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THE VICIOUS CYCLE OF THE FOREIGN MILITARY DEBT

By

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Abstract

This paper aims at estimating first the effects of defense spending on the main determinants of growth, and second the extent to and the channels through which the military debt of Greece influences the overall debt burden of the country, and consequently the critical determinants of economic growth and development. Increased imports of sophisticated weapons and military equipment can be financed at the cost of investment (guns v. ploughshares), or/and at the cost of human capital formation (guns v. butter and chalk), or at the cost of increasing the foreign debt of the country. It is this last case which is investigated in this paper. Our empirical results indicate that whatever the necessity and the benefits of the security aspect of defense, its economic costs are quite substantial. The military as a claimant of resources has a negative and non trivial effect on physical capital accumulation, and human capital formation. Moreover, financing increased military imports through borrowing from abroad has a negative and significant effect on the determinants of growth and development.

Key Words: Defense Burden, Foreign Military Debt, Growth Rate, Investment, Education.

JEL Classification: H56, H63, F34.

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1. Introduction

This paper aims at estimating first the effects of defense spending on the main determinants of growth, and second the extent to and the channels through which the military debt of Greece influences the overall debt burden of the country, and, consequently, the critical determinants of economic growth and development.

Defense is a public good par excellence, and inevitably almost all of military expenditure (milex) comes from the government budget. Allocation of expenditures to procurement of sophisticated weapons and military equipment go, however, to a large extent to imports at the expense either of investment or/and of the current government spending or by increasing the external debt of the country. Since long-term growth rates are sensitive to budgetary or external imbalances, persistently high rates of military spending may contribute significantly to macroeconomic disequilibria.

Investigating these issues appears to be of particular interest given the increased defense priorities of today on the one hand, and the pressing needs to meet the strict requirements for the participation in the European Monetary Union on the other.

The recent disputes, conflicts and wars in the Balkans create a very unstable strategic environment in the area. Moreover, cumulative evidence suggests that Turkey has undertaken a wholesale attempt to overturn the power balance in the Eastern Mediterranean by increasing dramatically its military spending in the 90's, by displaying force through infringements and violations of Greece's air space and waters, and by raising revisionist claims against the post-war status quo in the Aegean.[1] Table 1 presents comparative figures on the overall defense spending of the two countries after 1980, Table 2 presents the respective milex figures for procurement of weapons and military equipment during the same period, and Table 3 presents the number of yearly incidents of violations of Greek air space and Greek territory since 1985.

The obvious divergence from the traditional levels of power balance in favour of Turkey during the last decade, forces Greece to increase the already high levels of its milex, and especially the one for procurement of imported weapons and military equipment. It is not yet clear whether the increase in military imports of approximately $1.5 billion per year, which was announced by the Greek government, will be at the cost of investment (guns v. ploughshares), at the cost of consumption (guns v. butter and chalk), or at the cost of increasing the foreign debt burden of the country. It is this last case which is investigated in this paper.

[1] See Balfousias and Stavrinos (1996), Platias (1997), and Stavrinos (1997) for an insight into the security problems and into the role of military power in managing the current defense priorities of Greece.

TABLE 1 : Yearly Military Expenditure of Greece and Turkey
(Millions of Constant 1990 Dollars)

	1980-84 (Average)	1985-89 (Average)	1990-93 (Average)	1994	1995
GREECE	3,820	4,028	3,763	3,778	3,893
TURKEY	3,765	4,212	5,720	6,173	6,379
GR/TUR (%)	101	96	66	61	61

Source : NATO, SIPRI*

TABLE 2 : Yearly Expenditure of Greece and Turkey on Procurement of Weapons and Military Equipment
(Milions of Constant 1990 Dollars)

	1980-84 (Average)	1985-89 (Average)	1990-93 (Average)	1994	1995
GREECE	665	743	845	922	771
TURKEY	343	776	1,295	2,173	2,405
GR/TUR (%)	1094	96	65	42	32

Source : NATO, SIPRI*

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TABLE 3 : Number of Yearly Incidents of Violations of Greek Air Space by Turkey Planes

	1985-89 (Average)	1990-93 (Average)	1994	1995	1996
Violations of Greek Air Space	363	365	695	523	1130
Overflying Greek Territorus	8	28	117	73	559
Total Number of Incidents	371	293	812	596	1689

Source : Ministry of Defense

TABLE 4 : Outstanding Foreign Military Debt and Total Public Debt of Greece.
(Millions of Current Dollars)

	1960	1970	1980	1990	1993	1994	1995	1996
Military Debt	17	214	1,261	4,474	3,620	3,809	4,369	3,995
Civilian Debt	126	714	4,204	20,682	25,118	30,478	31,153	34,400
Total Public Debt	143	928	5,465	25,156	28,738	34,287	35,522	38,395

Source : Bank of Greece

Borrowing from abroad in order to finance increased military imports may exert an adverse effect on both the domestic and the foreign sector: on the former due to the slow down of economic growth, and on the latter because of the burden on the balance of payments, which causes the need for more borrowing, thus creating a vicious cycle of an ever-increasing foreign debt. Table 4 presents the evolution of the outstanding foreign military debt and of the outstanding total foreign debt of the country.

