Military Spending and Economic Growth in Greece, Portugal and Spain

J Paul Dunne
and
Eftychia Nikolaidou[1]

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Abstract:

Analysing the relationship between military spending and growth has been an important area of empirical research. Early studies focussed on large cross sections of countries, but criticisms of these led to a focus on case studies of individual countries and studies of groups of relatively homogeneous countries. Granger causality methods have also become common techniques for such analyses, both as single equation analyses and more recently, within a cointegrating VAR framework. This paper does two things. First it provides an empirical analysis of three of the EU's poorest, peripheral economies, namely Greece, Portugal and Spain. It also considers the range of available Granger causality techniques and compares their results. It finds that the results differ across the methods used, indicating the problems with earlier studies, and across the countries, indicating the problems of drawing inferences across even relatively homogeneous economies.

[1] Dunne is at School of Economics, University of the West of England, Bristol, BS16 1QT, UK, John2.Dunne@uwe.ac.uk and Nikolaidou is at City Liberal Studies, Thessaloniki, Greece, enikolaidou@city.academic.gr
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1. Introduction

In the post Cold War world the opportunity of reduced military expenditures may provide a means of improving the relative economic performance of a number of countries. This will of course only benefit the economies if military spending does not play a positive role in their economic development. Yet the economic effects of military spending remain a topic of considerable debate, despite the fact that it has been an important area of empirical research and has produced a large literature. The earliest studies following (?) were on large cross sections of countries, but criticisms of these led to a focus on case studies of individual countries and studies of groups of relatively homogeneous countries. The methods of analysis have also changed, from simple cross country correlation analyses to regression analyses and to more advanced time series methods (Dunne,1996). In recent years Granger causality methods have become common techniques for such an analyses, both as single equation analyses and more recently, within a cointegrating VAR framework. The increasing sophistication of the methods used has failed to lead to any clear result and the debate continues.

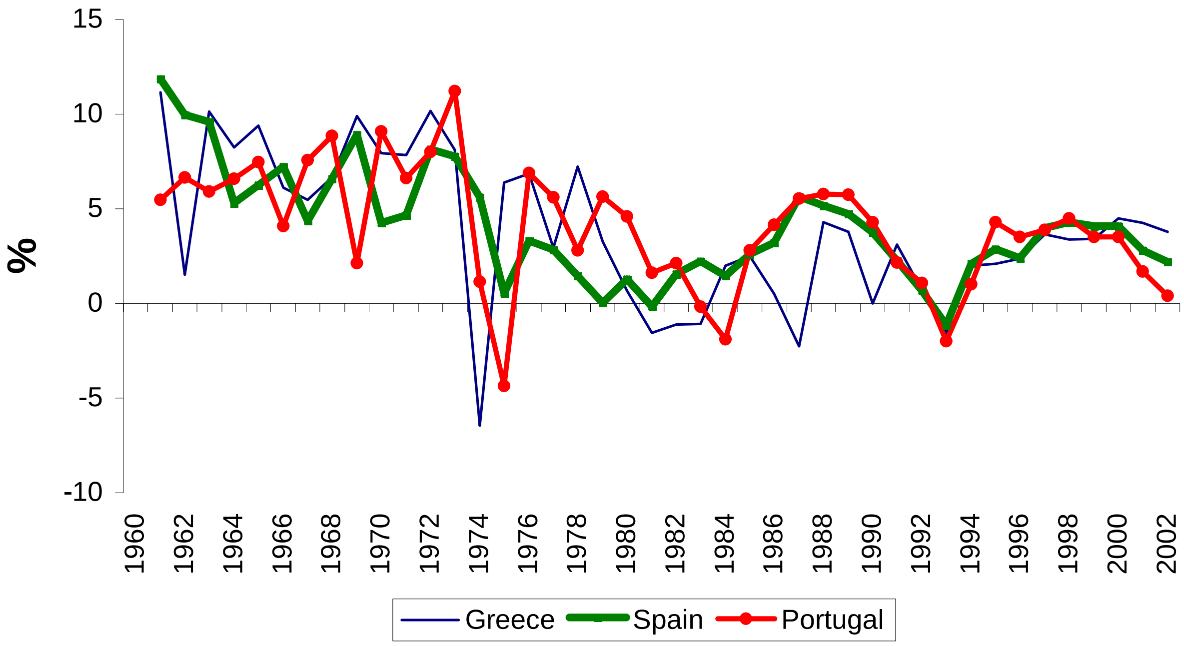
This paper makes a contribution to the ongoing debate by investigating the relation between military burden and growth for three relatively similar countries, the peripheral economies of the European Union, namely Greece, Portugal and Spain. They have the potential to benefit from improved security arrangements within the EU and Europe, which could allow them to reduce their military burdens. It uses Granger causality techniques and compares the results from the different methods. Section 2, provides an outline of the development of the three economies and of their military expenditures. Section 3 briefly discusses the defence-growth nexus, section 4 introduces the methods used and presents some results. Finally, section 5 presents some conclusions.

