Defence Studies

The problem of allocating resources to defence

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Abstract

This article addresses the problem that societies face for properly allocating resources to grant security to their members. It examines the methods and ways for setting and distributing these resources to obtain enough military capabilities to face threats. This problem: the choice of an allocation that optimises social welfare is an old and constant concern of public policies.

The main novelty of this article is exploring this problem from the bounded rationality of the human being, i.e. choices made under imperfect information, preferences unsupported by economic rationality or the constrained effectiveness of non-market arrangements for deciding adequately. These issues may drive to allocations that do not obtain the largest welfare.

Keywords: defence and welfare economics, public choice, efficiency, market performance.

Subject classification codes: D20, D60, D70, D80, H40, H56, L10, O30.

Introduction

Security against any kind of aggression is a public good *par excellence* that societies shall provide to their members. In fact, accordingly to Maslow (1943), it is the second need of the human being after physiological needs and it is key for warranting his welfare (Kahneman *et al.*, 1999). Enthoven and Smith (1971) explored this question in their seminal work and Tilly (1990) showed its relevance in the formation of the State-nation, as nowadays it is known.

This article addresses this question, namely the allocation of resources to defence, i.e. its amount and distribution for providing security to their citizens, a demanding task that nations shall confront. It contends from its analysis that the methods, institutions and arrangements usually employed for such goal are subject to significant constraints, which may drive to decisions far from optimal.

The paper is organised as follows. First, it examines how the defence expenditure is determined. Second, it analyses the methods used to allocate this budget for obtaining the military capabilities that will provide security. Third, it assesses how these capabilities are obtained. Fourth, it examines the institutional framework used for expending the named budget. Fifth, it analyses the procurement of the means required by such capabilities. Finally, the paper concludes.

The determination of defence expenditure

The institutions, norms and conventions for deciding the expenditure in public goods is a consequence of the historical evolution of societies. Those who have favoured their development and growth have been the enduring ones, being the most extended the one that is described below in general terms, which also applies to defence.

This choice is made collectively, through Parliaments, were political parties, democratically elected, debate and decide on this issue. Negotiations based upon their political program on defence will drive to consensus supported by majority. The party, or the coalition of parties, that governs, plays a key role since they set the goals to achieve, over which a budgetary proposal will be crafted with the assistance of the organisations and agencies that compose the State Administration[1]. In this way, decisions are taken with relative low effort, in terms of information and negotiation, something important since the Defence Commission usually lacks enough competence, time, resources, and information to draw a budget (Wildavsky, 1979: 162). This allows agreeing a reasonably satisfactory, yet imperfect, budget with a reduced workload (Wildavsky, 1979: 49)[2].

1 Alliances on mutual defence provide advantages in terms of higher and less costly security, a question that would not be addressed for space reasons. It can be assumed that such commitments have been considered within the security goals agreed in the Parliament.

2 The budget is discussed in a Parliamentary Commission and the results of other Commissions are undisputed, thus impeding the simultaneous activation of a huge and confusing array of interests (Wildawsky, 1979: 131) as could be the defence needs against other social needs.

This method raises, however, some problems. First, citizens do not directly decide the defence expenditure nor its allocation among the different tasks[3]. They trust their representatives and the programme of the political party to whom they have voted, although its defence programme is usually wide broadly stated. Second, whereas the Parliament is the organisation that decides and approves the budget for achieving the desired defence goals, it will need the technical support of the Public Administration bodies, but these bodies also have interests to protect, which can be resumed in attaining the largest budget for them[4]. Third, the unbearable cost of achieving unanimous decisions means that the majority rule prevails, usually ignoring the opinion about these expenditures of the citizens, which have voted parties outside the governing coalition or party (Buchanan and Tullock, 1962: ch. 6). In sum, this procedure may approve a budget, which ultimately collides or differs from citizens preferences over the appropriate goods and services for defence, as for example between conventional or nuclear weapons[5].

This budget is, in any case, constrained by the resources that the State can afford, mainly through the taxes charged on economic activities (recorded in the GDP), which are a fraction of national wealth, although, in some cases, it can proceed from the issuing of public debt. It is also constrained by other social priorities and needs as health, education, justice or the communications and transport infrastructure. Whereas, according to economic theory social welfare is maximized, when the marginal utility divided by the marginal production cost of the quantity allocated equates the value of the remaining public goods identified, such amount is rather difficult to determine. This is because a utility function, able to calculate marginal values, cannot be built, since, aside from the intrinsic difficulty to determine individual preferences and production functions. Moreover, it is impossible to develop a social preference function that can be collectively acceptable departing from individual preferences as Arrow (1951) demonstrated. In other words, there is not a procedure or algorithm to set such value objectively.

Furthermore, the assessment of options will be constrained by the scarceness of reckon resources since economizing in this task makes sense. It will restraint the set of alternatives to explore, the precision and quality of the gathered information and the sophistication of the forecasting and prediction methods, as well as the number of variables to consider and the range of consequences to assess (Simon, 1997: 94). In this context, heuristics, aimed at achieving only satisfying solutions, without considering all the potential alternatives, replaces the search of optimal solutions (Simon, 1972)[6]. Such process can be reduced, in the worst case, to

3 Citizens may have a biased preference due to their scarce knowledge on defence issues. Since preferences are normally built (Slovic, 1995), political parties, special-interest groups and media play a key role in shaping preferences, despite not being their view necessarily objective.

4 Over this issue, see the classic works on public choice of Tullock (1965), Niskanen (1971) or Buchanan and Tollison (1972).

