Experimenting with the All Pay First Price Auction

Idea for Future Research

By James Sly

When doing my initial research on deficit bias (Sly 2018a), one of my most important discoveries was a very unique auction, the all pay first price auction, that could result in some very unusual behaviors from those who played it. If you want to get a better sense of the importance and dynamics of the auction, check out my working paper that uses the auction to explore various strategies in foreign policy (Sly 2018b). This auction is fascinating to study because based on theory alone, there is such a wide variety of possible behaviors that analysts have no idea what will actually happen once the auction gets played. The perfectly rational strategy that is also the Nash equilibrium is so extreme that actually playing it would likely be very destructive when you do. Behavioral game theory offers its own opinions on how people might behave when playing the auction that are perhaps a bit more feasible and realistic. There is also a good chance that at least some players will place bids above the value of the prize in a simultaneous auction, which is a fascinating result in and of itself. Clearly, studying this auction in more detail to figure out how people will actually play is guaranteed to get interesting results no matter what happens, and since I have already identified two extremely high stakes applications for the auction, deficit bias and international conflict, this could have important real world applications as well.

My first idea for a specific research paper would put the all pay first price auction in the lab. Researchers could recruit say 50 to 100 people who would each get paid $25 for participating, and then researchers would split up this group into 25 to 50 pairs who each play an all pay first price auction for real stakes with a $1 prize and a $2 maximum bid. In the first phase of this experiment, participants would play the auction 10 times in a row with a different anonymous opponent each time to see how each player responds to the one shot game as they get a better sense of what their opponent will likely play as each round progresses. In the second phase of this experiment, participants would play the auction 10 times in a row with the same anonymous opponent each time to see how each player responds to the repeated game. Players could escalate or deescalate over time, or perhaps play a tit for tat strategy to punish those who bid high, or try and coerce the other side into bidding zero while they bid slightly higher and capture the whole prize. There is a great deal of uncertainty about how players will actually respond, which makes this lab experiment especially interesting to undertake.

My second idea for a research paper would examine a possible solution to the destructive behavior that might arise in the game when you only play it once with each opponent. In the game where you repeatedly play with the same opponent, each player has a recourse to punish the other side for behaving destructively that is not available to those who play against a different opponent each time. One obvious potential solution is to allow each side to send messages to one another before they actually place their bids in order to give them a chance to coordinate their behavior beforehand and arrange for each side to split the prize by having both bid zero. The initial problem of course is that the

auction itself suffers from a prisoner's dilemma type dynamic that encourages players to engage in destructive behavior even if it makes everyone worse if both sides do that. There is, however, an additional difficulty because the solution to this problem, coordinating their behavior by sending messages beforehand, also suffers from a prisoner's dilemma type dynamic since both sides can just lie about what they plan to do in their messages. This is why this auction can be so destructive when it occurs in real life and why it is so difficult to find solutions that reduce the overall harm.

The third idea for a research paper would basically convert the game theory competition set up by Robert Axelrod at the University of Michigan that tests various strategies for the repeated prisoner's dilemma game in a round robin tournament to see which strategy performs best. The tournament has been around for decades and in order to breathe some new life into the research project, instead of playing a repeated prisoner's dilemma where each side can only choose from only two different options each round, participants could come up with strategies about how to play the repeated all pay first price auction. In some ways this captures the same spirit as the old tournament, since the repeated all pay first price auction is kind of like a repeated prisoner's dilemma in many ways, but the advantage is that it is a continuous prisoner's dilemma where each player decides not just whether to cooperate or defect but how much to bid overall. Each player could offer a bid exactly at zero, just above zero, below the value of the prize but above zero, equal to the value of the prize, just above the value of the prize, the same as your opponents last bid, above your opponents last bid, or the maximum possible amount among many others. By having so many options to choose from this creates a whole new strategic dynamic to explore that would make the tournament even more interesting to play.

Clearly, the all pay first price auction is a fascinating game to play with very intricate and complicated strategic dynamics that is important to explore further, especially since it has some extremely high stakes applications in the real world. Learning how people actually play the game in real life is critical to understand when analyzing the implications of the game, and figuring how to avoid destructive behaviors when the game is played would also be an important line of research. Engaging in a round robin tournament would test to see which strategies do the best overall and how players adopting different strategies interact in a very complex environment. In each paper, the results would be interesting no matter how they turn out, so finishing the research early on would be an important priority for me because it influences a lot of my other research.

References

Sly, James. 2018a. "How Present Bias and Loss Aversion Leads to Deficit Bias." Unpublished working paper. February.

Sly, James. 2018b. "Optimal Insurgency Theory: Modeling International Conflict with the All Pay First Price Auction." Unpublished working paper. February.