2. Greece, Spain and Portugal

Greece, Spain and Portugal make an interesting group of countries for analysis. They have all emerged from dictatorial rule, which in the case of the two Iberian countries, lasted for several decades and as Tsoukalis (1981) observed “had turned the three countries into observers of the international system". After more than a decade of uninterrupted growth in Western Europe, the recession of the mid-seventies also saw the collapse of the dictatorships in the three Mediterranean countries (mid-70s). The transition towards parliamentary democracy led to internal political and economic changes and a desire for international recognition. Starting with Greece the countries came to see membership of the European Community as a means of strengthening their economic and political situation. When they did join, their relative economic backwardness made them the poorest countries in the EU.

There are many similarities in terms of their economic performance but at the same time some differences in terms of the pattern of their military expenditure. Figure 1, shows the real growth of GDP for the three countries from 1960-2002, illustrating the similar patterns for the countries, with Spain performing slightly better over the period.

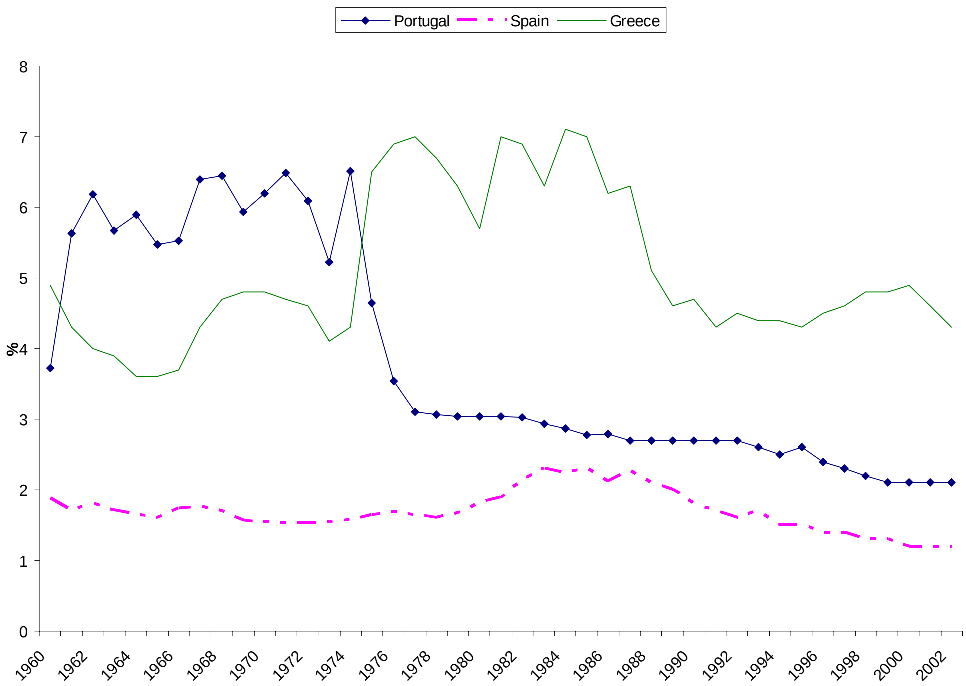
Figure 1. Real Growth of GDP for Greece, Portugal and Spain (%)*