5 Note that for other goods, citizens may resort to the market, as is the case of education or health, if they perceive that their preferences are improperly covered, obtaining the desired service level from private agents.

relatively naïve methods based on intuition and the knowledge gained through trial and error-ridden discoveries.

The allocation of the resources to the different capabilities

Security can be provided through the development of coercive measures that dissuade other groups from jeopardizing national interests and, in case of failing such dissuasion, win the confrontation facing damages below a certain threshold[7]. With that purpose, organizational structures[8], operational methods, training, installations and material means shall be developed to endow armed forces with capabilities that allow them to apply named measures, as for example air defence of undersea combat.

Determining the quantity and quality of such capabilities, and the investment in human and material resources for their accomplishment, is a challenging task. This is because there is not an accurate production function that translates the above-mentioned resources into measurable capabilities and their utility is hard to assess, due to the imperfect knowledge of threats and contingencies as well as how these capabilities will overcome such menaces in case of conflict.

Indeed, the information about threats is based on intelligence reports, which can be incomplete or incorrect, offering an imprecise or distorted image of the adversary[9,]. Even when there exist agreements for exchanging information about weapons arsenals, there is a lot of information that nations are unwilling to share, as for example the potential aid of allies or their future intentions[10]. This hardens the comparison between own and adversary capabilities to determine the suitable ones. Even when this information is correct and complete, it is difficult to determine the outcome of a confrontation, despite the availability of [computer] models to evaluate

6 Samuelson (1954) stated the theoretical optimal value of such expenditure, but he also recognized the revealed preference problem that may result in insufficient information to actually locate such optimum.

7 This article does not address, for space reasons, despite its undoubtable interest, the question of diplomacy aimed at protecting national interest, reaching consensus and avoiding conflict, which complements the military task.

8 They are key to establish the communication patterns as well as the decision-making processes.

9 This was the case of the USA overestimation of Soviet missiles and bombers in the decade of the fifties (Haines and Legget, 2007) that was only adjusted with the development of spy aircrafts and surveillance satellites. Hartley (2011: 79) also comments the overestimation of the Soviet defence effort during the Cold War when the American weapons prices were used for this purpose.

10 Issues like the quality of weapons, the force preparedness or the willingness to combat are hard to measure, and States will try to hide or bias this information through propaganda or fake news. Estimations based on quantifying the human and material means allocated to capabilities may be deceitful, as the low effectiveness of Iraqi army displayed in 1991, despite its large budget and soviet arsenal. Equally, allies, in comparison with Germans, seldom showed in WW II the organizational abilities and flexible habits of mind to make full use of the great resources endowed to them (Millet *et al.*, 1986). An inferior amount of personnel, equipment and systems does not automatically mean a lower capability if their advanced features and combined functioning warrants high operational effectiveness as can be a sophisticated intelligence, surveillance, target acquisition and reconnaissance capability.

such outcome, due to the simplified methods used, which may drive to unreliable, ambiguous or even biased results[11]. Moreover, the interdependence among capabilities in achieving mission success impedes the attainment of a homogeneous and objective yardstick for comparing their effectiveness. And the countless operational scenarios can vary substantially over the rehearsed ones, due to changes in the geostrategic or geopolitical context, defence policy, tactics or technologies, –as can be an agreement on armament control among nations–, altering such valuation. In other words, the true outcome will only be known *ex post*, once the mission ends. Therefore, it is impossible, in practice, to measure consistently the utility of the different capabilities.

Potential biases

The amount to invest in defence is subject to two sources of bias. The first is due to the uncertainty of properly assessing capabilities, which is mainly made through narratives where services and armies justify their preferences. It may drive to the assignment of excessive relevance to certain missions and their associated capabilities, far from its true utility. This assessment may be performed under risk aversion –quite likely in an environment of rivalry, mistrust and fear among nations– overvaluing the existing threats and the vulnerabilities of the current military capabilities, driving to a biased interpretative frame[12], supporting the desire to accumulate defence capabilities[13], rather than risking the imputation of failure[14,]. Therefore, the demand of resources can be promoted above, in quantity and quality, to the one which obtains in a framework of more complete information, where it could be accurately quantified the probabilities, utilities and outcomes, thus attaining, in such a way, a more coherent and effective set of capabilities and a more adjusted resource allocation.

11 Exercises and rehearsals can help, but the reliability of the value obtained is limited, due to the artificial environment used, and their cost that limits their amount.

12 The overweight of improbable events is relatively easy, and decisions can be described or framed in multiple ways, yielding to different preferences as Kahneman y Tversky (2000) show.

13 The frequent public statement of military staff requesting more means, to perform their missions with success, does confirm this fact.

14 This conduct can be considered rational since it aims to achieve more flexibility and manoeuvring margin (Downs, 1966: 124; Cyert and March, 1992: 41). For example, a predator stores energy in their tissues to face the uncertainty of chasing the next prey. A modest excess of capability in a power supply plant can solve the problem of a precise estimation of energy consumption peaks and can face better the demand fluctuations, making unnecessary a tighter prediction (Simon, 1996: 149). Alic (2007: 124 and 186) states that a wide material catalogue of the armed forces allows them a higher tactical flexibility, despite being excessive or inappropriate. In this environment of unknown war effectiveness of military capabilities, governments can authorize the development of redundant and overlapping ones.

This framework strengthens the aim to expand the defence budget[15, 16] for attending foreseen needs and can drive the Defence Administration to submit a higher budget, uncontested by alternative security providers since it is the unique provider[17]. Its specialised knowledge of defence needs, and the way to satisfy them, facilitates its claims, although equally effective but cheaper allocations may exist. Moreover, the Administration may lack of interest to unveil such allocations and choose some that are more costly and less consistent with defence goals. In this context, when the defence requested by the representatives of citizens is below the budget proposed, waste is feasible due to such inadequate allocation[18].

