembourg and Sweden indicating that in these countries increases in other non-defence government expenditure (health, education) lead to cuts in defence spending. Even more surprising is the result for Greece and Denmark where the coefficient is significantly positive. A possible explanation for Greece could be that whenever there are increases in non-defence government expenditures there are also increases in defence even if this means deterioration of the budget deficit.

The share of trade balance in GDP has a significant negative effect on the demand for military expenditure in the case of Austria, Ireland, Luxembourg and Sweden which is not a surprise given that these countries have a trade surplus. For Greece, the trade balance variable has a significantly positive effect on the demand for military expenditure which may imply that increases in trade deficit lead to increases in defence spending.

As far as the European NATO variable is concerned, it appears that only France, Italy and Luxembourg are not ‘followers’ of the alliance given the insignificant

coefficient. All other members (Belgium, Denmark, Germany, Greece, Portugal, Spain, The Netherlands and UK are ‘followers’ of the European NATO. Among the NATO countries, France, Denmark, Greece, Portugal and the Netherlands are also ‘followers’ of the US while Germany is the only country that behaves as a ‘free-rider’ in the long-run.

Following the ‘general to specific’ methodology and after various specification searches and testing exclusion restrictions, we end up with the following equations that best explain military spending in each of the 15 EU countries both in the long-run and in the short-run.

### ***Portugal***

The long-run estimates:

$$M = 18.91 + 1.38 Y - 3.03 P + 0.22 N + 0.08 US + 0.48 D6175$$

(3.25) (12.53) (4.81) (2.81) (3.68) (5.24)

The error correction representation is:

$$dM = 12.94 + 0.94 dY - 2.07 dP + 0.33dN + 0.05dUS + 0.33D6175 - 0.68 ECM(-1)$$

(2.61) (7.99) (3.53) (4.68) (3.51) (6.82) (8.59)

$$R^2=0.84, DW=2.03$$

$$X^2(1)=0.32, X^2(1)=1.99, X^2(2)=1.55, X^2(1)=0.06$$

### ***Spain***

The long-run estimates:

$$M = 14.92 + 1.60 Y - 2.83 P + 0.80 N + 0.75 D8205$$

(0.75) (3.25) (1.13) (7.87) (5.95)

The error correction representation is:

$$dM = 8.5 + 0.91 dY - 1.61 dP + 0.46dN + 0.43D8205 - 0.57 ECM(-1)$$

(0.81) (4.20) (1.27) (7.42) (6.78) (6.26)

$$R^2=0.68, DW=1.81$$

$$X^2(1)=0.16, X^2(1)=2.79, X^2(2)=2.27, X^2(1)=0.06$$

### ***Greece***

The long-run estimates:

$$M = -13.34 + 1.45 Y - 0.28G + 0.02TB + 0.43 N + 0.06 US + 0.15TK + 0.43 D74$$

(14.99) (13.09) (3.43) (1.87) (4.32) (1.86) (4.52) (3.60)

The error correction representation is:

$$dM = -9.12 + 0.99dY - 0.19dG + 0.007TB + 0.01TB1 + 0.30dN - 0.009dUS + 0.10T + 0.29D74 - 0.68ECM(-1)$$

(5.16) (5.46) (2.75) (0.98) (2.14) (2.97) (0.37) (4.93) (4.46) (6.17)

$$R^2=0.77, DW=1.90$$

$$X^2(1)=0.13, X^2(1)=2.91, X^2(2)=2.69, X^2(1)=0.23$$

**Sweden**

The long-run estimates:

$$M = -53.36 + 0.07 Y + 7.71 P - 0.62 G - 0.02 TB - 0.34 D96 + 0.15D7678$$

(4.29) (0.42) (4.75) (4.99) (5.78) (5.59) (4.34)

The error correction representation is:

$$dM = 40.68 - 0.06dY + 5.87dP - 0.47dG - 0.02dTB - 0.009dTB - 0.26D96 + 0.11D7678 - 0.76ECM(-1)$$

