*Review of Economic Paper:*

**Contests with Revisions**

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**Introduction**

In many business decisions, information is constantly controlled and contained for the benefit of the parties involved. Deals worth millions of dollars can fall through if details are leaked to the public before dates specified in NDA agreements. When one player has information about the other player’s choice or strategy, it can create a strategic imbalance between the two parties.

Dechenaux and Mago (2023) examine how test subjects react to the possibility of information leakage. The motivation of this study is to better understand how the strategies of players change when the probability of information leakage increases. For example, the observing player will be able to adjust their strategy to perfectly capitalize on the other player’s strategy to maximize their payoff. The observed player can take advantage of their choices being observed by committing a pre-action. They found that the value of flexibility increases as the probability of information leakage increases and that there is a strong discouragement effect for the potentially disadvantaged player in the all-payer auction. The rent dissipation affected the all-pay auctions to an extent that expenditures were significantly less than that of the lottery contest.

I extend on this study by examining the effect of risk tolerance on expenditures. I find that expenditures increase for all-pay auctions for risk tolerant subjects and expenditures decrease in lottery contests.

**Literature Review**

Rent-seeking contests or Tullock contests are situations where players expend a cost, usually monetary, to gain a reward. Since the cost is typically lower than the reward and wealth is not created, the winners are said to have earned economic rent. Many situations can be described by Tullock contests, including advertising, political campaigns, litigation, college applications, and R&D (Fey, 2008). The main characteristic of a Tullock contest is that even if a player does not win, they still lose their investment.

In all-pay auction, a version of a Tullock contest, all players place their bid and the highest bid wins the prize. When all contestants receive the same value from winning, there is an infinite number of equilibria and hence no truly dominant strategy (Baye 1996). Optimally, the bids would follow equation 1 however it is typically the case that, when all players are equal, there tends to be overbidding (Gneezy, 2006).

(1)

In lottery auctions, the probability of winning is based on the amount bid relative to the total bid by all players as represented in equation 2. There is also experimental evidence of overbidding in lottery contests (Dechenaux, 2015)

(2)

In both contests, the overbidding tends to be lower when there is difference between the players. When one player has a stronger incentive for effort – whether created through difference in abilities, endowments, or costs – the weaker players are discouraged from putting forth effort as they perceive the probability of winning as lower. This effect has been documented both in field studies (Brown, 2011, Franke, 2012, Sunde, 2009) and in the lab (Anderson & Stafford, 2003, Sheremeta, 2011, Hart et al., 2015)

Work has been done on the impact of risk preferences in lottery auctions. Cardona et al. (2020) found that risk averse bidders would bid less as they fear the uncertainty of the lottery contest. It has also been observed that players engage in riskier behavior when facing more competition. Bothner et al. (2007) found, in a study of NASCAR drivers using crashes as a proxy for risk taking, that drivers were more likely to crash when facing fiercer competition from their competition. It was also observed in the laboratory that players are more likely to take on risk when auctions are highly contested (Spadoni & Potters, 2018). In two player Tullock contests, risk aversion worsens the odds of success unless the player is already at a large advantage (March & Sahm, 2018)

**Experimental Design**

In Dechenaux and Mago (2023), the environment included 128 subjects that were all students at Purdue University. Each session had 6 parts. Parts 1 and 2 included 20 lottery pairs that were designed to measure a subject’s risk and loss aversion. Parts 3 and 4 corresponded to 20 auction periods with parts 3 and 4 different probability of information leakage. Part 5 consisted of an experiment designed to elicit subjects’ non-monetary utility for winning an auction. Part 6 consisted of a demographic questionnaire and a survey about the intensity of emotions.  
 In parts 3 and 4, subjects were anonymously paired each period and equally likely to be assigned role A or B. Half of the sessions used all-pay auctions while the other half used lottery contests. In the first round of each auction, players A and B submitted their bids without any information on the other player’s decision. At the end of the round the bids would be revealed to both players. Then with probabilities (α = .25 or .75), the A player would be given an opportunity to revise their bid, B could not change their bid but were asked to guess what they thought Player A’s new bid would be. The computer would then display the winner of the contest as well as the subject’s own payoff.

Expenditure levels were higher than the expected equilibrium levels for both auctions, α treatments, and player type. A larger probability of informational leakage decreased first round expenditure levels in the all-pay auction. The value of flexibility to player A was larger in the all-pay auction than expected and non-zero in the lottery contest. There is a large amount of within-subject variability in expenditures, especially for player B. Lastly, while a zero bid is not an equilibrium choice in the lottery contest, there is a fraction of players, both type A and B, that choose not to spend any resources.

