Journal of Behavioral and Experimental Economics 49 (2014) 1–7

Contents lists available at ScienceDirect

Journal of Behavioral and Experimental Economics

journal homepage: www.elsevier.com/locate/jbee

Individual and group behaviour in the traveler's dilemma: An experimental study☆

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ARTICLE INFO

JEL classification:
C91
C92
D81
D70

Keywords:
Traveler's dilemma
Individual and group decision

ABSTRACT

We provide an experimental test of the traveler's dilemma using individual and group data. Our investigation aims to assess whether individual decisions differ significantly from group decisions. Experimental findings reported in this paper show that: (1) groups are always more rational – i.e. their claims are closer to the Nash equilibrium; (2) the size of the penalty/reward influences convergence to the equilibrium both when decisions are taken individually or in groups; and (3) groups are more sensitive to the size of the penalty/reward.

1. Introduction

Almost twenty years ago Basu (1994) proposed the traveler's dilemma (henceforth TD) game in order to demonstrate the conflict between intuition and game-theoretic reasoning in a one-shot game, where backward induction occurs at an introspective level. What is puzzling in this game is that a small penalty/reward can drive claims to the Nash equilibrium prediction, where the outcome minimizes the aggregate payoff. On the one hand, the Nash equilibrium in the TD is independent by the size of the penalty/reward. On the other hand, intuition suggests that behaviour conforms closely to the Nash equilibrium when the penalty/reward is high, but when the penalty/reward parameter approaches 0, subjects' behaviour should reach the Pareto optimal solution.

Recently, an abundant experimental literature has tested the TD in the lab. Experiments confirmed, by and large, the intuition that claims may be higher than the Nash equilibrium. More precisely, the Nash equilibrium strategy solution proved to be a bad predictor of people's behaviour in a TD with small penalty/reward and a rather good predictor if the penalty/reward parameter was big (see, among others, Capra et al., 1999; Becker, Carter, and Naeve, 2005; Cabrera, Capra, and Gómez, 2007; Brañas-Garza, Espinosa, and Rey-Biel, 2011).

This experimental evidence confirms the idea that penalty/reward size does matter and precisely, that a larger penalty/reward induces subjects to behave more rationally. Another element, which can improve rationality, is whether choices are undertaken individually or in groups. Specifically, a growing body of experimental literature has explored differences between individuals and groups (or between groups of different size) in various decision contexts involving strategic behaviours. Examples are beauty-contest games (Kocher and Sutter, 2005), centipede games (Bornstein, Kugler, and Ziegelmeyer, 2004), ultimatum games (Bornstein and Yaniv, 1998), dictator games (Cason and Mui, 1997), signalling games (Cooper and Kagel, 2005), and pair-wise choices experiments (Bone, 1998; Bone, Hey, and Suckling, 1999; Bateman and Munro, 2005; Shupp and Williams, 2008; Masclet et al., 2009; Morone and Morone, 2012). This literature has consistently showed that decisions undertaken in groups are more rational, delivering the message that, usually, *two heads are better than one*.[1] Following this line of research, we shall

☆ The experiment was conducted at the ESSE Laboratory at the University of Bari and financed by the same University. The paper was written up while Piergiuseppe Morone was visiting the University of Castellón, for whose hospitality he is grateful.

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[1] On this very point, see Cooper and Kagel (2005) emblematically titled "Are two heads better than one? Team versus individual play in signalling games" and Sutter (2005) titled "Are four heads better then two? An experimental beauty-contest game with teams of different size". On the difference between group and individual decisions see also Song (2009), who investigated whether individuals behave differently as members in a consensus group in a strategic setting involving trust and reciprocity.

2214-8043/$ – see front matter © 2014 Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.socec.2014.02.001

investigate this proposition within a traveler's dilemma context assessing if groups are "smarter decision makers per se [... or] they learn faster than individuals" (Kocher and Sutter, 2005: 200).

We believe, investigating what drives people towards rationality is indeed a fascinating area of enquiry. In this paper we tackle this very issue presenting a laboratory experiment to evaluate whether (i) the size of the penalty/reward and (ii) group decisions, trigger rational behaviours in a repeated TD game. To the best of our knowledge, a comparison between individual and group decisions has never been addressed within a TD framework. The remainder of the paper is structured as follows: the TD and the experimental design are discussed in Section 2; Section 3 presents our experimental results and Section 4 concludes.

