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OPTIMAL GROWTH UNDER MILITARY THREAT

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National Defense is a public good that requires resources for its production and its availability affects the economic behavior of private agents. A major policy problem of the government is to find an optimal allocation of resources between private use and national defense. It is shown that, in a simple optimal growth framework, a government's solution may not be the one that satisfies the military authority's objective. Attention is drawn to the need of cooperation between these two bodies and to the importance of the transparency of military expenditures in reaching a compromise that satisfies the public.

Keywords: Defense, Optimal Growth, Public Goods, Decision Making

INTRODUCTION

A glance at history is sufficient to see that analysis of economic policy under 'peaceful' circumstances is hardly satisfactory in explaining the behavior of governments, democratic or otherwise. A country that faces a military threat will try to seek ways and measures to counter it. These may range from efforts on the diplomatic front (say, joining a military defense pact) to build up the necessary military potential to eliminate the threat (say, through developing a pre-emptive strike capability). Inevitably, these efforts require some of the country's resources to be allocated for national defense purposes. In other words, the people of the country will be asked to give up some of their current income, in exchange for an insurance against the probability of the realization of the military threat. It is clear that people will accept such a decision (i.e. imposition of a tax to finance national defense expenditures) only if they feel such a threat will adversely affect their well-being.

The purpose of this paper is to look at the problem of allocating resources between civilian use and national defense under a military threat and the decision-making process behind it. This problem is examined in a simple two-sector economy setting. The first sector is identified as producing an all-purpose commodity. It is produced by the private sector and this commodity can be used for consumption and investment purposes as well as the physical input in the production of the national defense good. The public sector, on the other hand, is solely

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engaged in the production of a public good, namely, the national defense service. It is assumed that, since issues pertaining to the national defense service require high level specialization and technical competency, all decisions related to its production and supply are delegated to a special agency (i.e. the military authority). The economic policy problem that the government is facing is, then, finding an optimal growth path for this economy by appropriately allocating resources between private and public use.

The paper is organized as follows. In the following section the main features of the economy in question are examined. The third section is devoted to the description of the demand and supply of the national defense service, which is treated as a public good. In the fourth section, the government's economic policy problem is formulated in finding the optimal growth path of the economy in question, under a given military threat. The fifth section is an attempt to offer a logical explanation for the likely diverging views of the government and the military authority on the issue of allocating resources to national defense. The paper concludes with the discussion of the importance of mutual trust and cooperation between the government and the military authority.

A SIMPLE TWO SECTOR ECONOMY: MAIN FEATURES

The following assumptions are presumed to hold in the economy in question.

(1) A single all-purpose commodity is produced by the private sector in a perfectly competitive environment. All investment is carried out by the private sector only to enhance commodity production capacity.
(2) The public sector is solely focused on supplying a single public good, namely 'national defense'. The national defense expenditures are financed by taxes. The budget is always balanced.
(3) The economic policy problem of the government is to maximize the inter-temporal social welfare function, which is assumed to depend on per capita consumption.
(4) The investment decisions of private agents (firms, households) are sensitive to the security level that the country achieved. An unsatisfactory security level induces *capital flight* (i.e. private agents prefer to invest abroad).
(5) The current account of the balance of payments is always balanced.

Under these assumptions the economy in question can be characterized as follows:
The national income identity is:

$$Y = C_p + I + G + F_p \tag{1}$$

where Y-national income; C_p-consumption expenditures of those that work in the private sector; I-investment (all investment is assumed to be undertaken by the private sector in Y good production); G-public expenditure, F_p-capital flight (investment abroad).