(3.96) (0.42) (4.31) (4.47) (4.51) (2.67) (5.98) (3.86) (8.22)

$$R^2 = 0.76, DW = 1.62$$

$$X^2(1) = 2.09, X^2(1) = 1.01, X^2(2) = 4.20, X^2(1) = 0.20$$

**Ireland**

The long-run estimates:

$$M = -40.94 - 0.06 Y + 5.87 P - 0.02TB - 0.32 D8789$$

(10.64) (0.44) (9.43) (5.31) (4.80)

The error correction representation is:

$$dM = -30.33 - 0.74dY + 1.01dLY1 + 4.35dP + 0.001dTB - 0.23D8789 - 0.74ECM(-1)$$

(5.59) (1.78) (2.15) (5.35) (0.28) (4.86) (6.46)

$$R^2 = 0.67, DW = 1.81$$

$$X^2(1) = 0.34, X^2(1) = 7.37, X^2(2) = 0.03, X^2(1) = 1.82$$

**Austria**

The long-run estimates:

$$M = -1.72 + 0.78 Y - 0.03 TB + 0.29 D64 - 0.22 D9305$$

(2.80) (15.17) (3.00) (3.56) (6.49)

The error correction representation is:

$$dM = -1.17 - 0.16Y - 2.08dY1 - 0.003dTB + 0.19D64 - 0.15D9305 - 0.68ECM(-1)$$

(2.42) (0.34) (4.81) (0.41) (3.85) (4.89) (6.92)

$$R^2 = 0.70, DW = 2.11$$

$$X^2(1) = 0.43, X^2(1) = 0.11, X^2(2) = 2.24, X^2(1) = 0.18$$

**Finland**

The long-run estimates:

$$M = 235.53 + 0.30 Y - 30.00 P - 2.21 G + 0.06 TB - 0.55 D87 - 0.93D959$$

(2.18) (0.39) (2.15) (2.88) (1.68) (1.88) (2.11)

The error correction representation is:

$$dM = 54.10 + 0.07dY - 6.89dP - 0.51dG + 0.01dTB - 0.40dM1 - 0.13D87 - 0.21D959 - 0.23ECM(-1)$$

(3.82) (0.40) (3.75) (3.85) (2.40) (3.58) (2.58) (3.61) (2.65)

$$R^2=0.61, DW=1.83$$
$$X^2(1)=0.40, X^2(1)=0.12, X^2(2)=11.33, X^2(1)=0.26$$

### **Denmark**

The equation that best explains the Dannish military spending in the long-run is:

$$M = 2.08 + 0.13 Y - 0.33G + 0.15 N - 0.11 D73$$

(2.03) (0.92) (4.77) (5.67) (3.58)

The error correction representation is:

$$dM = 1.58 + 0.10dY - 0.25G + 0.11dN - 0.09D73 - 0.76 ECM(-1)$$

(1.85) (0.94) (3.53) (4.92) (4.34) (6.83)

$$R^2=0.66, DW=1.91$$
$$X^2(1)=0.02, X^2(1)=0.35, X^2(2)=0.54, X^2(1)=0.39$$

### **Germany**

The long-run estimates:

$$M = 19.51 + 0.73 Y - 1.78 P + 0.22 N - 0.04 US - 0.36D91$$

(5.03) (6.39) (7.06) (3.07) (1.99) (3.29)

The error correction representation is:

$$dM = 10.50 + 0.39dY - 0.47dP + 0.12dN - 0.02 dUS - 0.19D91 - 0.54 ECM(-1)$$

(4.51) (3.79) (2.53) (2.54) (2.07) (4.65) (5.27)

$$R^2=0.64, DW=2.27$$
$$X^2(1)=3.49, X^2(1)=1.47, X^2(2)=1.71, X^2(1)=1.34$$

### **Belgium**

The long-run estimates:

$$M = -15.91 + 1.76 Y + 0.94 N - 0.66D92$$

(5.86) (8.84) (9.42) (2.73)

