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論文題目	Essays on Optimal Collusion-Proof Contracts （最適耐共謀契約に関する小論）		

（論文内容の要旨）

This dissertation studies optimal contracts in organizations where some agents may collude with each other. In particular, the author derives optimal collusion-proof contracts in several contexts where the principal cannot receive verifiable signals about the quality of the agents' work.

This dissertation has four chapters, and Chapter 1 is an introduction.

Chapter 2 analyzes an agency model with subjective evaluations. In the standard agency models, the agent's action generates a noisy signal that is verifiable to third parties like courts. In contrast, under subjective evaluations, the principal receives a noisy, private signal which is neither verifiable to third parties nor is observable to the agent. In this chapter, the author assumes that the principal hires a monitor who perfectly and privately observes the agent's action. The author also assumes that the monitor may collude with the agent. Thus, while the principal wants to write a contract inducing the monitor to truthfully report his observation, collusion between the monitor and the agent may prevent truth-telling. The main purpose of this chapter is to derive an optimal collusion-proof contract in this principal-monitor-agent model with subjective evaluations and is to compare with the optimal contract in the case without any monitor.

The author shows that the introduction of a monitor never hurts the principal even under possible collusion, in the sense that the principal's payoff under the optimal collusion-proof contract is not less than her payoff under the optimal contract without a monitor. Second, if the agency cost inherent to subjective evaluations, namely, the amount of money burning, is large enough under the optimal contract without a monitor, the principal attains a greater payoff under the optimal collusion-proof contract. Therefore, the role of a monitor is significant in environments with subjective evaluations.

Chapters 3 and 4 consider a model of consulting, where a principal seeks advice from experts for a decision making in the future. The expert can provide informative advice only when he makes unobservable efforts, and this unobservability creates a moral hazard problem. The principal thus attempts to resolve the problem by hiring two experts and letting them compete. The idea is to reward them when they make similar advice, so that each expert has an incentive to make efforts for informative advice, given that the other expert makes efforts.

Earlier papers on this setting characterize optimal contracts among all contracts such that it is an equilibrium for the experts to make efforts and to provide informative advice. This approach corresponds to a weak notion of implementation; in the game the experts play under the optimal contract, mutual effort and truthful reports form just one of the multiple equilibria. Indeed, an equilibrium may exist where no expert makes efforts and has a greater payoff than the equilibrium with mutual efforts. In order to resolve the problem, the author thus proposes a strong notion of implementation; the author characterizes optimal contracts among all contracts such that mutual efforts and truthful reports form a weakly Pareto optimal equilibrium.

Chapter 3 restricts attention to a simple setting where the experts have binary action sets. Then the optimal contract under the strong notion of implementation is explicitly derived. The contract exhibits an interesting feature such that the experts are rewarded even when their advice is not similar. Chapter 4 studies an extension of the model where each expert chooses own effort level from a general finite set. A main result of this chapter is a full characterization of the optimal contracts under the two notions of implementation. The result reveals that the primary feature of the optimal collusion-proof contract under strong implementability in Chapter 3, rewarding the experts even when their advice is not similar, need not hold in cases of three or more actions.

（続紙 ２ ）

（論文審査の結果の要旨）

This dissertation consists of three papers on agency models, all of which examine issues of collusion among the agents. The author focuses on two distinct frameworks. One is agency with subjective evaluations, so that the principal receives a noisy private signal about the agent's action, which cannot be written in a contract. The other is a model of consulting, where a principal hires two experts and induces them to compete, so that they make efforts for informative advice.

The main contribution of this dissertation lies in Chapter 2. In this chapter, the author sets up a model where a principal who can evaluate an agent only subjectively hires a monitor who perfectly observes the agent's action. The author introduces a possibility of collusion between the monitor and the agent, so that the overall effect of a monitor is not obvious. It is thus remarkable that, as the author shows, the introduction of the monitor never hurts the principal even if she must write a collusion-proof contract, in comparison with the case without a monitor. Further, a necessary and sufficient condition for a strict payoff improvement thanks to presence of a monitor is provided. These results show how monitors are helpful in organizations when verifiable signals of efforts are hard to obtain. While the positive role of a monitor has been pointed out in the standard agency model with verifiable evaluations, the results in this chapter show a different source of payoff improvements. Namely, they can reduce the expected amount of money burning, an agency cost inherent to subjective evaluations. This is a novel insight and is a valuable contribution to the literature.

Chapters 3 and 4 study a model of consulting with multiple experts. Earlier papers on this model examined contracts under which the experts' mutual efforts and provision of informative advice form an equilibrium. A major criticism to this approach is that its notion of implementation is so weak that the game the experts play may have a zero-effort equilibrium which Pareto dominates the equilibrium with efforts. This is indeed the case for simple contracts and the literature therefore explored more elaborate contracts.

The author takes an alternative approach which strengthens the notion of implementation. Namely, these chapters characterize simple contracts where the experts' mutual efforts and provision of informative advice form a weakly Pareto optimal equilibrium. This approach is in line with the one in the previous chapter; the principal wants to prevent the experts from colluding for a different equilibrium from the target one. The characterization of optimal collusion-proof contracts is an interesting result.

The dissertation has considerable substance but is also subject to some criticism. First, the strong result demonstrating the positive role of a monitor in Chapter 2 seems to depend on the assumption that the monitor observes the agent's action without any noise. The case where the monitor receives a noisy but more informative signal than the principal would be an interesting extension of the model, because asymmetric information between the monitor and the agent due to imperfect observability may make it difficult for them to collude. Further, extension to the case of risk-averse parties is also an interesting direction of future research.

Second, the weakly Pareto optimal equilibria studied in Chapters 3 and 4 are not strongly Pareto optimal, in the sense that they do not maximize the experts' total payoffs among all equilibria. This indicates that the optimal collusion-proof contract is vulnerable to side payments between the experts. In other words, the author's analysis hinges on implicit assumptions prohibiting side payments and other devices that may facilitate collusion. Making those assumptions more explicit is important, from the perspective of organizational design.

However, the author can address these issues in his future research, and the overall quality of this dissertation is significant.

Due to those evaluations, this dissertation is recognized as worthy of a doctoral degree in economics. This decision has been made after the thesis defense on February 1, 2024.

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