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Hypotheses and methodology

for the economic analysis of Disarmament

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Geneva

Abstract : Disarmament and development appear to exert simultaneous relationship, each being at the same time both the cause and the result of the other. Conflicts are not confined to arms production, but also find some expression in economic, political and cultural domination. There are three main forms of disarmament with various economic effects (destruction of military stocks, prohibition of the production of specific weapons, reduction of Military expenditure). Moreover the analysis of the economic determinants of military expenditure is essential in order to understand how to work efficiently with a disarmament process. Finally, what are the main methods for the analysis of the economic effect of a disarmament process (theoretical deductive analysis, mathematical models, simulation, evaluation of structural and reduced forms, Computational General Equilibrium Model, Input-Output analysis, Historical and Case studies)

The present disarmament process is highly exceptional. In a situation of economic crisis, discontent grows. It becomes even more difficult to run a heavily militarized economy. The economic analysis of disarmament is difficult for three main reasons.

1. On its own, economics is a discipline that is incapable of encompassing all the problems of defence. For half a century past, economists have attempted to establish the existence of regularities and laws that did not fit in well with the real constraints of power, impending danger and conflicts. This attitude has been an essential element in the continuous neglect of the multidisciplinary aspects of defence. War is often synonymous with profound social transformations. The basis of war is not exclusively economic; it exists in the context of the struggle for power, and of religious and ideological convictions.

2) States have to protect their wealth or run the risk of being deprived, ultimately, of their rights over the distribution of the world's wealth, a situation pithily summarized in the maxim: "Money to get the power and power to keep the money". The economist, however, cannot be content with this recommendation, despite the fact that it is often borne out. He must also consider what burden of defence the economy of a country can assume without putting its growth at risk. Defence expenditure is a vital necessity for developed countries that do not wish to be plundered. Japan and Germany are special cases, in the sense that their armed protection has been entrusted to other powers, and they are thus left free to realize their full potential in the economic sphere. In a war situation, defence takes over the whole of the national economy. In peacetime, governments faced with a military reluctant to see defence imperatives subordinated to economic considerations have to take into account the balance that must be maintained between expenditure that may prove to be impoverishing and the maintenance of national security. There is, therefore, a choice to be made between today's and tomorrow's security, a choice dependent on the nature and strength of international tensions. The defence effort, which we know to be covered by unproductive expenditure, may have adverse effects on the economy as a whole. When the State and the Nation are one and the same, military expenditure is public property in the full sense, so that its quantitative and even its qualitative determination are independent of the market. Under those conditions the government has to make a choice, which it may sometimes be free to make (particularly in a war situation), but which is often at least partly determined by the inertial effects of military expenditure, the extent of the strategic threat and the country's actual economic situation. The State must therefore settle on the "razor's edge" of spending just the amount needed to give itself military protection in the short term without threatening the increase in wealth needed to maintain the defence effort. It is extremely rare

for what is militarily rational also to be economically rational. Furthermore, the economy of the day is a battlefield, and any limitation of the defence effort may lead to a progressive alteration in the global geography of the satisfaction of needs. The possible effects of a reduction of military expenditure or of disarmament are not confined to improvement of the macroeconomic results of the country concerned; they also modify the distribution of the advantages of growth, and effect a partial redistribution of the cards of international competitiveness, thereby transforming some quite delicate balances and giving rise to the at times unbearable tensions inherent in periods of change.

3) Does disarmament give rise to economic factors or do they stem from it? If disarmament is a "discrete" (not economically deterministic) decision of a political nature, reduction of military expenditure is then seen as an instrumental or exogenous variable that modifies the conditions of economic growth. If, on the other hand, economic factors condition the disarmament process, it becomes more of a consequence of a state of crisis in society brought about by failure to satisfy national consumer requirements or by an increase in the rate of unemployment. Disarmament and development would appear to exert simultaneous relationships, each being at the same time both the cause and the result of the other. Advocates of the New Economic Order see disarmament more as a consequence of development. Under those conditions disarmament processes initially follow a course of the development of the poorest countries and even in some instances of a more equitable distribution of world resources. Conflicts are not confined to arms production, but also find expression in economic, political and cultural domination. There is therefore no point in negotiating disarmament if nothing else is done to reduce or eliminate the causes of the arms race. In an increasingly interdependent world, geopolitical considerations involve a definition of security that is both economic and military. The Declaration of the Panel of Eminent Personalities in the Field of Disarmament and Development established that underdevelopment is a threat to world peace.

Present day economic analysis is not such as to permit a clear reply to the three fundamental questions of the economics of defence and consequently of disarmament:

- What choice should be opted for between guns and butter (i.e. the opportunity cost of military expenditure in civilian production)?
- What is the explosive power of a dollar (the "bang for a buck"), i.e. the explosive power of a dollar spent on national defence?
- How much has to be spent and in what way must it be spent (i.e. the search for the optimum level of military expenditure)?

These questions are, moreover, very closely interconnected, since the explosive power of a dollar is worth knowing as an indication of how much must be earmarked for national defence in a situation of relative scarcity. Economists concern themselves mainly with the first and third of these questions. There are many myths connected with thinking on the dividends of peace, which are supposed to be considerable, and capable of solving the economic and social problems of countries, despite some inherent costs and difficulties (Hartley, 1990). In the context of a study of disarmament, economists have to give consideration to:

- 1) The forms of disarmament.

- 2) Whether military expenditure is endogenous or exogenous;
- 3) The scientific methods employed in the economic analysis of disarmament;

1. The Forms of Disarmament

There are four main forms of disarmament: Destruction of military materials, cuts in military expenditure, a ban on the production of certain types of armaments, and thoroughgoing disarmament. These four procedures, which do not have the same economic significance, may moreover be carried out simultaneously.