The second bias source is the absence of conflict, which can convince citizens, or their representatives, with a smaller knowledge, that fewer expenditure in coercive capabilities is enough to dissuade and to keep the risk of conflict low, allowing the allocation of this remnant to other peremptory social needs.

The combined effect of both biases will depend on the negotiation between the legislative and executive branch, which may result in the acceptance, increase, reduction or rejection of the budget initially outlined. Parliament members will choose, however, under adverse conditions, due to: their limited knowledge about the budget appropriateness to reach the defence

15 This can be simplified in phrases like *more is better* or *new and complex is better*. The reason of such preference, among which there may be personal ones, is described in Niskanen (1971: 38). Simon (1997: 11, 144, 287) offers a similar argument based on what he names functional identification, where the Administration personnel tends to develop loyalty to its organisation that conditions their decisions about what is socially beneficial. This is because many of the personal values, not only depend on the organisation, but on its growth, its prestige or its success. Their salary and their power are related to the size of the organisation they manage. And its growth offers him, and his collaborators, wage increases, advancement and opportunity to exercise responsibility. This growth, according to Downs (1966: 27), helps also to raise moral and reduce internal conflicts. Although this identification is in the root of the organization effectiveness (Simon, 1996: 44), due to its ability to reduce problems of opportunism and moral hazard (Simon, 1991), it also impedes impartiality in the evaluation of the cost against the value obtained (Simon, 1997: 290) since, when a collaborator identifies with a goal, he tends to measure its organization in terms of adequacy rather than efficiency. Therefore, terms as *standard of desirable service* or *standards of minimum adequate service* lacks scientific base, until it is known its cost, the available resources for financing it and the curtailment in other services or private expenditures that this service increase will demand. In such case, the Administration officer can overweight certain social value with which he is concerned, disqualifying him, from the psychological point of view, to make decisions about what shall be assigned to his function (ibid.: 291).

16 Whereas there are rules to reduce the discretionary power of the Administration (Milgrom, 1988) and to discourage behaviours that favour personal interest, as the mandate to consult technical committees or being accountable regarding performed actions, there is always the chance that vested private interests keep some influence on decisions.

17 Competition may unfold among the services aimed at maximizing their role and budget, as it was the case of obtaining the nuclear weapon during the Cold War in the USA.

18 As for example, marketing activities aimed to highlight the relevance and value of defence and to promote expenditures in this field, or exotic, but inconsistent, activities like horse breeding.

goals and its objective valuation; the limited time available to its review, their reduced technical skills to offer alternative defence services with a better quality/cost ratio, or the low incentive of this task, since other subjects or activities have a bigger influence in their re-election[19, 20].

The hard task of determining the different budget items means that relatively naive methods, based to some extend on trial and error, are used. The basic reference is the expenditure of the previous year, being such items modified usually in small amounts around the last value (Lindblom, 1959; Davis *et al.*, 1966; Majone, 1989: 152). This simplifies the process, because, when there are not significant contextual changes, as the strategic or financial scenario, the same distribution is preserved, being the debate downplayed to those items that vary or are subject to higher scrutiny (Wildavsky, 1979: 3, 136, 150). That is to say, decisions are of incremental nature and changes are more by reaction than prediction of potential troubles (Cyert and March, 1992: 204)[21]. The main advantage is that, although goals are not reached immediately, but throughout a long sequence of small yearly adjustments, it allows to observe what occurs, evaluate its consequences and adjust allocations, avoiding unforeseen or undesired effects (Lindblom, 1959; Wildavsky, 1979: xxiii).

In a nutshell, it is an experimental process, in which events guide the decision making, since it cannot be established absolute values nor precise prognosis regarding the capabilities demanded by a future conflict. Under such circumstances, optimal allocations are unfeasible, being this task reduced to partial *ex post* amendments of goals, capabilities and resources, offspring of observed outcomes and gained experience. The uncertain utility of a capability, and the way to achieve it, will drive to improper allocations whose unavoidable correction will cause project cancelations, irrecoverable losses and over-costs. Whereas the development of civilian capabilities can drive to similar problems, the larger uncertainty and imperfect information of defence worsen this problem.

The acquisition process

The acquisition of defence capabilities and associated means requires centralized planning and coordination since the procurement of the human and material means has a complex maturation process and these capabilities display strong interdependences among them.

This planning requires a constant review and adaptation, due to the geostrategic evolution and the changes in threats, when doubts about the dissuading capability and effectiveness of current means arise. Its amendment involves the constant analysis of the contextual changes and

19 The deputies of the Defence Commission may consider especially relevant this service for society showing a benevolent attitude to the presented budget. Moreover, the objective valuation may be contaminated when their constituency receives investments that will generate jobs and wealth, a term known as “pork barrelling”.

20 The absence of information reasonably objective and contrastable explains that both *dove* and *hawk* policies can be sustained.

21 This is due to the instability that may occasion taking too seriously incorrect predictions caused by the difficulty of anticipating the future.

the achieved outcomes to validate the capability goals and the estimates correctness. Since calculation and analysis are insufficient to determine the best option, being necessary the experimentation and the observation to reduce uncertainty and decide properly (Williamson, 1967: 245), misjudgement will be an intrinsic feature of this process. In other words, plans are only indicative (Schlesinger, 1967) and it is illusory to believe that the human being has enough foresight to perform *ex ante* optimal allocations of capabilities and resources that ultimately will not demand subsequent changes (Davis, 2003).

