Optimal Versus Required Defence Expenditure Revisited

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INTERIM 3

"The distribution of power is the major determinant of strategy"
Thoukidides

The Internet site of the Greek Ministry of Defence is not exactly very descriptive when informing the user about the Integrated Defence Doctrine. It appears, anyway, that this doctrine is a vital component of the National Defence Strategy in its revised form, as this has been expressed on the basis of the new dogma[1] that places emphasis on speed and flexibility of small, well-trained units equipped with latest technology weapons. The reader is reminded at this point that the decision to emphasize on technology rather than manpower has been dictated by the adverse demographic developments in Greece and the persistence of the authorities on curtailing the country's defence budget. Concerning the Greek National Defence Strategy, this dictates the deterrence of the threat mainly from the part of Turkey and, to a lesser extent, from a number of other sources in conjunction with a tension de-escalation policy. It is rather straightforward, therefore, that such a dogma describes a defensive strategy beyond any doubt, designed to maximize the efficiency of the Greek Armed Forces when facing any external threat. To cope with their task the Greek Armed Forces must be reliable and determined to retaliate rapidly and effectively, something which requires defence sufficiency,

[1] The Greek Ministry of Defence determines the National Defence Strategy by formulating the guidelines that describe the use of the defence resources of the country, the design and development of its defence structure as well as the decision-making process on defence matters. The National Defence Strategy forms part of the Greek National Strategy, which aims at promoting the Greek interests in the international environment.

flexibility of reaction and control, and coverage of the Integrated Greece-Cyprus Defence Doctrine.

What the Greek government does by pursuing the logic of defence sufficiency is to exercise a form of constrained optimization in the following sense: It aims at providing the means in terms of property and human resources, adequate to avert any external threat, by mitigating, in parallel, the adverse repercussions of an arms race, to the best possible extent. The focus on cost-benefit issues is an essential part of this logic which is safeguarded by the introduction of latest technology defence systems that contribute to the defence policy as force multipliers. Concerning flexibility of reaction, the Defence Dogma dictates that it is a necessary condition to face any form of crisis. To do so, the Greek Armed Forces must be prepared to offer a wide variety of options, which will attain all targets in the Aegean, the North and Cyprus, in the context of the Integrated Defence Doctrine. The essence of the latter is that an attack against the Republic of Cyprus shall be considered as an attack against Greece in the sense of the so-called extended deterrence. It follows, therefore, that the reaction from the part of Greece to any such assault will not necessarily be restricted to the Cyprus area, bearing in mind the military disadvantage in terms of distance that Greece will be facing in such a case. On the contrary, any such reaction shall cover the broader reference area of the Doctrine (Aegean, North of Greece and Cyprus) and shall focus on any part of the assaulting country's sovereignty, at a carefully selected place and time.

At least in paper, therefore, the Integrated Defence Doctrine sounds a very impressive dogma indeed! Yet a number of people argue that in terms of substance this formal declaration has added very little to the defence philosophy of the two allies as this had been conceived and exercised between mid seventies and mid eighties, long before this formal statement. Moreover, one cannot help noticing that the ambitious targets of this doctrine can hardly be pursued in practice given the relative weight of the two allies in the international political and strategic environment. Still more people question the way in which the costs and benefits of such an alliance, be it political, strategic or economic, have been allocated between the two participants.

The extent to which these arguments stand to reason is far too intricate a matter for this book to tackle, nor are we qualified to question or praise the efficiency of the

Integrated Defence Doctrine. What we can do, however, is use our knowledge and conclusions of our study on this case so far, in order to offer some answers to certain aspects of this alliance. To be more specific, given the importance of human resources in the conflict between Greece and Turkey and using the relative security coefficient that underlines this importance, we have compared the benefits in relative security terms that the two allies derive. This comparison, which clearly favors Greece, offers some room for a proposal concerning the allocation of costs and benefits between the two allies. We feel that this proposal will contribute to the efficiency of the Integrated Defence Doctrine and make it much more substantial than just a theoretical structure based to a considerable extent on wishful thinking.