A) Destruction of Military Stocks

This may initially involve the reduction of excess levels of armament, in which case one has to define what is meant by an excess level. Given that the destruction of weapons is a costly business, its initial effect is to tend to increase the economic burden of defence, even if the appreciable savings on the storage of weapons soon offset this factor. A saving of a billion dollars on the budget of the Pentagon has as an immediate result the loss of 38,000 jobs. In other words, disarmament taking the form of the destruction of military materials now appears as a cost, and the possible transfers of resources will initially serve to offset the costs that this collective decision entails. The disarmament process currently in progress under the Treaty between the United States of America and the Union of Soviet Socialist Republics on the Elimination of Their Intermediate-Range and Shorter Range Missiles (the INF Treaty) is finding its initial expression in the destruction of existing stocks (some 4 per cent of the total nuclear missiles) but also in the foreseeable and seemingly unilateral limitation of military expenditure. Disarmament is, however, currently more "political" than economic, even if the estimates of world military expenditure for 1991 have not yet been revised downwards. On the other hand, a disarmament process involves control and verification, the cost of which is obviously not inconsiderable and must be allowed for and allocated between the various Parties to the Agreement itself. Even if no procedure is effectively established the States will themselves verify the reality of disarmament by the opposing Party, for which purpose they will have to undertake a new form of expenditure based in particular on observation satellites and systematic data gathering.

For example, the cost of the INF Treaty is quite considerable. Gregory Bischak and Michael Oden (1989) have attempted to compare the reduction of military purchases, operational and maintenance costs and personnel costs with the financial commitments occasioned by the destruction of arms and the verification of the agreement. According to them, the effect of such an agreement is to lead to an overall reduction of military expenditure (Table 1).

Table 1. Impact of the INF Treaty on Net Military Expenditure (in millions of constant 1987 dollars)

Fiscal years 1992-2000	1988	1989	1990	1991

Reduction of military purchases		- 474	-230	-159	- 99	- 209
Reduction of military personnel costs		0	-126	-236	-173	- 456
Treaty setting up and verification costs	+160	+138	+106	+ 48	+ 51	
Reduction of net costs implicit in setting up the INF treaty		-314	-218	-289	-224	- 614

B) Prohibition of the Production of Specific Weapons

A ban on the production of certain weapons (nuclear, chemical) is indirectly an expression of the willingness to control armaments, and as such may be likened to a disarmament procedure. Thus, the decision not to produce very short range nuclear missiles modifies the output of the enterprises working in that sector. There are several factors that complicate the change-over, notably the difficulty of using specialist equipment for civilian production, the dangers inherent in use of the specialist skills of the military personnel without additional training, differences between the behaviour of monopsonic markets or bilateral monopolies and the competitive markets of the civilian sector, and the practices associated with small batch production. Having regard to the smallness of the disarmament under the INF Treaty, conversion to the civilian sphere is rarely carried out. That is why the cancellation of orders for GLCM products from the Titusville plant of McDonnell Douglas was compensated by contracts for ground and air cruise missiles. Conversion may have perverse effects. Converted industries faced with increased international competition may in particular seek new outlets that imply competition with the exported or locally marketed products of developing countries. Unless the poorest countries engage in real protection, their national concerns may suffer loss of competitiveness under those conditions and they may suffer economic collapse or, at best, the establishment of foreign industries may drastically reduce the freedom of the State to manage the economy.

Under the Ricardian theory of international trade, for example, the United States does not have any obvious interest in reducing its output of cruise missiles under an agreement on disarmament. The government normally seeks to keep those arms for which it has the greatest comparative advantage. Economic considerations will therefore be involved in the negotiations. They become all the more important, but remain as difficult to analyze, as the forms of defence become more diversified. When all other things are equal, it is in the interest of a great power to opt for the agreement that is most costly in economic terms to its potential adversary. If two States are productive both of security and prosperity, each country should be aware of the conditions of production of these sectors and of the elasticity in the supply of workers and scientists. If prosperity is a product that makes high demands on the numbers of scientists for country A, despite restrictions on the supply, whereas the supply of labour exceeds the demand, and if the converse holds for country B, it will be in the interest of country A to demand disarmament relating to the types of arms that create bottlenecks in its own civilian economy, having

regard to its situation over the factors of production. Country B will have less advantage under this proposal. Lastly, there are great inertial effects in existence for the defence effort from the very fact of the size of the flows and the stocks in this sector. This should lead us to ponder the determining factors of military expenditure.

C) Reduction of Military Expenditure

Politicians have often demanded the reduction of military expenditure. It must be said that disarmament may be imposed by disastrous economic conditions nationally. In other words, should modern armament have a recessionary effect on the economy it may hold back future arms production and consequently affect future defence. The dynamics of military expenditure is progressively undermining the economic basis of the great powers, especially when the international political and social climate complicates economic exploitation of the possible effects of domination generated by the balance of strength of national armed forces. Reduction of military expenditure must be analyzed in opportunity cost terms. At the global level it is expressed in the very short term by loss of jobs or regional recession which may be offset after some time by expenditure on education, health or the infrastructure. National economies are, however, heavily subject to inertial effects that greatly limit flexibility over the work force and industrial equipment. There are time lags that may give rise to considerable economic difficulties in a branch of the economy or in a region. This situation may be overtaken rapidly by the positive effects of expenditure, unless failure to achieve the minimum activity threshold leads to the establishment of a vicious circle that complicates the use of substitutable resources. Reduction of military expenditure, if negotiated, raises problems of international comparison and comparison over time that are difficult to resolve, but for which it has already been possible to find some interesting solutions (Cars & Fontanel, 1985). The economic factors are likely not to be the best source of reliable indicators. On the one hand, having regard to the international agreements in force and the technological features of the munitions, some types of delivery vehicle, e.g. nuclear missiles, are clearly more effective than conventional weapons, and at a relatively low cost in terms of the strategic, military and political advantages that they confer. On the other hand, relations of strength are often expressed in terms of thresholds and a homothetic reduction of military expenditure does not necessarily result in the former balance of forces being maintained. Disarmament by reduction of defence budgets implies that the structure of expenditure be taken into consideration. Thus, a great power could reduce its expenditure by the order of 20 per cent by increasing its financial investment in the nuclear sphere and by deciding to substitute a less expensive conscript army for an army of professional soldiers. Because military rationality and economic rationality do not have the same values disarmament cannot be determined solely by comparisons of national reductions in military expenditure.

