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Equilibrium selection in signaling games with teams: Forward induction or faster adaptive learning?[☆]

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ABSTRACT

Teams are shown to violate the most basic of equilibrium refinements in signaling games: single-round deletion of dominated strategies (part of the Cho–Kreps intuitive criteria). This is important because, to the extent that teams can be easily induced to violate the most basic of equilibrium refinements even under a "best case" scenario (teams that rapidly develop strategic play in games of this sort), it implies that one must rely on learning models, and past empirical research with these models, when predicting equilibrium outcomes.

1. Introduction

Previous research shows that two-person teams learn to play strategically much faster than individuals in signaling games, to the point that they meet or beat the demanding truth win's norm (Cooper and Kagel, 2005). Previous research also shows that individuals in signaling games violate a number of standard equilibrium refinements, including Cho and Kreps's (1987) intuitive criteria and single-round deletion of dominated strategies (Brandts and Holt, 1992, 1993; Cooper et al., 1997b). The superior performance of teams over individuals raises the intriguing issue of whether or not teams will use forward induction, or whether their superior adaptive learning behavior will somehow help them those equilibrium refinement criteria that individuals fail to satisfy under similar circumstances.

The short answer to this question is that teams do no better than individuals on this dimension. Teams indeed continue to learn to play strategically much more rapidly than individuals. But they also violate one of the weakest of the equilibrium refinements, single-round deletion of dominated strategies, under the same circumstances that individuals do. With individuals one cannot determine whether or not failure of this most basic refinement results from signalers' inability to recognize that a strategy is dominated or to beliefs that the dominated strategy is too subtle to be recognized so that senders must provide the clearest possible signal to receivers. However, with teams one can distinguish between these two possibilities through inspection of the team dialogues. This analysis shows that while senders are at times concerned with receivers "getting" the signal, most of the time this is applied inappropriately as there appears to be no explicit recognition of dominated strategies except when the dominance is obvious (e.g., through the use of negative payoffs for the action in question).

The issue of equilibrium refinements in signaling games is important since there are typically a large number of multiple equilibria depending on agents' out-of-equilibrium beliefs. The refinements literature is designed to rule out less plausible equilibria using forward induction arguments. To the extent that these do not predict well even under a "best case" scenario

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Table 1
Player A's payoffs as a function of player B's choice[1].

a

A's choice (output)	A1 (MH) B's (E's) choice		A2 (ML) B's (E's) choice		A's choice (output)
	x (IN)	*y* (OUT)	*x* (IN)	*y*(OUT)	
1	150	426	250	542	1
2	168	444	276	568	2
3	150	426	330	606	3
4	132	408	352	628	4
5	56	182	334	610	5
6	38	162	316	592	6
7	NO	CHOICE	298	574	7

b

B's choice	B's (E's) payoffs A's (M's) type	
	A2 (ML)	A1 (MH)
y (OUT)	250	250
x (IN)	200	300

c

B's choice	B's (E's) payoffs A's (M's) type	
	A2 (ML)	A1 (MH)
y (OUT)	250	250
x (IN)	200	500

(teams rapidly develop strategic play and understand the underlying concepts well enough to generate strong positive transfer in related games), it implies that one must rely on learning models, and past empirical research with these models, to sort out between different equilibria.[2]

The plan of the paper is as follows. Section 2 describes the basic signaling model we are working with along with the experimental design and procedures. Section 3 provides the details underlying the design of the experiment along with the results. Section 4 provides a brief summary of our finding and ideas for future research.

2. Experimental design and procedures

2.1. Experimental design and equilibrium predictions

The experiment employs a stylized version of Milgrom and Roberts' (1982) entry limit pricing model that focuses on signaling aspects of the game. We report results from two experimental sessions conducted with different payoff tables, both of which get at the same general principle. We discuss our design and procedures in detail in terms of Session 1 followed by a brief discussion of the design and procedures in Session 2.

The game is played between an incumbent monopolist (M) and a potential entrant (E). It proceeds as follows: (1) M observes its type, high cost (MH) or low cost (ML), with the two types realized with equal probabilities that are common knowledge. (2) M chooses a quantity (output) whose payoff is contingent on the entrant's (E's) response (see Table 1a). (3) E sees this output, but not M's type, and either enters or stays out. The asymmetric information, in conjunction with the fact that it is profitable to enter against MHs, but not against MLs, provides an incentive for strategic play (limit pricing).[3]

The game is played with two types of entrant E: high cost types, (Table 1b) for which there exist both pure strategy pooling and separating equilibria, and low cost types (Table 1c), for which there exist no pure strategy pooling equilibria. Only one type of potential E is present in any given play of the game, with changes in type of E being a primary treatment variable. Sessions proceed with several rounds of play with Table 1a and b, followed by a number of rounds of play with Table 1a and c.

Past research shows that with high cost Es, play reliably converges to a pooling equilibrium at 4 (Cooper et al., 1997a,b). This is supported by the fact that (i) E's expected value of OUT is greater than that of IN (250 versus 187), so that pooling

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1 Terms in parentheses were not present in the payoff tables actually used.

2 One counter-argument to this is that more "sophisticated" agents (as opposed to the students in the typical economic experiment) will use forward induction arguments of the sort underlying the refinements literature. This is, of course an empirical question which has yet to be investigated systematically. As such the best answer to this counter-argument is that signaling models of the sort studied here apply to far broader classes of issues than ones in which such sophisticated agents of this sort would dominate. Further, as far as intelligence goes, the typical experimental subject is far more sophisticated than the general population or even the general college level population (Casari et al., 2007).

3 The original Milgrom and Roberts game has two stages. We collapse stage 2 – what happens in response to E's decision to enter (the two share the market) or stay out (M plays as an uncontested monopolist) – into the payoffs in Table 1a. This greatly simplifies the experimental design, focusing subject's attention on the signaling aspects of the game.