Public expenditures, G, consist only of expenditures related to national defense. Under this heading, two types of expenditures can be distinguished. The first is the salaries paid to the military personnel, W_g, and the second is the expenditures for procuring military equipment and for operations and maintenance, G_m.

$$G = W_g + G_m \tag{2}$$

Suppose that the production function for the private good is of the Cobb–Douglas type:

$$Y = K^{\alpha} L^{1-\alpha} \quad \alpha \varepsilon (0, 1) \tag{3}$$

where K is the capital stock and the L_p is the labor (assumed to be homogeneous) employed in the production of the private good Y. Since perfect competition assumption is made, all factors of production are paid according to the value of their marginal products:

$$w_p = \frac{\partial Y}{\partial L_p} \quad \left[and \quad r = \frac{\partial Y}{\partial K} \right] \tag{4}$$

where w_p is the wage rate in private good production and r is the rate of return on capital. It is further assumed that the same wage rate also applies to the military personnel, L_g.[1] Under these assumptions, the amount of tax revenue, T, needed to finance national defense expenditures, can be written as:

$$T = \frac{\partial Y}{\partial L_p} L_g + G_m \tag{5}$$

Levying such a tax, obviously, requires public approval (say through voting in the parliament).

Total consumption, C, is the sum of the consumption of the privately employed, C_p, and the consumption of the military personnel, C_g. Let us denote it by C and assume that the aggregate consumption function for this economy is a linear function of the aggregate disposable income:

$$C = \gamma(Y - T) \quad \gamma \varepsilon (0, 1) \tag{6}$$

From equations (5) and (6), under balanced current account and budget assumptions, total savings for this economy can be expressed as:

$$S = Y\text{-}C = Y - \gamma(Y\text{-}T) = (1 - \gamma)Y + \gamma \left[\frac{\partial Y}{\partial L_p} L_g + G_m \right] \tag{7}$$

The last entity in the national income identity is investment, I_p. In this economy all investment is assumed to be undertaken by the private agents to inject capital in to the production of private good, Y. Capital is assumed to depreciate at an instantaneous rate δ. Therefore:

$$I_p = \frac{\mathrm{d}K}{\mathrm{d}t} - \delta K = \dot{K} - \delta K \tag{8}$$

THE DEMAND FOR *NATIONAL SECURITY GOOD* AND ITS SUPPLY

How much a country demands national security good (service), Z, depends on the intensity of the threat that the country is perceived to be subjected to and the size of the country. Suppose that the population of the country is used as a proxy for its size. Let L denote the total population of the country, which is assumed to grow at a constant rate n (i.e. $\dot{L}/L = n$). Then, the demand for national defense good can be expressed as a function of the level of the perceived threat, γ, and the size of the population of the country, L:

[1] It is assumed that $L = L_p + L_g$.

$$Z^d = Z^d(\Upsilon, L) \tag{9}$$

Let us assume that Z^d can be written in the following decomposable form:

$$Z^d(\Upsilon, L) = Z_1^d(\Upsilon) \times Z_2^d(L) \tag{10}$$

Suppose that the perceived threat level, ξ, is fixed. Then the first expression on the right-hand side can be written as:

$$Z_1^d(\Upsilon) = \xi \tag{11}$$

The public good characteristic of the national defense good is introduced into this framework by setting its elasticity of demand with respect to the size of the population $v < 1$.[2] In other words:

$$Z_2^d(L) = L^v \qquad v\varepsilon(0,1) \tag{12}$$

Under these assumptions the demand for national defense service to counter a given threat is obtained by inserting equations (11) and (12) into (10) as:

$$Z^d(\Upsilon, L) = \xi L^v \tag{13}$$

In order to characterize the national defense good production, it is assumed that the armed forces' organization is based on its weapons arsenal. Since each weapon needs a strictly defined crew to operate it, the personnel requirements of the armed forces can be derived from its weapons' profiles. In other words, the national defense good is assumed to be produced by a Leontief-type fixed coefficient production function:

$$Z^s = \min\left[\theta \mathrm{G_m},\ \beta L_g\right] \tag{14}$$

where θ and β are the output to physical input[3] and labor coefficients, respectively. Assum-

[2] Notice that when $v = 0$, the size of the population does not affect the national defense requirements. This is pure public good case. On the other hand, $v = 1$ corresponds to pure private good case, where need for national defense service is a linear function of the size of the population. In fact the $v < 1$ case corresponds to what is referred to as *social infrastructure* in Chin (2002). The assumption $v < 1$ implies that an increase in the size of the economy (measured say by its population) requires a higher (but not proportionally) military force. For example suppose a city with a population of 750,000 can effectively be defended against air strikes by three surface-to-air guided missile batteries. The same air defense system may still be sufficient when the population of the city increases to 1 million and one more battery may be needed when the population is between 1 and 2 million.