D) Thoroughgoing Disarmament

Thoroughgoing disarmament may have several causes - economic, political, strategic and even ideological. In fact, this form of disarmament appears on the scene when military expenditure becomes more of an endogenous

unproductive (Fontanel & Smith, 1985). As regards armament, we may consider how the State can make strategic choices that are also economically effective. What do soldiers produce (what is their output)? What types of armament (or disarmament) should be demanded? It is difficult to provide answers to these questions, and all are open to dispute. The theory of public financing provides interesting ideas on the optimum level of government expenditure of public property. Public property is endowed with some remarkable properties in economic theory: it is indivisible, and there is no rivalry or exclusion in its consumption. Defence is usually analyzed as public property pure and simple, with no rivalry or exclusion in its consumption, which remains true in the context of a military alliance (Olson & Zeckhauser, 1966). The view is, however, one that is not always borne out because defence strategies may modify this monolithically public nature of the satisfaction of the need for international security. Nuclear deterrence from the weak to the strong and the balance of terror are strategies that verify the three basic properties of public property pure and simple. On the other hand, the non-violent strategies of Gandhi's India and of the civil defence developed in particular by the Swiss Confederation make it impossible to continue to define the defence effort as public property pure and simple, since they imply greater autonomy in the taking of decisions by those involved. Hewitt (1991a) is of the opinion that, despite appearances, military expenditure does not lend itself readily to the traditional economic analysis of public expenditure. The optimum level of military expenditure is a concept that is prescriptive, political, strategic, psychological, economic and even moral, with the result that theoretical analysis of public property is relatively powerless when it comes to revealing the financial choices of defence. That is not to say that the economist can neglect the economic analysis of military expenditure, but there is the need to be aware that it has its limits and that it has a bearing on only one part of a multidisciplinary body of thought.

Economists generally regard military expenditure as an element or cost needed to ensure national security. Defence is therefore an output measured in terms of the level of security ensured by the size of the military expenditure relative to the external threat and the actual political situation. Just like the idea of utility, however, the concept of defence is scarcely such as to permit the definition of cardinal units capable of providing clear indications of the degree of security of each country. That being the case, economists regard the level of defence as a monotonic function of military expenditure, whatever its form, the strategy and the arms that it procures. Introduction of the idea of conflict and security makes a distinction between cosmopolitan economics (as the science whose subject is the economics of material well-being) and political economy (as a project by which a State achieves prosperity, security and power). Only occasionally does economic rationality coincide with political and strategic rationality (Saby, 1991). Thus, the military expenditure of one country constitutes a threat to other countries and that helps to accelerate the arms race. The connection between military expenditure and the benefits of defence is the subject of conflicting debates over, in particular, the dangers of invasion, and the correspondence between military expenditure in the prevention of an attack, the quality-cost estimates of each force or arm (which should be the same for all the instruments of defence in an economic optimum concept), the sectorial, regional and temporal redistribution of the economic profits and losses of the military effort and the potential satisfaction of other collective aims from the costs of the military sector.

Military expenditure is not, in general, taken as a variable in national or international macroeconomic models, and when it is such expenditure is treated as an exogenous variable unilaterally determined by the State. This view is unsatisfactory because military expenditure as an instrument of defence or of war is in the category of essential economic variables whose impact is not confined to discrete actions (in the mathematical sense of the term) of possible disarmament agreements or armed conflicts, but is also expressed in the continuity of the national defence effort needed in the long term. Depending on the immediacy of the threat and the power of the States, economic factors are more or less heavily involved in the determination of military expenditure (a fact frequently presented as the choice between guns or butter). Collective choices both of what is an acceptable economic defence effort and of the establishment of concrete measures of national security are however often influenced to a considerable degree by other factors, notably strategic and political factors, such as the imminence of war, the ideological struggle, and the view taken of the risk of international and even national conflicts, having regard to the costs involved and the risks entailed by the foreseeable defence systems.

B) Military Expenditure and the Structure of Public Expenditure

Through the inertial effects that they exert on economic flows, military budgets maintain the activity of whole branches of industry, ensuring them some financial security and an additional growth potential through the development of economies of scale and effects of domination. Relying on a study of the proportions of military expenditure and private expenditure in the GDP, Russett (1969, 1970) concludes that military expenditure modifies investment, individual consumption and State and regional expenditure. According to him, there is a substitution effect between social expenditure and military expenditure in the United States. However, this hypothesis has not always been borne out when reexamined by more sophisticated methods and over a longer period of time (Russett, 1982). A similar conclusion was arrived at by Domke (1983) for the United States, the United Kingdom, West Germany and France.

Studies on the relationship between military expenditure, expenditure on health and expenditure on education yield contradictory results for developing countries. While the reports of Brandt (1980, 1988), Palme (1982) and Thorsson (1981) assert that military expenditure is a threat to economic growth and development, and therefore to future security, they condemn the use of public funds in the military sector to the detriment of health and education. As was the case for the developed countries, econometric studies on the negative relationship between expenditure on health and military expenditure yield contradictory results. Thus, while Deger and Looney confirm this hypothesis, it is questioned by Kennedy (1974), Ames and Goff (1975), Hayes (1975) and Verner (1983). In fact, we may question the permanency of a relationship that may change with the actual economic situation in which choices are exercised by governments. Most of the analyses that have been made in developing countries conclude that countries in which military expenditure is low are also modest consumers as regards education and health (and vice versa), that military expenditure is just as vulnerable as other forms of public expenditure to a reduction of the

