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 Cho-Kreps intuitive criteria). This is important because to the extent that teams can be easily induced to violate even 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.

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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-Kreps (1987) intuitive criteria and single round deletion of dominated strategies (Brandts and Holt, 1992, 1993; Cooper, Garvin and Kagel, 1997b). The superior performance of teams over individuals raises the intriguing issue of whether or not teams will use forward induction, or that 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 (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.[1]

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[1] 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

The plan of the paper is as follows: Section 1 describes the basic signaling model we are working with along with the experimental design and procedures. Section II provides the details underlying the design of the experiment along with the results. Section III provides a brief summary of our finding and ideas for future research.

Experimental Design and Procedures:

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) Ms choose a quantity (output) whose payoff is contingent on the entrant's (Es) 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).[2]

[Insert Table 1 here]

The game is played with two types of Es: 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 Es' type being a primary treatment variable. Sessions proceed with several rounds of play with Tables 1a and b, followed by a number of rounds of play with Tables 1a and 1c.

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is, of course an empirical question which has yet to be investigated systematically. As such the best answer to this counter argument at this time 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, Ham and Kagel, 2007).

[2] The original Milgrom and Roberts game has two stages. We collapse stage 2 – what happens in response to Es 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.

Past research shows that with high cost Es, play reliably converges to a pooling equilibrium at 4 (Cooper, Garvin and Kagel, 1997a, b). This is supported by the fact that (i) E's expected value of OUT is greater than IN (250 versus 187) so that pooling deters entry and (ii) out-of equilibrium beliefs that any deviation involves an MH type with sufficiently high probability to induce entry.[3]

In games with low cost Es there is an efficient separating equilibrium in which MLs choose 6 and MHs choose 2. It does not pay for MHs to try and mimic MLs choice of 6 since 2 dominates 6. There is also an inefficient separating equilibrium in which MLs chose 7, with MHs choosing 2. In both of these equilibria Es play OUT in response to 6 or 7, and IN in response to 2, with the equilibrium supported by out-of-equilibrium beliefs (OEB for short) that any deviation from 6 (or 7) represents an MH with sufficiently high probability to support the equilibrium. In terms of the equilibrium refinements literature, single round deletion of dominated strategies (part of the intuitive criteria) rules out the OEB that any deviation from 7 to 6 represents an MH type, as 6 is dominated for MHs and will never be chosen.

Note that we have purposely made the inefficient separating equilibrium totally transparent by indicating that MHs cannot choose 7, while making the efficient separating equilibrium less transparent (to non-game theorists at least) by having positive payoffs that are nevertheless dominated for MHs. A previous experiment with individual agents (Cooper et al., 1997b) showed that play was converging on the *inefficient* separating equilibrium in spite of the fact that MHs essentially never chose 6. This was predicted by a model of stochastic fictitious play in which we assumed that (i) MHs never chose 6 and (ii) that Es failed to recognize that 6 was dominated by MHs but that 7 was dominated (see Cooper et al., 1997b for details). In contrast, in sessions where payoffs for 6 and 7 are replaced with *negative* numbers 7 is essentially never chosen and play converges on the efficient separating equilibrium, because the negative numbers make it clear that 6 will never be chosen by MHs. This transparency is clear from team dialogues (Cooper and Kagel, 2005).

Session 2 used the payoffs reported in Table 2 where once again it is common knowledge that the two M types are equally likely. Sessions proceed with several rounds of play with Tables 2a and b, followed by a number of rounds of play with Tables 2a and 2c. Since based on the

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[3] There are pooling equilibria at output levels 1-5, each of which is supported by out-of-equilibrium beliefs that any deviation from the output level in question represents an MH with sufficiently high probability to induce entry. Of these, 4 and 5 satisfy the Cho-Kreps intuitive criteria (see Cooper et al., 1997b).

prior probability that the two M types are equally likely the expected value of IN is greater than OUT in both payoff tables for Es, there do not exist any pure strategy pooling equilibria in either case, only pure strategy separating equilibria. What the change in Es' payoffs do in this case is to switch which M type chooses to signal: With payoff Table 2b, the efficient separating equilibrium is for ML to choose 7 and for MH to choose 2 with Es playing IN on 2 and OUT on 7.[4] There are also inefficient separating equilibria in which MLs choose 8 or 9 (with MHs always choosing 2). In this case we do not expect either of these inefficient separating equilibria to attract much attention since the negative payoffs for MHs at 7 make it reasonably obvious that these are dominated.