CHAPTER 4

Optimal Versus Required Defence Expenditure Revisited

The Case of the Greek – Cypriot Alliance

By

Andreas S. Andreou, Konstantine E. Parsopoulos, Michael N. Vrahatis and George A. Zombanakis

4.1 INTRODUCTION

The scope of this paper is to supplement our earlier work on the issue concerning the Greek-Cypriot Integrated Defence Doctrine. The term describes a purely defensive dogma the scope of which is to face any form of offensive action against one or both of the allies. It aims, in addition, at defending the strategic and political interests of the two allies in the Aegean Sea and the broader East Mediterranean area in an environment of an arms race against Turkey (Hellenic Ministry of Defence 2000). Given the complexity and multi-disciplinary aspect of this issue we restrict ourselves to focusing on a very interesting aspect of the topic that has not been considered in the literature thus far. What we examine, more specifically, is the relative security contribution of Greece and Cyprus to their alliance and the benefits that each side derives in that respect. The background theory supporting our research is presented in section 2, while the model modifications are discussed in section 3. The results of our experiments and the conclusions derived are given in sections 4 and 5 respectively.

4.2 LITERATURE OVERVIEW[2]

The economics aspect of the Greek-Cypriot alliance has already been considered in the first part of our research (Andreou et al. 2002), while the background theory has been provided by Andreou and Zombanakis (2000 and 2001). These papers make extensive use of advanced techniques of analysis to prove the existence of an arms race between Greece and Turkey and to underline the importance of human resources in it. The leading role of human resources in this case has justified the introduction of a relative security measure to evaluate the extent to which Greece contributes to the defence of Cyprus in the context of the "Integrated Defence Doctrine". This relative security measure, which relies on the population growth rates of both allies and Turkey, has assumed the role of a spill variable as suggested by the conventional theory of alliances (Hartley and Sandler 1995).

The research mentioned above, however, has focused exclusively on the contribution of Greece to the security of Cyprus, an issue that has assumed particular importance in view of the Cyprus full EU membership and the anticipated reactions from the part of the new Islamic government of Turkey since early November 2002[3]. What remains to be seen, however, is the extent to which Cyprus may be able to contribute to the security of Greece in the context of their alliance. This is an issue that has acquired increasing importance during the recent past, given the restrictions imposed on the defence equipment purchases of Greece by the Conventional Forces in

[2] The references cited in this section have been restricted to the bare minimum given that a comprehensive overview of the relevant literature has already been presented in Andreou et al. (2002), on which the present research has been based.

[3] "The landslide victory of the Justice and Development Party (JDP) in the 3 November 2002 elections marked the beginning of a new era in Turkish politics, with potentially profound repercussions for domestic and foreign policies. Both its opponents and supporters perceive the JDP as having an Islamic agenda. Although in the short term it is likely to concentrate on consolidating its grip on power rather than trying to erode the secular principles enshrined in the Turkish constitution, there are already signs that the Turkish establishment - led by the military - is mobilizing to restrict the JDP's room for maneuver and undermine its authority by targeting the JDP leader, Recep Tayyip Erdogan" (IISS 2002).

Europe (CFE) Treaty[4], and the additional burden imposed on the country's economy due to its commitments with NATO and the Euroarmy[5].