State budget, and that there are scarcely any consequences on appropriations for health and education following an increase in military expenditure. In the recent study by Harris, Kelly and Pranowo (1988), the hypothesis that the greater is the amount of public expenditure allocated to military expenditure, the lower is the share of expenditure on health and education was borne out in only 40 per cent of cases examined relating to 50 countries. Effects of substitution between military expenditure and social expenditure are weak and military expenditure is found to be quite sensitive to a reduction of public expenditure, at all events clearly more so than is social expenditure. In developing countries military expenditure is first and foremost a matter of personnel costs, and this characteristic reduces the ability of a government drastically to modify the level of such expenditure. There is therefore an inertial effect that is all the stronger to the extent that employment is a factor in the decision. The analysis of Hicks and Kubisch (1983, 1984) emphasizes that social expenditure is less vulnerable than expenditure on defence and administration to a reduction of public expenditure in developing countries, and far less vulnerable than the productive sectors and the infrastructure. This analysis has been verified for developing countries by Hewitt (1991a) and by De Masi and Lorie (1990). In the first case governments were confronted with a rise in interest rates; they tackled this by increasing their public expenditure and reducing the importance of some sectors, in particular military expenditure and expenditure on economic services. Social expenditure, on the other hand, tended to be maintained or even to increase. According to the authors of the second study, military expenditure was slightly reduced when the adjustment programme requested by the World Bank called for a tight fiscal policy. On the other hand, when public expenditure could be increased it was the non-military sector that took priority. The inertial effects of military expenditure were higher than those of other public expenditure. There was therefore a stabilizing effect, referred to by Galbraith (1968) as the safety margin.

C) Military Expenditure as an Endogenous Variable

The last decade has witnessed the development of a number of formalized studies, often backed by econometric research of varying degrees of complexity, the aim of which was to explain the economic foundations of military expenditure. The results obtained have not always been either coherent or generalizable on account of the contradictory analyses in time and space that they prompt. However that may be, current economic analysis is still failing to produce decisive results in this field of thought, in which most studies are relatively recent, mainly post 1965. In the economic context, military expenditure is limited by the available resources, although national security implies costs that are often determined by other than economic considerations, such as the extent of the threat, how the possible conflict is viewed, the will for power of those concerned etc.

Military expenditure may be regarded as a variable that is half endogenous and half exogenous. That is how authors who take a marxist line come to consider that military expenditure serves both to offset the weakness of internal demand (Cypher, 1974; Krell, 1981), and to soak up the surplus that monopoly capitalism secretes (Baran & Sweezy, 1966), or to weaken the socialist economies obliged to accept the arms race in order to survive

(Gerbier, 1984). More generally speaking, several economic determinants of military expenditure have been discovered.

1) The more powerful is the State, the more likely is it to have significant resources. There is a positive relationship between the civil budget of the State and military expenditure (Lotz, 1970; Harris, 1986; Fontanel, 1980), from which it would appear that the vagueness that is a feature of the options of governments in matters of security was countered by an inertial effect inducing governments to set military expenditure at a more or less constant proportion of the public budget from one period to the next;

2) Military expenditure is often seen as an economic burden. The larger is per capita income in a country, the less, proportionally, is the State inclined to increase its military expenditure (Lotz, 1970). This is the analytical expression of the choice between guns and butter;

3) As a factor of development, urbanization also exerts a positive influence on the level of military expenditure, probably because the regrouping of the population carries with it the threat of new internal dangers (demonstrations, conflicts, etc.) and external threats (Lotz, 1970);

4) The availability of petro-dollars is a factor that tends to increase military expenditure in developing countries, both to curb the territorial, political or economic ambitions of neighbouring countries and to take up the surplus of abundant resources, giving way to the "demonstration effect" in emulation of richer countries (Deger & Smith, 1983);

5) Cyclic movements of the economy (Griffin, Wallace & Devine, 1982), in particular the attempt to maintain full employment in the short term (Smith & Deger, 1983), are not unimportant cause variables of the military expenditure of developed countries. Under those conditions, the status of military expenditure vacillates between the endogenous and the exogenous, it being understood that endogenous stimuli restrict the possible scope of a partly exogenous decision, making it the object of a vote and of a spectrum of possibilities, the width of which will vary with the immediate economic, political and strategic circumstances;

6) The existence of a military and industrial complex tends to have a positive effect on military expenditure (Melman, 1974; Kidron, 1970; Griffin, Wallace & Devine, 1982). Such a complex is undeniably economic in nature, even if the epithet does not suffice to characterize its social and political scope. Militarization of the economy is briefly defined as a particular social attitude according to which war, the threat of war or preparation for war are a major collective concern, implying a substantial degree of legitimacy, considerable political influence of the military sector over government decisions and a significant allocation of national resources to cover the constraints of national defence. Militarization embraces the sociological, political, economic and social dimensions of the production, sale and use of arms. For Ron Smith (1983), militarization involves the level of military expenditure, the militarization of internal social relationships, trends towards war or the use of force in international relations, and the proliferation of nuclear arms. In a broader setting, and with reference to the United States, Adams and Gould (1987) point out that the extent of military expenditure is dependent on national security (and mainly on ideas relating to "the margin of superiority"

or "windows of vulnerability"), but also on the workings of the Pentagon, stemming in particular from competence, but also from the services promoting themselves and from the rivalries between them, from the realities of the competition between arms manufacturers and the perception of insecurity. The "iron triangle" or "the government within the government" (the government, the arms industries and the Congress) has some impact on the choice of materials, their quantity, their make-up and their cost, with all the wastage that such a situation implies, and it operates by virtue of a great complicity of special interests based on close working relations, with considerable links between Federal officials and arms firms and increasingly tenuous contacts with the democratic machinery of government. Under these conditions it is no longer the Head of State and the constitutional bodies that decide the level of military expenditure, but a network of interests.