2. TD experimental design

Consider the following story: two travellers spend their holiday on a tropical island, where they purchase identical and expensive items; on the return trip, the airline loses their luggage containing the purchased items. In order to reimburse the two travellers for their loss, the airline representative asks each traveller separately to fill out a claim, with the understanding that claims must be at least x and no greater than X (with $x < X$). Claims will be fully reimbursed if they are equal. But if they are different, both travellers will receive the lower claim. Additionally, the lower claimant will receive a small reward, and the higher claimant will incur a small penalty deducted from the reimbursement. Obviously, each person has an incentive to "undercut" the other, so no common claim above x can constitute a Nash equilibrium.

We tested this story through a context-free experimental design. The experiment was conducted at the ESSE laboratory of experimental economics at the University of Bari in November 2008. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). Participants were undergraduate students from different disciplines, enrolled at the University of Bari.

Students played a repeated TD game; in total, six experimental treatments were run, each producing 20 independent observations. Treatments 1, 2 and 3 involved 20 participants each; treatments 4, 5 and 6 involved 40 participants each, which were divided into 20 randomly created groups of two. Written instructions on the experiment were distributed prior to its commencement.[2] In all treatments, amounts were denoted by *ECU* (Experimental Currency Unit), where 100*ECU* = 1€. The average payoff was 9€ (including a participation fee of 3€). Treatments in the group block lasted, on average 32 min; the control treatments lasted on average 13 min.

As mentioned, the experiment consists of six treatments, grouped into two blocks: *control* (T1, T2, and T3) and *group* (T4, T5, and T6). The control block is based on Capra et al. (1999) experimental design. Hence, results obtained in these treatments (T1, T2 and T3) cannot be considered as new findings as they just replicate existing once. Each treatment was carried out once. The two blocks are designed to investigate (i) the impact of the size of the penalty/reward and (ii) the impact of group decisions.

In the first period of each control treatment (T1, T2 and T3), players were randomly paired and were allowed to interact for 10 periods in a 'partner design'. During each period subjects were asked to report a number between 40 and 200. If both subjects in a couple reported the same number, then their payoffs would have been the reported number. If they reported different numbers, then they would get different payoffs. More precisely, the subject who reported the smallest figure received the minimum reported figure plus a reward, and the subject who reported the largest figure received the minimum reported figure minus a penalty. In T1 the reward/penalty was set equal to 2*ECU*; in T2 the reward/penalty was set equal to 25*ECU*; in T3 the reward/penalty was set equal to 40*ECU*.

Table 1
Treatments' parameterization.

Penalty/reward	Treatments	
	Control	Group
2*ECU*	T1	T4
25*ECU*	T2	T5
40*ECU*	T3	T6

Group's treatments (T4, T5 and T6) were identical to the control treatments but, this time, decisions were made by randomly created groups of two subjects (dyads) instead of single subjects. During each period, subjects were asked to report a number between 40 and 200.

These treatments involved 20 dyads, which were subsequently paired to play the TD game. In order to avoid unintended effects, the groups were computerized – i.e. the dyads were anonymous and subjects within a dyad could interact only through computerized chatting. At the beginning of each period, dyad's members had 2 min to chat and reach an agreement on how much to claim. Then, they individually posted a claim. If the claim posted by both members of the dyad coincided, the claim was passed and they moved on; otherwise, they went back to the chat screen and tried to reach an agreement. Only when participants reached an agreement and their claim coincided did they move on to the next stage. If both dyads reported the same claim, all four subjects received the reported claim. If the claims of the two dyads differed then they would get different payoffs. More precisely, subjects of the dyads that reported the smallest figure both received the minimum reported figure plus a reward, and subjects of the dyads that reported the largest figure both received the minimum reported figure minus a penalty. The time taken to complete the experiment varied between sessions, treatments, and also across subjects.

In all treatments, decisions were referred to as "claims" and the earnings calculations were explained without reference to the context (i.e. without mentioning the luggage travelers' scenario); hence, all treatments were designed to be context free. A table summarizing the structure of the experiment is reported below (see Table 1).

As discussed above, this experiment will allow us to test the following research hypothesis:

Research Hypothesis 1 – *in a TD game, the size of the penalty/reward has an impact not only on individual decisions, as previously documented, but also on group decisions.*
Research Hypothesis 2 – *in a TD game, groups are more rational than individuals (i.e. converge earlier to the Nash equilibrium).*

3. Results

3.1. Penalty/reward size impact on decisions

In order to address our first research question (i.e. the impact of the penalty/reward on subjects' claims) we calculated and reported for treatments 1, 2, and 3, the period-by-period claims' mean (see Fig. 1, panel (a) – the data plots are bounded by two horizontal dashed lines that show the maximum and minimum claims of 200*ECU* and 40*ECU*, respectively), as well as, the period-by-period claims distribution by means of a box-plot (see Fig. 1, panel (b)).

[2] An English translation of the Italian instructions for the experiment is reported in Appendix A.