In section 2 we present the econometric model which is used for the investigation of the impact of increased military debt on the critical determinants of economic growth and development, in section 3 we discuss the data and the empirical results, and in section 4 we present a summary of the findings of this paper.

2. The model

The model to be estimated consists of the following six behavioural equations:

$$g = g (k, e, m, mx) \quad (1)$$
$$k = k (g, m, f, p, c) \quad (2)$$
$$e = e (g, m, n, sb, yd) \quad (3)$$
$$m = m (g, pm, Nat, Tur) \quad (4)$$
$$mc = mc (g, pc, cd) \quad (5)$$
$$mm = mm (g, pm, md, m) \quad (6)$$

where:

g = the annual growth rate of real GDP,
k = the share of total investment in GDP,
e = the share of public education expenditure in GDP,
m= the share of military expenditure in GDP (military burden),
mc = the share of non-oil civilian imports in GDP,
mm= the share of non-oil military imports in GDP.

The full model, together with the identities and the list of the variables is given in the appendix.

The first three equations represent the domestic sector of the economy.

Equation (1) explains growth in terms of its main ingredients: accumulation of physical capital, public education expenditure as a proxy for the degree of mobilization of human resources, and the ratio of imports to exports as an index for the performance of the external sector. The military burden is included to account for the direct effects of military spending on

growth in the form of spin-offs.[2] In the classical framework of sufficient growth in demand, the level of savings constitutes the main determinant of growth. Assuming adequate demand for investment goods, savings are totally converted into investment. Sectoral allocation of investable goods and the choice of appropriate techniques are further determinants of the rate of growth on the supply side. It is, however, well-established in the literature that the lack of sufficient aggregate or intersectoral demand, and the level of absorptive capacity of the economy may constitute effective constraints to output expansion, especially in developing countries. A rise in savings may not be totally converted into productive investment either because of lack of sufficient domestic and foreign demand (Kaldor,1979) or / and the existence of extraneous constraints on the investment process, such as low profitability, the supply of skilled labour, administrative capacity, entrepreneurship, social compromise etc., which all together are termed «the absorptive capacity» of the economy.

This explains the presence of investment instead of savings in the growth equation which is thus taken to represent the production function of the economy. Human capital formation affects production and, therefore, the rate of growth of the economy. The variable for the human capital formation used in this case, is public education expenditure. As regards defense expenditure, this accounts for the direct effects of military spending on growth. These effects may be favourable or adverse. In fact, increased defense spending may bring about a direct positive effect on economic growth through increased capacity utilisation, production and employment, caused by Keynasian-type demand effects. These favourable effects, however, tend to be offset significantly by the indirect effects of military spending through capital formation, skilled labour supply and various other externalities which may adversely affect productivity and growth in the long run. The direct and indirect effects must be both considered in terms of an overall assessment of the impact of milex on growth. The first perspective in this assessment refers to the so-called "modernisation models", closely associated with the work of Benoit (1978). According to these, the main adverse effects of defense spending on growth are the following:

> **a. Investment effects:** Purchasing by the defense sector of domestic investment goods, or using foreign exchange to purchase imported goods, may lower the growth rate of the civilian output.

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[2] General surveys of the effects of military expenditure on growth and development are given in Cappelen et al (1984), Chan (1985, 1992), Mosley (1985), Lindgren (1988), Renner (1991), Isard and Anderton (1992), Pivetti (1992), UNIDIR (1993), E.C. (1994), Mintz and Stevenson (1995), and Ward et al (1995) among others. For comprehensive bibliographies in English see Klein et al (1995), Gleditsch et al (1994) and Hartley and Hooper (1990).

b. **Productivity effects:** The government sector shows no measurable productivity increases. Thus, an enlargement in defense spending shifts resources from the productive to the non-productive sector of the economy.

c. Income-shift effects: A shift of resources to defense reduces the size of the civilian, non-defense sector. Since the latter is smaller, by definition, than the GDP, a shift of one per cent of GDP to defense reduces non-defense spending by more than one percent.

Turning to the favourable effects of milex on growth, one can list the following:

a. Training effects: Military power receives training which introduces people to modern methods and social skills such as discipline and regimentation, following and transmitting precise instructions, living by the 'clock', understanding and working with bureaucracy, traveling around the country, maintaining and repairing machinery, and exposed to general inculcation of 'national values and attitudes'. This professionalism and management expertise of the military may overflow into the civilian sector.

b. Consumable effects: The services provide a substantial number of people with food, Clothing, shelter and medical care. They also engage in 'civic action' programs, in emergency operations, etc.

c. Infrastructure effects: Military expenditure in social overhead capital - roads, docks, bridges, airports, communications etc. - often benefits directly the civilian sector especially 'up country'. Also mapping, geographical and meteorological services have civilian spin-offs.

d. Security effects: To the extent that the military provides security to the country, it enables an atmosphere conductive to investment and long-term planning decisions. In this respect defense can be viewed as a form of insurance policy towards actual or perceived threats to national interests. Threats can reflect a struggle for power, resources or 'national values', or any kind of difference perceived as weakening a nations security.