The debate on the matter has been enriched by three new studies. For Gonzales and Mehay (1990), military expenditure is dependent on population, on the military expenditure of allied and opposing countries (although this has not been confirmed for developed countries), on the per capita Gross National Product, and on the democratic nature of the societies concerned or constitutional limitations on expenditure. Hewitt (1990b) used a two-equation model for simultaneous determination of the level of central public expenditure and military expenditure. The public budget is dependent on the availability of funds, both national and international, on the material well-being of citizens, on the political situation and on the ideological priorities of governments. The results show military expenditure to be dependent on economic, financial, political and geographical variables. Military expenditure has a favoured position in the sense that the greater is the National Product and the less the richness effect, the more positive is the effect on it. On the other hand, whereas indebtedness tends to reduce the defence effort, the situation is different for public international aid, although this hypothesis is refuted by Cashel-Cordo and Craig (1990). Furthermore, the existence of wars, both civil and international, monarchies, military governments and socialist States are, in decreasing order of importance, factors that increase military expenditure. Geographic variables such as land area or land frontiers (and sea frontiers, to a lesser degree) have a positive effect on the defence effort. Lastly, it should be noted that consideration of the military expenditure of opposing and allied countries sometimes plays a not inconsiderable part, especially in highly conflict-prone regions. In the third study, Rajmaira and Ward (1991) established that the United States and the USSR differed in their recollection of what was done by the other; The United States tended to recall the long history of its conflict with Moscow, whereas the USSR harked back rather to the very brief period of cooperation of the last few years with Washington. In other words, the United States were adjusting more slowly to the attempts at cooperation between the two great powers. This characteristic was to be seen in the evolution of the respective military expenditure of the two countries.

It remains the case that factors other than economic ones are more generally advanced as explanations for military expenditure. They include the bureaucratic procedures involved in the allocation of military resources (Treddenick, 1985), ideological struggles (Thee, 1982), elections (Nincic & Cusack, 1979), the power struggle (Terrell, 1971; Grindle, 1986; Griffin, 1982), changes in society (Grindle, 1986), dictatorship (Kende, 1980), the

militarization of society (Maizels & Nissanke, 1986; Thee, 1982; Whynes, 1979), the arms race (report of the United Nations on the Economic and Social Consequences of the Arms Race ..., 1982), strategy (Fontanel & Smith, 1990) and imperialist rivalries (Gerbier, 1984; Thee, 1982). Empirical studies are dependent on the measurement of military expenditure and it is possible to have different theoretical interpretations of the factors that explain the evolution of military expenditure conditioned by how the dependent variables are defined and calculated (Fontanel & Smith, 1990). Comparable studies should be undertaken to elucidate the different econometric results obtained as a function of the statistical sources. Although governments do make choices over military expenditure, their freedom of choice is very limited by all the partial cause variables, the basis for which is strengthened to the extent that the international strategic and economic situation evolves slowly.

3. Methods for the Economic Analysis of Disarmament

All the methods in general use in economic analysis may be applied to the economics of disarmament. No economic situation is ever repeated in exactly the same form. The experimental approach is practically impossible in economics, and in any case the information that it yields is limited because events do not repeat themselves. Under these conditions the methods of analysis most employed are deductive analysis based on postulates, empirical simulation models, evaluations of reduced forms, input-output tables, and historical and monographic studies (Smith, 1989). Nevertheless, the theoretical problem and the practical difficulty of demonstrating the validity of models argue in favour of the use of several methods simultaneously or in an iterative procedure.

A) Theoretical Deductive Analysis

For the rationalist method (the method of testing the truth of axioms), economic theory consists of a set of logical deductions based on unverifiable premises that cannot be objectively experienced. The validity of theories depends on the definition of the symbols that they embody and on the rules of deductive logic. The conclusions are dependent on the axioms and validation of the theory amounts to demonstrating its internal coherence. Nevertheless, "rationalist" economists have very frequently ignored the military reality which, it must be quite clearly stated, was very far from the rational forms of behaviour of economic man. "Deductive" analyses of the economic effects of armament (or disarmament) have not led to a unified view of the nature of military expenditure and its impact on the basic economic variables of a Nation; that is clearly not surprising when we recognize the extent and the diversity of the debates to which political economy gives rise. By way of synthesis, however, it may be said that economic theory suggests that the defence effort has not inconsiderable economic effects, particularly on the volume of public demand, the structure of supply, the organization of production, trade and distribution, and on the competitiveness of companies and, consequently, on economic growth.

The thrust and extent of the impact of military expenditure on the national economy are dependent on chance contingencies such as the pressure of effective demand, industrial organization, the economic policies pursued etc. It has been argued in several deductive studies that the (long term) structural effects may differ from the effects of the situation. Thus, an increase in military expenditure may, in the short term, have a favourable effect on economic growth when the situation is one of underemployment (keynesian analyses), but it is also liable to give rise, in the longer term, to inertial effects harmful to socioeconomic development. Having regard to these developments, that are contradictory over time, and to the specific nature of the economic relationship of each State to defence (whether it produces or imports arms, the comparative importance of its defence effort in the light of the actual economic situation etc.), it could be said that economic theory was incapable of providing an unambiguous reply to the question whether a greater military effort was likely to slow down or accelerate economic growth (Faini et al., 1984). It has been commented that the comparison of these theoretical models with the statistical series of military budgets compiled annually by several bodies, with a view to verifying the capacity of the various models to provide explanations, is no easy matter owing to the obvious deficiencies in the specification of the variables and parameters adopted in most models, and in explaining their dynamic functioning. Mercantilist, physiocratist, classical, marxian and neo-classical thoughts are based on rational hypotheses which are not clearly demonstrated. Then, their analyses, founded on a rigorous rationality and a philosophical conception, can be accepted, if you agree with the basic axioms.

