

DEMOCRACY AND MILITARY EXPENDITURES: A CROSS-COUNTRY ANALYSIS*

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Abstract - This paper analyses the provision of defense by governments. The main concern is to investigate whether political regimes affect military budgets. To do so, we perform a cross-section estimation of a military expenditures equation with data of 159 countries. We find a negative and significant relationship between democracy level and defense expenditures. As long as military activity crowds-out the resources available for non-military consumption, this result reinforces the desirability of democratic institutions.

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INTRODUCTION

The provision of military goods by governments is an important issue in the public finance literature. On the theoretical side, defense is perhaps the most typical public good, which makes it an interesting source of empirical information to test different types of public choice models. On the practical side, the importance of studying defense can be credited to the fact that, despite the end of the cold war in the beginning of the nineties, the shares of GNP's devoted to defense has never been so high. The reason why governments stick with large military budgets even in peace times, reducing the global availability of resources for consumption, is still a puzzling question. This paper investigates the determinants of military expenditures across countries. The idea is to use the cross section data of 159 countries to assess the impact of some key variables on the defense budget. Specifically, the paper analyzes whether the degree of democracy/autocracy of countries influence the military activity.

The first step is to set up a model of military purchases that takes into account the level of democracy. Using an explicit model not only ensures consistency to our findings, but also provides a better interpretation of the parameters. Theoretical models of defense have typically been constructed in two different ways. The first one is based on the median voter framework. Basically, these models assume that the level of military expenditures is defined through a referendum. Under certain conditions, this referendum results in the median choice, done by the median voter. Thus, it suffices to analyze the median voter's choice via its individual utility maximization problem. The second way in which military expenditures have been modeled moves away from this democratic device to the idea of a central decision-maker. The level of expenditures in defense is determined by a central planner who maximizes a welfare function, or its own discretionary utility function. Murdoch et al. (1991), test empirically the adequacy of these two types of models to explain the demand for military activities of members of the NATO alliance. Their result is that some countries abide by the central planner model, others by the median voter model, and others by neither.

In order to introduce the level of democracy in the theoretical model, we use a different structure. The idea is that the central authority maximizes a convex combination of the utility of the median voter and its own utility, with the weight parameter defining the degree of democracy. Thus, the more democratic a country is, the closest is the maximization problem to the median voter approach. Likewise, highly autocratic countries assign a higher weight to the utility of the central planner, moving the model towards the central decision-making framework.

The empirical studies about military expenditures have been using different econometric techniques. Smith (1989) uses time series data of UK and France to test an equation of demand for military goods. A cross-section analysis with data of developing countries is done by Maizels and Nissanke (1986). Alliances are also a recurrent theme in the literature of military expenditures. A great deal of concern has been paid, for example, to the public good and free riding nature of military expenditures within alliances. Murdoch and Sandler (1989) investigate the spill-over effect of the collective provision of defense by the NATO allies. Smith (1980) shows that in the cold war period, UK was a free rider on US military spending. Political factors have also attracted some attention, especially

the effect that military coups may have on the pattern of defense expenditures. Zuk and Thompson (1982) showed that the type of political regime – military, civilian, or mixed – does not help to predict defense spending. Still into the assessment of political issues, Garfinkel (1994) presents a theoretical model that solves the optimization problems of voters and political parties, concluding that political competition generates a negative bias on the nation's military expenditures. The main insight is that the electoral uncertainty of democratic regimes can induce cooperation between countries, lowering the defense expenditures and allowing a higher level of global non-military consumption.

The paper is organized as follows. Section II presents the theoretical model that ends up in an equation of military expenditures. In section III we use a cross-country data set to estimate the parameters of the military expenditures equation. Finally, section IV concludes the paper.

II. A Model of Military Expenditures

The crucial aspect in the analysis of resources allocation to the military sector is the public good nature of defense. In this regard, there are basically two different approaches. The first one is the median voter model, in which a referendum is used to decide the amount of expenditures directed to defense. A basic result in the public choice literature is that if the number of voters is odd and preferences are single-peaked, then the referendum results in the median choice done by the median voter (since an equal number of voters will be on each side of the median choice).¹ Therefore, the level of military activity can be defined simply by the maximization of the utility of the median voter. The second approach is based on the central decision-making idea. Rather than assuming a purely democratic mechanism, the military expenditure is defined by a central authority that plays the role of a rational actor. The central decision-maker maximizes some objective function subjected to appropriate constraints that define the space of feasible social outcomes. This objective function can be a normative welfare function, as well as a function that portrays the decision-maker's own private interests (in the case of a non-benevolent authority).