The information problems mentioned previously generate an adverse environment for this planning. They may give room to ineffective decisions, particularly when assumptions used are weak. In this context, the aim will be to find satisficing more than optimal solutions. In other words, the attempt is not to maximize any value, but solve problems characterized by different and incommensurable goals[22] in an environment of immeasurable uncertainty (Slovic, 1995; Schlesinger 1963: 310). In this context, thought focuses more in armed forces needs and feasible solutions, and less in terms of resource scarceness and taxpayer savings[23]. And planners will be hardly awarded for reducing costs, but easily sanctioned if they err understating the needed capability (Keupp, 2021: 36).

The generation and evaluation of a reasonable and long-term set of alternatives becomes especially hard. As Simon (1996: 165) states planning has an intrinsic myopic character, since it tries to unfold a better future looking into the short term. According to this author (p. 158), the unconcern with a distant future is not a mere failure of empathy, but the recognition that we will be probably unable to foresee and calculate the consequences of our own actions for more than short distances into the future, and that those consequences will in any case be diffuse rather than specific. Such myopia can even make that today preference between two options, making everything else equal, will reverse with the passage of time as Bowles (2004: 106) shows when the hyperbolic discount function used by human beings is applied. Alic (2007: 130), based probably on the same intuition, claims that a far extrapolation of combat experience is a weak reference for defence decisions. Furthermore, surrounding factors can exacerbate such myopia, as the temporary horizon for setting the military capabilities, conditioned by the electoral cycle (Wildavsky, 1979: 265), which complicate the desirable agreement among parliamentary forces for the procurement of capabilities with a long maturation period.

In sum, the acquisition of military capabilities resembles more an iterative process of developments, essays, rehearsals, failures, retries and error learning than a linear process. This improvement process absorbs a considerable time and effort until a capability, truly effective in a wide range of scenarios, is obtained. Once more, this process is harsher in defence when compared to the civilian sector since information is less observable and verifiable.

22 E.g.: human life, adversary assets or international reputation.
23 This explains why, methods as the American PPBS, have had a limited success. A critique of this method is available at Wildavsky (1979: 137, 199, 221 and 228).

The institutional framework of budget execution

Security today is provided directly by the State. However, it has not always been the case. Sometimes, its provision has been left in the hands of private organisations as the contracting of mercenary armies by States shows through history (Axelrod, 2014)[24]. Today private military firms provide battlefield and battle support operations, as has been the case of Iraq or Afghanistan[25, 26]. In this section, the advantages and disadvantages of each arrangement are analysed to illuminate the issues associated to the search of efficient resource allocations.

The decentralized solution

Our analysis departs from the unpublished article *Design for a streamlined war economy* of the economist Abba P. Lerner (Hitch, 1960: 222), which suggested the allocation of resources for defence through the market mechanism in WW II[27]. The idea was to create military units having its own budget and freedom to contract personnel and material whose prices would be set by the interaction of market supply and demand, helping providers and collaborators to make better choices. The Chief of Staff would distribute the defence budget among these units based upon their value or utility, in such a way that the last dollar allocated to each unit would have the same value, i.e. when the utility obtained from a marginal increase of the budget of one unit would be neither superior nor inferior to the other ones. Commanders, based upon their specialised knowledge, would have freedom to allocate their budget internally and contract resources with the aim of maximizing profit. Competition would obtain capabilities in the most economic and efficient way, because such units would be more agile in exploiting chances, since competition: avoids collusion and offers solutions with a higher performance-price ratio; promotes innovation; allocates internal resources appropriately, searching efficiency, avoiding slackness and prices above their true value (Bowles, 2004: 485). In other words, the market, according to the fundamental theorem of welfare economics, facilitates an efficient organization and allocation of resources and production factors. However, the implementation of this idea raises important problems[28].

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24 There are a lot of cases as the 10,000 soldiers of Xenophon in 400 b. C., the Roman Empire deal with barbarian tribes to protect its borders, the Cid Campeador army contracted by Taifa Kingdoms in the Middle Age, the Big Catalonian Company of Roger de Flor in XIV century, the Swiss Guard or the German *landsknechte* in XV century, the *condottieri* of Italian City States in XVI century, the regiments of the count Albrecht von Wallenstein or the private armies of the English and Holland Oriental Indian Companies in the XVII century. The army of Louis XIV was based on regiments managed by colonels, which were paid for creating, equipping, training and maintaining such units. They profited with the difference between the treasure payment and the cost of sustaining such regiments, whose quality was evaluated by the inspection corps of the State Secretary of War (Niskanen, 1971: 203).

25 This trend is discussed in Markusen (2003).

26 Probably the compulsory service supported by patriotism was a proper incentive for the defence service in the XIX century and the outset of the XX, but it seems insufficient when the military service is not mandatory and the main mission is peacekeeping or peace-enforcement in faraway locations.

27 Keupp(2021: cap. 5) also explores a reform based on decentralization.

First, whereas in competitive markets the margin of benefit over the cost of the service should be relatively low, there is no guarantee that it will be the case when market agents are few and implicit collusion is feasible[29]. Even more, the Administration may prefer to pay a price above the value of a perfectly competitive market, to assure the fulfilment of the contract and the quality of the strategic service provided (Klein and Leffler, 1981; Akerlof, 1982; Shapiro, 1983; Tirole, 1988: 95; Bowles, 2004: 260). For example, Gintis (2009, 224) shows that governments may pay a higher value than the military firm next best alternative using the threat of not renewal to induce a high level of effort. That means that prices will not clear the market giving way to spared resources, which are an important social cost, when opportunities in other market niches are lacking. Hence, potential savings could be less than expected.