*calculated from figures in 1995 mn Euros. *Source*: Eurostat

During the period 1960-1973 all three countries enjoyed higher rates of growth than the rest of the EC or even any individual member country, with low inflation and unemployment rates (Tsoukalis, 1981). This situation was soon followed by a period of both high inflation and unemployment, with unemployment particularly high in Spain. This depression in the early 1970s which coincided with the collapse of the dictatorships in all three countries (for Greece these coincided with the Turkish invasion of Cyprus as well), is reflected in the negative growth of GDP, reaching at around -5% for Greece and Portugal in 1974 and 1975, respectively, while Spain managed to avoid the "below zero" rate. This crisis led to a huge drop in investment for all the countries and substantial increases in Government debt after 1975, a problem that has become more serious over the last two decades, especially for Greece.

Figure 2. Military Burden for Greece, Portugal and Spain



Source: SIPRI

As Figure 2 shows there are clear differences in the evolution of the countries military burden. Spain had throughout the period the lowest military burden among the three countries, and it remained stable at around 2% of GDP, with a slight increase in the 1980s (due to the development of the arms industry and the expansion of production). But when it comes to Portugal and Greece, things are quite different. Clearly, 1974 was a critical year for both countries, as can be seen from Figure 2. Portugal had a high military burden (higher than Greece) for the years prior to 1974 and after that a dramatically decreased one. Exactly the opposite pattern is observed for Greece that before 1974 had a lower military burden compared to the years after 1974. The reduction of the Portuguese military burden after 1974 was attributed to the end of the dictatorship but most importantly to the end of the Colonial Empire. 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. These features are particularly important when analysing empirically the defence-growth relationship.

3. Analysing the Military Spending-Growth nexus

Most of the studies on the defence-growth relationship are based on the Neoclassical or Keynesian theoretical frameworks, which allow the development of consistent formal models. Neoclassical models concentrate on supply-side (modernisation, positive externalities from infrastructure, technological spin-offs), with the main empirical focus being the estimation of the Feder-Ram model[2]. Keynesian models concentrate on demand-side (crowding-out of investment, exports, education, health). In order to overcome the problem of concentrating on the demand or supply-side only, efforts to include both influences have been made. These models capture the demand-side influences in a Keynesian aggregate demand function and the supply-side ones in a growth equation, which is derived from a production function[3]. These models hypothesise possible direct effects of defence on growth through Keynesian demand stimulation and other spin-off effects and negative indirect effect through reductions in savings or investment. They usually include three or four equations one of which is a growth equation and the others a savings or investment equation, a trade balance ratio and a defence burden one. Although these models provide a more complete picture of the defence-growth relationship by accounting for the interrelationships between the variables, they have been criticised for not being strongly based on theory and thus, relying on more ad-hoc justifications.

An alternative approach, is to examine the series without developing a structural model. Using Vector Autoregressive (VAR) models has the advantage that they are dynamic specifications, free of economic assumptions imposed a priori. Thus, they allow for the testing of causal linkages without the need to first construct arguments and develop hypotheses justifying those linkages (Georgiou et al., 1996). Research into direction of statistical (Granger) causality between defence and growth has become a commonly used

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[2] See Biswas and Ram (1986), Alexander (1990), Mintz and Huang (1990), Mintz and Stevenson (1995), Sezgin (1996), Murdoch, Pi and Sandler (1997), Nikolaidou (1998), Batchelor et al. (2000). Dunne et al (2005) provide a critique.

method in the literature. Researchers, such as Kinsella and Chung (1998) and Dunne and Vougas (1999), began to develop the analysis to allow for long run information in the data. In their analysis of South Africa, Dunne and Vougas (1999) found that this changed the results from an insignificant positive Granger causality from military burden to growth to a significant negative one. They argued that failing to take account of the long run information led to misspecification of the estimating equation. But although they used a VAR framework for their analysis, they employed the Engle-Granger simple two-stage cointegration procedure and this has been superseded in the literature by the Johansen's cointegrating VAR framework. This paper uses this approach and compares it with the other two methods.