In this section we construct a theoretical framework that serves as the basis of our subsequent empirical section. Instead of using the median voter or the central authority approaches, we follow a different route, specifying an objective function that is a weighted mixture of the utility of the median voter and the utility of the central authority. The weights are defined by the degree of democracy of each particular country. The idea is that democratic countries tend to privilege the utility of the median voter and autocratic countries tend to privilege the utility of the decision-maker. This type of structure allows us to investigate together countries with different types of government.

We assume an economy with two goods, a private numeraire good, y , and a military public good, x . The price of the military good is p , and the numeraire good has its price normalized to the unity. There are I consumers (indexed by $i = 1, \dots, I$, with I being an odd number). Consumer i is endowed with w_{yi} units of the numeraire. Also, consumer i has preferences represented by the utility function:

$$u_i = u_i(y_i, s) \quad (1)$$

¹ See, for example, Mueller (1989).

where s defines what we call “security level”, which is a subjective measure of safety from foreign attacks. We assume that this perceived security depends on the amount of the military public good x , and on a measure e of the “strategic environment”, according to the function

$$s = s(x, e) \quad (2)$$

where $s_x > 0$ and $s_{xx} < 0$. The strategic environment can be proxied by many different variables. For example, e can be the level of military expenditures of neighbor or rival countries, the territorial extension of the country, or its engagement in wars in recent years. Intuitively, if for example my neighbor increases his military activity I’ll need a higher level of the military good to produce the same level of security. Likewise, a country with a large territory would need a larger military apparatus than a small country, to have the same security level, *ceteris paribus*. The recent involvement in wars may affect negatively the security level in the sense that wars tend to enhance rivalry. Thus, even if a satisfactory settlement was done, countries perceive a higher likelihood of wars in the future.

The utility of the central authority is given by

$$U = U(y, s) \quad (3)$$

where $y = \sum_{i=1}^I y_i$ is the overall consumption of the numeraire non-military good.

We assume that the utility functions of the consumers and of the central authority are strictly increasing in both arguments, strictly concave and twice-continuously differentiable. We also assume that consumers are not allowed to purchase individually the military good. Defense is fully provided by the government, and financed by a uniform tax share of τ over individual’s endowments of the numeraire. The balance of government expenditures and revenues requires that

$$px = \tau w_y \quad (4)$$

where $w_y = \sum_{i=1}^I w_{yi}$ is the overall endowment of the numeraire. Therefore, when the central authority chooses the optimal level of the military good, it univocally defines the level of taxation $\tau^* = px^*/w_y$. As we emphasized before, the central authority maximizes a composite function of its own utility and the utility of the median voter. Hence, the maximization problem is defined as follows.

$$\underset{y \geq 0, y_m \geq 0, x \geq 0}{Max} (1 - \alpha)U(y, s(x, e)) + \alpha u_m(y_m, s(x, e)) \quad (5)$$

$$\text{subject to: } y_m \leq (1 - \tau)w_{ym} \quad (6)$$

$$y + px \leq w_y \quad (7)$$

where the sub-index m indicates the median voter, and $\alpha \in [0, 1]$ is the weight of the median voter utility in the objective function. In a fully democratic country $\alpha = 1$, and the level of x is obtained through the maximization of the median voter’s utility. In a completely autocratic country $\alpha = 0$, and only the utility of the dictator matters. So, α can be interpreted as the degree of democracy of a particular country. With strictly monotonic preferences, we know that the constraints (6) and (7) hold with equality. Thus, we can substitute (4) on (6) to eliminate τ , and then insert the resulting expression together with (7) on (5). By doing that, the maximization problem becomes

$$\underset{x \geq 0}{Max} (1 - \alpha) U(w_y - px, s(x, e)) + \alpha u_m(w_{ym} - px w_{ym} / w_y, s(x, e)) \quad (8)$$

