Personality and cooperation in finitely repeated prisoner's dilemma games☆

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HIGHLIGHTS

- Personality trait agreeableness is related to cooperation in finitely repeated prisoner's dilemma.
- Effect of agreeableness on cooperation is robust to inclusion of controls including cognitive ability.
- One standard deviation increase in agreeableness raises chance of cooperation by 15% points.

ARTICLE INFO

ABSTRACT

We investigate the role personality plays in Finitely Repeated Prisoner's Dilemma (FRPD) games. Even after controlling for demographic factors such as race, course of study, and cognitive ability, we find that cooperative behavior is significantly related to the Big Five personality trait Agreeableness. A one standard deviation increase in agreeableness increases the predicted probability of cooperation by a subject with modal demographic characteristics from 67.9% to 80.6%.

1. Introduction

Economists are increasingly concerned with the role personality traits play in economic outcomes (Heckman et al., 2006; Borghans et al., 2008; Becker et al., 2012). Much of this work is done using survey data, but experimental economists are beginning to explore personality traits, which are easily measured in the laboratory (e.g., Deck et al., 2012; Feliz-Ozbay et al., 2013; Fréchette et al., 2013; Proto and Rustichini, 2013).

We examine the role personality plays in one of the most replicated results in experimental economics: early round cooperation in a finitely repeated Prisoner's Dilemma (FRPD). Several theories have been proposed and explored to account for these decisions (e.g., Kreps et al., 1982; Neyman, 1985; Selten and Stoecker, 1986; Jeheil, 2005). We hypothesize that early round cooperation in FRPD games is in part related to personality traits, in particular to the Big Five personality trait "Agreeableness". Agreeableness is a broad trait associated with more specific traits—altruism, trust, cooperativeness. Previous attempts to link measurable traits in experimental games similar to the standard prisoner's dilemma game have been reported in Boone et al. (1999), Pothos et al. (2011) and others, but none have done so within the context of FRPD games,

Table 1
Summary statistics.

Variable	Mean	Standard deviation	Minimum	Maximum
Extroversion score	3.11	0.74	1.88	4.75
Agreeableness score	3.70	0.64	1.67	4.78
Conscientiousness score	3.47	0.69	1.67	4.67
Emotional stability score	2.66	0.75	1.38	4.50
Openness/Intellect score	3.44	0.59	2.19	4.80
SAT composite score ($N = 25$)	1218	149.44	930	1420
ACT composite score ($N = 28$)	27.89	3.03	21	34
White	0.60			
Black	0.10			
Chinese	0.19			
Male	0.63			
Science and engineering	0.31			
Business and economics	0.40			

Note: Sample size equals 52 unless otherwise noted. The personality traits are measured using scales with 8–10 items, each scored using a five point Likert scale. The number reported for each trait is the average score over the items and can range from 1 to 5. The composite score for the SAT includes the math and critical reading sections but not the writing section; the national mean score on these two sections was 1010 in 2012. The national mean score for the composite ACT score was 21.1 in 2012.
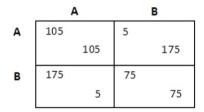

Fig. 1. Payoff matrix in ECUs.

while simultaneously controlling for cognitive ability, as is done here.[2]

2. Experimental design and data

Subjects played 10 super-games each consisting of 10 simultaneous-move, FRPD games; stage payoffs are given in Fig. 1. Payoffs were denominated in experimental currency units (ECUs) which were converted into dollars at the rate of $1 = 250$ ECUs. Payoffs were computed over all plays of all the super-games and paid in cash at the end of an experimental session along with a $6.00 participation fee. Upon completion of the last super-game, subjects completed a short demographic questionnaire, as well as a 44-item Big Five Inventory (BFI John et al., 2008).[3] Subjects consented to allowing the registrar to furnish us with their GPAs and SAT/ACT scores. Table 1 provides summary statistics for the demographic information.[4] The experiment was programmed in z-Tree (Fischbacher, 2007). A total of 52 subjects participated in 5 sessions lasting about 1.5 h each.

3. Experimental results

Table 2 reports marginal effects from probit models – incorporating various controls – of the likelihood that a subject cooperates in the first round of a super-game.[5] In all cases the dependent variable is 1 if a subject cooperated, 0 otherwise, with standard errors clustered at the subject level. Column 1 includes basic regressors suggested by Dál Bo and Fréchette (2011) for infinitely repeated super-games: *Previous opponent cooperated in Rd. 1* is a dummy variable equal to 1 if a subject faced an opponent who cooperated in the first round of the previous super-game (0 otherwise), *Subject cooperated in Rd. 1 of first super-game* is a dummy variable equal to 1 if a subject cooperated in the first round of the first super-game (0 otherwise; included to capture innate tendencies to cooperate), and *Super-game* is a linear time trend variable included to capture any learning or experience effects in the data. All three variables are significant at the 5% level or better in column 1 and every subsequent specification.

Column 2 adds basic demographic variables – gender, ethnicity/ nationality and academic major – obtained from the university Registrar's office. There are several ethnicity/nationality categories but approximately 88% of subjects identify as white, black, or Chinese, so we include these three categories and collapse the other categories into one group, Other Group. Among these categories, white and black subjects are primarily US citizens, while those identifying as Chinese are primarily students from the People's Republic of China.[6] Adding these controls to the variables shows that non-white subjects are less likely to cooperate: Chinese subjects are 32.3% less likely to choose to cooperate relative to whites ($p = 0.03$), and blacks are 29.2% less likely to cooperate ($p = 0.09$). We do not have any a priori hypotheses with regard to race. Moreover, our experiment is not designed to investigate hypotheses about race and subjects were not aware of the other player's race. The significant marginal effects for blacks are not robust to the inclusion of other control variables in columns 3 and 4, but the marginal effects for Chinese are. That Chinese subjects in our sample are less cooperative stands in contrast to the findings in Hemesath and Pomponio (1998), suggesting that more work is necessary to understand any cultural differences. The existing literature finds

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[2] Boone et al. (1999) look at a different set of personality measures on cooperative behavior in a Prisoner's Dilemma: locus of control, self monitoring, sensation seeking, and type A behavior; they find that cooperative behavior is systematically related to a number of these traits. Among psychologists, Hirsh and Peterson (2009), Pothos et al. (2011), and Lönnqvist et al. (2011) look at the impact of Big Five traits on behavior in variants of the Prisoner's Dilemma. However, these studies are all one-shot games with some combination of non-neutral language, a lack of financial incentives, a lack of additional controls, or substantial variations from the standard Prisoner's Dilemma (e.g., sequential moves, larger strategy space).

[3] The Big Five personality characteristics represent a consensus among personality psychologists on a general taxonomy of personality traits. The focus of the Big Five is on internal consistency rather than predictive ability, designed to measure personality at a very broad level of abstraction; with each dimension summarizing a large number of distinct, more specific, personality characteristics.

[4] No norms are available for the BFI, but a large comparison set can be found in Appendix A.

[5] Statistical tests for cooperation rates focus on outcomes in the first round because subsequent behavior is highly dependent on earlier outcomes, creating complicated interdependencies that are difficult to account for econometrically. Further, once two or more rounds have passed in which one agent has defected, in the overwhelming number of cases both agents defect for the remainder of the super-game.

[6] One subject who identified as black was from Nigeria, while one subject who identified as Chinese was from Malaysia.