Table 1. Variables, data and sources

Code	Data Series	Source
GGDPCS	GDP of Greece, Constant Prices	Greek National Accounts
CGDPCS	GDP of Cyprus, Constant Prices	Cypriot National Accounts
GTIS	Greek Government Total Investment Expenditure (share of GDP)	Greek National Accounts
GDEFCRS	Defence Expenditure of Greece (share of GDP)	SIPRI
CDEFCRS	Defence Expenditure of Cyprus (share of GDP)	SIPRI
TDEFCRS	Defence Expenditure of Turkey (share of GDP)	SIPRI
GNDEFCRS	Non-Defence Government Expenditure of Greece (share of GDP)	Greek National Accounts
CNDEFCRS	Non-Defence Government Expenditure of Cyprus (share of GDP)	Cypriot National Accounts
GBOP	Greek Balance – of – Payments Deficit (share of GDP)	Greek National Accounts
CBOP	Cypriot Balance – of – Payments Deficit (share of GDP)	Cypriot National Accounts
DRDL	Drachma / U.S. Dollar Exchange Rate	Bank of Greece
DLCP	U.S. Dollar / Cypriot Pound Exchange Rate	I.F.S.
GCPI	Greek Consumer Price Index	I.F.S.
CCPI	Cypriot Consumer Price Index	I.F.S.
GPOP	Greek Population Growth	I.F.S.
CPOP	Cypriot Population Growth	I.F.S.

[4] The CFE Treaty imposes a roof on the purchases of the participant countries regarding tanks, armored vehicles, artillery, helicopters and fighter planes. The Treaty also provides for a roof on the armed forces personnel of the countries involved. It is important to remember that Turkey has never signed this treaty.

[5] The extent to which the NATO and Euroarmy commitments burden the Greek defence budget can be realized by considering that the cost of just one of about ten programmes required, namely that of the procurement of 10 to 12 transport aircraft (C17 Globemaster or Airbus 400M) amounts to roughly 1.8 billion dollars.

4.3 THE MODEL MODIFICATIONS

To assess the contribution of Cyprus to the security of Greece we have used the coefficient employed in our research thus far (Andreou and Zombanakis 2001) adjusted to measure the relative security of Greece with reference to Cyprus (data variables are listed in Table 1). This means that the formula of the relative security measure required in this case will be:

$$RSG_C = \exp[x] \quad (1)$$

$$\text{where} \qquad x = (\dot{p}_C - \dot{p}_G) / \dot{p}_T \quad (2)$$

and RSG_C represents the relative security of Greece with reference to Cyprus and $\dot{p}_C$, $\dot{p}_G$ and $\dot{p}_T$ stand for the Cypriot, the Greek and the Turkish population growth rates respectively. Introducing (1) in the demand for defence expenditure function for Greece used by Andreou et al. (2002), we come up with the following form:

$$GDEFCRS=f(GGDPCS, GNDEFCRS, GBOP, DRDL, RSG_C, TDEFCRS, DGDEF) \quad (3)$$

where GDEFCRS is the Greek GDP share of defence spending, GGDPCS is the Greek GDP at constant prices, GNDEFCRS represents the share of non-defence expenditure in the Greek GDP, GBOP stand for the Greek balance-of-payments deficit as a GDP share, while DRDL denotes the drachma exchange rate against the US dollar. The threat variable is TDEFCRS, which represents the share of defence expenditure in the Turkish GDP. Finally, DGDEF captures all revisions in the long-run defence programmes of Greece or lump-sum purchases settled through bilateral agreements without appearing in the external accounts of the country (e.g. the procurement of the Type-209 submarines from HDW by the Greek Navy during the beginning of the seventies and the so-called purchase of the century involving the procurement of a large number of Mirage fighters during the mid-eighties, its revision after the change of the Greek government at the beginning of the nineties). All series have been found to be I(1), that is, stationary in their first differences on the basis of the ADF test while the explanatory power of all six equations is satisfactory. The short-run estimates presented

in Tables 2 and 3 comprise an error-correction model, with all coefficients bearing the expected signs and accompanied by their t-values in parentheses[6].