It is argued in the literature that the combination of favourable and unfavorable effects of military spending produce non linearities between the level of milex and the rate of growth: at low levels of defense spending and low levels of development, the favourable effects dominate the unfavourable ones inducing a positive relation between milex and growth. Beyond a certain level, however, the impact of milex on growth becomes negative as the resource use effect comes to dominate.

Turning to the last explanatory variable in this equation, namely the external transactions, it is chiefly used to indicate the existence of an external constraint imposed on the growth rate of the economy. The discussion regarding the reasoning on which this variable is introduced in the analysis, as well as the specific role of the external sector, are examined later on in this paper.

Equation (2) makes the share of total investment in GDP a function of military burden, the rate of growth, and the GDP shares of the net foreign capital inflow, of the total profits and of the total credit to the private sector. Much theoretical and mostly empirical research has shown that defense expenditures have a greater and more pernicious crowding-out effect than other related forms of national and governmental spending.[3] This area of research utilizes the so called 'capital formation models' to explore the chain of causality leading from increased milex to lower investment and growth rates, to the extent that increased defense spending entails higher tax rates or government borrowing. This analysis is usually conducted in terms of shares in GDP. Of course, one cannot rule out the case of both investment and milex rising together, with no absolute crowding-out. However, if the 'social wage hypothesis' is right, then, in terms of ratios, there is an increased probability of one-to-one trade-off between defense and investment.

This is mostly the case of developed democratic societies in which, for a given level of GDP, the share of social wage is relatively inflexible, since governments in these countries face electoral costs and high institutional pressure which prevent them from attempting to reduce the proportion of social wage to national income for longer periods. The story may be somewhat different for developing countries: the limited national budgets and the non-existence of capital markets, result in defense budgets mainly at the expense of social expenditure, such as education, health, housing, transport etc. This forces the people to spend more on health, education, and so on, thus increasing their consumption expenditure, and reducing the saving ratio. In turn, lower savings lead to low investment, and hence to declining growth rates. In addition, government investment, a major engine to growth in these economies, falls, with debilitating consequences on the economy.

There are other ways also in which increased defense spending may crowd-out investment in developing economies: military procurement tends to be highly import demanding than other forms of public spending, and thus contributes considerably to an unfavourable balance of payments. Moreover, foreign exchange to import all kinds of goods is limited and an increase in defense procurement eventually decreases the amount of foreign exchange to import investment goods. Some also argue that since technical progress in developing economies tends to be embodied in new capital, crowding out of

[3] For some recent contributions see Chan (1992), and Gold (1993).

investment retards also technical progress and affects productivity and technological position. For a developing economy we may conclude that, although the military contributes to some extent to absorptive capacity, nevertheless, the net long run effect of defense spending on investment will be depressive because of crowding-out and the indirect effects on human capital formation. The presence of the other explanatory variables in equation (2) is easily explained, with growth rate capturing cycle effects.

Equation (3) explains the share of public education in GDP in terms of the growth rate, the share of military expenditure, the rate of population growth, the social budget and the per capita disposal income. Human capital formation is a key policy objective in both developed and developing countries. It is widely considered as an important determinant of absorptive capacity, productivity and technological progress and, therefore, a crucial element of production, growth and development.[4] The effects of military expenditure on human capital accumulation operate in several ways. According to Deger(1986) these are termed as 'spin-offs', 'social attitude effects', 'growth effects' and 'government revenue constraint effects'. The share of public expenditure in GDP is the usual operational proxy for the quality of human capital in empirical considerations, since it is widely accepted as the main, and probably overwhelming determinant of absorptive capacity, social mobility, and labour-augmented technological progress.

The direction in which the level of military burden affects the share of education in GDP, determines also, in all probability, the rate of growth of human capital. Under the government revenue constraint, one must expect a negative relation between defense spending and human capital formation. The improvement of human capital can be stimulated through government spending on health, and other social services as well. However, an increase in the share of social spending may crowd out education expenditure, and consequently, the net effect of an increase in the share of social spending (net of education) cannot be determined on a priori considerations. The effect of per capita real disposal income is expected to be positive, whereas, the presence of the rate of growth of GDP and the rate of growth of population in equation (3) is easily explained.

The military burden in equation (4) is considered as a function of the growth rate, the price of military equipment, the external threat and spillovers. As discussed earlier, the major determinants of military burden in Greece are the twin concepts of 'security' and 'threat'[5]. One may also consider spillovers since Greece is a member of the NATO alliance.[6] As

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[4] Looney (1992), and Aben and Daurès (1993) constitute important recent contributions on the issue.

[5] See Stavrinos (1992).

