

Principal Findings and Conclusions

This document reports on a research project which involved new applications of game theory to arms control and disarmament verification. Many useful results and valuable insights have been developed.

Three specific research directions were explored actively: the development of allocation models in inspection games representing chemical weapons treaty verification problems; the application of agency theory to the bilateral verification problem; and the extension of basic bilateral verification principles to the multilateral case. In the main text of this report, the problems, methods and results for each research direction are described; technical details about the findings and techniques are contained in the appendices.

Following are some of the results, principles and insights arising from this research which will be of value to policy makers:

- (1) In negotiating a treaty, it may be necessary to consider trading off measures which increase the detectability of cheating (longer inspections, a larger inspection team, etc.) against measures which increase the penalty for detected cheating (increased negative publicity, the right to control facilities where violations have occurred, the right to destroy stocks and equipment, etc.). The methods developed in this research provide techniques for estimating the net effects of such trade-offs.
- (2) It is possible to assess the effects of certain treaty variables such as the total number of inspections allowed and concealment effort on the amount of violation.
- (3) Uncertainty over inspections always deters the violator, so that it is better to fix the number of inspections over longer rather than shorter time periods, in order to reduce the total amount of violation. For example, a treaty with k inspections allowed each year for 2 years should be altered to allow $2k$ inspections over 2 years. This step alone can be expected to reduce substantially the total number of violations over the two years.
- (4) Agency theory shows that information asymmetry between the inspector and inspectee is the major cause of compliance disputes. In order to reduce information asymmetry and consequently minimize these disputes, a treaty should be written clearly. Unless ambiguous and uncertain provisions are reduced, the treaty can be even worse than a second-best contract.
- (5) Agency theory provides a rigorous explanation why a treaty should contain as many cooperative verification measures as possible. Since it is virtually impossible to attain a "first-best" arms control treaty, it is wiser to concentrate on incorporating cooperative verification measures in the treaty rather than to strive for an ideal treaty with absolute verification.