[Insert Table 2 here]

The change in Es payoffs to Table 2c means that entry will now be encouraged against the MLs. This generates an efficient separating equilibrium in which MHs choose 2 and MLs choose 5, with Es playing OUT on 2 and IN on 5. There is also an inefficient separating equilibrium in which MHs choose 1 and MLs choose 5. Again we use the fact that there are positive payoffs at 2 for MLs to disguise the fact that (for most non-game theorists at least) 2 is dominated by 5 for MLs. In contrast, the negative payoffs for MLs at 1 should (and in fact do) make it reasonably clear that it is dominated. Both of these separating equilibria are supported by OEBs that any deviation from 1 or 2 represents an ML with sufficiently high probability that they will be entered on. However, once again in terms of the equilibrium refinements literature, single round deletion of dominated strategies rules out the OEB that any deviation from 1 to 2 represents an ML type with sufficiently high probability, as 2 is dominated for MLs and will never be chosen.

Experimental procedures: Both sessions employed two person teams acting as a unified economic agent. Team parings were determined randomly by the computer at the beginning of each session and remained the same throughout the session. Teammates were able to communicate and coordinate their decisions using an instant messaging system with no other team having access to their messages. In addition to instructing subjects that the instant messaging system should be used for coordinating their decisions, they were told to be civil to

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[4] It is a bit of a misnomer to label the A2's in this case MLs since at output levels 1 and 2 they are less profitable than the MHs (A1s).

each other and not to identify themselves. The message system was open continuously, and messages were time stamped with the period of the game played.

Payoff tables on the computer screen had a column labeled “partner’s choice” on the left and a column labeled “my choice” on the right. When a subject entered a choice, the possible payoffs were highlighted in blue. When their partner entered a choice, possible payoffs were highlighted in pink. Once choices coincided possible payoffs were highlighted in red and teammates had 4 seconds to change their choice before it was binding. Teams started out with 3 minutes to coordinate their choices. If a team failed to coordinate within this time constraint, the dialogue box was closed and one teammate was randomly selected as “leader” with his choice implemented unilaterally. Disagreements of this sort were rare. Each team member got the full payoff associated with their team’s choice. Payoffs were in “francs” which were converted into dollars at the rate of 100 francs = \$2.50. [5]

Both sessions primarily employed experienced subjects from sessions reported in Cooper and Kagel (2005): All but two subjects in Session 1 had participated in one prior session using similar payoffs to Table 1a and b, either in teams or as individuals.[6] As such these subjects would have had experience with a game that converged on a pooling equilibrium at 4. Subjects in Session 2 had all participated in one and in most cases two prior sessions in teams, including sessions with low cost Es so that they would have had experience in games with a separating equilibrium.[7] Being experienced subjects, an abbreviated version of the instructions were read out loud at the start of the sessions, with each subject having a written copy to follow along with (including copies of Ms and Es payoff tables). Subjects rotated between roles with Ms (Es) becoming Es (Ms) every 4 games. We refer to a block of 8 games in a session as a "cycle." Within each half-cycle, each M was paired with a different E for each play of the game.

Subjects in Session 1 started with a full cycle of play using payoff Table 1b for Es, while subjects in Session 2 started with 1.5 cycles of play with payoff Table 2b. Following this the old payoff tables were collected and the new payoff tables were distributed along with a brief announcement read that play would continue for the remainder of the session with the new

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[5] At the time these sessions were run – Spring of 2001 – \$1.00 was worth somewhat more than 1 Euro.

[6] A single practice round was run in order to familiarize the inexperienced subjects with the procedures. Their partners, who were experienced, would have helped them as well. Payoffs in the previous sessions these subjects participated in were the same as in Tables 1a and b except that MHs payoffs at 6 and 7 were negative in the prior experiment.