Since the sum of strictly concave functions is also strictly concave, the first order condition is necessary and sufficient for a maximum in this problem. Thus, we have

$$(1 - \alpha) [U_1(w_y - px^*, s(x^*, e))(-p) + U_2(w_y - px^*, s(x^*, e))s_x(x^*, e)] + \alpha [u_{1m}(w_{ym} - px^* w_{ym} / w_y, s(x^*, e))(-p w_{ym} / w_y) + u_{2m}(w_{ym} - px^* w_{ym} / w_y, s(x^*, e))s_x(x^*, e)] \leq 0 \quad (9)$$

(with equality if $x^* > 0$). The sub-indexes 1 and 2 denote the partial derivatives of the utility functions with respect to the consumption of the non-military good and the security level, respectively. Assuming a positive level of military activity in the optimum and rearranging terms, we have

$$s_x(\cdot) [(1 - \alpha) U_2(\cdot) + \alpha u_{2m}(\cdot)] = p [(1 - \alpha) U_1(\cdot) + \alpha u_{1m}(\cdot) w_{ym} / w_y] \quad (10)$$

Intuitively, expression (10) states that the optimal level of military activity x^* must be such that the marginal gain from an extra unit of the military public good (left-hand side) equates its opportunity cost, which is the reduction in utility that results from the foregone consumption of the private numeraire (right-hand side).

We cannot go further without making specific assumptions about the utility functions and the security function. However, expression (9) generates an equation relating the optimal choice x^* with the main variables, that can be stated as

$$x^* = x^*(\alpha, p, e, w_y, w_{ym}) \quad (11)$$

The goal in the next section is to estimate the parameters of equation (11) and investigate whether the independent variables significantly affect military purchases, and the direction of these effects.

III. Empirical Assessment

In this section, we estimate the military expenditures equation (11). To do so, we perform a cross-section estimation with data of the military purchases of a set of 159 countries. The analysis relies essentially on the data of the "Bureau of Arms Control", of the US State Department. This data set provides annual information of military activities for all the countries in the world, from 1987 to 1997. Instead of taking a specific year, or doing a panel data investigation, we calculate the time averages and use these averages as our cross-section information. For the monetary variables, like the level of military expenditures, GNP and GNP per capita, we obtain the averages of the values expressed in billions of US dollars of 1997. Throughout this time span of 11 years some countries were created and some others disappeared. The criteria adopted here is to include in the sample only the existing countries in 1997.²

² By that means, Soviet Union, Yugoslavia, Czechoslovakia, East Germany and Yemen (Aden) are excluded from the sample. New countries like Ukraine, Slovakia or Croatia are included in the sample, but time averages are calculated through a smaller time span (for example, 6 years for the ex-soviet republics). Some other countries are also excluded because of the very bad quality of data. These countries are Afghanistan, Bhutan, Equatorial Guinea, Eritrea, Liberia, Somalia and Turkmenistan.

Our main concern is to analyze the effect of the five independent variables established in (11) over the military expenditures. The overall wealth w_y can be proxied by the GNP. This is intuitive and straightforward: the GNP or any other measure of real income dictates the limits of military purchases that a country can afford. Finding a proxy for the median voter income, w_{ym} , is, however, a more controversial issue. Country-specific measures for the income of the median voter do not exist. Perhaps the best proxy for that would be the median income (although we cannot assert that these two measures are equal). But again, excepting some few countries, like US and Denmark, this information is not available at all. Murdoch et al. (1991) suggest two alternative proxies for the income of the median voter. The first one is the ratio of GDP and the number of employed workers in the economy, and the second one is the GDP per capita. Since income distributions are typically skewed to the right, these two proxies most likely overstate the true median voter income, if we consider the median income as the ideal proxy. In the absence of a better alternative, we adopt the second proxy suggested by Murdoch, but instead of GDP, we use the GNP per capita. Intuitively, a higher GNP per capita allows the median individual to consume more of all the goods, including security.

The price of military goods, p , is a key variable in equation (11). An obstacle here is that military price indexes are available only for a reduced number of countries. Also, the international comparison of price indexes would be a questionable procedure because the composition of Armies purchases differs widely between countries. The typical bundle of military goods purchased by African countries is certainly different from the US military consumption (implying that we would be comparing prices of different things). Therefore, we assume a constant price p between countries, excluding it from the set of independent variables.³

As we pointed out in section II, the strategic environment e can be proxied in different ways. Here, we choose the involvement in wars from 1980 to 1999. The idea is that recent engagement in wars would worsen the strategic environment, producing a downward shift in the function that relates security to the level of military expenditures. The implication is that a larger level of military goods would be required to deliver the same level of security.