4. Methods

Within the literature there have been a number of approaches to using the concept of Granger causality to study the military spending growth nexus[4]. Such tests presume the use of stationary data and so augmented Dickey-Fuller (1979) unit root tests (ADF), using an autoregression that includes only an intercept or both an intercept and a linear trend are applied. The standard Granger causality test then assumes that the information for the prediction of the variables SM_t, the share of military spending in GDP, and Y_t, GDP, is contained only in the time-series data of these variables. The test involves estimating the following regressions:

$$Y_t = \sum_{i=1}^{k} \alpha_i SM_{t-i} + \sum_{j=1}^{k} \beta_j Y_{t-j} + u_{1t}$$

$$SM_t = \sum_{i=1}^{m} \lambda_i SM_{t-i} + \sum_{j=1}^{m} \delta_j Y_{t-j} + u_{2t}$$

The first equation postulates that current SM is related to past values of SM itself as well as of Y and the second postulates similar behaviour for Y. Generally, if SM Granger causes Y, then changes in SM should precede changes in Y. Therefore, in a regression of

[3] This framework was first developed by Smith and Smith (1980) and since then further developed by Deger and Smith (1983), Lim (1983), Faini, Annez and Taylor (1984), Deger (1986), Scheetz (1991), Chletsos and Kollias (1995), Antonakis (1997), Dunne et al (2000), Dunne and Nikolaidou (2001), Klein (2004).

[4] Granger causality studies include: Joerding (1986), Chowdhury (1991), Chen (1993), Kollias & Makrydakis (1997), Dunne et al (2001), Atesoglu (2002), Kollias et al (2004), Karagol and Palaz (2004).

Y on other variables (including its own past values) if we include past or lagged values of SM and it significantly improves the prediction of Y, then we can say that SM Granger causes Y and vice versa for SM. As mentioned, this analysis was developed to allow for long run information in the data, by testing for cointegration and if found introducing an error correction terms to the equations above (Dunne and Vougas, 1999).

In the analysis we follow other contributors in looking at the relation between output and military burden. This is not unproblematic as there is no specific underlying structural theoretical model and it is not clear what the identifying assumption should be. This means the results can be open to alternative theoretical interpretation[5].

It has been claimed (see Harris, 1995) that unit roots tests often suffer from poor size and power properties (i.e. the tendency to over-reject the null hypothesis of non-stationarity when it is true and under-reject the null when it is false, respectively). This has meant that in practical applications, it is quite common for there to be tests for cointegration even when the preceding unit root analysis suggests that the properties of the variables in the equation are unbalanced (i.e. they cannot cointegrate down to a common lower order of integration). This might be justified on the grounds that the unit root tests are not reliable, and consequently the variables may indeed all be, say, I(1). It is also not necessary for all the variables in the model to have the same order of integration. Using this approach, we test for a cointegrating relationship and if one exists, we impose restrictions on the vector and estimate the restricted Error Correction Models (ECMs)[6].

The reduced form of the system for Y and the share of military expenditure in SM for the three countries can be written in VECM (Vector Error Correction Model) form of a first order VAR (Vector Autoregression) specification (see Smith et al, 1999) as:

$$\Delta Y_t = \delta_{11} + \delta_{12} Y_{t-1} + \delta_{13} SM_{t-1} + u_{1t}$$

$$\Delta SM_{2t} = \delta_{21} + \delta_{22} Y_{t-1} + \delta_{23} SM_{t-1} + u_{2t}$$

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[5] For example, the identifying assumption could be that the income elasticitity of demand for military expenditure was unity and so the results were supply effects. On the other hand it could be argued that the results reflect differences of the elasticity from one.

[6] Studies using these techniques include Birdi and Dunne (2002), Kollias et al (2004)

where $E(u_{it}) = 0$, $E(u^2_i) = \omega^2_i$, $E(u_{it}u_{jt}) = \omega_{ij}$, $E(u_{it}u_{jt-s}) = 0$, where $s\neq 0$ and i, j =1,2. There will be Granger (1969) causality from Y to SM if $\delta_{22} \neq 0$ and from SM to Y if $\delta_{13} \neq 0$.