[7] Sixteen out of twenty subjects were twice experienced.

payoffs (and the only thing that had changed were Es payoffs). The number of plays of the game was announced in advance at the start of each session. Session 2 employed the extra half cycle of play prior to the crossover as the only pure strategy those payoffs supported involved separating which we knew, from experience, take more time to develop than the pooling equilibrium supported by the payoffs prior to the crossover in Session 1. Details regarding subjects experience and the number of periods of each treatment condition are summarized in Table 3.

[Insert Table 3 here]

Before each play of the game the computer randomly determined each M's type and displayed this information on Ms' screens.[8] The screen also showed the payoff tables for both types with the payoff table for the player's own type displayed on the left. Once *all* Ms had confirmed their choices, each M's choice was sent to the E they were paired with.[9] Es then decided between IN and OUT with their possible payoffs highlighted on their computer screen.

Following each play of the game subjects learned their own payoff, the payoff for the player they were paired with, and M's type. In addition, the lower left-hand portion of each player's screen displayed the results of all pairings: M's type, M's choice, and E's response ordered by output levels from highest to lowest. The screen automatically displayed the three most recent periods of play, with a scroll bar available to see all past periods.[10]

Subjects were recruited primarily via direct e-mail contact with students enrolled in introductory economics classes at Ohio State University. Sessions lasted a little under two hours. Subjects were paid $5 for showing up on time. Earnings averaged between $33 and $40 a session with larger payouts for Session 2 due to the larger number of plays of the game.

Experimental Results: Figure 1 reports results from Session 1 beginning with cycle 1 (games with high cost Es) where play is converging on a pooling equilibrium at output level 4 with all but one ML selecting 4 and 81.3% (13 out of 16) of MHs' choosing 4 as well. Convergence to the pooling equilibrium at 4 is quite typical with these payoff schedules (Cooper and Kagel,

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[8] We employed a block-random design so that the number of high and low cost types was equal (or as close to equal as possible) in each round.

[9] This was done as the type of M that is supposed to play strategically typically take more time to choose, which subjects pick up on rather quickly.

[10] We employed this procedure on the basis of the results in the pioneering signaling game experiment reported in Miller and Plott (1985) which showed that without it, the emergence of separating equilibria are much slower and less reliable. We are in the process of exploring the impact of this "market wide" feedback.

2005) both with and without teams. What team play does is to speed up the development of strategic play.

[Insert Fig 1 here]

The remaining panels show what happens following the change in Es payoffs. A separating equilibrium starts to develop immediately, with 56.3% (9 out of 16) of MLs choices involving limit pricing (output levels greater than 4) in cycle 2. Of these, 88.9% (8 out of 9) chose 7, the *inefficient* separating output level. Most importantly for present purposes, the efficient separating output level of 6 had very little drawing power in any cycle of play, with 0, 3 and 2 choices of output level 6 in the three cycles following the change in Es payoffs (out of 16 ML choices in each cycle). The same two teams were responsible for all the choices of 6, one of which also chose 6 as an MH in cycle 3. Entry on 6 was minimal, occurring 1 out of the 6 times it was played, and that in the last cycle of play. We will look to the team dialogues in the next section to determine to what extent these choices of 6 represent the natural evolution of play towards the inefficient separating equilibrium (as the early choices of 5 by MLs represent), or some sort of recognition that 6 was a less expensive way than 7 for MLs to clearly signal their type. Figure 2 reports the results from Session 2 beginning with the full cycle of play immediately prior to the change in Es payoffs (Cycle 1), continuing with the two full cycles immediately following the crossover (Cycles 2 and 3), and concluding with the final full cycle of play (Cycle 4).[11] Output levels 8 and 9 were never chosen, so these two choices are deleted from the figure to make it more readable. Limit pricing by MLs (choice of 6 or higher) in Cycle 1 accounts for 61% (11 out of 18) of MLs choices. The differences from Session 1 in terms of the development of strategic play prior to the change in Es payoffs can largely be accounted for by the fact that (i) it always takes longer for a separating equilibrium to develop than a pooling equilibrium (Cooper, Garvin, and Kagel, 1997a) and (ii) there were substantially larger changes in the payoff tables relative to players' prior experience than in Session 1. The change in Es payoffs generate a remarkably clean, and immediate, separating equilibrium with 80% of MHs choosing the inefficient separating output level 1 to distinguish their type in Cycle 2 (and a like percentage of MLs playing their part, choosing 5). The inefficient separating equilibrium emerges even more strongly in later cycles. We'll cover the dynamic underlying the inefficient separating equilibrium in the next section when going through the team dialogues. However, the