The error correction representation is:

$$dM = -4.03 + 1.30dY + 0.24dN - 0.17D91 - 0.25 ECM(-1)$$

(4.20) (3.49) (4.92) (4.27) (4.58)

$$R^2=0.67, DW=2.25$$
$$X^2(1)=0.82, X^2(1)=2.30, X^2(2)=0.82, X^2(1)=0.17$$

### **UK**

The long-run estimates for the UK:

$$M = -7.69 + 0.95 Y + 0.27 G + 0.56 N + 0.03US - 0.81D81 + 0.32D91$$

$$(2.38) \quad (2.50) \quad (1.23) \quad (4.95) \quad (1.24) \quad (2.42) \quad (3.56)$$

The error correction representation is:

$$dM = -2.95 + 0.37dY + 0.11dG + 0.21dN + 0.01dUS - 0.09D81 + 0.12D91 + 0.29dM - 0.38ECM(-1)$$

(2.42) (2.45) (1.19) (4.38) (1.19) (2.52) (3.67) (2.44) (5.68)

$$R^2 = 0.60, DW = 1.70$$

$$X^2(1) = 1.83, X^2(1) = 0.10, X^2(2) = 0.92, X^2(1) = 0.60$$

### **France**

The long-run estimates:

$$M = -2.54 + 0.89 Y + 0.27N + 0.02 US - 0.31D69 - 0.18D00$$

(2.39) (12.63) (5.03) (1.08) (3.93) (2.74)

The error correction representation is:

$$dM = -0.71 + 0.25dY - 0.02dN + 0.02 dUS - 0.09D69 - 0.05D00 - 0.28 ECM(-1)$$

(2.23) (5.35) (0.52) (2.93) (4.54) (2.97) (5.93)

$$R^2 = 0.70, DW = 2.06$$

$$X^2(1) = 0.09, X^2(1) = 0.49, X^2(2) = 1.91, X^2(1) = 0.01$$

### **Luxembourg**

The long-run estimates:

$$M = -49.99 + 2.82Y + 5.51 P - 0.97G - 0.02TB + 1.80N - 0.11US$$

(4.02) (3.85) (2.27) (3.38) (2.88) (3.38) (1.75)

The error correction representation is:

$$dM = -20.05 + 0.18dY + 2.21dP - 0.07G - 0.01TB + 0.14dN - 0.40dN1 - 0.04dUS - 0.40ECM(-1)$$

(3.92) (0.52) (2.16) (0.33) (2.54) (1.06) (3.32) (2.36) (3.91)

$$R^2 = 0.63, DW = 2.19$$

$$X^2(1) = 0.84, X^2(1) = 1.32, X^2(2) = 1.85, X^2(1) = 0.62$$

### **The Netherlands**

The long-run estimates:

$$M = -6.72 + 1.11 Y + 0.46 N + 0.04 US$$

(3.13) (7.32) (6.04) (1.83)

The error correction representation is:

$$dM = -2.45 + 1.00dY + 0.17dN + 0.01 dUS - 0.30dM(-1) - 0.36 ECM(-1)$$

(3.33) (3.00) (4.77) (1.88) (2.54) (5.16)

$$R^2=0.54, DW=2.07$$
$$X^2(1)=0.38, X^2(1)=0.86, X^2(2)=0.45, X^2(1)=0.14$$

### *Italy*

The long-run estimates:

$$M = 22.74 + 0.71 Y - 2.06 P - 0.21 D80 - 0.23 D95$$
$$(1.94) \quad (6.09) \quad (1.70) \quad (2.25) \quad (2.62)$$

The error correction representation is:

$$dM = 11.19 + 0.35 Y - 1.01 P - 0.10 D80 - 0.11 D95 - 0.49 ECM(-1)$$
$$(1.83) \quad (3.48) \quad (1.62) \quad (2.77) \quad (3.00) \quad (4.31)$$

$$R^2=0.51, DW=2.07$$
$$X^2(1)=0.10, X^2(1)=0.22, X^2(2)=1.05, X^2(1)=0.04$$

Considering the error correction representation of the demand, the ARDL models for all countries have relatively high explanatory power and successfully pass all tests for serial correlation, functional form, normality and heteroskedasticity. Furthermore, most of the variables are significant and have the expected sign while the error correction term enters the equations with the expected negative sign.