If the long-run relationship is $Y_t = \beta SM_t$, then the disequilibrium is measured by $z_t = Y_t - \beta SM_t$ and the VECM takes the form:

$$\Delta Y_t = \delta_{11} + \alpha_1 z_{t-1}$$

$$\Delta SM_t = \delta_{21} + \alpha_2 z_{t-1}$$

and the feedbacks are stabilising if $\alpha_1 < 0$ and $\alpha_2 > 0$.

5. Results

Our empirical analysis starts with an analysis of the three countries data, using the logarithm of GDP (Y_t) and the military burden (SM_t) for the period 1960-2002. Prior to applying Granger causality tests we need to establish the integration properties of the time series. We apply the Dickey-Fuller (1979) unit root tests (DF), using an autoregression that includes only an intercept or both an intercept and a linear trend. For Greece and Portugal (considering log GDP with an intercept and a trend and SM with only an intercept) the results are consistent, the null hypothesis of a unit root cannot be rejected for any of the series, but can be rejected for the first differences of the series, implying that the series are I(1). Spain gives rather different result, suggesting that both series are I(2), though this is marginal for SM[7]. Given these results we test for cointegration using the two stage Engle Granger procedure, estimating the levels regression for Greece and Portugal and the difference regression for Spain and testing the residuals for unit roots.

[7] For LGDP with trend and allowing up to 6 lags: The data for Greece gives ADF(1) = -2.56 with 95% critical value -3.54 and for LGDP differenced without trend -3.09 and -2.94 respectively (reducing the maximum lacks makes the rejection more straightforward); For Portugal ADF(4) = -2.95 with 95% critical value -3.54 and for difference without trend ADF(3) = -3.25 and critical value -2.94; For Spain ADF(2) = -2.77 with 95% critical value -3.54 and for difference without trend ADF(1) =-2.46 and critical value -2.94 and for second difference without trend ADF(1) -5.97and critical value -2.95
For SM without trend and allowing up to 6 lags: The data for Greece gives ADF(3) = -2.07 with 95% critical value -2.94 and for SM differenced without trend ADF(1) = -4.42 and critical value -2.94; For Portugal ADF(1) = -0.98 with 95% critical value -3.54 and for difference without trend ADF(1) = -4.96 and critical value -2.94; For Spain ADF(2) = -1.65 with 95% critical value -2.94 and for difference without trend ADF(1) =-2.44 and critical value -2.94 and for second difference without trend ADF(1) -5.02 and critical value -2.95.

The static model results and the ADF test results (with t ratios in parentheses) are:

For Greece: $Y_t = 10.42 + 0.13\, SM_t + \varepsilon_t$
$(35.20) \quad (2.30)$
$ADF(0) = -0.132$, 95% critical value -3.51

For Spain: $DY_t = 13.36 - 0.35\, DSM_t + \zeta_t$
$(33.93) \quad (1.54)$
$ADF(0) = -2.18$, 95% critical value -3.51

For Portugal: $Y_t = 11.69 - 0.25\, SM_t + \theta_t$
$(110.6) \quad (9.86)$
$ADF(0) = -2.18$, 95% critical value -3.51

(t-ratios in parentheses)

In all cases the DF test is chosen which tests the restriction ρ=0 in a regression of the form:

$$\Delta u_t = \alpha + \rho u_{t-1} + \varepsilon_t$$

Where u_t is the estimated residual. Thus the failure to reject the null hypothesis means that u_t is not I(0) and so the hypothesis of a unit root cannot be rejected. This means surprisingly that there is no evidence of cointegration for any of the countries

Before testing for Granger causality there is another issue we should deal with. The pattern of the country data suggest that we need to consider the possibility of structural breaks and we attempt to deal with these using dummy variables. Specifically, for Greece a dummy is required for 1974, the year of the Turkish invasion of Cyprus, for Portugal a dummy for the period 1960-1974 (the period of the dictatorship which was accompanied by increased military spending) and for Spain a dummy for 1982-88 (during this period war broke out between Britain and Argentina over the Falkland islands and Spain supported Argentina's claims, it took active part in Condadora group and was very successful in arms exports to Middle East and Latin America).

