

Agency-Theoretic Approach to Arms Control Verification

Agency theory focuses on the optimal contractual relationship between two individuals whose roles are asymmetric. One, the principal, delegates work or responsibility to the other, the agent. An arms control treaty has important similarities to a contract representing the economic agency relationship. Both are agreements between *remote* parties. The parties are remote in that one party has difficulty observing the other's behaviour related to the agreement. The purpose of this research direction was to apply the agency theory framework to characterize explicitly an arms control treaty and the verification process within the treaty and to derive strategic implications based on these characterizations.

In Appendix B, agency theory is briefly reviewed with particular emphasis on information asymmetry. There are two kinds of information asymmetry: adverse selection and moral hazard. This research focuses on the moral hazard problem, especially on the hidden action agency model. Although there are many other variations of agency models, the *Standard Agency Model*, with rather rigorous assumptions, is presented. The standard agency relationship is modelled mathematically in Appendix B, where the assumptions are carefully interpreted. Any standard agency relationship has one of three broad forms of contracts: first-best, second-best, and second-best with additional information. A first-best contract can be achieved only when the principal has complete knowledge of the agent's performance. A second-best contract results from imperfect information flow. A second-best contract can sometimes be augmented with additional information to improve it for both the principal and agent.

Given specific arms control definitions, it is argued that the Standard Agency Model applies to the arms control situation. Some of the assumptions of the Standard Agency Model are further explained in the arms control context. It is argued that unless there is perfect information flow between the inspector and inspectee, the use of National Technical Means (NTM) guarantees only a second-best contract at most. Here lies the importance of cooperative verification measures which assist NTM (non-intrusive cooperative measures) and independently collect data that NTM cannot (intrusive cooperative measures such as on-site inspections) in order to increase the inspectee's compliance level and consequently to decrease weapon stockpiles. Culminating the presentation in Appendix B is a simple example of a nuclear missile reduction treaty.

First-best arms control treaties are rarely possible except for a few cases such as the 1957 Antarctic Treaty in which an absolute level of verification is feasible. Obtaining additional information through monitoring is regarded as secondary monitoring in arms control, whereas NTM have the role of primary monitoring. The integration of additional information into an arms control treaty is seen as the use of cooperative verification measures. Information obtained through cooperative verification measures is more than what is conveyed by NTM only. Consequently, this information is valuable in the sense that both parties' expected utilities can increase with cooperative measures.

One important practical guideline for writing arms control agreements which is suggested by the application of agency theory is that a treaty should contain as many cooperative verification measures as possible -- this is better for both parties. Since it is difficult to design a first-best arms control treaty in practice, it is wise to concentrate on incorporating cooperative verification measures in a treaty rather than to hold out for an ideal treaty with