Three Essays on Auction, Bargaining and Contract Theory

Dissertation Abstract

Chapter I: Bargaining over Incentive Contracts (Job Market Paper)

Many real-life contract agreements actually involve negotiations in which both parties have some bargaining power. However, standard contract theory assumes that the principal holds all of the bargaining power. The literature has typically modeled that with a one-shot game in which the principal makes a take-it-or-leave-it offer to the agent. Then, the agent is only able to accept or reject the offer.

In this paper, we relax the standard assumption and introduce bargaining into contract theory. By allowing alternating offers and strategic delay to the standard non-linear pricing model, we give the principal and the agent approximately equal bargaining power and we transform the standard one-shot contracts design game into an infinite-horizon contracts bargaining game.

In our contracts bargaining game, a seller (principal) and a buyer (agent) bargain over the price and the quality of some goods. The seller has no private information, while the buyer has private information about his marginal valuation for quality. The players make alternating offers with strategic delay, beginning with the seller. The seller can offer a menu of contracts from which the buyer can select, while the buyer can counteroffer with a single contract. The game ends when the two players agree on a contract.

Our paper presents the following new results. When the difference between the two buyer types is sufficiently large, for all discount factors and all possible distributions of types, the complete information efficient outcome is achieved. The sequential bargaining generates type-dependent continuation payoffs and the high-type will have a higher continuation payoff if he reveals his own type rather than mimics the low-type.

When this difference between the two buyer types is not sufficiently large, we attain either the “sequential separating equilibrium” or the “simultaneous separating equilibrium” depending on the proportion of types. If the probability of the low-type buyer is sufficiently small, then there exists a unique sequential separating equilibrium path. In this equilibrium the seller’s first offer is a single contract intended for the high-type. The high-type buyer accepts the seller’s first offer while the low-type buyer does not. The low-type buyer makes the counteroffer of his "least-cost-separating contract". In this counteroffer, the low-type uses both the quality distortion and the strategic delay to signal his type. Hence, our newly defined "dynamic least-cost-separating contract" is more general than the usual static "Riley outcome".

Furthermore, if the probability of the low-type buyer is sufficiently large, then there exists a unique simultaneous separating equilibrium path. In this equilibrium, the seller’s first offer is a menu of contracts from which the buyer can self-select. Both buyer types accept the menu without delay and each self-selects his preferred contract thus revealing his type. Contracts characterized in this case are what we call "bargaining-proof contracts" with incomplete information.

Standard bargaining theory focuses on one-dimensional bargaining, where a buyer and a seller usually bargain over the price of a good. In our contracts bargaining game, however, the buyer and the seller bargain over multi-dimensions, i.e., the price and the quality. The main problem with the one-dimensional bargaining literature is that there are too many equilibria even after applying refinements. If the multiple dimensions are correlated so that the players can combine those dimensions to either screen or signal for the types as we have done in this paper, the multiple equilibria problem of the standard bargaining literature can be mitigated or even resolved.
Chapter II: Repeated First-Price Auctions

In many real-life repeated first-price auction cases, the objects auctioned each period are approximately the same, the bidders' identities are also the same across time and the winners do not drop out.

In this paper, we study a model of two-round first-price sealed bid auctions with two bidders and two identical items. We make the following three assumptions. First, both bidders want to purchase both items. Second, a bidder's valuation for the object remains the same in both rounds. Third, there is no collusion between the bidders.

In the first round, the valuations of bidders are drawn from the same distribution, so it is an ex ante symmetric auction. After the conclusion of the first round, the winner and the winning bid are publicly announced. The bidders use this information to update their beliefs about the valuations of their opponent. Once a particular bidder has won, her behavior and valuation are different from the other. Therefore, the second round is an asymmetric auction. Thus, our two-round first-price auction game sequentially combines a symmetric auction with an asymmetric auction, which makes this research theoretically interesting and challenging.

We characterize the equilibrium for both the discrete type and the continuous type case. We find that compared to the standard results of one-shot first-price auction, the bidders bid lower in the first-round of our model. We show that the first-round loser bids more aggressively in the second-round than the first-round winner. Lastly, we present that the two-round first-price auction generates less revenue for the auctioneer than the two-round second-price auction.

Chapter III: Complementarity, Strategic Know-how Disclosure and R&D Cooperation

One interesting phenomenon in the IT industry is that many product market rivals actually cooperate in their R&D. For instance, although Intel and AMD compete in the product market, they actually cooperate in the R&D stage.

This paper argues that the complementarity of firm-specific resources or inputs, such as human capital, knowledge, information, etc., is one of the reasons that the firms cooperate in R&D. More specifically, we model the complementarity of know-how between two firms and characterize the equilibrium with R&D cooperation.

We design an infinitely repeated, two-stage complementary know-how disclosure game. The first stage models R&D cooperation by allowing the two firms to disclose part of its know-how to each other. The second stage models the final product market by using a Cournot game. An adverse selection problem arises from the uncertainty about the other firm's know-how level. Moreover, a moral hazard problem arises from each firm's opportunistic behavior of disclosure levels to the other.

By letting the two-stage game infinitely repeat, we allow firms to learn about the behaviors of each other, to update beliefs, and to decide whether or not to continue playing. We characterize the whole equilibrium set and specify the equilibrium path where the firms begin at very low level cooperation initially and reach the full cooperation finally.