[6] See Lazaretou and Kapopoulos (1993), Kollias (1995), and Balfousias and Stavrinos (1996) for the determinants of defense spending in Greece.

threat variable we introduced the military burden of Turkey and as spillovers the military burden of the NATO European countries, other than Greece and Turkey. In addition, economic variables might be important, and certain theories have been proposed to analyse such determinants of defense spending. Per capita income and government revenue or expenditure are the most frequent explanatory variables in such empirical considerations. Since all these variables are positively related to growth , we included the rate of growth of real GDP as the overwhelming economic variable in sustaining high rates of milex.

A negative association between growth and defense could be also plausible, however, since we might expect that a country with greater strategic problems, such as Greece, will go for a high defense share of national output, even though its growth rate is low; security considerations where, and still are paramount for Greece, even with major economic problems elsewhere. The issue, therefore, is mostly empirical and the proof of the pudding will be in the eating. Prices are expected to come up with a negative sign as usual.

The next two equations, together with the identities in the appendix, trace the channels through which the foreign military debt generates adverse repercussions on the overall debt, and subsequently on the domestic sector of the economy. Exports are considered exogenous in this model, while the demand for imports is endogenous for both civilian goods and military equipment, and is taken to be affected by arguments traditionally used in such cases, like the domestic activity and prices. The key variable to consider in this case is the payments for both civilian and military outstanding debt, which is expected to exercise an expansionary effect on the imports of both categories.[7] These two equations, and particularly the one describing the behaviour of military imports, are crucial for the analysis since they indicate how the external debt, both civilian and military, is involved in an amphidromous relationship with the rest of the endogenous variables in the model.

[7] See Athanasoglou and Zombanakis (1992), for the effects of the external debt on the Macroeconomic Policy of a small open economy like Greece. See also Rothschild (1973), Deger (1986), Chan (1988), and Gold (1990) for some significant contributions in the area.

3. The data and empirical results

This analysis uses annual data for the period 1958 to 1993. Military expenditure is usually reported in current prices in local currency terms. For most purposes of economic analysis, however, it is the share of military expenditure to GDP - the military burden - that is of most interest because it reflects the relative priority given by the state to military demands and because it measures the relative burden or resource costs.[8] Its calculation does not depend on the choice of a specific price index, since it is the ratio of two measures in current domestic currency. It is a pure number that can be compared over time and across countries and it is by now extensively used in empirical investigations. There is, however, caution expressed in the literature in that measuring the military spending and the other variables in the model as shares or proportions of GDP, can be misleading and may introduce biases in the measurement of certain coefficients (e.g. see Chan, 1985).

A change in the defense burden can result from either a change in military expenditure (the numerator) or a change in GDP (the denominator), which in turn raises the following concerns: First, assume that a country's military expenditure has remained constant for a certain period of time, whereas, GDP has grown. In this case though the actual amount of defense spending has not changed, the defense burden would drop. More important, the decrease in the defense burden could be misinterpreted as having caused the economic growth, when the growth was due entirely to extraneous factors. Second, the GDP variable appears on both sides of the equations. For example, it is used as the denominator for measuring the military burden on the right hand side of the investment equation and as the denominator on the left hand side of the same equation for measuring the share of investment in GDP. An increase in GDP will naturally result in lower defense and investment shares. Thus, with constant levels of military expenditure and investment but an expanding economy - due for example to the utilization of existing capacity - the over-time decline in the defense burden will be positively correlated with the over-time decline in its investment share, and this positive correlation between the two variables will bias upwards the coefficient of the defense burden in this equation. Third, the growth rate is introduced as the dependent variable in the growth equation, and also as an explanatory variable in the other equations. Following the steps of the previous reasoning, there is the danger of a built-in negative correlation because positive and certainly increasing growth rates on the one side of the equations will necessarily mean a decrease in the shares of the defense or/and the investment etc., on the other side of the equations.

[8] See Goertz and Diehl (1986), and Herrera (1994), for the comparison of different approaches in measuring military allocations.

The foregoing discussion raises concerns as to whether we should focus on the levels of the defense burden, the investment share etc., or should we focus on the changes of these variables. Chan (1984) identified two quite distinct data patterns characterizing the OECD countries: whereas high levels of defense burdens tend to be negatively correlated with economic growth, high rates of increase in defense burdens tend to be positively correlated with economic growth. These patterns feature respectively, the stagnant economies of the larger and more established OECD members with their relatively high but steady defense spending on one hand, and the smaller and newly industrializing OECD members - like Greece in the sixties and seventies or Turkey in the eighties and nineties - with rapidly increasing defense spending and growth on another. In estimating the proposed model we measure our variables as percentages of GDP.

Looking at the performance of the Greek economy, we did not justify the drawbacks which have been pointed out in the foregoing discussion, during the period considered. Neither defense or investment expenditures - as well as the other variables in the model - remained constant, even in real terms, over a shorter or longer period of time. Instead, a variety of economic policies and security considerations, reflecting the unstable political and strategic environment of post-war Greece, allowed the variables to have enough independent variation over time. Consequently, the analysis in terms of GDP percentages has been considered most appropriate in order to investigate the effects on economic growth of the priorities given by the state to military demands. The effects of changes in the defense priorities became more pronounced in cases like the Turkish invasion in Cyprus in 1974 and the Greek-Turkish crises in 1982 and 1987, in which adjustment of the defense priorities became imperative, resulting in the reallocation of resources and thus affecting the growth prospects of the country.