We use the data of the “Center for Systemic Peace”, which provides a broad list of all the armed conflicts in the world in the post *II World War* period. Three categories of wars are selected for our analysis: civil wars, ethnic wars and international wars. Hence, three dummy variables are constructed, one for each kind of war. A value of 1 is attached to countries that participated of at least one war between 1980 and 1999, and a value of zero is assigned for the peaceful countries. Another dummy variable is created for the general participation in all the three types of armed conflicts.

The main concern of the paper is to investigate the relation between democracy and military expenditures. With that in mind, important and controversial issue here is how to measure the level of democracy of the countries. Political scientists have long been concerned with the assemblage of a nation democracy index. Perhaps the most famous and reliable attempt to quantify democracy performed so

³ Prices of military equipment do vary across countries, especially for strategic reasons. Indeed, we are solely assuming that this variation is not large enough to invalidate our findings related to the other variables.

far is the “Policy Project”. Basically, this project constructs a democracy index, ranging from –10 to 10. The more autocratic a country is, the closer from –10 is its evaluation. In the same way, highly democratic nations are close to 10. The index is available for almost all countries, covering a large period of more than one hundred years. Occasionally, a political change occurs and the country is not evaluated for some time. This is called a transition period.

This paper uses the data of Polity III (1998). For each country we took the period from 1987 to 1997 and calculate a weighted average of the values reported in the project. Hence, it is constructed an index of the average degree of democracy for this time span of 11 years. The good feature is that this average index turns out to be continuous (while the original discrete measure considers only round values, –10, –9, ..., 10).⁴ Yet, another transformation is required. The original index (as well as the 1987-97 average index) ranges from –10 to 10, while the democracy level defined in the theoretical model goes from 0 to 1. So, in order to obtain an empirical measure of democracy that fits the theoretical model, we need to normalize the average 1987-97 index by summing 10 to each observation and dividing the sum by 20.

Table 1 presents the results of the OLS estimation of the military expenditures equation. The regressions are run with the natural logarithm of military expenditures as the dependent variable. The regressors include a constant term, the GNP and the GNP per capita (both expressed in natural logarithms), the democracy level and the war dummies.

Columns 2 and 3 of the table show that the GNP and the GNP per capita are positively correlated with military expenditures. The coefficients are all significant at the level of 10% and in most of the cases are also significant at 5% and 1%. These results are somewhat expected. A higher GNP implies that the country can afford a higher aggregate consumption of all goods, including security. But more security means a higher optimal level of military goods. In terms of our theoretical model, a larger GNP allows the central authority to reach a larger level of utility. Likewise, a higher GNP per capita increases the budget set of the median individual, who will demand more security and consequently more military activity. The most interesting aspect is the low variability of the GNP coefficients and their high significances. The estimated coefficients are very close to one suggesting that GNP and military expenditures are unitary elastic. Hence, if an economy is 10% larger than the other, one can expect that its military expenditures will be very close to 10% larger as well. Also, a considerable part of the high R^2 statistics obtained in the first six regressions seems to be due to the GNP. When the GNP is excluded, in the last regression of Table 1, the R^2 is sharply reduced, from something around 92% to 46%.

The results for the war involvement dummies are also interesting. In the first regression it can be seen that the coefficient for the general war dummy is positive and highly significant, implying that countries that recently participated in wars in fact tend to spend more with defense. In the three subsequent regressions,

⁴ For example, in the original index, Nicaragua has the following measures: –1 from 01/01/1987 to 24/02/1990; 6 from 27/2/1990 to 31/12/1994; and 8 from 01/01/1995 to 31/12/1997. Therefore the weighted average index is: $t = [3(-1) + 5(6) + 3(8)] = 4.63$. To decide the index of a particular year in which a change occurred, we look for the value that prevails in the largest part of the year (for ex., in Nicaragua’s weighted average index, the year 1990 is considered as having the value 6, and not –1).

the general war variable is decomposed into dummies for specific types of war. Positive and highly significant coefficients are again obtained for the international and ethnic war dummies, but not for the civil war dummy. These results indicate that international and ethnic wars make countries purchase more military goods. Civil wars, however do not seem to affect defense expenditures.