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[11] Two half cycles, the first and eighth, are not reported to save space.

important thing to note here is that there were no choices of 2, the efficient separating output level for MHs following the change in Es payoffs. Rather, all strategic play of MHs involved choice of 1, corresponding to the inefficient separating equilibrium.

Conclusion 1: *In implementing a game in which the efficient separating equilibrium is not transparent (to non-game theorists at least) we are able to induce two person teams to converge on an inefficient separating equilibrium. Even though teams develop strategic play in signaling games much faster than individuals, this is not enough to save even the simplest of the equilibrium refinements, single round deletion of dominated strategies as an organizing principle of play.*

Team dialogues: The focus in this section is to use the team dialogues to better understand the underlying process whereby the teams failed to choose the efficient separating output levels. In particular, we want to understand whether this result comes from a failure to recognize dominated strategies as opposed to Ms recognizing them but not playing them out of fear of Es not understanding the signal?

The benefits of the inefficient separating output levels were immediately obvious to most teams, thereby generating a strong attraction. Two typical comments along these lines from Session 2 are as follows:

> 2: "I think 1 may be the way to go for A1 (MHs)"
> 1: "why"
> 2: "they will choose y (OUT) because it is a negative payout for A2's (MLs)"
> 1: "ok"
>
> 19: "3?"
> 3: "if we do 1, we are pretty much guaranteed 429"
> 19: "ok"

If a team did not recognize the value of separating at the inefficient output level, they got it from watching other's choices. The following quote is from one of the few teams that initially chose 3 as MHs in Session 2:

> 12: "a1's (MHs) are choosing1's now to get 429 instead of our sucky 158 ….."
> 8: "you are really studying this aren't you"
> 12: "hey I want beer $$$"

There is only one team in Session 2 that one *might* claim recognizes that 1 is dominated and that 2 should be sufficient to distinguish themselves:

> 16: "if we are a1 (MH) we should choose 1"
> 11: "looks that way"

> 16 “maybe 2 …”
> 11: “2 would be better initially”
> 16: “perhaps. But 1 is always safe”

In Session 1the change in Es’ payoffs makes it immediately obvious that it will be worthwhile for Es to take a chance on entry when they are unsure of Ms type:

> 9: “… now its worthwhile for them to guess x (IN).”
> 10: “i know”
>
> 2: “picking x-you have nothing to lose hardly … the payoff is worth it if u miss one or two.”

The real question for these teams is what they should do as Ms. In the two cases cited above, both of which were MHs, the teams chose 4 and were entered on. As for MLs, the inefficient separating output level of 7 has a strong and immediate attraction:

> 9: “if we were an A2 (an ML) we should go with 7”
> 10: “why 7?”
> 9: “its pretty obvious then for them to pick y (OUT) …they will know that were not an A1 ((an MH).”
>
> 16: “here’s what we have to figure out … when we’re an A player (an M), how do we get the other team to choose Y?”
> 7: “do you think it has anything remotely to do with the removal of the 7 choice for A1s (MHs)”
> 16: “possibly …let me ponder that one”

And in the next play of the game:[12]

> 16: “yeah, actually that’s a really good point about the 7 choice … when we’re A2 (ML) let’s pick 7”
> 7: “ok”
> 16: b/c then they’ll know we’re A2 (ML) and SHOLD pick Y (OUT) since they get more money”

There is some discussion of choosing 5 as “…the pay for a #5 is only good for A2 (ML)” along with some concerns about whether Es will recognize this fact and play OUT:

> 9: “5 might work though too, that’s pretty bad for A1s (MHs) too”
> 10: “yeah, but i’m thinking the way people play, they won’t care …and they’ll pick x (IN) anyway …but we can try”

This same team, one of the two teams to choose 6, continues discussions along these lines adding 6 to their possibilities:

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[12] These two dialogues occurred while the team in question was in the E role.