Estimation of the proposed model, requires us to provide a specific functional form for the stochastic equations of the model. Since economic theory does not provide any guide as to the functional form of any of these equations we approach the issue empirically. As a first step, all the variables in the stochastic equations have been expressed in natural logs and tested for integration. The results of the ADF-tests, or the Perron (1990) test in cases of notable shifts in the variables in Table 5, indicate that all variables are I(1), with the exception of p (the share of profits to GDP) and pm (prices of imported goods) which are I(2), and n (the rate of growth of population) and Tur (the military burden of Turkey) which appear to be I(0).

TABLE 5 : ADF (or Perron) Test Statistics for Unit Root

Variables	Levels	First Differences	Second Differences
g	- 1,83	- 4,03**	-
k	- 2,30	- 6,17**	-
l	- 2,01	- 4,32**	-
m	- 1,69	- 4,86**	-
mx	- 2,38	- 4,27**	-
f	- 1,19	- 3,19*	-
p	- 0,11	- 2,07	- 6,38**
c	- 1,29	- 4,76**	-
n	- 4,56**	-	-
sb	- 2,01	- 3,85**	-
yd	- 2,59	- 3,35*	- 3,90**
pm	0,82	- 1,61	-
Nat	- 1,79	- 4,25**	-
Tur	- 4,74**	-	-
mc	- 1,22	- 4,11**	-
pc	0,40	- 4,57**	-
cd	- 1,63	- 4,09**	-
mm	- 1,56	- 4,69**	-
md	- 1,06	- 5,76**	-

Note : * indicates significance at the 5% level.
** Indicates significance at the 1% level
Mackinnon critical values for rejection of hypothesis of a unit root are -2,93 and -3,59 for the 5% and 1% levels of significance respectively.
The description of the variables is given in the appendix.

TABLE 6 : Pairwise Granger Cousality between the Endogenous Variables.

H_o : X does not Granger Cause Y	F - Statistic
g → k	3,15*
→ e	3,68*
→ m	4,09*
→ mc	3,67*
→ mm	2,78*
k → g	3,43*
→ m	1,18
e → g	2,51
m → g	3,19*
k	7,09**
e	2,72
mm	13,02**
mc → g	10,42**
mm → g	4,61*

Note : * Indicates significance at the 5% level.
** Indicates significance at the 1% level.

In addition of the previous theoretical considerations, we next investigated the empirical causal links between the endogenous variables. The results of Granger causality tests in Table 6 - augmented to incorporate contemporaneous causality as well - provide statistical support to our theoretical model and further guidance as to the inclusion of certain variables in the individual equations.

In the next step we investigated empirically the existence of equilibrium relationships between the variables in the individual equations using the Johansen and Juselious (1990) M.L. procedure. The results in Table 7 indicate the existence of exactly one such normalized equilibrium relationship for the equations (1), (2), (3), and (5), and two cointegrating relationships for the equations (4), and (6).

TABLE 7 : Johansen Cointegration Tests for the Six Equations.

VARIABLES IN THE EQUATION	**Eigenvalues**	**Likelihood Ratio**	**Hypothesized No. of C.E(s)**
g, k, e, m, mx	0,59	76,51	None*
	0,37	40,82	At most 1
L.R test indicates 1 cointegrating equation at the 5% level			
k, g, m, f, p, c	0,69	110,36	None*
	0,56	70,28	At most 1
L.R test indicates 1 cointegrating equation at the 5% level.			
e, g, m, n, sb, yd	0,84	140,12	None**
	0,53	75,88	At most 1
L.R test indicates 1 cointegrating equation at the 1% level.			
m, g, pm, Nat, Tur	0,74	125,01	None**
	0,58	74,12	At most 1**
	0,32	18,51	At most 2
L.R test indicates 2 cointegrating equations at the 1% level			
mc, g, cd, pc	0,63	62,79	None**
	0,34	27,17	At most 1
L.R test indicates 1 cointegrating equation at the 1% level			
mm, g, m, pm, md	0,69	89,82	None**
	0,45	48,27	At most 1*
	0,36	26,87	At most 2
L.R test indicates 2 cointegrating equations at the 5% level			

Note : * Indicates rejection of the Null Hypothesis at the 5% level.
** Indicates rejection of the Null Hypothesis at the 1% level.

Since one of our primary interests is to look into the dynamics of mutual interactions between the endogenous variables, we have searched for the cointegrating equations using the general to specific methodology of Hendry (1986). Due to sample size limitations we started with two lags in each variable, and deleting the insignificant lags after a rigorous testing, we ended up with the final six OLS equations. In the next step the individual

OLS equations were re-estimated within the context of a simultaneous equations system, using the estimation method of 3SLS.