**Empirical Replication**

Replicating the results of Dechenaux & Mago (2023) was mostly straightforward with some small hiccups. The replication files came with instructions that, when followed, did not run at all. However, with the changing of a few file names, the figures were easily replicated. I did not notice any differences in the graphs generated from the replication files and the ones published in the paper.

When attempting to replicate the tables, I found that some variables were not included in the dataset that were required to complete the analysis, namely the calculated value of flexibility. The paper did provide instructions on how it calculated the equilibrium value but did not provide instructions on how the realized value was calculated in the results.   
 I propose 3 equations to calculate the value of flexibility. Equation 3 represents the expected payoff of A, given all payments, subtracted by the expected payoff of the optimal bid in a 1 round auction, given by equations 1 and 2. This should represent the value of flexibility because it represents the difference in expected payoffs between a situation where player A has flexibility and one where he does not. If the optimal bid in a 1 round all-pay auction is (V(n-1)/n), then the expected payoff is 0.  
 (3)

Equation 4 represents the expected payoff of A subtracted by the expected payoff of B given all payments. This should represent the value of flexibility because it is the difference in expected payoffs between the players with and without flexibility. Using all payments measures the value of flexibility captured by player A in each round.

(4)

Equation 5 represents the expected payoff of A subtracted by the expected payoff of B, given the bids in round 1 and assuming A will use the optimal strategy in round 2. This should represent the value of flexibility because it is the difference in expected payoffs between the players with and without flexibility. Using the optimal round 2 strategy instead of the observed strategy captures the full benefit afforded to player A by the flexibility given to him and captures value that A may fail to capture if he uses a suboptimal strategy in round 2. It also allows the measurement of the value of flexibility in rounds that did not reach round 2. The optimal strategy for A in round 2 of the all-pay auction is to bid as close to but still larger than , so I set for round 2 in the equation. In the lottery contest, there is no incentive to change bid after receiving information on another’s bid. Hence the optimal strategy is for .

(5)

**Table 1: Replication of Dechenaux & Mago (2023) Table 3**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Contest | **Probability of Leakage** | | | | | | | |
| α = 0.25 | | | | α = 0.75 | | | |
| **Observed** | **Eq 3** | **Eq 4** | **Eq 5** | **Observed** | **Eq 3** | **Eq 4** | **Eq 5** |
| *All-Pay auction* |  |  |  |  |  |  |  |  |
| Average Expenditure |  |  |  |  |  |  |  |  |
| Type A : Round 1 | 47.18\*(31) | 47.18\*(31) | ~ | ~ | 26.25\*\*\* (30) | 26.25\*\*\* (30) | ~ | ~ |
| Type B :  Round 1 | 40.56\*\* (35) | 40.56\*\* (35) | ~ | ~ | 31.87\*\*\* (39) | 31.87\*\*\* (39) | ~ | ~ |
| Type A : Round 2 | 39.91\*\* (34) | 39.91\*\* (34) | ~ | ~ | 24.99\*\*\* (33) | 24.99\*\*\* (33) | ~ | ~ |
| Frequency of revision | 0.89 | 0.89 | ~ | ~ | 0.86 | 0.86 | ~ | ~ |
| Value of Flexibility | 19.79\*\*\* | 23.18\*\* | 32.59 | 32.48 | 66.37\*\*\* | 62.51\*\*\* | 83.22 | 77.92\*\*\* |
| *Lottery* |  |  |  |  |  |  |  |  |
| Average Expenditure |  |  |  |  |  |  |  |  |
| Type A : Round 1 | 45.71\*\*\*(32) | 45.71(32) | ~ | ~ | 40.76\*\* (33) | 40.76\*\* (33) | ~ | ~ |
| Type B :  Round 1 | 44.76\*\*\* (35) | 44.76(35) | ~ | ~ | 45.49\*\*\* (34) | 45.49\*\*\* (34) | ~ | ~ |
| Type A : Round 2 | 42.15\*\*\* (35) | 42.15(35) | ~ | ~ | 45.84\*\*\* (35) | 45.84\*\*\* (35) | ~ | ~ |
| Frequency of revision | 0.67 | 0.68 | ~ | ~ | 0.74 | 0.74 | ~ | ~ |
| Value of Flexibility | 7.04\* | 18.79\*\*\* | 4.62\*\* | 3.06 | 18.25\*\*\* | 42.34\*\*\* | 8.66\*\* | 2.13 |

Table 1 compares the results found in Table 3 of Dechenaux & Mago (2023) with those replicated using my replications. I was unable to replicate the results estimating the value of flexibility. There are 131 observations for equation 3 and 66 observations for equations 4 and 5 where Stata was unable to calculate a value of flexibility. This could account for some of the discrepancy between my estimates and those found in the paper. All other statistics in Table 3 replicated perfectly with no missing observations.