Second, the difficult measure of the utility, and its marginal value may drive to incorrect estimates and suboptimal budget allocations among units. As Cyert and March (1992: 93) claim the implementation of this theoretical concept is unfeasible in practice. In the same line, Alchian and Demsetz (1972) and Tirole (1988: 38) signal the difficulty of determining in a productive system the contribution of each part to the outcome.

Third, the transaction costs –i.e., the cost of defining the supply, finding the provider, contracting the supply and verifying its quality– will be considerable, since stating the service to provide and its price, based upon unknown states of the world, where defence needs are difficult to settle, is rather complex. The writing and the control of such service and the rights and obligations of parties, related to the different situations that can unfold along the contract, are quite complicated. This is because the ensuing changes will force the adaptation and renegotiation of the always incomplete contract, which impede fixing clauses for all the events and contingencies that may occur throughout its life[30]. These negotiations will be contaminated by the unproductive rent-seeking (e.g. lobbying), in an environment of imperfect information and the specificity of assets invested by each party.

The cost of verifying the quality of the service, a necessary task since the provider has incentives to economize on performance, offering lower values than contracted, can be significant, being firms uninterested in unveiling such loss. This oversight is complex since the valuation of the defence service requires talent and it is hard to observe and compare. Furthermore, the contract ambiguities will cause that parties make representations *ex post* favouring the mapping of the states of the world that benefit them.

In sum, the transaction cost may be considerably high, having in mind the critical and sensitive nature of the defence service, due to the significant

28 Note that the generation of forces for each mission would be centralized by the Chief of Staff using the available capabilities possessed by these units.

29 For example, price competition can be avoided agreeing to compete on less burdensome and more subjective issues as the quality of the service. Even price competition may occur for no avail if future contingencies assure a favourable framework for renegotiating extras later on.

30 Whereas trust and fair play can downplay these costs, there is no assurance that they disappear.

damage and catastrophic social consequences that a disagreement, and the loss of trust, of parties may cause.

Fourth, in a competitive framework where contracts are incomplete, the interdependencies of units, required to support operational capabilities, could jeopardize the combined effort that is needed. Overlooking such externalities could have damaging repercussions, as for example the absence of support claimed by other units, in a critical state during a mission, because less relevant, but more profitable, tasks were attended. Contract clauses that assure such collaboration and set proper incentives would be again difficult to fix and would drive to synergy losses.

Fifth, the idiosyncratic knowledge acquired by the first awarded firm, and the high cost of achieving such knowledge, will make that in the contract renewal, the number of bidders will fall considerably and steer to negotiation with a short number of firms, where a price that statistically shows the real value of the service is absent. In this framework, the provider will be better informed that the purchaser about the supply conditions, lacking, however, of incentives to display honest information preferring to partially appropriate of the saving that the State will obtain in the renewal. This asymmetrical information united to opportunistic behaviour[31] can drive to suboptimal transactions, whilst achieving information parity may be too costly for the Administration. This opportunism is unlikely with large competition –because it will drive to a reputational loss and, ultimately, the resort to ostracism–, yet likely, with few providers (Williamson, 1975: 5-10).

Lastly, the decentralized provision of this service cannot afford economies of scale when assets are indivisible and they cannot be jointly shared by firms, as for example training centres or logistic units.

In a nutshell, the provision of military capabilities through the market can unfold costs and degrade the quality of the service provided, overcoming the benefits of this arrangement[32]. This is due to the difficulty of creating a true defence services market, a consequence of the unreliable information about the price, quality, technology, market size, number of suppliers or property rights, which impedes an efficient decentralized solution.

The administrative solution

The previous difficulties suggest, as more appropriate or efficient, the internalization of the defence service through a bureaucratic or administrative organization, where a subordination or hierarchical structure prevails[33]. They may explain why core-competences remain internal and the market mechanism is reserved for outsourcing goods and services as

31 Opportunism can be defined as a lack of candour or honesty in transactions to include self-interest seeking with guile (Williamson, 1975: 9). It is rather feasible when profit-making rules firm behaviour.

32 This is an open question subject to debate as the GAO (2010) report shows comparing State Department Employees versus Contractors for Security Services in Iraq.

33 Hierarchies offer relevant advantages (Arrow, 1974: 68). On the one hand, it economizes in information exchange and decision making, since it is not necessary that everybody talks with everybody. On the other hand, it allows the specialization in decision making for a reserved number of employees.

transport, logistic, base support or mission equipment[34]. Such organisation obtains, on average, higher flexibility and lower transaction costs than an external contract that sets the adaptations that will be claimed when contingencies unfold, avoiding some of the undesirable effects mentioned before. It also suggests that the government can provide the defence service at a lower cost than markets, although internal transactions are also costly. However, internal regulations, drawn to improve efficiency, but made by a fallible Administration, subject to political pressures and without a competitive check, may not necessarily provide an efficient service. These regulations can be inappropriate or inconsistent with the goals agreed by the Parliament when they do not fit properly with all unfolding situations and impede the adaptations required to coordinate properly the large number of persons, organisations and equipment involved[35].

The core element of this organisation is the labour contract, which assures the availability of resources to perform the defence tasks demanded. This relationship, in which the principle of authority allows to postpone the definition of the tasks to perform and to adjust managers the provision of the service, allocating more efficiently the internal resources and the contribution of everyone, something essential when risks are hard to define and the required adaptations less predictable.