Estimating a general first order model in error correction form:

$$\Delta Y_t = a_0 + a_1\, \Delta SM_t + \alpha_2\, Y_{t-1} + \alpha_3\, SM_{t-1} + a_4 D_t + u_t$$

$$\Delta SM_t = \beta_0 + \beta_1\, \Delta Y_t + \beta_2\, SM_{t-1} + \beta_3\, Y_{t-1} + \beta_4\, D_t + \varepsilon_t$$

gave rather poor results. Testing the exclusion restrictions $a_1 = a_3 = 0$ on the first equation and $\beta_1 = \beta_3 = 0$ on the second suggested no Granger causality either way for Greece, only from Y to SM for Portugal and both ways for Spain until the second difference form was used[8].

Moving on to use the preferable cointegrating VAR approach we test for the order of the VAR[9]. Starting with a VAR(4) in growth, military burden and the relevant dummy variable suggested that we should have a VAR(2) for Greece, a VAR(1) for Portugal and a VAR(1) in differences for Spain. Starting with Greece the cointegrating VAR procedure with unrestricted intercepts and restricted trends gave results for the Likelihood ratio tests that reject the null hypothesis of no cointegration in favour of the alternative of one cointegrating vector, with the Schwarz selection criterion concurring. Estimating the VECM gives a long-run solution where military burden has a significant positive effect on log output, with a significant positive trend:

$$\underset{}{Y} = \underset{(3.58)}{0.255\,SM} + \underset{(6.83)}{0.042\,Trend}$$

the error correction models are:

$$\Delta Y_t = \underset{(3.48)}{-\,0.526} + \underset{(1.94)}{0.231\,\Delta Y_{t-1}} + \underset{(2.10)}{0.015\,\Delta SM_{t-1}} + \underset{(3.63)}{0.062\,Z_{t-1}} - \underset{(5.28)}{0.143\,D74_t}$$

R^2 =0.58; SER=0.02; DW=1.64

$$\Delta SM_t = \underset{(4.43)}{-11.866} - \underset{(3.95)}{8.326\,\Delta Y_{t-1}} + \underset{(1.32)}{0.170\,\Delta SM_{t-1}} + \underset{(4.49)}{1.361\,Z_{t-1}} - \underset{(0.35)}{0.169\,D74_t}$$

R^2 =0.41; SER=0.45; DW=2.14

(t-ratios in brackets)

Imposing the restriction that the coefficients of ΔSM_{t-1} and Z_{t-1} in the first equation are zero was rejected by the Wald test, $\chi^2(2) = 15.97$ [.000] and similarly for ΔY_{t-1} and Z_{t-1} in the second equation with $\chi 2(2) = 24.49$ [.000]. This suggests there is Granger causality from military burden to growth and vice versa. The short run effect of military burden on growth is positive, but the equilibrium adjustment will be negative. However, the coefficients on

[8] LR tests for Granger causality from SM to Y gave for Greece Portugal and Spain, with p values in brackets: 2.5 (.28); 4.20 (.12); 13.37 (.00) and from Y to SM 0.70 (.74); 8.7 (.01); 15.92 (.00). Results for Spain for second difference form were 0.30 (.86) and 0.81 (0.6) respectively.

[9] Since the Engle Granger test uses the residuals of an OLS regression, it relies on an arbitrary choice of normalisation. The more sophisticated VAR approaches use systems of equations that treat variables symmetrically.

the error correction terms are both positive, which implies the feedbacks are not stabilising and raising concerns about the specification..

Moving on to Portugal, we find one cointegrating relation suggested by the tests and selection criteria and estimating a cointegrating VAR with unrestricted intercepts and restricted trends gives a long-run solution:

$$\underset{(2.28)}{Y = 0.675\, SM} + \underset{(0.47)}{0.060\, Trend}$$

and error correction model results:

$$\Delta Y_t = \underset{(0.5)}{-0.034} \underset{(0.9)}{-0.008\, Z_{t-1}} + \underset{(2.9)}{0.048\, D6074}$$

$R^2 = 0.31$; $SER = 0.03$; $DW = 1.64$

$$\Delta SM_t = \underset{(11.6)}{-0.803} - \underset{(11.4)}{1.066\, Z_{t-1}} + \underset{(11.8)}{1.98 D6074}$$

$R^2 = 0.79$; $SER = 0.27$; $DW = 2.03$

In the growth equation, the restriction that the coefficient of Z_{t-1} is zero cannot be rejected $\chi^2(1) = 0.812$ [.367], while for the growth equation it can $\chi^2(1) = 129.11$ [.000], suggesting Granger causality from growth to military burden, but not the other way round.