Table 2. Model equations for Greece (t-values in parentheses)

	GGDPCS	**GDEFCRS**	**GPOP**
C	0.022 (3.281)	-0.029 (-2.553)	0.001 (1.371)
GNDEFCRS		-4.872 (-17.598)	0.012 (1.837)
GNDEFCRS(-1)	0.100 (1.931)		
GTIS	0.235 (6.350)		
GBOP(-1)		-0.295 (-4.859)	
GBOP(-4)	-0.056 (-1.878)		
DRDL	-0,062 (-1.635)	0.547 (8.289)	
GGDPCS			0.026 (2.286)
GGDPCS(-1)	0.476 (4.869)		
GGDPCS(-2)		0.354 (2.102)	
GCPI(-2)			-0.0003 (-4.927)
RSG_C (-1)		0.010 (2.327)	
GDEFCRS(-3)			-0.005 (-2.001)
GPOP(-1)			0.635 (6.606)
TDEFCRS		0.112 (2.197)	
RES(-1)	-0.048 (-1.984)	-0.147 (-1.904)	-0.113 (-3.054)
DGGDP	0.047 (-5.416)		
DDIC	0.048 (5.994)		
DGDEF		0.086 (9.881)	
DGDEMO			0.006 (5.547)

The key feature of the constraints structure in our optimization exercise can be traced in the equation describing the Greek demand for defence expenditure. In fact, the direct relationship between the defence expenditure of Greece and the country's relative security denotes the shift of the Greek defence policy to its new doctrine as a result of its negligible – sometimes even negative-birth rates. This strategy revision places the emphasis of the defence procurement programmes on quality, advanced technology and

[6] For a detailed evaluation of the constraints structure see Andreou et al. (2002).

modernization of the structure of the Greek armed forces in order to make up for the population deficiency.

Table 3. Model equations for Cyprus (t-values in parentheses)

	CGDPCS	**CDEFCRS**	**CPOP**
C	0.052 (9.331)	0.024 (1.521)	-0.004 (-0.614)
CNDEFCRS	0.227 (2.953)	-16.595 (-26.348)	
CNDEFCRS(-4)			0.055 (1.889)
CBOP	-0.515 (-6.520)		
CBOP(-1)		-0.367 (-2.037)	
DLCP	0.250 (3.189)	-0.455 (-2.578)	
CGDPCS			
CGDPCS(-2)			0.065 (1.823)
CGDPCS(-3)		0.372 (2.197)	
CCPI			-0.016 (-4.026)
RSC_G(-2)		-0.014 (-1.538)	
CDEFCRS(-3)			
CPOP(-1)			
TDEFCRS		0.418 (3.320)	
RES(-1)	-0.164 (-7.383)	-0.704 (-5.442)	-0.382 (-8.645)
DCGDP	0.130 (10.071)		
DCINV			0.031(5.275)
DCDEF		0.210 (8.222)	
DCDEMO			-0.118 (-10.175)
TIME			0.004 (8.886)

In addition to the shift from human to capital resources, emphasis is placed on the close co-operation and co-ordination of the actions of all three branches of the armed forces, their rapid reaction to threat accompanied by an increase of fire volume and efficiency (Hellenic Ministry of Defence 2000). This change in the defence dogma is a necessary, however expensive solution calling for increased spending on modern defence equipment and extensive training and restructuring of the existing units. In such a case, and according to equations (1) and (2), it will be inevitable that the burden of counterbalancing the Turkish population increases must fall on the Cypriot side. This

will in fact be the only way to raise RSG_C which thus assumes the role of a spillover variable in the sense employed in the literature, replacing conventional variables like, for example, the military burden of the NATO countries except Greece and Turkey.

4.4 EMPIRICAL RESULTS

The optimization algorithm used is the one we employed in our earlier research involving an Interior Penalty Function Method, with Steepest Descent and Armijo Line Search (Vrahatis et al. 2000, Parsopoulos and Vrahatis 2001 and Parsopoulos et al. 2001). It is important to remind that the constraints structure introduced in this algorithm is of purely economics nature, aiming at specifying the defence expenditure that the two allies are able to afford in the context of the theory of alliances. The literature background described in section II provides the framework within which our analysis will develop, as follows:

a. There is an arms race between Greece and Turkey.
b. The role of human resources is very important and it turns against Greece and Cyprus and in favor of Turkey.