B) Modelization and Simulation Studies

A catalogue of facts does not give rise to any theory because it is necessary to go beyond the observation of events in order to arrive at a proper understanding of their reality. Deduction rests on observation and vice versa, and there cannot be any induction in the absence of initial hypotheses. The validity of a model cannot be restricted to the truth of the hypotheses, but must also be dependent on the capacity of the system as set out to predict the behaviour of the real system, even if, in some instances, the cause and effect relationships or simultaneous relationships misrepresent or simplify the reality. The "positivist" economics advocated by Phelps or Friedman emphasizes that a model is valid if it yields correct information on the actual operation of the system. The first step in the construction of a model is the creation of the information. Formal systems are merely artefacts, products of human ingenuity, that imitate how events appear and are characterized by functions. Models have to be evaluated in terms of how well they communicate and the quality of the information created in relation to the objectives laid down at the time of construction. The economist has therefore to consider which variables should be accepted, the level of their aggregation, the relationships being tested and the basic aims of the study. For example, military budgets may be disregarded in a macroeconomic growth model concerned with the relationship between labour and output, whereas a study of the economic impact of the defence effort requires military expenditure to be adopted as a key variable of the formalized system. Nevertheless, this methodology is not without its shortcomings, prominent among which are the dubious significance of the results obtained, the obvious

risk that the relationships will be unstable and the low degree of relevance as a tool in economic decision taking.

Simulation studies require the establishment of strategic-economic models that emphasize the economic effects to be expected from ongoing disarmament. The econometric results are based on the empirical characteristics of the national economy under consideration, while relationships and military and economic "feedback effects" are established by the system of equations. Theoretical experimentation affords new scope for an understanding of the economic phenomena involved through multiplication of the possible scenarios. Nevertheless, macro-models do have their limitations, which are well known, and the results remain specific to the country under investigation. There is a need to develop empirical tests on the conclusions derived from the simulation model. Comparison of the results of the simulation with the actual facts may then result in the partial abandonment of the theoretical hypotheses, with the economist seeking to determine the areas of application arising from the experiment. With this method economists may, however, conduct theoretical experiments on the impact of military expenditure or investment on the key economic variables. The present situation is that the main makers of models have not always built the dimension of national security into their formalized system, and that when they have done so it has all too often been after the core of the model has already been constituted, with the result that the variables of the defence economy are tagged onto it. Even so, these studies have very interesting results, although they are not always easily explicable, having regard to the complexity of the model. Many specific models make use of information drawn from several countries in a horizontal (cross-sectional) approach, thereby neglecting chronological analyses. Moreover, it is of some interest to note that multiplier effects are typically analyzed on economic information of the same year (horizontal spatial analysis) and with respect to more than one country, depending on the criteria of homogeneity specific to each study. Econometric models in which chronological series of data are used lay the emphasis on short-term effects, since all the information considered relates to the recent past. Conversely, models based on a sample of data concerning a broad range of countries in different stages of development generate parameters of long-term impact. Taken in conjunction, these two types of analysis provide a good overall view of the effects of military expenditure on development. There is a lot of econometric and simulation models built for the analyse of the economic consequences of military expenditure (Fontanel & Smith, 1985, Royer 1985).

The microsimulation analyses represent the behavior of individual agents, such as consumers, workers, firms, government agencies and other organizations and give some knowledge on proces, market allocations and social welfare functions subject to constraints. This approach is useful for the study of the effects of a Defence Ministry decision on defense contractors. But the economic analysis still have not a satisfactory economic theory of price formation and they are not often used, because of the special nature of defence sector.

C) Evaluation of Structural and Reduced Forms

Simulations employ structural relationships that emphasize the basic connections between the main variables in the economic process. In the absence of models of this type, the evaluation of reduced forms of simple equations or of small formalized systems yields interesting information on the relationships between investment, unemployment or prices and the economic variables of defence. The formalized system will be deemed valid if, in the event, it confirms the calculated prediction within a degree of accuracy laid down in advance. This method is of value for the detection of statistically significant relationships corresponding to the initial hypotheses. It is applied heuristically (especially to back up the researcher's intuition regarding the nature of the basic macroeconomic relationships), but is also used to verify the application of a theory on a concrete example (Benoit, 1978, Looney, 1988). It is an intuitive assumption of this highly empirical method that observation is the main source of knowledge. In fact, the economist analyses events by creating and trying out hypotheses. The main question is to determine the dynamic relationships of feedback in order to identify the Grangerian causality of military expenditure on the other economic variables (Chan, Hsiao & Keng, 1982; Georgiu & Smith, 1983). These relationships do not really explain the basic relationships of the process; they operate in accordance with the "black box" procedure and consequently yield little information on the mechanisms of transmission and on what needs to be done to alter the "course of events".

D) Computational General Equilibrium Model

The computational general equilibrium models determine equilibrium prices and quantities for the national economy, with data such as tastes (preference relationship), resources (raw materials, workers..), technology (production function) and general organization (ownership structure and the influence of State). These models are very useful comparing the resulting prices and quantities before and after a political or economic decision on disarmament or armament. They provide some data on the impact of a general decision on equilibrium prices and quantities. They reveal the importance of forward and backward linkages in the economy and they serve to examine changes in demand due to changes in prices (which is not possible with input-output analysis). These models suffer of three main shortcomings. They work on the assumption of constant returns to scale technologies for all branches and perfect substitutability for all inputs. The level of aggregation is very dependent on the input-output data and the financial and monetary variables are absent. These shortcomings are important, if we have on mind the difficulty of the conversion of military enterprises, the nature of economic competition and the influence of monetary variables on the national economies.

E) Input-Output analysis

The Input-Output analyses are mainly interested by the technological structures and interindustry relationship in the economy. They are very useful for the measure of the direct or indirect changes in output, employment or capital utilization induced by a change in the structure of the demand of final goods. This analyses require detailed data on the actual technological structures of military and civilian productions. The main

Input-Output model on disarmament and development was built by Leontiev and Duchin (1980a,b, 1983). The transfer of resources to poor countries furthers their economic development in the model of Leontieff and Duchin. Disarmament for development is therefore desirable. Ongoing disarmament would have a positive effect for all the regions of the world and the transfers of resources would appreciably increase consumption and the per capita GDP of the arid countries of Africa, and the low-income countries of Asia and tropical Africa. Nevertheless, the econometric results obtained do not seem to us to be very significant to us. They give only a very global idea of what the economic impact of disarmament means.