This arrangement allows more nuanced monitoring of the delivered service and the awarding of prizes and sanctions to employees based upon performance. It will favour efficiency and alleviate shirking. It will enable a better adjustment of salaries to real productivity and the promotion of worthwhile personnel within established rules and categories to reduce opportunistic behaviours. In such a way, dysfunctionalities will be perceived and corrected more easily, achieving a finer adjustment and, ultimately, a higher cooperation in the accomplishment of the organization goals.

This structuring offers also other advantages. First, the organisations of the Defence Administration do not pretend to extract benefits of exchanged goods and services among them. Furthermore, internal transactions, in comparison with external ones, maintain more common goals which favour the convergence of behaviours for such purpose. In this way, opportunistic representations as well as the manipulation of information, or the false representation of intentions, are attenuated, allowing a cheaper control and more efficiency in contrast with external transactions more subject to constant haggling where the equitably share costs and benefits among

34 The span of control means to sacrifice attention to detail as well as problems in the transmission or interpretation of information. Such problems distort orders and loosens the control of employees favouring discretional behaviour. It produces diseconomies of scale becoming in such a case rational –especially having in mind that the military lack of an idiosyncratic knowledge on supply– to externally contract such supply. In particular, for goods and services whose delivery is subject to less ambiguity, few contingencies, less skilled labour and a large number of competitors (e.g. when no much up-front capital to bid is needed), since such supply will be then more efficient.

35 For example, innovation and individual initiative may be dismissed in regulated environments where economic incentives and personal promotion are weaker and where it is difficult to accurately determine the individual contribution to the development of a military capability.

parties under new circumstances is more difficult. Second, the internal machinery of incentives and control is more extended and refined than the one obtained through the market. This allows a long-term investment view and a better adjustment to the changing defence circumstances in an adaptive and sequential form[36]. Auditions can be made more easily and the conflicts regarding internal transactions solved more dexterously due to the authority relation instead of haggling. The internal auditor will support the Defence Administration and will receive more internal aid, avoiding costly litigations and the appeal at courts. Third, this organization allows saving in the always scarce calculation capability, particularly true regarding adaptive decisions made sequentially, where it is too costly or impossible to generate the decision tree and assess all the paths that the different contingencies may generate, focusing attention to what occurs. This is important when approximation should replace exactness in decision making and when sound future transactions cannot be assessed *ex ante* due to uncertainty.

But this organisation also faces problems as Williamson (1975: 119) advises. For example, managing officers can be reluctant to reorganizations, even when they will not lose their job[37]. This is because, it is unlikely that they maintain their *status* when its position is eliminated, being probably altered their promotion perspectives. This reluctance may drive to subsidized positions despite their scarce utility, which explains the organisation inertia to renewal (Downs, 1966: 106; Millet *et al.* 1986: 56). In such cases, there can be opportunism in the search of subgoals of a part of the organisation, something that is well sustained when there is a *quid pro quo* relationship between the different managers, since they may hide or distort information and search for compromise solutions rather than efficient ones. This may explain the permanence of certain outdated and low value services within the armed forces (see note 17). Another example is the continued investment in acquiring a doubtful capability due to the spent amount, something discarded when starting from scratch. Unveiling such mistake can be difficult due to reasons of prestige or personal reputation. In this context, the decision to continue, despite the awareness of the mistake, will be transformed in a commitment for success –notwithstanding its stranded costs, favouring that useless projects are never abandoned since there is not a market [or confrontation] test for assessing its worthiness.

Whereas a common internal language reduces communication and raise interpretation issues, there can still appear situations with impact on efficiency (Williamson, 1975: 22-23, 122). For example, subordinates usually disclose information that confirms, rather than questions, the view of their superior to avoid doubts about their loyalty or value (Downs, 1966, 78), largely warping information. The problem is that managing officers can misdecide when they are short of valid information and their employees lack of incentives for its provision, something only available through costly audits and verifications. Furthermore, if there are more units involved in one issue, it will be harder to know what really occurred, as can be the reasons that

36 Indeed, the contract duration can make that firms plan inadequately their investment if they believe that the returns will fall when renovation fails.
37 Lay off of armed forces members or defence officers is quite rigidly regulated.

drove to the loss of a battle. In other words, internal control also displays limitations.

The procurement of means

The procurement of the defence material means faces problems as well. Its importance derives from the key role they play on the operational effectiveness and the neutralization of the adversary as well as the large budget share of such procurement. It often requires an intense activity of research and development for covering mission needs, which demands specialised organisations as research centres or the industry. It is frequently characterised by unpredictability, regarding the quality, performance and cost of the good as well as the expected return of the investment, which are hard to estimate *ex ante* and will differ normally from expectations.

The Defence Administration plays here a significant role, since it: plans the purchases, determines the quality and quantity of the means needed, chooses the suppliers, finances substantially their research and development, regulates the market and even owns some industrial assets and firms.

The features of these goods explain their different acquisition ways. The market is preferred for purchasing existing ones or those relatively easy to produce with the current industrial assets, while the sophisticated ones have a process characterised by a more regulated and integrated relationship with the Administration, i.e. closer to an internal organization, where the market plays a minor role, despite the use of public bidding. This is because the provisioning of these goods is subject to contingencies that recommends a long-term contract between the Defence Administration and the firm. It applies also to the contractor and the rest of firms that compose the supply chain, being the market only resorted when the transaction has a lower cost than the internal supply (Coase, 1937) as can be the acquisition of off-the-shelf components. This conduct provides substantial advantages, but it also raises problems described in the next paragraphs[38].