TABLE 8 : 3SLS, System Estimates, 1957-1993*

g_t =	-1,30	- 0,23g_{t-1}	+ 0,63k_t	+ 0,35k_{t-1}	+ 0,29e_t	- 0,30m_{t-1}	- 0,18m_{t-2}	- 0,38mx_t	
	(-1,56)	(-2,32)	(3,17)	(2,41)	(2,21)	(-2,50)	(-2,11)	(-2,73)	
kt =	1,05	+ 0,68kt-1	+ 0,20gt	+ 0,08gt-1	- 0,15mt	+ 0,05ft	+ 0,03ft-1	- 0,04pt	+ 0,09ct
	(2,43)	(6,85)	(3,71)	(2,92)	(-2,54)	(2,38)	(2,02)	(-2,23)	(3,13)
et =	0,66	+ 0,90le-1	+ 0,04gt	- 0,08nt	- 0,02mt	- 0,02sbt	- 0,01sbt-1	- 0,02ydt-1	
	(2,10)	(11,02)	(1,95)	(-2,24)	(-2,31)	(-2,18)	(-1,98)	(-2,13)	
mt =	1,42	+ 0,76mt-1	- 0,08gt	- 0,05pmt	- 0,47Natt	+ 0,13Turt	+ 0,08Turt-1		
	(2,06)	(6,63)	(-1,97)	(-1,80)	(-2,23)	(2,36)	(2,05)		
mct =	1,34	+ 0,60mct-1	+ 0,51gt	+ 0,09cdt-1	- 0,07pct				
	(3,44)	(4,99)	(2,98)	(2,43)	(-2,13)				
mmt =	0,73	+ 0,80mmt-1	- 0,09gt	- 0,28pmt	+ 0,16mt	+ 0,10mt	+ 0,16mt-1		
	(2,58)	(9,24)	(-3,73)	(-1,78)	(3,44)	(2,08)	(2,39)		

* Figures in parentheses are t-values.

TABLE 9 : Equation Diagnostics

	g	k	l	m	mc	mm
R^2	0,63	0,90	0,96	0,86	0,91	0,95
D.W.	2,18	2,23	1,87	2,01	1,97	1,98
AR(1) & AR(2) (F)	1,43	0,57	0,26	0,03	0,46	0,10
	(0,25)	(0,57)	(0,77)	(0,97)	(0,63)	(0,90)
ARCH-1 (F)	0,12	0,12	0,01	2,08	0,19	0,46
	(0,73)	(0,73)	(0,91)	(0,16)	(0,66)	(0,50)
Normality (X2)	4,03	1,14	2,48	0,12	2,82	2,70
	(0,13)	(0,56)	(0,28)	(0,94)	(0,26)	(0,25)
Heteroscedasticity (F)	1,81	0,60	0,25	0,59	0,73	1,02
	(0,12)	(0,80)	(0,99)	(0,81)	(0,67)	(0,49)
Functional Form (F)	(11,02) **	0,55	0,31	0,002	0,000	0,002
	(0,001)	(0,46)	(0,58)	(0,96)	(0,98)	(0,96)

Figures in parentheses indicate the probability of the null hypothesis.
* The null hypothesis is rejected at the 0,05 level.
** The null hypothesis is rejected at the 0,01 level.

TABLE 10 : Solved Static Long - Run Equations[1]

g_t =	-1,06	+ 0,80k_t	+ 0,24e_t	- 0,37m_t	- 0,31mx_t		Wald - $X^2(4)$ = 20,87 (p=0,0003)**
	(-5,14)	(2,71)	(2,28)	(-2,63)	(-2,40)		
kt =	3,28	+ 0,88gt	- 0,47mt	+ 0,24ft	- 0,11pt	+ 0,29ct	Wald - X2(5) = 21,84 (p=0,0006)**
	(2,48)	(3,99)	(-2,83)	(2,48)	(-2,12)	(3,51)	
et =	6,59	+ 0,36gt	- 0,79nt	- 0,21mt	- 0,32sbt	- 0,22ydt	Wald - X2(5) = 32,74 (p=0,0002)**
	(4,62)	(2,26)	(-2,86)	(-2,45)	(-2,83)	(-2,65)	
mt =	5,92	- 0,33gt	- 0,23pmt	- 1,98Natt	+ 0,89Turt		Wald - X2(4) = 9,87 (p=0,043)*
	(2,72)	(-2,16)	(-1,98)	(-2,53)	(2,47)		
mct =	3,34	+ 1,28gt	+ 0,09cdt	- 0,07pct			Wald - X2(3) = 45,76 (p=0,0000)**
	(4,78)	(3,22)	(2,67)	(-2,33)			
mmt =	3,65	- 0,45gt	- 1,42pmt	+ 0,82mdt	+ 1,31mt		Wald - X2(4) = 9,63 (p=0,047)*
	(2,90)	(-4,61)	(-2,02)	(4,01)	(2,69)		

[1] Figures in parenteses are t - values
* Indicates significance at the 5% level.