Moving on to the Spanish data, with unrestricted intercepts and restricted trends, the results suggest the existence of one cointegrating relationship in the differences. The long run relationship is:

$$\Delta Y = \underset{(2.95)}{-0.524\, \Delta SM} - \underset{(3.4)}{0.002\, Trend}$$

With the error correction model results:

$$\Delta\Delta Y_t = \underset{(0.07)}{-0.0003} + \underset{(0.91)}{0.056\, Z_{t-1}} + \underset{(1.69)}{0.014\, D8288}$$

$R^2 = 0.07$; $SER = 0.02$; $DW = 2.33$

$$\Delta SM_t = \underset{(6.10)}{0.163} - \underset{(7.11)}{2.22\, Z_{t-1}} + \underset{(0.92)}{0.038\, D8288}$$

$R^2 = 0.15$; $SER = 0.10$; $DW = 1.84$

For the growth equation, the restriction that the coefficient of Z_{t-1} is zero cannot be rejected $\chi^2(1) = 6.827$ [.363], but it can for the military burden equation, $\chi^2(1) = 50.56$

[.000], suggesting Granger causality from growth to the change in military burden, but not vice versa. A similar result to that for Portugal, though in the case of Spain we are dealing with I(2) variables.

Table 1. Summary of results (1960-2002)

Approach	Country	SM $\rightarrow$ Y	Y$\rightarrow$ SM
Regression	**Greece**	No	No
	Spain	No	No
	Portugal	No	Yes
Cointegrating VAR	**Greece**	Yes	Yes
	Spain	No	Yes
	Portugal	No	Yes

5. Conclusions

This paper has investigated the relationship between economic growth and military burden in the three peripheral countries of the European Union, Greece, Spain and Portugal. Their economic similarities and security differences make them an interesting object of analysis as they represent the relatively homogeneous groups of countries that much of the recent work in the area has focused. In the empirical analysis the paper also went beyond the usual tests of Granger causality used in the literature, adopting a VAR methodology and allowing for cointegration between the variables.

Unit root tests suggested that military burden and output, for Greece and Portugal, and the change in military burden and growth, for Spain, were all I(1). Using the Engle Granger two stage procedure to test for cointegration, by testing the residuals of the levels regression for a unit root, suggested that the series were not cointegrated. Adding dummy variables to deal with various security issues and estimating a dynamic model, only found evidence of Granger causality from output to military burden in Portugal. Adopting the cointegrating VAR framework, suggested single cointegrating relations for all three countries. There was evidence of Granger causality from military burden to output only for

Greece, though there was evidence for all three countries the other way. One reason why the Spanish data may be giving strange results is that unlike Greece and Turkey, Spain has seen little in the way of exogenous shocks, meaning there is little information in the data. It is, however, worth noting that these results are rather different to those found by Nikolaidou (1998b) on slightly shorter time period.

Overall, there is no general empirical conclusion that can be drawn as to the economic effects of military spending on these small industrialised economies. The results show the difficulty of making judgements even across a group of relatively homogeneous countries. They also illustrate the difficulties in using Granger causality analyses and suggest that it is important that the long run information in the data is taken into account. While the use of the cointegrating VAR methods is a considerable improvement on earlier methods, it is clear that the techniques must be used with care as results can be sensitive to changes in the sample period and to structural breaks. It is important to remember that the time series properties we find are for the data series in a particular time period, not the variable itself. Also, as we mentioned the practice of looking for Granger causal links between output and military burden can be problematic as the lack of a specific structural model makes identification difficult. It is difficult to interpret what the results mean, whether they are picking up demand or supply effects. Thus, while the literature may be improving technically it seems it is no closer to reaching a conclusion and will need to be more careful with underlying theory and data issues to move forward.

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