9: “did you notice that 5 got a y (OUT) in the last round?”
10: “sure did”
9: “we might want to go with 5 or 6 next time were an A2 (ML)”
10: “I personally would think an A1 (MH) would never pick so low …right”
9: “especially 6”

This team eventually does choose 6 as an ML, never trying 5 as “…i don’t trust the A group w/5 …i mean the B group (Es)” “yeah, it looks like they are (IN) about 50/50 on 5”. However, this same team in their role as Es enters on 5 in the next cycle – “i think we should risk it” – only to find they were facing an ML!

The striking thing about these dialogues in Session 1 from a game theoretic point of view is that there is never explicit recognition by any of the teams that 6 is a dominated strategy for MHs.[13] There is considerable discussion of 5 being a viable strategy for MLs but not choosing it on account of the Es being “too stupid” to recognize it. But in those cases where MLs start to choose 5 they are imitated by MHs which, in turn induces entry on 5. One can argue that from the “as if” point of view underlying most of economic theory that explicit recognition of dominated strategies is not necessary or even relevant to embrace single round deletion of dominated strategies as an equilibrium refinement. But as our results here show, without such explicit recognition we get violations of this simplest of the equilibrium selection criteria. In short, outside of people trained in game theory, search for dominated strategies is simply not part of decision makers’ natural repertoire and so that dominated choices can be easily missed unless the dominance is obvious (e.g., through the use of negative payoffs or deleted choices).

Conclusion 2: *There are consistent violations of the most fundamental of the equilibrium selection criteria – single round deletion of dominated strategies – in both sessions. This is not a result of Ms recognizing the efficient dominated strategy but not choosing it out of fear that Es would fail to understand the signal and enter anyway. Rather explicit search for dominated strategies is simply not part of decision makers’ natural repertoire so that they can easily be missed when such strategies are not obvious.*

As a post script to this section, there was a single team in Session 2 that reverted back to its myopic maximum (output level 3) after several trials in which they had chosen to play strategically (output level 1). This was team 3-19 quoted in the first part of the present section. The reversals (there were two of them) appear to be due to player 19 who had originally gone

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[13] The other team to choose 6 appears to have stumbled on it first having chosen 3 twice as an ML and once having chosen 6 as an MH!

along with her partner’s suggestion of 1 only to argue for 3 later on to which her partner agreed somewhat reluctantly:

> 3: “1?”
> 19: “maybe 3?”
> 19: “1?”
> 3: “okay, 3”

And after E played IN in response to their choice of 3, the team immediately reverted back to player 3’s suggestion of output level 1: 3: “let’s try 1 this time” …19: “1 is good”. Note this same process repeated itself after this! No doubt this rests on the fact that player 3 never explained her insight to 19 and was not spurred to do so by 19, with player 3 going along with 19’s suggestion even though she appears to have known, in both cases, that it would invite entry. This is part of the “process loss” that psychologists refer to when discussing the (typical) failure of teams to meet or beat the “truth wins” norm – doing as well or better than the best member of the team (Davis, 1992; Kerr and Tindale, 2004).

Discussion and Conclusions: We present results from two experimental sessions designed to get teams to violate the most basic of equilibrium refinements in signaling games – single round deletion of dominated strategies (the intuitive criteria of Cho-Kreps is more restrictive than this). This is done through making the efficient dominated strategy less than obvious (at least to non-game theorists) along with having an inefficient but obvious dominated strategy available for players to seize on. Similar violations have been reported for signaling games with individual decision makers (Cooper et al., 1997b). We used teams for two reasons: (1) Past research shows that teams substantially outperform individuals in terms of the development of strategic play in signaling games so that perhaps they might do better on this dimension as well, and (2) team dialogues would enable us to distinguish whether any failures to satisfy the refinement were a result of senders not being aware of the efficient separating signal or their being aware of it but concerned that receivers would fail to recognize the message and treat them as low quality types.

