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récis

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OLIGOPOLY BIDDING BEHAVIOR IN A QUASI-COMPLEX EXPERIMENTAL GAME

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An experimental game was designed to require the conflict and the cooperative behavior characteristic of oligopolies. The context of the game was a simulated local three-firm automobile repair industry. Each subject, representing one of the three firms in the industry, placed a written bid on a job opportunity and then learned the results of this bidding before being exposed to the next job opportunity. Repair jobs for the experiment were based on survey data from businessmen who were subjects in the original run of this game. A repair job opportunity was stated in terms of the standard number of labor hours needed for completion and the wholesale and retail prices of the required parts. These attributes varied with the type of automobile damage the opportunity represented. Each run of the experiment began with 100 repair jobs of 25 different types. The total included sixteen overhead jobs to adjust past work.

Runs of the experiment contained up to nine industries, i.e., up to nine groups of three interacting subjects. Runs lasted for 50 trials. At each trial, one job opportunity was drawn randomly (without replacement) from the total of 100 jobs and was presented simultaneously to all subjects in the run. The drawings differed from run to run. Runs were conducted over five sessions with varying amounts of time between sessions. At least two real weeks were required to complete a run.

The 100 possible jobs represented full capacity for the three firms for four weeks, assuming ideal sequencing and perfect allocation among firms. Thus, the 50 drawings represented two weeks of operations under conditions of uncertainty.

Each firm faced identical fixed levels of shop capacity and fixed overhead. Subjects were admonished to maximize their profits. Labor cost was \$2.50 an hour. An historical description of the industry showed that "normal" profits could be made by charging

TABLE 1
Summary of Five Runs of the Oligopoly Bidding Experiment

Run No.	Subjects	No. of Industries	Possible Industry Gross Margin if at Standard Bids	Average Industry Gross Margin Actually Achieved
1.	Businessmen	3	\$3,668	\$2,185
2.	Students	9	3,635	2,312
3.	Students	5	3,174	1,663
4.	Students	9	4,052	2,577
5.	Students	6	3,646	1,750
		—		
		32		

\$5.00 an hour for labor plus list price for parts, which was defined to be the "standard" bid.

Structurally, the experiment was a three-person, nonconstant-sum, mixed-motive, complete-information experimental bidding game with infinite alternatives, an infinite payoff matrix, and a high level of communication among subjects. Essentially, this characterizes an oligopoly. In particular, the experiment simulated a bidding oligopoly where firms win all or none at each bid rather than a price-setting oligopoly where firms compete for continuing market shares.

In five runs of the experiment, covering 32 simulated industries, subjects were in general unable to cooperate sufficiently to earn what had been given to them as the historical normal profits for the industry. On the other hand, their conflict behavior did not lead to ruin. In later runs, when opportunities for collusion were injected about halfway through a run, joint payoffs failed to increase significantly. Results for five runs are shown in Table 1.

Table 1 compares the average industry gross margin (overhead plus profit) achieved at each run with what would have occurred for an industry if bids had been made at the standard amounts of \$5.00 an hour plus list price for parts. The 100 opportunities, if ideally sequenced and distributed among the three firms, would represent for the two simulated weeks a contribution to overhead and profit per firm of \$1,184. Of the 96 simulated firms shown in Table 1, only three earned contributions exceeding this amount (\$1,738, \$1,290, \$1,209). Eleven firms exceeded \$1,000. At standard bids, a firm, given the random drawings of the run in which it played, might expect one-third of the standard gross margins in Table 1, so that expectations for firms ranged between \$1,058 and \$1,350, depending on the run, yet actual performance averages for runs ranged between \$583 and \$859.

In a sixth run, with highly sophisticated subjects who held advanced degrees in business and economics, effective industry cooperation was finally observed. However, the motivation of these subjects to cooperate was clearly academic and differed from the motivations of subjects in previous runs.

Experimental games of many varieties have demonstrated that conflict strategies dominate cooperative strategies. The conclusions from this experiment are that homogeneous subjects with strong particularized special interests were required to overcome the dominance of conflict strategies. Bid-by-bid protocol statements obtained from subjects in later runs revealed that multiple motives are operating in complex games and that this nonsingularity of motive may well thwart cooperation. The protocol

statements also revealed that the dynamics of interaction among subjects over time affected both joint outcomes and individual behavior. This observation emphasizes the importance of sequential interactions in game play and the need for new research methodology for complex games.

Readers interested in obtaining a copy of the complete paper should write:

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