First, the security of supply recommends avoiding foreign firms' proposals, due to the risk caused by the denial of the operational means needed for the successful ending of a conflict when the State, whose company provides such item, opposes this conflict and blocks deliveries. This forces to preserve industrial autonomy for the design or modification of equipment driving to more expensive and less profitable supply lines, since the domestic industrial market infrastructure is too small to achieve economies of scale. Equally, the restriction of foreign investment in the national defence industry may weaken the policy role of the capital market on industrial performance, which will adversely affect the cost, efficiency or innovativeness of industry (Hartley, 2011: 23 and 235)[39]. Second, the need of equipment with advanced functionality and performance, well above

38 A complete integration lacks sense, because the over-dimension of the defence organisation, as has been signalled, generates significant diseconomies of scale, while firms can reap economies of scale when they manufacture similar goods.

39 Competition in the capital market can be weak when firms are unable to offer transparent information about their business, caused by the risk and uncertainty of defence procurement.

adversaries, requires significant investment in its development and production[40], whose risk shall be assumed by the Administration due to the unfeasibility that firms assume the hazard of meagre returns or even losses. However, since only a limited number of projects are financeable, the competition playing field will be slanted, because few firms will access such aids, whose advantages will force non-awarded ones to exit the market.

The complicated procurement also reduces competition since large industrial structures are needed for such developments and for an efficient production, supported by economies of scale, scope and learning[41]. In other words, this industry behaves as a natural monopoly since average cost constantly falls when the number of produced units raise. The outcome is scarceness of suppliers or lack of competition, which impede a better performance / price ratio fruit of industrial rivalry[42]. In addition, it also strengthens the market power of the firm in the negotiation process, something less feasible in a reasonably competitive market where rent seeking behaviours are unlikely (Martí, 2019)[43].

Third, the need to preserve, in case of crisis or emergencies, the military production capabilities, whose resumption, once suspended may be too costly, as can be key specialised equipment, requires nurturing constantly the defence suppliers to maintain their assets or even create excessive industrial, yet unprofitable, capabilities. Such support may be controversial when such capabilities does not deliver an operationally useful or competitive product, as can be the purchase of an unneeded ship when an arsenal order book is low[44].

Fourth, on occasions, there are restrictions to pure competition on price or quality. So, offers shall be made in consortia to receive State aids in order to promote collaboration, as it is the case of the European Defence Fund. For equity reasons, it shall be a mandatory promotion of Small and Medium Enterprises (SME) through State aids, despite not being necessarily the best option. Or there may be restraints over the eligible R&D costs that can be financed or the allowed profit rate[45].

Fifth, the principal-agent procurement relationship demands adequate incentives in order that the agent (the firm) performs the appropriate effort.

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40 This fact explains the growing cost trend of defence (Kirkpatrick, 2004).

41 According to Nelson, Peck y Kalachek (1967: 53), the defence and aerospace sector require big size firms for their research activities.

42 These problems extend to the supply chain where the providers of a certain subsystem or component are limited.

43 Firms can profit their monopoly status for obtaining extraordinary benefits that sustain them in falling demand cycles, over-pay their subcontractors when quality of service cannot be fixed accurately in the contract (Bowles, 2004: 260); or overpay their employees to preserve skills that will be key in future contracts and whose substitution costs are high in case of leaving such firms (Milgron, 1988).

44 This is commonly known as the *follow-on imperative* (Kurth, 1972).

45 This article does not address the issues related to the lack of transparency of the defence market, which may favour illicit behaviours as bribery or corruption. Side payments or services for those in charge of procurement may certainly distort competition and reduce efficiency at the taxpayer’s expense. Whereas honesty, ethical principles and supervision bound such hazard, it is suitable as media periodically report.

This is problematic in an uncertain environment when the available expertise or information of the principal and the agent differ (Arrow, 1984). The first difficulty is that the agent performs actions that the principal cannot observe or verify easily as it is the case of R&D activities. This problem, known as moral hazard, means that the agent can act discretionally in ways unconcerned with principal goals that will impact in the cost or the quality of the service contracted. The second difficulty, known as adverse selection, means that the agent manages more technical and economic information than the principal does, often under the appearance of protecting proprietary information. It can be used to influence on the principal decisions, despite not promoting his interests, as for example underrating project complexity or duration; overrating its quality or performance, or rejecting better SMEs proposals[46]. In any case, the uncertainty of the requested delivery will demand a price premium over a fixed price contract, that will raise the final cost. The principal (the Administration) finding this value excessive may prefer to support by himself the risk and arrange a contract that covers the cost plus a rate over this cost as benefit for facing unclear or evolving requirements. But this option weakens the agent incentive to expend frugally, allowing him to shirk or even reallocate resources to tasks unrelated with this contract (Williamson, 1975: 84)[47]. Whilst quality supervision cost audits, restrictions over benefits and future contracts denial can downplay abuse, such measures certainly will increase the transaction cost.

Conclusion

The problems outlined in this article show the difficult allocation of resources to defence, which can drive to inappropriate choices, whether by default or by excess, for facing a crisis, a conflict or a war. These problems affect social welfare, because such allocation always means a sacrifice in terms of goods and services that would not be assigned to cover other needs. I.e., this expenditure has an opportunity cost that shall be considered in the decision-making.