Striking results are obtained for the coefficients of democracy level. As can be seen in column 4 of Table 1, they reveal a clear-cut negative relation between democracy and military expenditures. In almost all regressions, these estimates are significant at the 1% level. Hence, less democratic countries tend to spend more on military goods than the more democratic ones. In terms of the theoretical model presented in section II, this finding may be an evidence that the central authority appreciates security more than the median voter. In other words, for each level of consumption of the numeraire and of the military good, the ratio between the marginal utility of the military good and the marginal utility of the private good seems to be higher for the central authority compared to the median voter.

Our estimates give in fact an empirical support to Garfinkel (1994) theoretical findings about the relation between political uncertainty and defense budgets. The results presented in Table 1 reinforce the importance of democratic regimes as a way to reduce the wasteful and unproductive military spending, and use the proceeds to raise consumption of non-military goods.

IV. Conclusion

This paper investigates the determinants of military expenditures. The main concern is to assess empirically the effects of democratic institutions on the level on military spending. The theoretical model proposed in the paper makes a link between the two frameworks used in the literature to model the allocation of public goods, namely, the median voter and the central decision-maker approaches. The basic assumption is that the central authority decides the level of military activity based on the maximization of an objective function that is a weighted average of the utility of the median voter and the individual utility of the central authority. The level of democracy defines the weights. The more democratic a society is, the higher is the weight of the median voter on the objective function. This is an efficient way to introduce the democracy level in the theoretical model.

The estimation of the military expenditures equation is performed through a cross-section analysis with data of 159 countries. Ordinary Least Squares techniques are used to assess the effects of GNP, GNP per capita, recent participation in wars and the level of democracy on the defense expenditures. As expected, GNP and GNP per capita affect positively the military purchases, a result that is in line with the theoretical predictions. Recent involvement in international and ethnic wars seem to push the military activity up. This finding reinforces the idea that recent wars enhance rivalries, increase the fear of new conflicts in the future, and force countries to purchase more military gear in order to achieve a given level of security. Finally, the estimations point to a negative relation between the democracy level and the military activity. In this sense, the evidence found in this analysis suggests that the preservation and strengthening of democratic institutions may contribute considerably to the achievement of higher levels of global welfare. The perverse crowding-out effect that defense expenditures cause on the resources globally available for consumption tend to be minimized with democracies.

A possible suggestion for future research is to go through a more detailed treatment of the security equation $s = s(x, e)$. Specifically, a richer description of the strategic environment variable e would certainly pull interesting issues to the investigation. In the paper we proxied e as the engagement in past wars. But we believe that other proxies could increase the fit of the model even more. Using the level of military expenditures of neighbor or rival countries, for example, would bring an interesting game-theoretical character to the model that was not explored here.

TABLE 1:
Cross-Country Least Squares Estimation of The Military Expenditures Equation

Constant	GNP	GNP Per Capita	Democracy	War Participation				R ²
				General	International	Civil	Ethnic	
-4.133 *** (0.279)	0.968 *** (0.036)	0.174 *** (0.051)	-1.077 *** (0.183)	0.569 *** (0.116)				0.925
-3.665 *** (0.297)	0.993 *** (0.037)	0.099 * (0.052)	-1.109 *** (0.198)		0.508 *** (0.162)			0.918
-4.054 *** (0.311)	1.014 *** (0.037)	0.143 *** (0.054)	-1.301 *** (0.190)			0.244 (0.161)		0.914
-4.106 *** (0.290)	0.991 *** (0.036)	0.178 *** (0.053)	-1.360 *** (0.181)				0.556 *** (0.154)	0.920
-3.901 *** (0.296)	1.021 *** (0.037)	0.123 ** (0.053)	-1.350 *** (0.188)					0.913
-3.584 *** (0.266)	1.075 *** (0.029)		-1.209 *** (0.180)					0.910
-1.279 * (0.699)		1.073 *** (0.102)	-0.980 ** (0.467)					0.455

Note: Standard errors are in brackets. The symbols ***, **, and * denote significance at the levels of 1%, 5% and 10%, respectively. The regressions are run with GNP, GNP per capita and the level of military expenditures expressed in natural logarithm.

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