（ 続紙 1 ）

京都大学	博士（経済学）	氏名	水　忠昊
論文題目	Three Essays on Repeated Games and Games with Incomplete Information （繰り返しゲームと不完備情報ゲームに関する三つの小論）		

（論文内容の要旨）

This dissertation contains one paper on the theory of repeated games and two papers on two classes of games with incomplete information: auctions and cheap-talk games.

The dissertation has three chapters. Chapter 1 proposes a new equilibrium concept in the infinitely repeated games with discounting. A strategy profile is a degree-K subgame perfect Nash equilibrium if at any history no coalition whose size is up to K has a deviation which improves its members' joint payoffs. Assuming that the players' actions are perfectly observable, the author considers two models where hidden deviators within a deviating coalition, who play as in the equilibrium, can and cannot be detected, respectively. In each model, the author characterizes the set of payoff vectors sustained by the new equilibrium concept if the players are sufficiently patient. Specifically, the equilibrium payoff vector set when the hidden deviators are detectable satisfies generalized versions of feasible individual rationality and non-equivalent payoffs, which are a sufficient condition for the standard folk theorem.

Chapter 2 considers auction environments where the auctioneer has motives other than revenues and hence dislikes too high winning bids. More concretely, the auctioneer is assumed to have a non-monotonic utility function with a unique maximizer. This assumption is reasonable when the auctioneer wants to avoid aggravation of bubbles in the market (like China's local government in land auctions) or when winning bids tend to be tremendously high (like spectrum auctions) and potentially cause the winner to go bankrupt. A key insight is that the auctioneer wants to set an upper bound on bids, called a rejection price. The main result is to characterize the optimal rejection price for the auctioneer under the first-price and the second-price auction formats, respectively. Further, the author provides conditions as to which auction format (under the optimal rejection price) the auctioneer prefers.

Chapter 3 extends the cheap-talk games, one of the most extensively studied classes of games with incomplete information, to environments where both the sender and the receiver are not fully aware of the entire type space. Here the information a player was not aware of is similar to events whose prior probability is zero, but a difference is that upon learning the previously unaware information the player updates her beliefs in a non-Bayesian and an ambiguity-averse manner.

The author starts with an observation that analysis of this type of model is closely related to that of a standard cheap-talk model with complete awareness where the sender's type belongs to the union of several disjoint intervals. The main result is to show existence of an equilibrium in the model with unawareness. The equilibrium is similar to the partition equilibria, which are well-understood in the literature under complete awareness.

（論文審査の結果の要旨）

This dissertation studies three distinct theoretical topics on game theory: (i) a new equilibrium concept for the repeated games, (ii) design of auctions when the auctioneer has a non-monotonic utility function, and (iii) cheap-talk games with unawareness regarding the type space. Both the author's motivation to tackle those diverse topics and his analytical skill to obtain quality results are remarkable.

Chapters 1 and 2 are the main contributions of this dissertation. In Chapter 1, the author incorporates an interesting idea on the equilibrium concept for the infinitely repeated games, which is to allow deviations by a coalition whose size is up to some given level. It is well known that if a grand coalition can deviate, many games, whether static or dynamic, suffer from nonexistence of an equilibrium. A key finding here is that if only coalitions up to some size are allowed, existing equilibrium constructions are applicable and lead to a characterization of the equilibrium payoff vectors. The author also shows that even when the grand coalition can deviate, existence and characterization of equilibria are shown in some repeated games. The results in this chapter are both original and surprising, and constitute an important contribution to the literature.

Chapter 2 introduces another interesting viewpoint, non-monotonicity of an auctioneer's monetary utility function, to equilibrium analysis and design of auctions. The non-monotonic utility function seems a peculiar assumption but is justifiable in cases where the auctioneer is a government which is not solely concerned with revenues and where the bidders are financially constrained and may default. The author successfully solves plausible equilibria of the first-price and the second-price auctions with a given rejection price respectively, and then studies the optimal rejection prices under the two formats and compare them. The chapter showcases his creativity and solid skill, which should be praised highly.

Chapter 3 is based on the author's criticism to the standard setting of incomplete information, to the effect that economic agents in reality are not completely aware of their type spaces. Borrowing from literature on games whose players are unaware of some possible states, the author extends the cheap-talk games to the case with unawareness and examines basic properties of the equilibria. Though the setup is potentially interesting, the analysis is still at a rudimental stage and should be made more elaborate in future research.

The dissertation has considerable substance but is also subject to some criticism. First, in the degree-K subgame perfect Nash equilibrium concept in

Chapter 1, the author studies a setting where the deviating coalition can be detected even when some members play in the same way as in equilibrium. However, it is not clear how to implement such information structure. While the author simply assumes presence of an outside observer who can detect any coalitional attempt to deviate, it is desirable to suggest technology and devices which play the role of the observer. Second, in the analysis of the first-price and the second-price auctions with a rejection price in Chapter 2, the author explicitly derives the optimal rejection price under the second-price auction format, but not under the first-price auction format. An explicit formula and/or some comparative statics results are useful, especially when we compare the two auction formats.

However, the author can deal with these issues in his future research, and the overall quality of this dissertation is unquestionable.

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 January 23, 2020.