

different problems relating to the IAEA's allocation of inspection resources, problems which were introduced above. Each of these problems is addressed in one of the subsections to follow. The content of each subsection is based on the analysis in the corresponding section of the Appendix.

### 3.1 *How much inspection effort should be applied in a state?*

The model appearing in the Appendix as Problem 1 is in fact a more complete specification of the violate/comply decision problem given in Figure 1a. It provides a simple but useful picture of the mechanism by which inspection programs deter violations. The model admittedly lacks in verisimilitude, but it does demonstrate, at a very fundamental level, what determines whether enforcement is effective enough to deter violations.

Inspection effectiveness, defined in Section 2, is proportional to the probability that a violation would be detected in an inspection. As the Appendix indicates, if a threshold level of inspection effectiveness can be identified, there may be a minimum level of inspection resources that would achieve it, depending on the particular relationship between inspection resources and inspection effectiveness.

The analysis in the Appendix shows that the level of inspection effectiveness necessary to deter violation by a state is related inversely to that state's *value ratio*, defined as

$$\frac{\text{Loss for detected violation}}{\text{Gain for undetected violation}} = \frac{b}{d}$$

where  $b$  and  $d$  are the quantities defined in Section 2. To illustrate, the value ratio increases as the loss for a detected violation increases, or as the gain for an undetected violation decreases. The value ratio can thus be interpreted as a "political" parameter, measuring the state's motivation not to violate.

Increasing the state's value ratio, either by increasing the penalty following detection or reducing the benefits of undetected illegal behaviour, decreases the threshold level of inspection effectiveness necessary to deter violation. Conversely, if the state discovers it has less to fear from a detected violation, or more to gain by violating, then the level of inspection effectiveness sufficient for deterrence increases.

It is worth emphasizing that this model shows that the success of a safeguards program depends essentially on a comparison between value ratio, a political parameter, and inspection