THE ECONOMICS OF CHEMICAL AND BIOLOGICAL WEAPONS

Carlos Seiglie
Rutgers University, NJ, USA

Mayeul Kauffmann
Université Pierre Mendes France, Grenoble, France

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1. Introduction

Economics can be useful in analyzing the problems inherent in the deployment and use of chemical and biological weapons by countries. A country's national security can be viewed as being produced by using its own resources and those of its allies for defense, as well as being reduced by the resources employed by adversarial nations for military purposes. These resources are the troops deployed in the military sector, as well as the weapons and other resources necessary to meet the military objectives of the country. Chemical and biological weapons are a subset of all these instruments available to the decision-makers. Yet, these weapons are different than conventional ones and therefore require a variation on the typical analysis. The aim of this entry is to highlight these differences and then discuss particular issues that must be accounted for by the international community. The paper is set out as follows. In the next section, a theoretical framework is outlined which presents the salient features of the problem. The analysis of the private costs and benefits of acquiring chemical and biological weapons follows this. Finally, it is shown how the presence of externalities, which make social costs greater than private costs, may require international sanctions to increase the international community's welfare.

2. Conceptual Framework

Suppose the military seeks to minimize the cost (C) of producing a given level of national security, S_0, by optimally choosing the amount of chemical and biological weapons (B) and conventional weapons (W). Then the optimization problem can be

stated as:

$$\underset{B,W}{Min}\, C = P_B B + P_W W \quad subject\ to\ S_0 = S(B,W,B^*,W^*)$$

where P_B is the unit price of chemical and biological weapons, B is the number of chemical and biological weapons, P_W is the cost of conventional weapons and W is the number of conventional weapons employed. The production of national security or defense is positively related to the number of conventional and biological and chemical weapons deployed by the country, and inversely related to the amount of these deployed by the opponent which we denote with an asterisk, B^* and W^*. More specifically,

$$\frac{\partial S}{\partial B}, \frac{\partial S}{\partial W} > 0; \quad \frac{\partial S}{\partial B^*}, \frac{\partial S}{\partial W^*} < 0$$

For simplicity, we ignore military personnel without any loss in generality.

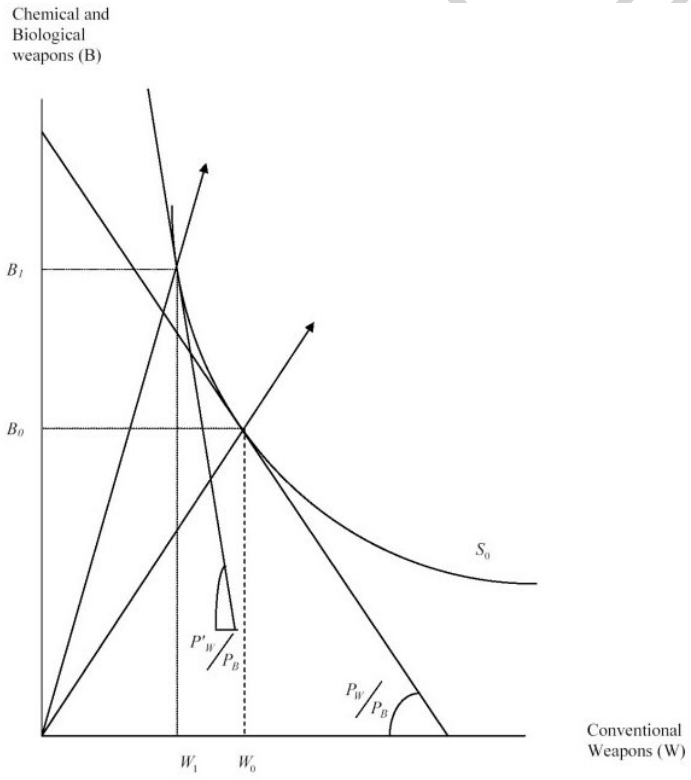

Figure 1: Optimization of the amount of Chemical and Biological Weapons (B) and Conventional Weapons, for a given level of National Security.

Figure 1 shows that the optimal amount of biological and conventional weapons needed to provide a given level of security S_0 is B_0 and W_0 when their costs are P_B and P_W, respectively. Notice that as the relative price of conventional weapons rises to P'_W/P_B, the optimal strategy to provide for a given level of national defense becomes more intensive in chemical and biological weapons (W_1/B_1 decreases).

This theoretical analysis can be adapted to the complexity of the real world by first enlarging the concept of the price of chemical and biological weapons. There is no world market (with perfect competition) for chemical and biological weapons. Thus, one should take into account all the "private costs", rather than the "price", of acquiring chemical and biological weapons (i.e. the cost for the country that acquires them).

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Biographical Sketch

Mayeul Kauffmann teaches economics at Université Pierre Mendès France, Grenoble. He has PhD in International Economics. He is a member of the CESICE (Center for studies on international security and European cooperations). His main researches are in the fields of peace and defence economics and of econometric analyses that are usefull to it.