For most of the countries, there is a significant positive effect of income (Y) on military spending suggesting that increases in income lead to increases in military spending. Specifically, income has a positive and significant effect for Portugal, Spain, Greece, Belgium, UK, The Netherlands, Austria, Germany, France, Luxembourg and Italy. The only countries where income does not have any significant effect on military spending are Sweden, Ireland, Finland and Denmark which indicates that income constraints have little impact in these countries.

The public good effect of defence is verified for the case of Portugal, Finland, Germany and Italy suggesting some cost sharing effect<sup>4</sup>. Non-military government spending (G) has a significant negative coefficient in the case of Greece, Sweden, Finland, Denmark and Luxembourg, suggesting that military spending will tend to crowd out other government spending. The trade balance variable is positive and significant for Sweden, Ireland, Austria, Luxembourg and the UK while its impact is negative and significant in the case of Greece and Finland.

Clearly, there are important strategic factors determining long run military spending. European NATO military spending (N) has a positive impact on the military expenditure for Portugal, Spain, Greece, Denmark, Germany, Belgium,

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<sup>4</sup> The non-exclusiveness and non-rivalness features of a public good like defence would suggest that an increase in population should not lead to increases in military expenditure, at least not proportionate increases

UK, The Netherlands which suggests that these countries are followers of the alliance both in the short-run and in the long-run. Furthermore, followers of the US both in the short and in the long-run appear to be Portugal and France while Greece is a US follower only in the long-run. Only Germany appears to be a free-rider as far as the US variable is concerned. The dummies for the strategic or economic events are all significant with the expected signs. For Greece, apart from the dummy for the Turkish invasion of Cyprus, the Turkish military burden has a significant positive sign suggesting that one of the major determinants of Greek military expenditure has been the perceived threat of war.

It becomes obvious that there are clear differences in the long and short-run determinants of military expenditure. What is clear is that both economic and strategic variables are important, but there are clear individual country specificities that are also important.

Clearly, a simple demand model that attempts to take into consideration major institutional and strategic factors can be a surprisingly successful means of modeling the determinants of military spending. The ECMs are well defined and provide interesting results for each of the countries. However, the specificities of the individual countries experience, both economic and strategic are important and make it difficult to draw common conclusions.

## **5. Conclusions**

This paper has provided an empirical analysis of the determinants of military spending in the EU15 countries. The fact that they all have had marked reductions in military spending after the end of the Cold War, and that they all have good time series data available make them an extremely interesting group of countries to study especially because of the recent discussions towards the development of a CESDP.

A relatively simple demand model provides a surprisingly useful basis for an investigation of the relative importance of strategic and other social and economic factors for the 15 countries. It also provides some interesting results. There are clear differences in the processes determining their military spending, both the long run and short run. Military spending appears to respond positively to output changes in both the short-run and in the long-run for most of the countries. As far as population changes are concerned there is diversity among the 15 countries, while there is evidence of a 'follower' behaviour of the European NATO by most countries. There is some evidence that military spending crowds out other forms of government spending in Greece, Sweden, Finland, Denmark and Luxembourg, in the sense that other government expenditures have a negative impact on military spending. It is also important to take account of the particular historical and institutional feature of the countries in modelling the demand for military spending. Using simple year dummies takes the analysis a surprisingly long way,

but future modelling efforts might benefit from finding more sophisticated ways of quantifying political and strategic factors.

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