HW 9
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Referee Report: "Resilient Cooperators Stabilize Long-Run Cooperation in the Finitely Repeated Prisoner's Dilemma," by Mao et al. (2017)

The authors are trying to fulfill a gap in the existing literature regarding cooperation in finitely repeated games. Although the literature has been able to provide some insights about this phenomenon using traditional lab experiments, these studies have been limited by the number of periods that can be simulated in the lab. To overcome the timescale constraints, the authors proposed a virtual experiment in which 94 subjects play up to 400 ten-round games of Prisoner's Dilemma. By using this approach, the researchers are looking to unveil how individuals of a specific population behave in cooperation games that repeat over a finite period but when the game takes place over long intervals of time.

The authors used experiments done in the past by other researchers and increased the time frame under which those experiments were conducted. The experiment consisted in pairing individuals anonymously for ten rounds and reorganizing the pairs after the tenth round. The reorganization process was done 20 times. The authors used Amazon Turk to recruit the 113 individuals. The authors are using "virtual labs" to have the possibility of observing the individuals in their "virtual lab" for a month (August 4-August 31, 2015). The sample that the authors obtained through Amazon Turk was distributed among 31 U.S. states, and contained individuals between 18-61 years old of which 47% were females. To reduce attrition, the researchers offered an extra payment of $20 to all individuals that completed at least 18 sessions. Additionally, after each session of 35 minutes, players were paid based on their cumulative payoff in the round. Individuals played around 375 ten-round games, given the researchers 3,720 decisions to analyze per individual, and 374,251 in total.

The authors argue that their experiment explores questions not responded by the theory and the empirical studies done in the past. Specifically, the authors claim that is still widely unknown "how many cooperators are needed to sustain cooperation indefinitely" (Mao et al. 2017 p. 2). Their virtual approach allows them to test if Embrey and Yuksel (2015) were right by stating that the temporal restriction did not allow to observe the levels of cooperation go down to zero, but that "sufficiently long timescale cooperation will eventually unravel all the way to zero" (Mao et al. 2017 p. 2).

According to the authors if individuals are rational as the theory states, then they should observe that individuals defect in all rounds because they anticipate that the other players are rational individuals that will defect and start defecting earlier and earlier until the equilibrium is all players defect on all rounds. On the other hand, if a large number of players are conditional cooperators, then rational players will cooperate indefinitely because they will anticipate the behavior of the conditional cooperators and realized they are better of cooperating. In this scenario, the literature has stated that cooperation can be sustained for indefinitely periods.

The authors observed that nearly 40% of the individuals decided to continue cooperating even if they were exploited by the majority, as long as their partners continued cooperating. In other words, these individuals refused to defect first even after being exploited. Their findings suggest that although a minority, the conditional resilient cooperators had an important effect on maintaining cooperation after exploitation had occurred for several days. The behavior of the conditional resilient cooperators led to a sustainable level of cooperation even among the other 60% players.

According to the authors, their contribution to the current literature is to determine how many conditionals cooperators are needed to achieve a sustainable cooperation state, and moreover, the level of resilience that these conditional cooperators must have to sporadic cases of exploitation by rational players. However, the experiment carried out does not reveal information about how many conditional cooperators are needed, the only information it provides is that when 40% of the population are cooperators, the cooperation is sustainable and does not tend to zero as Embrey and Yuksel (2015) argue. Moreover, the article would benefit from a clear explanation of why the design of previous experiments is useful to answer these new questions when the only change is the time frame. It is clear that by increasing the number of periods the authors can test Embrey and Yuksel partially, but it is unclear how this experimental design gives us information about the level of resilience that must be present and the minimum number of cooperators needed to achieve a stable cooperative outcome. A potential way in which the authors could have addressed in two ways.

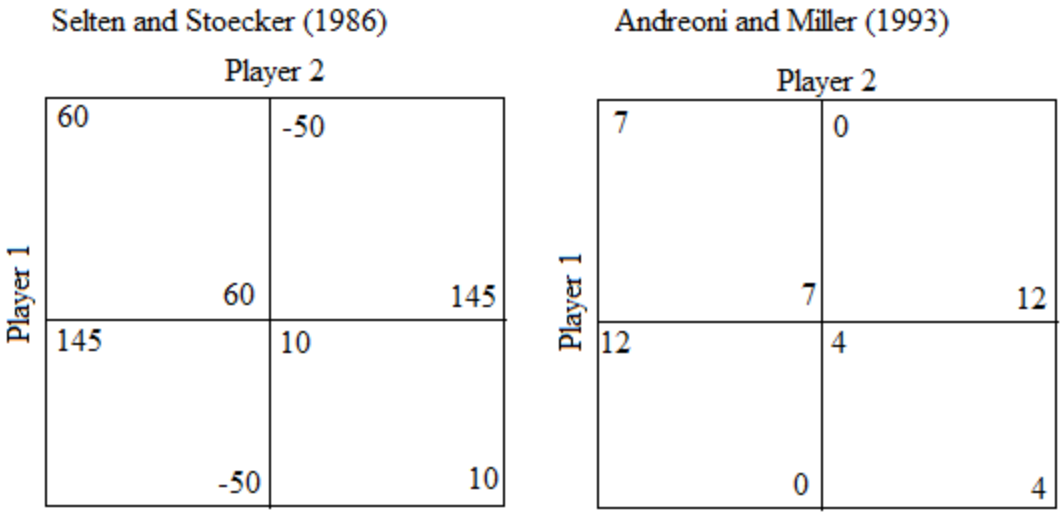
First, they could have done a second wave of the experiment randomly selected subsamples changing the composition of cooperators and not cooperators in each subsample. In this way, they could have used the information of who is a cooperator and who is not, to test if the 40% is necessary independently of the size of the whole population, or if depending on the size of the total population the minimum percentage changes. Additionally, taking into account that the literature has shown mixed results in this regard and that the parameters used play an important role in those contradictory findings, I suggest that the authors used different parameters to test if the 40% depends on the chosen parameters. Second, the authors could have used the simulations to vary the parameters and test if the 40% they obtained can be upheld independently of the parameters. Moreover, by varying the parameters and the size of the sample they can see if there is any relation between the parameters, the size of the sample, the temporal framework, and the number of cooperators needed to have stable cooperation.