[3] There are two issues to be discussed concerning this formulation of the production technology for the national defense good. The first is related to the malleability of the single all-purpose commodity. It is assumed that it can take any shape, including various types of weapons. This assumption makes it possible to aggregate the weapons arsenal of the armed forces under a single physical input category. The military personnel, like the labor force in the private sector, is assumed to be homogeneous.

The second issue is the treatment of capital input in the production function for the national defense good. The formulation given in equation (14) is based on a circulating capital model. In other words, physical inputs are assumed to wear/tear in one production period, which does not correspond to the reality in many instances. Many weapon platforms (bombers, warships etc) have quite long operational life to be considered as circulating capital inputs. For example, the Boeing B-52 jet bomber entered USAF service in 1952 and is still operational in 2003. A similar example can be given from the Soviet Union. The Tupolev Tu-95 turbo-prop bomber entered the Soviet Air Force service in 1956 and is still operational in 2003. Long enduring warships are not uncommon. *HMS Vengeance* joined the Royal Navy in 1945. It was still operational in 2002 in the Brazilian Navy as *Minas Gerais*. Finally the Chrysler (later became General Dynamics Land Systems) M-60 MBT, which entered the US Army arsenal in 1960, is still operational in many armies of the world, including Israel and Turkey, and some are kept in Reserve and Army National Guard Units in the USA.

ing efficiency in the national defense good production, its supply can be expressed as a linear function of the active military personnel as[4]

$$Z^s = \beta L_g \tag{15}$$

It is clear that under ideal conditions, the government is expected to satisfy the demand for national defense fully. However, in reality there may be some discrepancies. At a given level of threat, excess demand for national defense good

$$E(z) = Z^d - Z^s \tag{16}$$

may or may not be zero. If national defense is a matter of concern for the people living in the country in question, then the sign as well as the magnitude of the excess demand for national defense good can be expected to influence their behavior. Simply by looking at the excess demand for national defense good three cases can be distinguished:

(i) $E(Z) = 0$. The supply of national defense good matches the demand, and therefore the desired security level can be assumed to be reached. Under these conditions people can be expected to behave as if there is no threat.

(ii) $E(Z) < 0$. There is an oversupply of national defense good. This may either be due to waste or excessive military build-up aimed for another purpose than national defense. In this case, people may either be concerned about the efficiency in the public sector or the possibility of an aggressive policy pursued by their government.

(iii) $E(Z) > 0$. There is excess demand for national defense good. In this case, people of the country may have concerns about their security. From an economic point of view this is the interesting case, since the degree of insecurity that the people feel can be expected to reflect itself on to their economic decisions.

In order to explore the last case in the simple framework of this paper, let us define the following variable:

$$\sigma(Z) = \frac{E(z)}{Z^d} = 1 - \frac{Z^s}{Z^d} = 1 - \frac{\beta L_g}{\xi L^v} \tag{17}$$

It is clear that $\sigma(Z) \in [0, 1]$. The calculation of σ requires specific information concerning the military technology chosen, β; the level of military threat, ξ; and the number of the military personnel, L_g. It is reasonable to assume that only the military authority is endowed with such information and the technical capability to process it. Private agents, on the other hand, are

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One way of interpreting the circulating capital treatment of weapons is to assume that such long enduring weapon platforms are either leased or the portion of G_m allocated to such weapons refers only to the installment payments for their acquisition.

It should also be pointed out that the operational life of a weapon platform can be extended effectively only by the continuous introduction of modifications required by the advances in the military technology. A second interpretation for using the circulating capital model in national defense good production is based on this observation by introducing two assumptions. The first assumption is that the weapon platforms are infinitely enduring. However, due to rapid advance in military technology, modifications are required to extend their operational life.

Going back to the example given above, the most successful long-range bombers of the aviation history, the B-52 and Tu-95 were modified almost continuously during their operational lifetime. In fact, eight variants of B-52 and nine versions of Tu-95 entered the service of their respective air forces, and they were also simultaneously upgraded. For more information see Gunston & Gilchrist (1993, pp. 87–102) and Baugher (1998) for B-52 and Gunston (1995, pp. 424–427) for Tu-95.