** Indicates significance at the 1% level.

The significant gains in efficiency indicated the existence of correlation among the residuals of the individual equations. Table 8 reports the final 3SLS estimates. We also re-estimated the model over the period 1958 - 1987, with the observations for the next six years up to 1993 reserved for testing the forecasting performance of the estimated model. The estimated equations over the full sample fitted the data well by standard criteria, and survived the usual battery of within-sample diagnostic tests, for normal white-noise residuals. Table 9 summarizes the results of these diagnostic tests and the forecasting RMSPE (Root Mean Square Percentage Error) for the six equations, and Table 10 gives the solved long-run (cointegrating) equations and the direct effects of each variable on the dependent ones in terms of elasticities.

One may accept that defense spending made tangible contributions to the civilian economy during the crucial years following the end of the second world war and the consequent civil war, by feeding, clothing and housing a considerable number of people, providing medical care, vocational and technical training, and engaging in a variety of technical and scientific civic-action programs. Estimation of an analogous model over the period 1948-1960 (e.g. see Stavrinos, 1993a), showed, indeed, a positive, though not significant, effect of military spending on growth during this early stage of development. However, during the high growth period of the sixties and seventies, there was sufficient advance in development so as the civilian sector not to get much leverage from the modernization induced by the military. At the same time, the economy was not advanced enough to benefit from the military-industrial complex, and consequently the beneficial spin-off of defense spending became less important compared to the negative allocation and mobilization effects.

Nevertheless, the considerable increase of per capita income sustained the unprecedented levels of public expenditure by the rising base of taxation purposes, and the modest defense burdens were easily accommodated with temporary short term adjustments without considerably depriving investment and the social budget. The heavy defense burdens which followed the Turkish invasion of Cyprus in 1974 and the consequent tension in the Aegean, combined with the depressing effects of the first oil-crisis, put a strain on government budgets with defense crowding investment and the social wage. The negative effects were reinforced in the eighties and nineties when low to zero growth rates, progressive inflation, and underflow of investment were confronted with increased social spending and pertaining high defense burdens, thus driving to extremes the public civilian and military debt of the country. Overall, we may conclude that the growth-defense relationship has passed through different stages of intensity, with the

negative mobilization and allocation effects of the last two decades highly dominating the weak spin-offs of the fifties and sixties.

Coming to investable resources we observe that the estimated coefficient of the defense share in the investment equation is significant and negative. There is little doubt in that an increase in defense spending leads to a reduction in investment as a proportion of GDP. The magnitude, however, of the estimated elasticity is well bellow unity and this reflects an almost equal effect on the social headings of the budget as well. The negative sign of the share of profits is rather surprising and combined with the low elasticity of the total credit to the private sector indicates the prevalence of conditions of low absorptive capacity in the productive sector. Foreign capital inflow did have a positive effect, although not enough to offset the diversion of domestic funds from investment to military expenditure (see also Stavrinos, 1993, p. 826).

The elasticity of the share of public education in GDP with respect to military burden was found negative and statistically significant, indicating a moderate crowding out between defense spending and education over the period considered. Results, however, in Stavrinos (1993a) over the period 1960-1983, revealed a positive but not significant correlation between the two indices (the estimated elasticity was 0.246). One can observe that the share of public education in GDP remained constant until the end of the seventies, and certainly on the low side to support a balanced growth-development strategy. It is evident that the emphasis was put on physical capital formation, whereas human capital was almost neglected. The educational reform which was initiated in the mid-sixties was blocked out by the repressive military regime until 1974, and despite the consequent social pressure the strict budgets of the following decades could not accommodate any but small increases in the share of education to GDP.

On the other hand, these small increases in educational expenditure were accompanied by sharp increases in defense burdens, resulting thus in a degree of positive but not significant correlation. This, however, does not reflect the competing nature of the two headings of the budget which is expressed through the indirect effects of defense spending on education. According to Stavrinos (1993a), one way of looking into this relation is the following: During 1983 the shares of defense and education in GDP were 7.2 and 3.2 respectively, whereas the actual sums involved were 196 and 86 billion drachmas. If the share of the military in GDP could be brought down to the 1961-1973 (before the invasion in Cyprus) mean level of 4.7% (a reduction of 2.5%) this could allow actual public educational expenditure to increase by 80%. These figures leave but little doubt about the «hidden» trade-off between defense and public education expenditure.

Table 11 : Long-run Elasticities of of the Main Enologeuous Variables with Respect to Military Debt

	g	k	e	m	mc	mm
md	-0,3	-0,3	-0,1	0,8	-0,3	0,9

The results for civilian imports may be considered as normal for a developing country like Greece for which the determinants of external trade are of a structural nature. The positive sign of the growth variable reflects the strong import penetration over the post war period, even under the sharply accumulating civilian debt (as a share of GDP) during the eighties and nineties. The equation for military imports on the other hand indicates that an increase of 1% in the military burden increases military imports directly by 1.31%, whereas 82% of any increase in the military debt is directed to military imports. Finally, the long-run elasticities of the main endogenous variables with respect to military debt are given in Table 11, and it can be seen that these effects are negative and quite significant.