E) Historical Studies

History serves as a means of confirming or invalidating conclusions from explanatory theories in all current research on the validity of models. The inadequacies of quantitative analyses make it essential to utilize qualitative information, and that implies historical research on the influence of the variables of defence on national economies. History is, however, unable to make allowance for the logic of the subsequent sequence of the constituent parts of economic situations. Even when there is systematic data gathering, no more than a trace of the structures and behaviours is retained, and the tools of history are scarcely adequate to translate the complicated succession of events in dynamic systems. The drawing of an analogy between past and future events comes up against the difficulty of the description of situations observed at different periods and in different terms with quite precise structures. The past is gone for ever in economics. The great lesson of history is the diversity of events and the relativity of laws. Social reality is unique and historical; it is the end and the beginning of other series of events. The method is a very useful one for the study of situations in which the hypothesis of structural stability cannot obtain, in particular during periods of war or intensive disarmament. Furthermore, historical studies bring out political and social factors that do not lend themselves readily to calculation and statistical analysis. Times of great change call for qualitative historical analysis.

Economists were convinced in the 19th century that military technology was corrupting its civilian counterpart (Edgerton, 1987). This outlook was gradually modified by some extraordinary technical performances by the military sector and there are many theories stating that such militarization is capable of having positive effects on the national economy. Robert Merton (1938) is of the opinion that the military sector exerts a considerable outside influence on the development of science and technology. This relationship is not of very recent date. For example, the theses of Galileo were demonstrated thanks to the practical applications of theoretical work on projectiles needed by the army. From Descartes to Papin, taking in Newton, Bernouilli, Euler and Leibniz on the way, many scientific discoveries have been due, in origin, to the problems raised by the art of war, equally with those stemming from the economy and the intransigent values of puritanism and protestantism. The traditional system of patronage was conducive to this relationship between men of science and the army, but a new model of it began to appear with the industrial revolution. Lewis Mumford (1934) even thought that only the military sphere and war offered sufficient scope for the use or absorption of the output of the new capitalistic installations. The army was a consumer

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perfectly tailored to the industrial system and the economic interests of industrialists and military men were complementary. This was the first version of the idea of the military and industrial complex. There are many factors that support this thesis, for example the rational model of management and the application of Taylorism in military arsenals. Industry has learnt a great deal from war as regards organization, discipline, standardization, the coordination of transport and supply operations, the separation of functional and hierarchical services, and the division of labour. The basic principles of the American industrial system as regards machine tools, spare parts, and serial production were extended to the civilian sector from arsenals, armouries and military sub-contractors. Furthermore, given the volume of modern R & D investment, civilian industries have not been able to keep up. The army has contributed its mass effect.

The mechanization of military operations came onto the scene with the First World War. New technologies tried out for the first time during the combat included tanks, radio equipment, poison gas and aviation. Under these conditions, science and technology were deliberately organized and maintained for military purposes. The war itself, however, was not won by the scientists, who did no more than modernize old weapons employed in conservative and rather unimaginative strategies. The war was one of attrition rather than of technology. In contrast to the First World War, the nuclear weapons and the technical know how that emerged at the close of the world conflict of the mid twentieth century differed considerably from the arms that existed at the outset. The authorities began to invest in science for reasons of security. The post-war period was even marked by the pursuit of scientific secrecy, by the capacitation of defence, and by a massive influx of scientists into the military-economic complex. The ready availability of finance for scientific projects, the ability successfully to carry out projects that would have been unrealizable under other circumstances, and the acquisition of a special status in society were essential elements of this mutual attraction. The law of secrecy became the rule from 1950 onwards, with the making of the hydrogen bomb, decided upon by Truman, despite the opposition of his scientific advisers. The national economy and national science would henceforward be at the disposition of the government. The power of the military-industrial complex was increased with the setting up of national industrial "think tanks" such as the Rand Corporation in the United States to work on the new problems of national security. The war had taught scientists and other academics to work together and had shown them the effectiveness of team research; it had also brought about decisive changes in the method, spirit and scale of laboratory research. Scientists sometimes found themselves hostages, caught between the desire to continue their research and the more readily available funding in the military sector. This procedure has been more recently maintained with the Strategic Defence Initiative (SDI). Little is to be expected in economic results from this military R & D of the SDI programme. Only a very small proportion of the patents are of interest to the private sector because they are too much concerned with the products of craftsmen and too little with improvements to processes. The armed forces of the United States hold many patents, but only one per cent of those developed by the Navy have actually become the subject of licensing agreements. The arms race became chiefly responsible for the chaotic development of the sciences and remained so until the 1980s, when Germany and Japan were to open up new paths little explored by the other powers, which had been too preoccupied with their military leadership.

The militarization of economies (defined as a situation in which war, the threat of war or preparation for war are a major collective preoccupation involving a high degree of legitimacy, much political influence in governmental decisions and a significant allocation of national resources) is still very strong (Fontanel, 1991). Many countries have based their industrialization on arms production, which is dangerous from an economic point of view, notably when stagnation develops in the international arms market, and which is a reducing factor, by virtue of the political and military constraints that are bound to emerge, and that restrict the degrees of freedom of civilian and military governments over disarmament (Kolodzjej, 1987). Even so, a serious economic study could provide evidence that some exporting activities are impoverishing, notably when payment conditions become difficult or even impossible, and when the largely subsidized arms industry is persuaded to sell at a loss... to the community (Smith, Humm & Fontanel, 1985; Chesnais, 1990).