[4] For the sake of simplicity, it is assumed that, referring one of the input coefficients is sufficient to identify a military technology. In the remainder of this paper, the output/labor ratio, β, will be used for this purpose.

assumed to lack such knowledge on rather technical military issues. Therefore, they can, at most, be expected to have some assessment of the level of national security that the country is enjoying. Suppose that their assessment can be translated into an estimate of σ, say $\hat{\sigma}$.[5] On the other hand, private agents will take this information into account in their major economic decisions.

Let:

$$\begin{aligned} \eta(\hat{\sigma}) &= \hat{\sigma} \qquad \hat{\sigma} \le \zeta < 1 \\ &= 1 \qquad \hat{\sigma} > \zeta \end{aligned} \tag{18}$$

where ξ is the 'security threshold' (i.e. the level of security that is considered satisfactory by the people of the country). Suppose that when the security level is below the threshold level, people get worried and curb their investments and capital flight occurs. A rather simple way of incorporating this phenomenon into the analysis is introducing an investment function of the following form:

$$I_p = \eta(\hat{\sigma})\left[Y - C - T\right] = \eta(\hat{\sigma})\left[(1-\gamma)Y + \gamma\left(\frac{\partial \mathrm{Y}}{\partial \mathrm{L_p}}\mathrm{L_g} + \mathrm{G_m}\right)\right] \tag{19}$$

This investment function indicates that capital flight occurs if and only if the excess demand for national defense is positive (i.e. $F_p > 0 \Leftrightarrow E(Z) > 0$).

The level of security threshold, ξ, has little, if any, meaning for a military decision-maker. The military authority is given the task of taking the necessary measures to counter the threat fully and, therefore, has the responsibility to base its decisions on its technical evaluation. The ignorance of the public does not play any role in the military decision-making. However, for the political authority, the threshold level is important, since it marks the point where the economic behavior of the private agents changes. For example, for the government it may not make sense (i.e. it may not be 'economical') to increase national defense expenditures beyond the threshold level.

THE GOVERNMENT'S ECONOMIC POLICY PROBLEM: FINDING THE OPTIMAL GROWTH PATH UNDER THREAT

Suppose that the government's economic policy objective is to find the optimal growth path for this economy, by taking into account the need to allocate some resources to national defense. For this purpose, suppose that the social welfare of the society is approximated by the per capita consumption and is given by the following inter-temporal social welfare function:

$$W(c) = \int_0^\infty u(c)\mathrm{e}^{-(p-n)t}\mathrm{d}t = \int_0^\infty \ln(c)\mathrm{e}^{-(p-n)t}\mathrm{d}t \tag{20}$$

where c is the per capita consumption, ρ is the subjective rate of time preference of the society, and $u(c) = \ln(c)$ is the instantaneous utility function.[6]

[5] For the sake of simplicity here, the government's ignorance level is assumed to be the same as that of the public. In fact, one can expect governments to be more knowledgeable on military issues than the private agents, but not as much as the military authority.

[6] This is a special case of constant-relative-risk-aversion utility functions. For In the relative-risk-aversion coefficient is 1, see Romer (1996, p. 40).

Let the share of military personnel in the total labor force be defined as:

$$\mu_g = \frac{L_g}{L} \tag{21}$$

Since the production function for the national defense good is of Leontief type, when military technology is given, under efficiency in production assumption, μ_g will also determine the physical input requirements for the national defense good production:

$$g_m = \frac{G_m}{L} = \omega\mu_g \quad \text{where} \quad \omega = \frac{\beta}{\theta} \tag{22}$$

Therefore μ_g can be considered as a proxy for *military strength*.
Let us denote the other relevant per capita variables as:

$$y = \frac{Y}{L},\ k = \frac{K}{L},\ i_p = \frac{I_p}{L},\ c = \frac{C}{L} \tag{23}$$

Since

$$\frac{\dot{K}}{L} = \dot{k} + nk \tag{24}$$

the following expressions can be derived:

$$y = \mu_g^{1-\alpha} k^{\alpha} \tag{25}$$

$$\dot{k} = i_p - (\delta + n)k \tag{26}$$

and

$$i_p = \eta(\hat{\sigma})\left\{\left[(1-\gamma)\mu_g^{1-\alpha} + \left(\frac{1-\alpha}{(1-\mu_g)^{\alpha}}\right)\right]k^{\alpha} + \omega\mu_g\right\} \tag{27}$$