Given the above, we shall employ one reference or baseline scenario that involves a dynamic simulation of the model without any policy measures taken by either side. Two policy scenarios will be introduced according to which either Greece or Cyprus undertakes the burden of counterbalancing the Turkish advantage in terms of human resources. This will require a number of demographic policy measures taken by either ally that are expected to lead to raising its rate of population growth. In such a case and according to equations (1) and (2) the security alliance target for Greece may be set as $RSG_C = 2.718$, once x assumes the value of unity. The same target may be assigned for RSC_G that reflects the relative security of Cyprus with reference to Greece as it is used in the Cypriot demand for defence expenditure equation. Thus, the optimization problem is formulated by requiring the minimization of a "welfare function" the arguments of which are the squared deviations of the endogenous variables from their respective targets, as these reflect the assumptions of the two policy scenarios. The

weights assigned to all endogenous variables are equal to unity, while the policy instruments used are the GDP shares of defence expenditure in the two allied countries.

The results obtained by the optimization procedure are very interesting and reflect the choices of the Greek armed forces as these are expressed through the recent dogma change. Indeed, the benefits in terms of security that Greece derives out of its alliance with Cyprus are multiple compared to those that Cyprus derives out of this alliance (Figure 1). Since, however, the demographic developments in Cyprus (Government of Cyprus 2001) are much more promising compared to those of Greece (Hellenic Republic 2001) this conclusion is not as preposterous as it appears at a first glance. This is a benefit that allows Greece to concentrate on advanced defence equipment and technology rather than manpower, an obviously expensive alternative, as the relevant defence expenditure figures indicate (Figure 2). Indeed, the average optimal value derived by the model approaches 4.5%, about one percentage point higher than the corresponding optimal defence expenditure levels calculated in our earlier research (Andreou et al. 2002). This margin is not at all negligible bearing in mind that it could buy Greece an extra 60 F-16s or about 30 F-15s, a fighter plane rejected a few years ago on the grounds of a very high price.

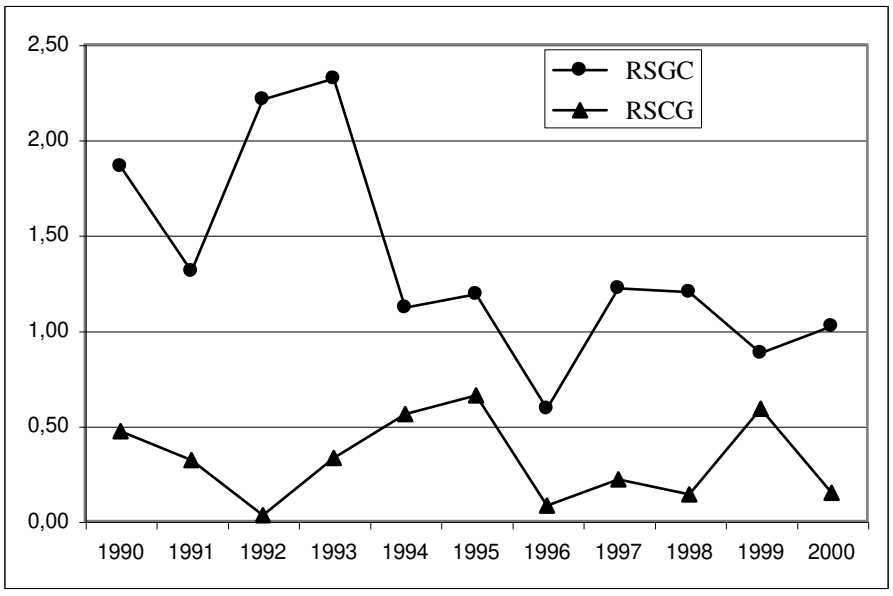

Figure 1. Relative Security of Greece (RSG_C) and Cyprus (RSC_G) (optimal values)

