

NETWORKING MECHANISMS IN AGENCY

Chiaho Chang, Department of Accounting, Law and Taxation, Montclair State University, Montclair, NJ 07043, 973-655-7458, changch@mail.montclair.edu

ABSTRACT

This paper studies communication and monitoring capabilities of agents in a networked environment in which the principal designs incentive contract to entice the agents to work hard while preventing them from colluding with each other. In an organization, communication and monitoring are considered informal mechanisms that interact with formal mechanisms such as incentive contract to help the agents carry out their tasks consistent with the principal's objective. The optimal incentive contract, the principal's expected salary costs and the agents' expected utilities are considered under various scenarios to unravel the impacts of communication and monitoring on organizational design.

INTRODUCTION

In an organization, delegation of jobs to an agent by the principal inevitably leads to the moral hazard problem. When the principal gets to collect (imperfect) signal about agent's activities and uses the information to design the incentive contract, the moral hazard problem is lessened as a result. This is known as the single-agent moral hazard problem.

In a more general setting, the principal delegates jobs to several agents whose individual efforts and cooperation help accomplish the principal's objectives. When only a team performance measure is available (but not individual agent's action choice), proper incentives will be needed to align the interests of the agents with that of the principal. Otherwise, multi-agent moral hazard problem will result.

To complicate the pursuit of an optimal incentive contract, the agents may interact in ways not previously considered in the literature. The agents, for example, may communicate with each other to coordinate their efforts. The agents may also monitor each other's actions to make sure that the agreed-upon efforts (or shirking) are carried out. This paper considers the impacts of these informal mechanisms on the multi-agent moral hazard problem.

Without communication, the agents are assumed to comply with the principal's choice of the Nash equilibria and work hard. With communication, the agents may negotiate and come up with a choice of the Nash equilibria that benefits themselves. Collusion becomes a distinct possibility. In terms of organizational design, the ease with which a communication channel can be established must also be considered.

Mutual or single-sided monitoring is supposed to help relieve the moral hazard problem. For monitoring to be effective, it has to be enforced through, say, a side monitoring contract that stipulates penalty for deviating from accepted behavior (e.g., work hard). This paper assumes that monitoring is effective, and looks instead at whether the monitoring mechanism may be established endogenously at a cost and its impact on the principal's optimal contract design.

This paper contributes to a growing literature on organizational design by studying two informal mechanisms, communication and monitoring. The major conclusions are:

- (1) Collusion exists when the agents prefer to coordinate their efforts and communication costs little.
- (2) To prevent collusion, the principal has to provide more monetary incentives.
- (3) When the agents are allowed to communicate with each other but monitoring is not feasible, the agents will choose not to communicate.
- (4) To induce single-sided monitoring, the incentive contract must satisfy the following conditions.
 - a. It must provide agents with enough incentives so Agent 1 will prefer to work hard while monitoring Agent 2's action.
 - b. It must provide Agent 1 with enough incentive so she will not deviate from the set course.
 - c. It cannot provide too much incentive to Agent 1; otherwise, she will still work hard but not monitor Agent 2, leading to Agent 2's shirking choice.
 - d. It cannot provide too much incentive to Agent 2; otherwise, she will choose to work hard, leaving Agent 1 with little incentive to do the monitoring.
- (5) To induce mutual monitoring, the incentive contract must satisfy the following conditions.
 - a. It must provide agents with enough incentives so both agents will prefer monitoring each other.
 - b. It cannot provide too much incentive to Agent 1 (Agent 2); otherwise, Agent 1 (Agent 2) will work hard while Agent 2 (Agent 1) will shirk.
 - d. It cannot provide too much incentive to Agent 1 (Agent 2); otherwise, Agent 1 (Agent 2) will work hard and Agent 2 (Agent 1) will stop monitoring.
- (6) When the information comes from individual agents, the principal can design contract to induce monitoring.
 - a. When Agent 1 is more capable of monitoring, the optimal contract will call for a single-sided monitoring.
 - b. When both agents are equally capable of monitoring, mutual monitoring is warranted.
- (7) The principal's salary cost is at the highest when the agents tend to collude without monitoring; it is at the lowest when the agents monitor each other's action choice.
- (8) The agents' expected compensation is at the highest when their threat to collude is credible; it is at the lowest when the agent is being monitored.

Literature review is presented next, followed by a description of the setting and the model formation. Four cases are considered: (1) when the agents are not allowed to communicate with or monitor each other, (2) when the agents can communicate with but are not allowed to monitor each other, (3) when the agents can communicate with each other, but only one of them does the monitoring, and (4) when the agents can communicate with and monitor each other. For each case, the optimal contract is solved and characterized in terms of the principal's expected salary cost, the agents' expected compensation and utility, as well as the optimal action choices. This paper is finished with a concluding remark.

LITERATURE REVIEW

One thread of the literature that discusses the moral hazard problem in multi-agent settings considers the availability of private information from observing each other's work and behavior. The principal may want to establish a reporting mechanism to solve the incentive problem. Holmstrom (1979) demonstrates the usefulness of any signal that will improve the principal's contract design. If the principal builds a direct revealing mechanism that encourages the agents to report truthfully their observations of others, the moral hazard problem will be reduced. Arya and Glover (1995) consider such a mechanism. The agents are assumed to be coalition-free.

Itoh (1993) proves that collusion among the agents renders the reporting mechanism ineffective. Kreps (1990) mentions two roles played by communication in non-cooperative games: one, costly, formal communication channel established to benefit the participants; two, informal, cheap talk that leads to negotiation. The reporting mechanism mentioned earlier belongs to the first one. This paper, instead, takes the second approach and allows for the presence of communication costs to see if the communication will be established endogenously.

Another line of research forgoes the reporting mechanism and looks instead at the agents' informal mechanisms, especially monitoring. Three papers, Itoh (1993), Macho-Stadler and Perez-Castrillo (1993) and Baliga and Sjostrom (1998), are discussed.

Itoh (1993) proves that the presence of mutual monitoring mechanism among homogenous agents benefits the principal. The principal thus has the incentive to induce monitoring. Macho-Stadler and Perez-Castrillo (1993) consider, among homogenous agents working on two team-based assignments, their commitment capacity and its impact on the principal. The result is that the principal will benefit more if the commitment capacity is increased. Baliga and Sjostrom (1998), instead, study heterogeneous agents working in a team and the principal's delegation choice. They find that the principal must authorize one of the agents to be the leader and conduct monitoring or induce others to work.

This paper assumes that the principal cannot observe the agents' action choice, that the agents are risk neutral, and that they are guaranteed a minimum pay. Similar assumptions are adopted by Shapiro and Stiglitz (1984), Park (1995), Kim (1997), Demougin and Fluet (1997) and Allgulin (1999). The minimum pay requirement, combined with risk neutral agents, means that the principal will have to pay extra to induce work.

In this paper, monitoring is considered beneficial to the principal and therefore encouraged. Collusion, on the other hand, happens when communication is possible. The principal has to impose additional constraint to properly align the agents' interests. That adds costs to the principal's contract.

(This paper is available upon request. Comments are welcome.)