Using equations (17), (21), (26) and (27), and assuming that the $\eta(\hat{\sigma})$ is known,[7] the government's economic policy problem can be formulated as an optimal control problem as follows:

$$\underset{\mu g}{Max} \int_0^{\infty} \left[\ln(c)\right] e^{-(p-n)t}\, dt$$

subject to

$$\dot{k} = \eta(\hat{\sigma})\left\{\left[(1-\gamma)\mu_g^{1-\alpha} + \left(\frac{1-\alpha}{(1-\mu_g)^{\alpha}}\right)\right]k^{\alpha} + \omega\mu_g\right\} - (\delta + n)k \tag{28}$$

[7] This assumption implies that the government is able to gather reliable information concerning $\hat{\sigma}$ and ζ.

where

$$c = (1-\gamma)\left\{\mu_g^{1-\alpha} - \left[\frac{(1-\alpha)\mu_g}{(1-\mu_g)^{\alpha}}\right]k^{\alpha} + \omega\mu_g\right\}$$

and

$$\mu_g \, \varepsilon \left[0,1\right]$$

In this problem, the control variable of the government is μg; the ratio of military personnel to total labor force. The state variable is k; the aggregate capital/labor ratio.[8]

Let

$$(\hat{\mu}_g, \hat{k}) \tag{29}$$

be the optimal solution of the economic policy problem given in equation (28). Then the resources allocated to national defense, in per capita terms, will be:

$$\hat{g} = \hat{\mu}_g \left\{\left[\frac{1-\alpha}{(1-\hat{\mu}_g)^{\alpha}}\right]\hat{k}^{\alpha} + \omega\right\} \tag{30}$$

ALLOCATING RESOURCES FOR NATIONAL DEFENCE: ECONOMIC AND MILITARY CONSIDERATIONS

The implementation of the solution of the economic policy problem given in equation (28) obviously requires information sharing and cooperation between the economic policy making body and the military authority, and also the consent of the public (for example through the approval of the budget by parliament). In fact, the rules for such cooperation are devised in all countries that have budgetary procedures. The military authority determines the military technology, β, and presents its budget proposal, $\breve{\mu}_g$, to the government. The government, then, uses this information to solve its economic policy problem.

If $|\breve{\mu}_g - \hat{\mu}_g| < \varepsilon$ for an arbitrarily small $\varepsilon > 0$, then the military authority's budget proposal can be considered to coincide with the optimal solution of the government's economic policy problem. However, such an outcome is highly unlikely. The differences in the responsibilities of the government and the military authority compel them to consider the allocation of resources for the national defense problem from different angles. It is, therefore, natural for these two bodies to have some divergence on this issue.

Consider the problem examined in the previous section. There, the government's purpose is to maximize welfare of the society. In this context, allocating resources to national defense is a necessity, since insufficient national security creates an unsuitable environment for investment and, therefore, adversely affects the growth performance of the economy. However, for the military authority the problem is different. The military authority's problem is to take all the necessary measures to counter the military threat. For the military authority, the economic consequences of such a decision is, at least, secondary. Once the differences in the tasks of the government and the military authority are taken into account, the military authority's budget proposal can hardly be expected to coincide with what is optimal for the government from an

[8] The problem depicted in equation (28) is the well-known Cass–Koopmans approach to finding an optimal growth path in a one-sector economy. See Chiang (1993, pp. 253–263) for a brief discussion.

economic policy point of view. Therefore, it is not a surprise to observe a disagreement over the national defense budget between governments and military authorities, when both do their jobs properly. The question, then, becomes making a choice between the proposal of a less knowledgeable *principal* (the government) and that of a more knowledgeable *agent* (the military authority) or finding a compromise. Reconciliation of these two, possibly conflicting, views requires effort from both parties towards understanding each other's concerns and the logic behind the arguments put forward.