4. Summary and conclusions

In this econometric investigation we have tried first to estimate the economic effects of defense spending on the growth-development process of Greece over the period 1958-1993, and second to estimate the effects of financing the increased defense needs of today by increasing the military debt of the country.

It is by now well established in the literature that defense spending can affect the growth and development process directly through the Benoit-type spin-off, and indirectly by influencing the supply of investable resources (savings), the absorption of available resources (investment), the formation of human capital (education, health, etc.), and the performance of the external sector (trade balance). The empirical results of this study indicate that in the case of Greece, the defense-growth relationship does not support the basic Benoit hypothesis that the military can have a positive direct effect on growth. The coefficient of the defense burden in the growth equation which is meant to capture the spin-off of defense spending on growth, was found to be negative and significant. This mostly reflects the weak military-industrial link in the post-war Greece. Arms production constitutes the main link between the military and the absorptive capacity of the economy. It stimulates strong backward and technical linkages in the productive sector, creating thus interindustrial demand and influencing the pattern of resource allocation, with a concomitant spin-off for the underlying industrial base. In the case of Greece, however, arms production remained on

a very low scale compared to arms imports, because the necessary industrial and human-capital base to support the military-industrial complex was inadequate. Our empirical estimates also reveal the indirect growth-depressing effects of defense spending on the mobilization and absorption of investable resources. The military, as a claimant for resources, has negative and non trivial effects on saving and investment which, under the present economic conditions and the recent trend for increasing the military spending, can be considered as prohibitive for the prospects of the domestic economy. Although our model detects a low negative association between defense spending and education, nevertheless, considering their actual shares in GDP, one may easily identify the hidden but hard trade-of between the two headings of the budget. Finally, the effects of financing an increase in military spending by increasing the military debt of the country, are found to be significant but on the low scale compared to the effects of increasing the civilian debt.

Our empirical results for Greece indicate that, whatever the necessity and the benefits of the security aspect of defense, its economic costs are quite substantial. However, the strategic environment and mainly the conflict with Turkey constitute the overall determinant of the nature and the quantity of military expenditure. The arms race between Greece and Turkey is becoming again a crucial element in studying the economic prospects of the country.

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Appendix

The complete model and the description of the variables is as follows:

$$
\begin{aligned}
g &= g(k, e, m, mx) \\
k &= k(g, m, f, p, c,) \\
e &= e(g, m, n, sb, yd) \\
m &= m(g, pm, Nat, Tur) \\
mc &= mc(g, pc, cd) \\
mm &= mm(g, pm, md, m) \\
mc &= (MC/GDP)*100 \\
mm &= (MM/GDP)*100 \\
M &= MC + MM + MPET \\
TIP &= i_c * D_{c-1} + i_m * D_{m-1} + IP \\
INV &= TIR - TIP \\
CRA &= (X - M) + INV \\
mx &= (M/X)*100 \\
L &= CRA - PUVP + AML - EAO - dGR + dR \\
f &= (PUVP/GDP)*100 \\
cd &= (CD/GDP)*100 \\
md &= (MD/GDP)*100 \\
CD &= L - AML + CD_{c-1} \\
MD &= D - CD
\end{aligned}
$$

The variables used in the model above are represented as follows:

g	Rate of Growth of Real GDP
k	National Investment Spending as GDP Share
e	Public Education Spending as GDP Share
m	National Military Spending as GDP Share
mx	Import to Export Bill Analogy
f	Net Private Capital Inflow as GDP Share
p	Total Profits of the Private Sector as a GDP Share
c	Total Credit to the Private Sector as GDP Share
n	Rate of Population Growth
sb	Social Budget Net of Defense and Education as a GDP share
yd	Disposable per Capita Income
pm	Military Import Prices (Non-Oil)
Tur	Turkish Military Expenditure/GDP Ratio
Nat	NATO Members Military Expenditure / GDP Ratio (excluding Greece and Turkey)

mc	Total Civilian Import Expenditure Less Oil as a GDP share
mm	Total Military Import Expenditure as a GDP share
pc	Civilian Import Prices (Non-Oil)
cd	Outstanding External Civilian Debt as a GDP share
md	Outstanding External Military Debt as a GDP share
MM	Total Military Imports
MC	Total Civilian Imports
CRA	Current Account Deficit
X	Total Exports Value
M	Total Imports Value
INV	Balance of Invisibles
TIR	Total Invisible Earnings
TIP	Total Invisible Payments
i_c	Interest Rate on Foreign Civilian Debt
i_m	Interest Rate on Foreign Military Debt
D	Outstanding External Total Debt as a GDP share
IP	Invisible Payments Less Interest Payments on Debt
MPET	Total Oil Import Expenditure
L	New Gross Loans From International Markets
PUVP	Private Sector Net Capital Inflow
AML	Amortisation Payments
EAO	Errors and Omissions
dGR	Gold Revaluation
dR	Change in Foreign Reserves
CD	Total Civilian Debt Outstanding
MD	Total Military Debt Outstanding