The authors present the cooperation results observed by round and day in Figure 1. From those results, the authors highlight the possibility of their sample being non-representative. Figure 1 shows that the individuals in the sample were cooperating more than the results observed in previous literature, which could mean that the individuals observed in this experiment could be more cooperative than the subjects in the entire population. Here the authors would benefit from using Garett Jones work (2008). According to Jones (2008), more intelligent individuals tend to cooperate more often. Based on the requirements to access Amazon Turk, it is reasonable to imagine that most of the people that access the platform are college educated individuals, and

probably self-selection of the smarter college-educated individuals is happening. This empirical evidence would give the authors better support to their claim that their individuals could be more cooperative than other samples.

Another explanation presented by the authors to explain the differences is that the parameters used in the matrix analysis can significantly influence the results, and therefore the use of different parameters can explain the divergence found in their results. Taking into account that the empirical evidence presented by Embrey and Yuksel (2015) that the contradictory results in the literature could be explained by the different parameters, it is not clear how these results are not contingent on the paraments used, and by using different parameters, the results could be contradictories. It would have been more appropriated to use the same parameters than previous studies to be able to compare their results. Because using the different payoffs available in the literature would be impractical, expensive and inefficient, I suggest using the two works cited by the authors as presenting opposed results. On the one hand, Selten and Stoecker (1986) suggest that there is no evidence that a cooperation outcome can be sustained in a finite game framework. On the other hand, Andreoni and Miller (1993) argue that the evidence suggests that a cooperation outcome can be sustained because of the presence of altruistic individuals in the group. The structure of payoffs was the following in each of the papers mentioned:

Figure 1. Payoff Structure Selten & Stoecker v. Andreoni & Miller



Source: Selten and Stoecker (1986); Andreoni and Millet (1993)

By observing the payoff structure, the negative payoffs used by Selten and Stoecker (1986) could be explaining the differences in their findings. The seminal work of Kahneman and Tversky (1981; 1991) show that individuals make different decisions under risk depending on the way the decision is frame: a win or a loss. Selten and Stoecker (1986) are presenting a case in which cooperate and being exploited signifies a loss, while the authors are using the same structure used by Andreoni and Miller (1993), the only consequence of cooperating and not being exploited is

not any win. Because the way the question is frame (losses or wins) matters, it is not obvious that the findings of the authors will be upheld in a payoff structure where the individuals will lose payoff.

To address this point, the authors could have divided their experiment and implemented both structures of payoffs to show that their results are consistent to changes in these variables. There are two ways in which the authors could have done this. First, by increasing their sample and making four groups instead of two, controlling for latency for each of the two groups with different parameters. This option implies an increase in the budget and its implementation is conditioned to the availability of funding to cover the recruitment and payment of additional subjects. The second option consists in dividing the already recruited population: take each group and divided by two groups and testing different parameters.

Finally, the authors missed some punctuations when they use abbreviations. Particularly, the authors used "US" to refer to the United States, however, the correct form is "U.S."; and they also missed the punctuation when using "Figs.". Additionally, the authors quote other researchers but do not cite them correctly. It is necessary to do a formatting revision to use the correct citation form (see page 2). Despite the problems highlighted in the text, the authors posit important questions that are relevant for theoretical and public policy reasons. Their work makes an important contribution to the current literature by using virtual tools to address the temporary restriction that traditional laboratory experiments have not been able to resolve.

Extension of the Paper

Based on the comments presented above and that the paper has already been published, what I would do is to implement one of my observations as an extension of their models. Specifically, I will focus on the framing of the question. As I mentioned before, the way the authors present the payoffs is regarding wins. If a person does not cooperate and she is exploited, then she is not going to win an x outcome. However, it is not clear how "altruism" will work in the timescale used by the authors and using losses in the payment structure. Taking into account that the authors already calculated a scenario similar to the one presented by Andreoni and Miller (1993), I will use the payoff structure presented by Selten and Stoecker (1986).

To maintain the similarities with Mao et al. (2017), I will use the same structure Amazon Turk, and if possible, I will try to use the same individuals the authors used. By maintaining in the sample, the same individuals or individuals with similar characteristics, I will control for specific particularities of the individuals and make sure I will preserve the 40% of the altruistic population in my sample. Additionally, I will use the same period (1 month) and use the same tenth round structure with 20 reorganizations.

By trying to replicate the same experiment and just changing the payoff structure for a losses structure, I will be able to compare the results and verify if, besides the timescale, the way in which the question is frame is an important factor to achieve a sustainable cooperative outcome. This experiment will reveal information about how altruistic people change their behavior if they

have losses or wins. From this extension, I anticipate two different results. On the one hand, I could end up observing that the behavior that Mao et al. (2017) found is robust to the framing of the question, and Kahneman and Tversky's (1981; 1991) conclusions are not applicable to this case. On the other hand, I could found that the cooperation levels are lower than the ones observed by Mao et al. (2017), or that a cooperative outcome cannot be sustained under this framing, and in this case, I will be showing that the inconsistent in the literature respond more to these framing differences than to the timescale.

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