In order to elaborate the points raised above, let us return to the simple framework developed in the previous section. The model presented there has three issues on which these two decision making bodies should come to an agreement. These are identification of the level of the military threat, ξ; choice of military technology, β; and determination of the military strength, μ_g.

Assessing the military threat, ξ, requires the evaluation of issues ranging from the military capabilities of the probable adversaries to their intentions. Therefore, determining the effective level of threat is a multi-criteria decision problem that can be approached in many different ways, so presenting diverging conclusions. This may indeed be one of the sources of the potential differences between governments and military authorities, as they approach the same problem from different viewpoints. For example, a well-functioning military authority may attribute more weight to the military capability of the potential source of threat than the political authority does, and less to the effectiveness of the international agreements in preventing the realization of such threat. The reverse may hold for the government.[9] In order to simplify the problem at hand, henceforth it will be assumed that the government and the military authority are in full agreement on the level of the military threat, ξ. For the remaining issues let us look at the military authority's problem, which is and should be, different from that of the government's.

The military authority's sole concern is to counter the military threat, to its possible full extent. Therefore, its objective function is to minimize the excess demand for national security. The military authority can achieve this objective by choosing the most appropriate military technology, $\tilde{\beta}$ (the control variable), and securing the necessary amount of resource, $\tilde{\mu}$, (the state variable). The military authority's problem, therefore, can be expressed as follows:

$$\begin{aligned} &\underset{\omega}{Min} \int_0^{\infty} \sigma(\beta, \mu_g)\, \mathrm{d}t \\ &\text{subject to} \\ &\dot{\mu}_G = \psi(\beta, \mu_g) \\ &\beta \in \mathbf{B} \end{aligned} \tag{31}$$

where **B** is the set of available military technologies. The equation of motion for the state variable indicates that, at any point in time, the change in the resource requirements for national defense depends on the military technology chosen and on the resources already allocated for this purpose. The military authority, thus, determines its choice of military technology and its resource requirements over time to counter optimally the perceived military threat (i.e. ($\tilde{\beta}$, $\tilde{\mu}_g$)).[10]

[9] One may also expect the military authority to have an upward bias in assessing the threat (i.e. placing more emphasis on the worst case scenario). On the other hand, the government may tend to exaggerate the political consequences of allocating less resource to civilian use.

[10] Since the objective function and the constraints of the problem are not explicitly stated in equation (28), this formulation pictures a less transparent environment than the government has in making its economic policy decision. This is assumed to reflect the secrecy related to national defense issues.

It is clear from equations (28) and (31) that the government and the military authority have different objective functions as well as different constraint and information sets. Therefore, it is natural for these two decision-making bodies to end up with different conclusions concerning the resources to be allocated for national defense. In particular, in contrast to the government, the military authority's solution does not take into account economic variables. The problem as posed in equation (31) is purely in military-technological terms.

In addition, governments cannot be fully knowledgeable on the deep and complex field of military technology.[11] Therefore, in most instances, the disagreements between governments and the military authorities over the military budget can be expected to stem from economic considerations. In order to see the implications of the differences between the government and the military authority, let us concentrate on the budget making process:

(1) The process starts with the military authority's request for resources, derived from the solution of equation (31), $(\tilde{\beta},\ \tilde{\mu}_g)$.
(2) The government takes $\tilde{\omega}$ as given and solves the problem given in equation (28) to find the optimal resource allocation rule, $\tilde{\mu}_g$.
(3) The disagreement arises only if $\tilde{\mu}_g > \tilde{\mu}_g$, i.e. when the resource demands of the military authority exceeds the budget that is consistent with the optimal growth path of the economy.

When $\tilde{\mu}_g > \tilde{\mu}_g$, the government has two options. The first is to ask the military authority to revise its proposal in order to squeeze into the limits of the government's budget. In this case, the military authority is expected to make the cuts in its resource needs and, if it is deemed necessary, modify its military technology proposal, $\tilde{\beta}$. In the latter case, the government will be in a position of solving its economic policy decision problem once more, as $\tilde{\beta}$ is one of the parameters in equation (28).[12]

[11] There are instances in which governments forget their informational disadvantages and take drastic decisions concerning specific weapons systems. In the history of military aviation, for example, one such wrong decision is not forgotten. On 4 April 1958, then the ruling British Conservative Government issued the notorious White Paper, the so-called *Duncan Sandys Report*, named after the Minister of Defense. In this report, it was claimed that the future defense policy of Great Britain will be based on the concept of nuclear deterrence and declared that the strike and defense capability will be left to ground-launched guided missiles. This decision, which effectively stopped all work on the military manned aircraft (with few exception), not only turned out to be wrong for the British Armed Forces, but also resulted in disastrous consequences for the British aviation industry.