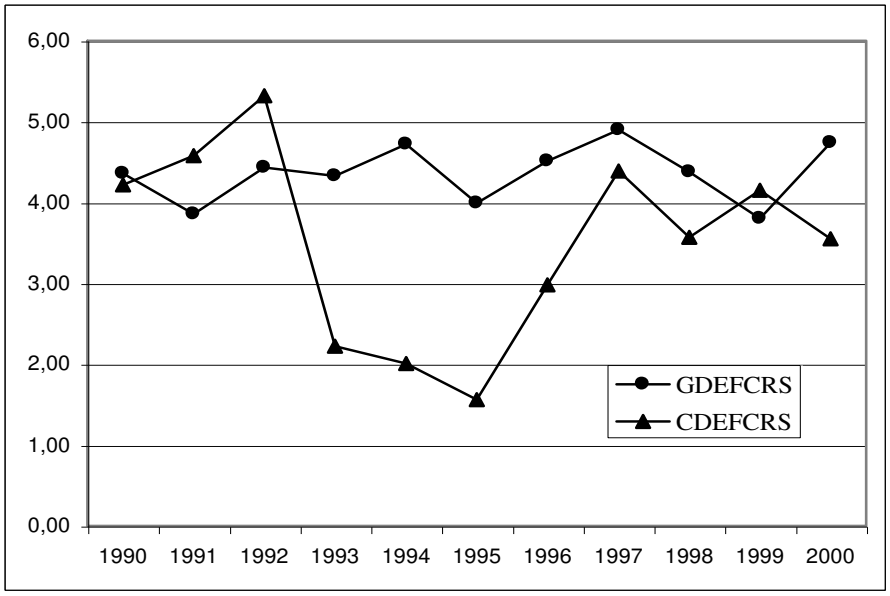

Figure 2. Defence Expenditure of Greece (GDEFCRS) and Cyprus (CDEFCRS) (optimal values in terms of GDP shares)

A further interesting finding is that this average optimal defence expenditure deviates from its target value, as this is set by the Greek authorities in the context of an arms race, by less than 40% compared to a more than 50% average deviation in the Cypriot case (Figure 3). An important consequence of these substantial deviations figures is that the attainable average relative security in Greece deviates from its desired target of unity by only about 25% as opposed to 42% in the case of Cyprus (Figure 4).

The defence expenditure deviation figures are considerably lower when measuring the gap between actual and optimal values (Figure 5), which amounts to an average of just 7.5%, and 18.5% in favor of the actual defence expenditure in Greece and Cyprus respectively. It seems reasonable to argue that these figures can be taken to approximate the peace dividend following a conversion from defence to non-defence expenditure in the economies of the two allies (Intriligator, 1996).