For Table 6, the provided code was mistakenly saving modified datasets over files that were required to finish constructing the table. Flexibility was also required to replicate Table 9 and was therefore not replicated.

**Alternative Approach and Results**

I hypothesize that risk preferences affect round one bids in lottery games. Specifically, those who have a higher risk tolerance will bid more in both contests, on average. To investigate this hypothesis, I performed multiple regressions using the same data collected by Dechenaux & Mago (2023). SwitchLine is the line where the subject switched from the uncertain payment to the certain one in the risk preferences elicitation in part 1 or 2. It is used as a proxy to indicate how much risk the individual can tolerate. Each additional line represents an additional 25 cents to the certain payment to earn compared to a $5 payoff with a 50% chance. Subjects with nonmonotonic risk preferences were removed from the sample.

**Table 2: Risk Tolerance affects Player B’s expenditures**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (2) | (3) | (5) | (6) |
| VARIABLES | **a = 0.25** | | **a = 0.75** | |
| SwitchLine | 0.322 | 0.503 | 0.812\*\* | 0.603 |
|  | (0.373) | (0.856) | (0.409) | (0.802) |
| Lottery | 12.13\*\* | 12.52 | 25.52\*\*\* | 23.41\*\* |
|  | (5.464) | (13.69) | (5.757) | (11.54) |
| SwitchLine\*Lottery | -0.856\* | -0.966 | -1.228\*\* | -0.964 |
|  | (0.519) | (1.293) | (0.548) | (1.160) |
| Constant | 37.26\*\*\* | 35.40\*\*\* | 23.46\*\*\* | 25.54\*\*\* |
|  | (4.069) | (9.404) | (4.345) | (7.953) |
|  |  |  |  |  |
| Observations | 1,253 | 1,253 | 1,265 | 1,265 |
| R-squared | 0.006 |  | 0.035 |  |
| Subject RE | NO | YES | NO | YES |
| Number of subjects |  | 126 |  | 126 |

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

I find no statistical evidence to suggest that risk tolerance affects the round one allocation of player B in all-pay auctions, except for a 0.812 increase, on average, for every additional line they preferred the uncertain payoff for. This was significant at the 5% level, however this effect drops out when individual random effects are included. There is a statistically significant effect of increased risk tolerance on lowering the round 1 bids of player B in the lottery contests, which contradicts the hypothesis. The size and significance of the effect increases with the probability of informational leakage, which is also unexpected and contradicts Cardona et al. (2020).

I theorize that the effect measured here is the opposite of what was expected because the risk tolerant individual is more comfortable with a lower probability of receiving the prize and therefore is willing to forego extra expenditures.

**Conclusion**

Understanding how people react in Tullock competitions is important because of its applications to so many real-world situations. The findings from Dechenaux & Mago (2023), show that the probability of information leaks can decrease the expenditure levels. It will be beneficial to put procedures in place to limit the possibility of information leaks and enforce punishment on those who allow it to happen in, especially in situations where expenditures have spillover effects on society, namely through R&D of new technology. While in more wasteful pursuits, increasing the availability of information may decrease expenditures.

My results improve my understanding of how risk tolerance affects participation in rent seeking competitions. It is intuitive that those who have high risk tolerance would be more willing to compete in a Tullock competition than risk neutral individuals since the payoffs are not certain at the start of the contest. However, it is interesting that those with higher risk tolerance have less expenditures in the lottery contest, on average. One possible extension to the research would be to see if this effect remains if participation was costly or, at least, if subjects weren’t given an endowment for participation in the contest.

I learned a lot about auctions while completing this replication exercise. Doing research for the literature review and fully understanding the concepts discussed in the paper brought a whole new branch of research into my field of view. It was also interesting to see the remnants of a paper that could have been. For example, the researchers collected a plethora of data about emotions and expectations of their subjects both during and after the experiment was complete, but it was just mentioned in passing in the published paper. It could be that Dechenaux & Mago are still waiting on a time to publish their other findings, or they dropped the project before it hit the presses.

After going through this process, I have more skepticism towards published results especially considering one of the main findings in the paper wasn’t replicable in their own replication files. However, I have acquired an appreciation for the work that experimental economists do. This was an interesting experiment, and the experimenters were able to collect an amazing dataset by just getting some undergrads to fill a room.

The research community loses some trust, in my eyes, knowing that not many papers regularly undergo a strict replication process or even publish their data at all. Not only is there the possibility of errors making it onto published journals, but the replication and extension of studies can also help contribute to the cumulative nature of scientific knowledge, especially if it provides evidence contrary to what is typically accepted. However, I’m sure most researchers are doing more important work than replicating somebody else’s, already finished, work. I don’t think there is a researcher who would argue that the best use of their time would be messing with file names to try and get someone else’s .do file to work and I agree with them.

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