

different, so a natural question is how the IAEA should divide its resources between them.

The model presented and analysed in the Appendix as Problem 3 bears directly on this allocation problem. Though the model represents simple decisions about violating and inspecting at declared vs. undeclared sites, it explicitly includes variable levels of inspection effort — which adds considerably to its complexity. Nevertheless, two important special cases are solved completely, and a partial solution is given for the general case. Important conclusions result concerning the IAEA's relative level of inspection effort against undeclared nuclear weapons development programs.

In the model, there is one state which possesses a declared site and an undeclared site. The state must choose whether to violate or comply, and, if it violates, at which site. (For technical reasons, violation at both sites is not permitted.) The model allows the state's value ratios at its two sites to differ. Such variation would reflect not so much the losses for detected violation (numerators of the value ratios), which are likely to be roughly equal at the two sites because they reflect mainly sanctions and penalties. Rather, the gains for undetected violations (denominators of the value ratios) may differ substantially between declared and undeclared sites, because of differences in timing, scale of operations, availability of equipment, etc. Possible differences in value ratios are an important feature of the model, allowing it to represent the influence of political considerations on choice of violation location.

The model has two decision makers — the state and the IAEA. The IAEA must decide how to allocate a fixed quantity of inspection resources between the inspection of the declared facility and the search for the undeclared facility. It is assumed that neither type of inspection ever yields evidence about the other type of violation, so the IAEA must somehow arrange that there is at least the threat of detection against either type of violation in order to deter it. Thus, the IAEA has flexibility in its decision of where to inspect, and must use it. A further complication is that large differences in inspection effectiveness must be taken into account by the IAEA when it makes its allocation.

Theorems 3.1 and 3.2 of the Appendix contain complete solutions to two special cases of this model — when the relation between inspection resources and effectiveness shows increasing and decreasing returns to scale. As well, the general problem of guaranteeing legal behaviour is addressed, and conditions guaranteeing its solvability are determined. The main point is illustrated in Figure 3.

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