Session 1 reports a handful of observations at the efficient separating signal. However the overwhelming majority of choices were at the inefficient separating signal. Session 2 had *no* choices at the efficient separating signal. Analysis of team dialogues shows that in Session 1 there were fears expressed regarding receivers’ ability to recognize an “obvious” better choice for high quality senders. However, these fears were directed to a signal that, although very expensive for the low quality type, was *not* dominated for them and which does in fact attract a number of low quality type choices until these are met by consistent negative responses. There was much less discussion along these lines in Session 2. Critically, in both sessions there is no explicit recognition that the efficient dominated strategy is in fact dominated for low quality types and should therefore be chosen. In short, for decision makers not trained in game theory, it appears that the notion of dominated strategies is not part of the lexicon unless these strategies are obvious (e.g., through the use of negative payoffs or a prohibition on low quality types making such choices). Among other things, this result shows that although teams can, under some circumstances, learn to play strategically much faster than individuals, teams do not necessarily provide a "magic bullet" that will save all sorts of rationality based arguments in economics when individuals fail to do so.

There are a number of obvious opportunities for additional research along the lines begun here. First, there is a need for more team data as our results are based on two sessions which is enough to be highly suggestive but not to be definitive. Further, arguably, Session 2 stacks the deck against teams identifying the efficient separating equilibrium as subjects all had prior play in games in which the efficient separating equilibrium had negative payoffs. This would no doubt increase the likelihood of seizing on the inefficient separating equilibrium here (as it had negative payoffs as well) with little additional thinking. Second, we still have no idea of the limits of non-obviousness. In both sessions subjects would need to look carefully at the payoffs to identify the efficient choices for the high quality types. Would we get similar results with positive but much lower payoffs for the efficient separating choice? What would happen if senders were allowed to make statements along the lines outlined in Cho and Kreps (1987) that could help clarify the nature of their choices and which, no doubt, they have the opportunity to do outside the lab? Third, would we see similar results from subjects that have some advanced training in game theory as might be anticipated in interactions between reasonably large firms? For this one might use advanced undergraduates in economics and/or MBAs. Such an experiment could even serve as a test of what these students had learned!

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Table 1a

A Player's Payoffs as a Function of B Player's Choice[a]

	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)	A's Choice (output)
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

Table 1b

B's (E's) Payoffs

A's (Ms) Type

B's Choice	A2 (ML)	A1 (MH)
y (OUT)	250	250
x (IN)	200	300

Table 1c

B's (E's) Payoffs

A's (Ms) Type

B's Choice	A2 (ML)	A1 (MH)
y (OUT)	250	250
x (IN)	200	500

[a] Terms in parentheses were not present in payoff tables actually used.

Table 2a
A Player's Payoffs as a Function of B Player's Choice[a]

	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)	A's Choice (output)
1	118	429	-250	-150	1
2	138	449	120	350	2
3	158	469	230	501	3
4	138	448	340	611	4
5	118	428	365	676	5
6	32	174	345	655	6
7	-243	-74	325	635	7
8	-360	-173	209	516	8
9	-477	-272	193	497	9

Table 2b
B's (E’s) Payoffs
A's (Ms) Type

B's Choice	A2 (ML)	A1 (MH)
y (OUT)	281	281
x (IN)	219	594

Table 2c
B's (E’s) Payoffs
A's (Ms) Type

B's Choice	A2 (ML)	A1(MH)
y (OUT)	281	281
x (IN)	594	219

[a] Terms in parentheses were not present in payoff tables actually used.