[12] Occasionally, but not very infrequently, governments go beyond this framework and they themselves limit or cancel procurements of certain weapons (i.e. *de facto*, change the military technology proposed by the military authorities). The following examples indicate that such governmental interventions are neither rare nor confined to democratic societies.

(i) In February 1949, the MD-450 Ouragan jet fighter made its first flight. The French Air Force wanted to acquire 850 Ouragans. In 2 August 1950, however, the French government reduced the order to 150.
(ii) In the first half of the 1950s, the Soviet Navy planned to acquire 110 Project 56 (Kotlin) class destroyers. Only 27 of them were acquired.
(iii) In 1976, the USAF was prepared to acquire 240 B-1A bombers. However, on 30 June 1977, President Carter terminated the project to procure B-1A bombers.
(iv) In 1980, Israel launched the IAI-Lavi multi-role combat aircraft project. The prospective IDF/AF requirement was 300 aircraft. IAI-Lavi made its first flight on 31 December 1986. However, on 30 August 1987 the project was terminated on budgetary considerations.
(v) In 1985, the Soviet Air Force made a request for 100 Tu-160 (Blackjack) long range supersonic bombers. Although the authorization was made, the production was terminated, in 1992, after the completion of the 36th aircraft. In fact, as a result of severe budget cuts, the Russian Air Force was able to acquire only 25 of them.
(vi) In 1990s, the USAF, planned to procure 133 B-2A Spirit stealth bombers. However, due to budget constraints, only 21 of these planes were acquired.

CONCLUSIONS

The preceding discussion reveals that allocating resources optimally between civilian use and national defense purposes is neither a pure economic decision problem nor it can be left to the discretion of the military authorities.[13] The government, being the less knowledgeable in military issues, may not fully appreciate the resource requirements for national defense. Therefore, it is more susceptible to committing mistakes that may endanger the national security of the country, if it acts alone. On the other hand, military authorities are well endowed with such information, but they are not in the position of evaluating the economic results of allocating resources between private use and national defense. Therefore, their resource demands to attain a national security level according to their standards may unnecessarily curb the resources available for private use and hinder the growth prospects of the country.

A Mutual trust and cooperation between the government and the military authority may make it easier and less costly for the country to find the optimal allocation of its resources between civilian and military use. Using the terminology of this paper, the government is assumed to be relatively more knowledgeable about the preferences of the public and is also more sensitive to their reaction. In particular, the government is assumed to be able to estimate accurately the private sector's response to the changes in the national security level, η, whereas the military authority is better qualified to measure the relative excess demand for national defense, σ. Under the mutual trust assumption, the government will take the military authority's proposal, $(\tilde{\beta},\ \tilde{\mu}_g)$, as a starting point and instead of searching for the optimal value of μ in the [0,1] interval, it may confine itself to the vicinity of $\tilde{\mu}_g$, say its δ-neighborhood, where $\delta > 0$ but is reasonably small. This will shorten the search period for the government. In return, the military authority will be more inclined to attribute budget cuts to the economic constraints that the government is facing and not to its ignorance on national defense issues.

Although the cooperation of the government and the military authority in achieving an optimal allocation of resources between civilian and military use is necessary, it can hardly be considered sufficient. From equation (5) it is clear that the taxpayers have the last word. They need to be convinced. This is the responsibility of the political authority. The government should be accountable to the public for its assessment of the threat and its decision to allocate funds to counter this threat. It goes without saying that the transparency of the military expenditures is an indispensable requirement for government in fulfilling this obligation.

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[13] See Günluk-Senesen (2003) for a concrete example of the inter-link between military and economic 'security', where she discusses the resource needs of the Turkish armed forces and its effect on the debt-burden of the country.