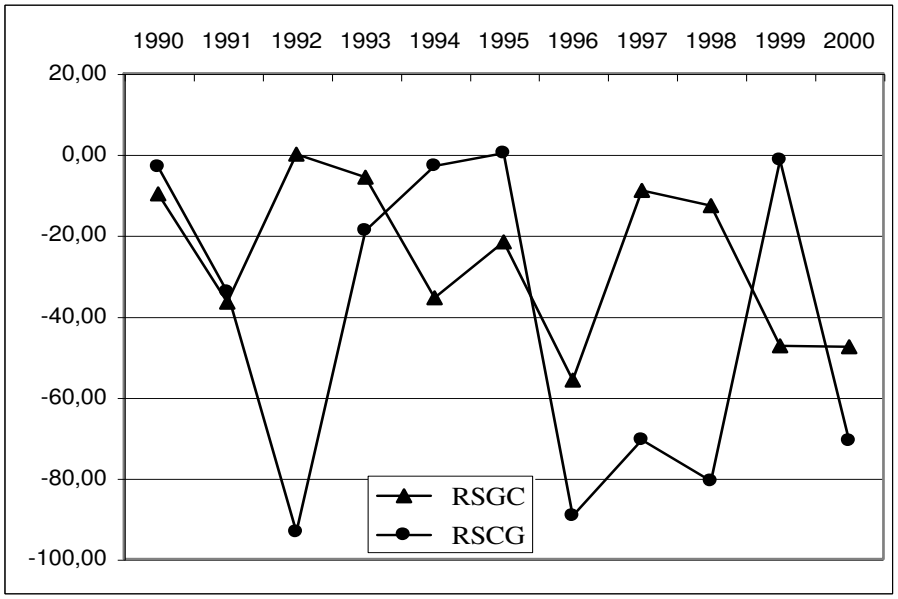

Figure 3. Relative Security deviations (%) of Greece (RSG_C) and Cyprus (RSC_G) (optimal with respect to target values)

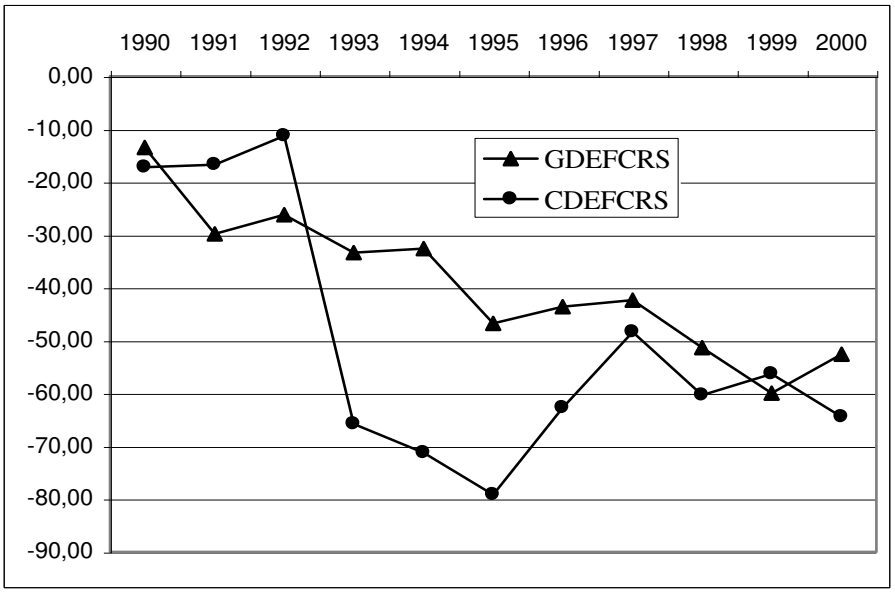

Figure 4. Defence Expenditure deviations (%) of Greece (GDEFCRS) and Cyprus (CDEFCRS) (optimal with respect to target values)