This paper has shown the boundaries of theoretical models to determine quantitatively optimal values for defence; in other words, the insolvability of determining *how much is enough*. It has also shown that the creation and maintenance of markets or quasi-markets for certain defence goods and

46 State ownership can remedy the damaging non-cooperative behaviour of industry that unfold in the framework of incomplete contracts and investments in specific assets. The power of the State in the board of directors can solve contract contingencies that will ultimately benefit defence. However, such ownership distorts the market when public-owned firms are preferred in biddings despite better proposals of private firms. Even more, its public nature can compromise its efficient allocation of resources when it does not face the risk of takeovers or bankruptcy. This secure context will favour a supply that does not keep the cost discipline demanded by open competition that excludes firms whose quality or price are out of the market. Politicians nominated for surveying the firm, to preserve public interest, can aggravate this problem when they do not adequately control its management (Tisdell y Hartley, 2008: 212).

47 Bower and Dertouzos (1994: 10 and 53) highlight this problem when they claim that awarding innovation, allowing a high margin of benefit over the cost, can induce a vigorous competition, but be damaging to embark in the hard learning of reducing the production cost.

services with enough variety of suppliers, to profit of the undeniable advantage of competition is hardly feasible. And that the limitations and fallibility of non-market arrangements (institutions, norms and conventions), for properly adjusting means to desired ends, seldom drive to agents conduct seeking social efficiency when they also attempt to promote their interests. Whereas non-compliance of such norms and institutions can be easily checked, their inadequate use driving to inefficient of improper allocations is harder to sanction (Keupp,2021:35).

They are a consequence of the principal-agent relation between the citizen and its political representatives, the parliament and the government, the government with the public administration, the administration with the industry and the industry with its suppliers. In all of them, it exists a clear stress to align the goals, partially conflicting of parties, which can drive to choices that disregard the common interest and steer to a suboptimal defence service in terms of cost or quality.

However, such arrangements show a considerable capacity to adapt and learn from internal interaction as well as from their environment to afford their goals. They can anticipate, to some extent, the consequences of their actions and responses, which endows society with a large recovery and survival capacity in a changing environment[48]. Anyhow, these arrangements lack an optimal state. They simply are enough flexible to choose options that practice unveils as more appropriate, through the development of new responses and the attachment of higher weight to successful ones in future decisions and in the formation on new rules of conduct, whilst reducing the role of options with worse results. In this way, solutions with good performance will prevail in the long term. But such evolution is not exempt of parsimony, in which getting out of inefficient or inadequate practices only accelerates after clear evidences unmask them, as can been a sound military defeat (Wolf, 1978) or a procurement scandal (Keupp, 2021: 44).

The limited rationality of the human being, due to imperfect information and processing shortcomings, plays a significant role in this process, since it impedes the exploration of all potential alternatives and solutions. This can drive to improper decisions as the overestimation of threats or spill over effects[49], wrong predictions of the future states of the world and unsound plans for facing such states (Davis, 2003). More generally, as Slovic (1995) highlights, decision-making is a way of processing information highly contingent, sensible to contextual factors such as its own complexity, the pressure of time, the response mode, the decision framework and the existence of proper references. In this context, the way in which information flows and is displayed or the beliefs and mental framework of the decision maker have a considerable weight in the final pronouncement, a problem also known as *framing*, where choices are more a matter of opinion rather than of logic, empirical measure and unquestionable rationality. For example, political or ideological values, unsupported by economic calculus, may be behind improper allocations.

48 In this sense, they can be seen as complex adaptive systems (David, 2003; Holland, 1992).

49 The profitability of military technologies in the civilian sector is not always assured.

The dynamics of the whole process also plays a key role, since the allocation decisions are made over the ones performed in the past. In other words, they are conditioned by the path chosen (David, 2000) and will condition future alternatives. Furthermore, since the own decisions pay-off depends on the adversary strategy and misrepresentations, such uncertainty may impair better choices, when based on wrong assumptions (Schelling, 1960: chapter 4; Bowles, 2004: 43-45). It may trigger, for example, a spiral of increasing resource investments by nations that ultimately will not achieve a net increase on mutual security. Hence, amending decisions, that *ex post* revealed wrong, will bring out irrecoverable expenditures that may be conceived as waste.

There are unaccountable examples of improper resource allocation for defence which have had a negative social effect as Kennedy (1989) reports as well as Easterly and Fischer (1994), Gleditsch and Njølstad (1990: 21) or Hartley (2011: cap. 3). A case in point could be the American allocation of military resources in Vietnam, which was clearly inappropriate to sustain a non-communist government in the south, which ultimately was cut when Congress rejected further financing. Equally, the cost of the Falkland War was considerably high for the United Kingdom, when compared with the economic value of these islands, having more weight the preservation of its international reputation or the future of their overseas enclaves; in other words, issues that lie outside the competence of economics.

Whereas the problems described also pervade the provision of other public goods, here it has been shown its tangled nature and its difficult resolution, mainly due to the uncertainty of information[50], the brittleness of the institutional framework and the huge cost of achieving sound military capabilities whose merit will be only unveiled in a conflict. Whereas this is a seminal paper aimed at identifying the nature and scope of the problem, more research is needed in order to develop sound alternatives to the current framework that warrant the choice of options that clearly display a better benefit versus cost ratio that is widely shared by society[51]. The considerable cost of experimenting with new institutions and norms[52] suggests that they shall be properly accompanied by a social debate characterised by transparency, rationality and objectivity as Majone (1989) advises.

50 Since it is non-observable, biased deliberately or non-accurate.
51 Schwenn *et al.* (2015) describe the Department of Defence acquisition system as a complex adaptive system. They suggest the use of agent-based models to understand it and develop proper more nuanced policies.
52 Their later suppression, once their poor results have been shown, is hard, since they generate interest around that difficult such task as the Soviet Union case clearly demonstrated.

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