



# Interaction of reasoning ability and distributional preferences in a social dilemma<sup>☆</sup>



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## ABSTRACT

In a within subjects design we evaluate distributional preferences and reasoning ability to explain choices in the Traveler's Dilemma. We recruit subjects from economics and non-economics majors to have a high variance of preferences and abilities. We find that economists follow the efficiency criterion while non-economists follow maximin. Economists also show a better reasoning ability. We, therefore, confirm the self-selection hypothesis of choosing a major. An equilibrium of an incomplete information version of the Traveler's Dilemma explains the behavior we observe. Subjects with low reasoning ability make choices away from equilibrium. Thus, (non)cooperative behavior might be misinterpreted if subjects' reasoning ability is not taken into account.

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## 1. Introduction

There are many models of social, distributional and norm-dependent preferences that attempt to explain behavior in experimental games (e.g., Fehr et al., 1999; Bolton and Ockenfels, 2000; Engelmann and Strobel, 2004; Krupka and Weber, 2013; Kessler and Leider, 2012; Kimbrough and Vostroknutov, 2016, among others). All these models rely on the assumption that preferences are heterogeneous in the population, which makes it possible to reconcile data and theory in games like social dilemmas where pro-social and selfish incentives are typically not aligned (e.g., Prisoner's Dilemma, Ultimatum game, Public Goods game etc.). Another strand of literature focuses on the ability to reason in games. For example, some studies investigate whether different measures of intelligence predict the ability to think strategically (Gill and Prowse, 2016; Fehr and Huck, 2015; Benito-Ostolaza et al., 2016; Kiss et al., 2016). More importantly, the relationship between the measures of intelligence and preferences has been found: Benjamin et al. (2013) and Burks et al. (2009) report correlation between intelligence and intertemporal preferences; Chen et al. (2013) show correlation between SAT and GPA scores and generosity;

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Proto et al. (2014) show that high IQ subjects are able to sustain cooperation in a repeated Prisoner's Dilemma, whereas low IQ subjects are not (see also Jones, 2008).<sup>1</sup>

These contrasting findings raise a question Which explanation should we attribute certain behaviors to: heterogeneous preferences or reasoning ability? For example, it is not inconceivable that in a one-shot Prisoner's Dilemma some subjects choose cooperation because the cooperative outcome is a norm, or a desired allocation, and because they do not think about what others might choose they do not act strategically. At the same time, other subjects might choose defection because they reason strategically and assume that their opponent does as well. In this situation, a misinterpretation of the data can occur if we try to explain these observations with heterogeneous distributional preferences: defectors would be wrongly classified as selfish and cooperators as pro-social, even though it is possible that both share the same distributional preferences.

In this paper we investigate the interaction between reasoning ability and distributional concerns and attempt to disentangle their influence on choices in the Traveler's Dilemma (Basu, 1994) – a game which combines elements of social dilemmas and iterative reasoning games à la beauty contest (Nagel, 1995) or Nim (McKinney and Van Huyck, 2007). To achieve this, we need experimental subjects' distributional preferences and abilities to reason to come from a wide enough range. We deliberately recruit students from economics and non-economics majors in order to achieve this goal. In many studies, a difference was found in pro-social behavior of economists and non-economists (e.g., Bauman and Rose, 2011; Faravelli, 2007). In addition, economics students are exposed to much more formal mathematics than students from other social sciences. Thus, we expect that they differ from non-economics students in their ability to think logically.

The second purpose of our study is to contribute to the literature on the influence of economics education on decision making. We try to understand in which dimensions economics and non-economics students ("economists" and "non-economists") are different and how this is reflected in their choices in the Traveler's Dilemma. In addition, we look at the length of time that students have spent at the university and test the self-selection versus indoctrination hypotheses (Frey and Meier, 2003, 2005).

We use a within subjects design in which each subject plays three games. First, subjects make a choice in one-shot Traveler's Dilemma; then they choose allocations in several three-person Dictator games, allowing for an estimation of the subjects' distributional preferences (Engelmann and Strobel, 2004); finally, subjects play several rounds of the Race to 15 game (Gneezy et al., 2010), a version of Nim, which is a good indicator of reasoning ability (Burks et al., 2009). We hypothesize that economists are more concerned with efficiency or Pareto optima than non-economists, who favor equality (Fehr et al., 1999) and/or Rawlsian principle of maximin, which allocates the highest wealth to the poorest individual (Rawls, 1971). Moreover, following a previous study (Kimbrough and Vostroknutov, 2016), we conjecture that non-economists should be more inclined to follow social norms and conventions than economists do. We further hypothesize that economists perform better than non-economists in the Race to 15 game. This should imply that they are better at strategic thinking. Finally, in the Traveler's Dilemma, we expect substantial fraction of non-economists to behave non-strategically and choose actions associated with a focal point or a norm and a substantial fraction of economists to act strategically and best respond to non-economists. Overall, we would like to demonstrate that both reasoning ability and distributional preferences should be taken into account in order to explain strategic social behavior.

Several recent studies are dedicated to understanding the behavior in Traveler's Dilemma. Basu et al. (2011) investigate the effect of changing bonuses on the choices. Brañas Garza et al. (2011) use choices in Traveler's Dilemma to classify subjects into types that further predict behavior in other settings. Chakravarty et al. (2010) study pre-play communication. Morone et al. (2014) and Morone and Morone (2016) look at group versus individual choice and the influence of focal points. Finally, an early study by Capra et al. (1999) shows the difficulties that conventional theories of choice in games face when confronted with the behavior in Traveler's Dilemma. Interestingly, none of these studies mention distributional preferences or reasoning ability as possible explanations.

Our results can be summarized as follows. We do find support for the hypothesis that economists favor efficiency and non-economists favor maximin. However, we find no support for the hypothesis that non-economists (or economists, for that matter) care about inequality. We do find that economists perform better in the Race to 15 game. In the Traveler's Dilemma we find that more than half of non-economists (versus 30% of economists) choose the maximum number of tokens. This corresponds to the most cooperative outcome which is also strictly dominated. We find that the choices of around half of economists lie in the support of a Bayesian Nash equilibrium, which we construct by amending the Traveler's Dilemma with incomplete information about distributional types following the work of Becker et al. (2005). Importantly, the non-maximal choices of non-economists do not seem to agree with the equilibrium prediction.

Comparing choices of economists and non-economists in all three games we can strongly reject the indoctrination hypothesis that studying at the university for a long time (or studying economics for a long time) changes preferences, reasoning ability or strategic behavior. Thus, our data support the self-selection hypothesis. We find some evidence that, on average, economists are more selfish than non-economists. However, it should be mentioned that many economists also show a tendency to favor efficiency.

Overall, using the Traveler's Dilemma, we show that behavior in social contexts cannot be used to directly infer social or distributional preferences as the bounds on reasoning ability should be taken into account. We show that in our example the

<sup>1</sup> It should be noted though that from the experiments of Proto et al. (2014) it is unclear whether cooperation in high IQ groups emerges because high IQ subjects are more cooperative or because they are more patient.

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