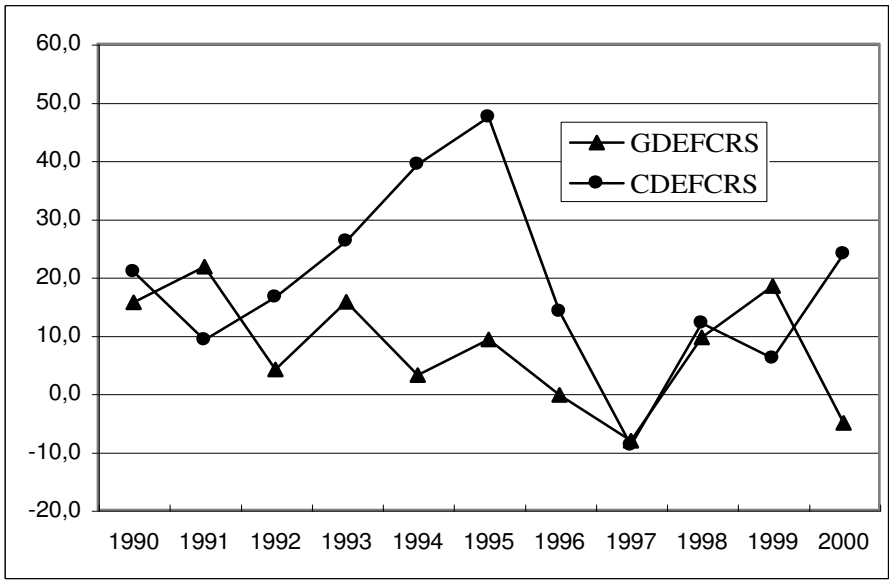

Figure 5. Defence Expenditure deviations (%) of Greece (GDEFCRS) and Cyprus (CDEFCRS) (actual with respect to optimal values)

It is important to remind once more that the values derived are "optimal" only from the economics point of view that is compatible to the constraints imposed by the model. Such values, therefore, are expected to differ compared to the corresponding actual values which can be considered as "de facto optimal" since their choice involves, in addition, geopolitical and strategic criteria that do not enter our constraints structure. Thus, the difference between the two aims at pointing out the resources devoted to defence over and above what the constrained optimization procedure indicates and may be regarded as the cost suffered as a result of the arms race in which Greece and Cyprus are involved against Turkey.

The final interesting conclusion concerns the choice of the ally that will be more successful in undertaking the human resources policy of the allies in view of the Turkish superiority as regards population developments. All our experiments lead to the conclusion that the relative security of both allies is maximized if Cyprus undertakes the task of counterbalancing the population developments that turn the relative security indices in favor of Turkey (Table 1). This is rather straightforward given the better

demographic performance of Cyprus in comparison to Greece and bearing in mind the structure of the relative security indices that rely exclusively on the demographic developments of the two sides. In case, however, that Cyprus undertakes the burden of counterbalancing the relative security gap against Turkey, then the actual defence expenditure of Greece is allowed to deviate from its optimal values by almost twice as much compared to the baseline figures mentioned before. The explanation in this case once again confirms the reasoning behind the change in the defence dogma since the human resources dimension is allowed to Cyprus to cope with, while Greece shifts to the more expensive solution of emphasis on technology and modern equipment.

Table 4. Human Resources (HR) policy effectiveness by individual ally

HR Policy Assigned to:	RSC_G	RSG_C	GDEFCRS	CDEFCRS
Greece	0.28	1.31	4.37	3.39
Cyprus	0.41	1.35	4.12	3.61

Under the circumstances, therefore, it might be worthwhile to consider the possibility that the well-known international trade recipe of comparative advantage might improve the efficiency of the Integrated Defence Doctrine. Bearing in mind our results, a suggestion may be to assign the alliance needs in terms of capital resources development and modernization to Greece, while Cyprus may be assigned to cope with the human resources in terms of manpower requirements of both allies.

4.5 CONCLUSIONS

The results discussed above may be summed up as follows:

i. The returns in terms of relative security that Greece derives as a result of its alliance with Cyprus are considerably higher compared to the benefits of its ally.

ii. The resulting average peace dividend measured as the deviations of the actual from the optimal defence expenditure values for the two allies does not exceed 10% and 20% for Greece and Cyprus respectively.

iii. Raising the relative security coefficient that relies exclusively on human resources is a task that will be better undertaken by Cyprus, given its better demographic performance in comparison to its ally. This will enable Greece to shift resources to capital equipment, technology and modernization of its armed forces, something that will counterbalance the weakness of both allies in the area of population developments vis-à-vis Turkey. This expensive task, however, faces a number of additional constraints imposed by the Conventional Forces in Europe (CFE) Treaty and the increased defence requirements of the NATO and the Euroarmy, not necessarily coinciding with the Greek national defence priorities.

4.6 REFERENCES

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