Militarism appears with the State system. The social position of the military is important. The army is often the symbol of national unity, even if its position in the military-political complex is the central one. The military hold their power in the name of their competence to defend the basic interests of the Nation. That is why societies that have conscription seem to be less productive of militarism. Militarism is born from clashes of interest, as well as from belief in violence and force. Disarmament sets the scene for the "civilization" of modern societies, the retreat of the ideas of militarism, the hierarchy, discipline, nationalism, patriotism and xenophobia. Outlooks and behaviour do not decree why this should not be so. The economy of disarmament does not stop at the mere reduction of military expenditure; it must also apply itself to the reasons on which the disarmament is based and which, if possible, make it irreversible. This latter point is not, however, one that can be tackled by economists on their own, for it involves consideration of the very nature of humankind.

F) Case Studies

Case studies may play a similar role at the microeconomic level to that of historical studies in macroeconomic analysis. A thorough examination of armaments manufacturers or of the cost of weapons systems yields details of value for an understanding of broader economic phenomena, and in particular for assessment of the quality of hypotheses on the behaviour of the military sector. Although such studies are uncommon, on account of the secrecy that surrounds military matters, they are often of interest (Hartley, 1983).

All the methods here reviewed may help to improve our knowledge of economic phenomena, but none can lay claim to monopoly in that respect. Economic analysis is devoted to reasoned observation, i.e. to statistical criticism and rational construction. A theory is verified when its consequences are borne out by observation. Following Karl Popper, it is worthwhile seeking to establish how far the preferred model is confirmed rather than to pursue its unattainable absolute verification. Confidence in the formalized system is increased if empirical tests fail to yield negative results. Gradual confirmation of the law replaces definitive attempts at verification.

To sum up, there is an apparent need to use combinations of methods in the treatment of economic problems relating to military expenditure.

Colonial wars are historically seen as basic, although not exclusive causes of underdevelopment. They promoted export crops to the detriment of the crops that provided food for the population, and they had the effect of stimulating the mining industry and destroying local craft industries; meaningless national frontiers were established and the economy developed in a disjointed way, entirely geared to the economy of the colonial power. These relationships of strength, which take various forms, some of them less blatant, have still not really been challenged, as is shown by the relative stability prevailing in the most underprivileged regions that are largely dependent on spheres of influence inherited from the antagonisms of the great powers and from colonization. Major international economic negotiations provide reminders of the existence of relations of conflict and the importance of the status of a nuclear power. The threat of armed force is always a decisive factor in the spread of the dominant modes of production and in the maintenance of existing powers. Moreover, the major economic powers use military and non-military aid to maintain their political, economic, ideological and even moral influence. The economy of a country is, however, even more affected when a partner exerts a structural ascendancy over it on the basis of military relations. Western technology is strongly influenced by the militarization of the advanced economies, which is still dominant in contemporary economic development despite the examples of Germany and Japan, where the contrary holds. The developed countries are therefore very favourably placed to make contracts, by virtue of spheres of influence that are often defined by force or by military agreements. Good relations with the United States government are of assistance in obtaining credit facilities from major international financial bodies. The existence of danger and the determination of States to oppose subjugation are factors that are largely dependent on the arms race of the great powers, and that are responsible for the subordination of economics to military and strategic constraints. Under these conditions, disarmament definitely does modify relationships of strength, and this is also reflected in the economic sphere.

Economic factors become weapons in constant use that cannot be constantly deflected from their essential functions for purposes of regeneration. The economy has become an instrument of power often applied to relations of conflict between States. Insecurity is dependent on the arms race, on inequality, international domination, and even social exploitation. Indirect strategies of dissuasion, economic forms of retaliation, embargoes and boycotts are all powerful weapons with economic and political effects dependent on defence measures, international expressions of solidarity and the potential for substitution (Baldwin, 1985). The economic weapon frequently comes within the scope of military conflicts since the economy provides the military resources by which to combat the enemy. All the dimensions of social life, of which the economy is a part, have to be taken into consideration in international strategy. Economic weapons are used with the aim of weakening the potential enemy. Direct (military) strategy is made difficult by the strength of nuclear forces and by the doctrine of the balance of terror. The number of degrees of freedom is very limited at super-Power level. States are therefore led to follow a strategy of "indirect manoeuvring" defined as the exploitation of the narrow limits for freedom of action avoiding nuclear dissuasion by other means.

The current political situation, which is favourable to disarmament, is probably connected with the economic crisis of the major military powers, which is obliging them, in the absence of incontrovertible military superiority, to seek a breathing space favourable to new economic growth. Under these conditions, disarmament would be the result of a readiness to "redeal" the cards of competition, given that all the players have a blocking hand increasingly opposed by public opinion (Lambelet & Luterbacher, 1987; Brito & Intriligator, 1987). In a situation of economic crisis it proves increasingly difficult to manage a heavily militarized economy. This situation produces much debated possible knock-on effects created by the freeing of trade and the upsurge of new effects of domination favourable to the developed countries and responsible for the constant bogging down of the economies of Third World countries. Nevertheless, the opening up of economic frontiers is not the panacea for generalized economic development since, in the absence of a real international organization laying down rules to protect vulnerable economies, such a policy inevitably leads to power balances and hence to international conflicts.

"While each of these technologies can, in its own, be used to analyze and to forecast the likely effects of disarmament and to evaluate policies in this area, each has a certain specific orientation and focus. An ideal quantitative methodology might therefore be an eclectic one, combining the strengths of each method. The creation of such methodology is a basic challenge in analysing the economic aspects of disarmament, but such an approach would be of enormous value, particularly in the design of policy' (Intriligator, 1992).

Conclusion

A disarmament that is progressive and attends to the issue of increasing global security will be one that attends not only to the issue of military expenditures but also to the issue of weapon stockpiles. Disarmament that focuses on one issue to the exclusion of the other will leave the door wide-open for disarmament to be de-stabilizing and increasing rather than reducing international security. Just as the armament process is best understood by examining both weapons stocks and military expenditures, a stabilizing disarmament process will also attend to both the stock and flow of weapons and will attend to a re-incorporation of a new political reality.

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