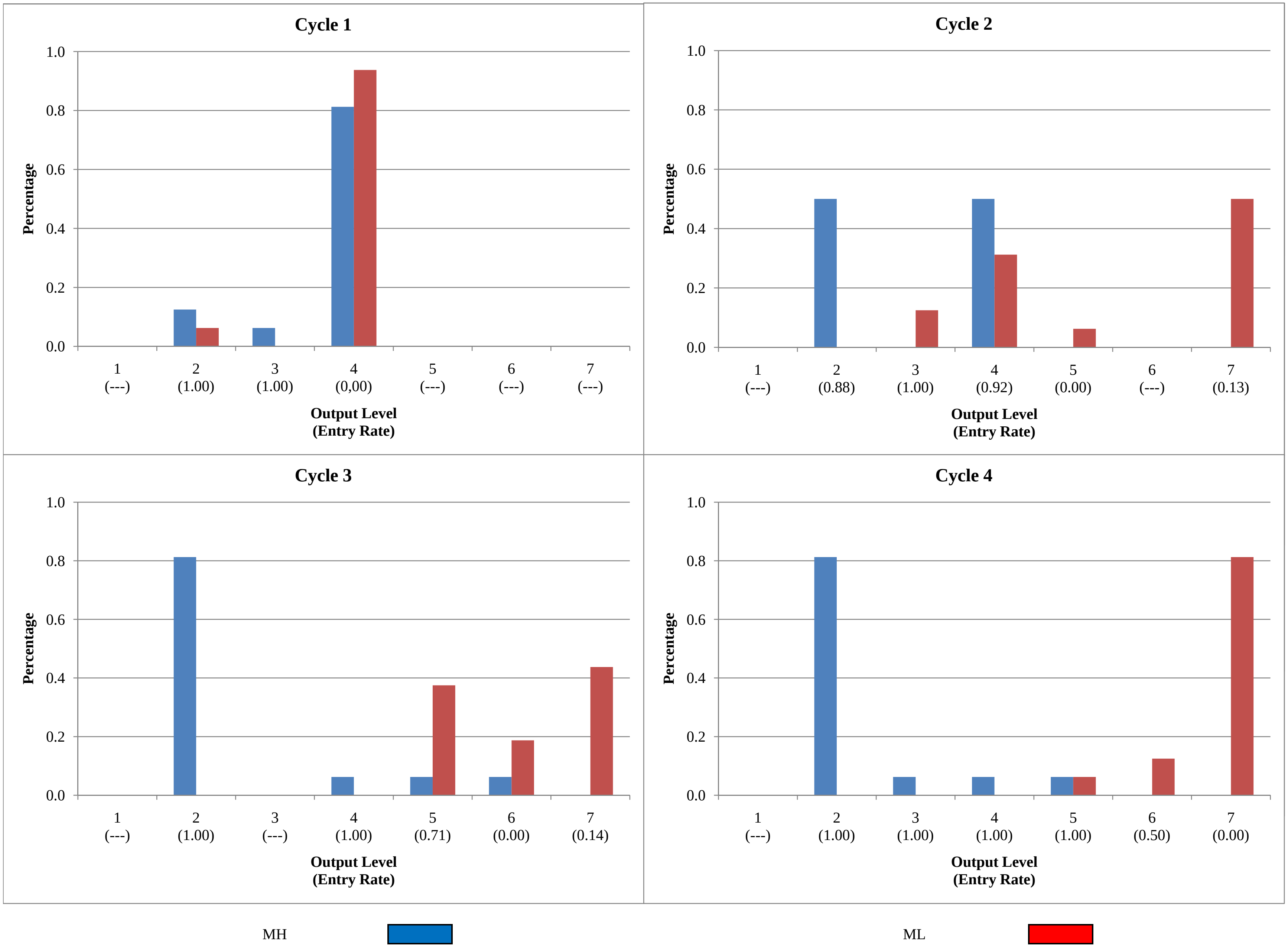
Table 3

Summary of Experimental Treatments and Prior Experience

Session	Periods	Payoff Tables	Number of Teams	Pure Strategy Equilibria	Prior Experence[a]
1	1-8	1a & b	8	Pooling and Separating	Games with high cost Es that converged on pooling
	9-32	1a & c		Separating	
2	1-12	2a & b	10	Separating with MLs playing strategically	Games with low cost Es that converged on the efficient separating equilibrium
	13-40	2a & c		Separating with MHs playing strategically	

[a] Prior experience in the games reported in Cooper and Kagel (2005).

Figure 1: Summary of Session 1 Data



Cycle 1

Cycle 2

Cycle 3

Cycle 4

Figure 2: Summary of Session 2 Data