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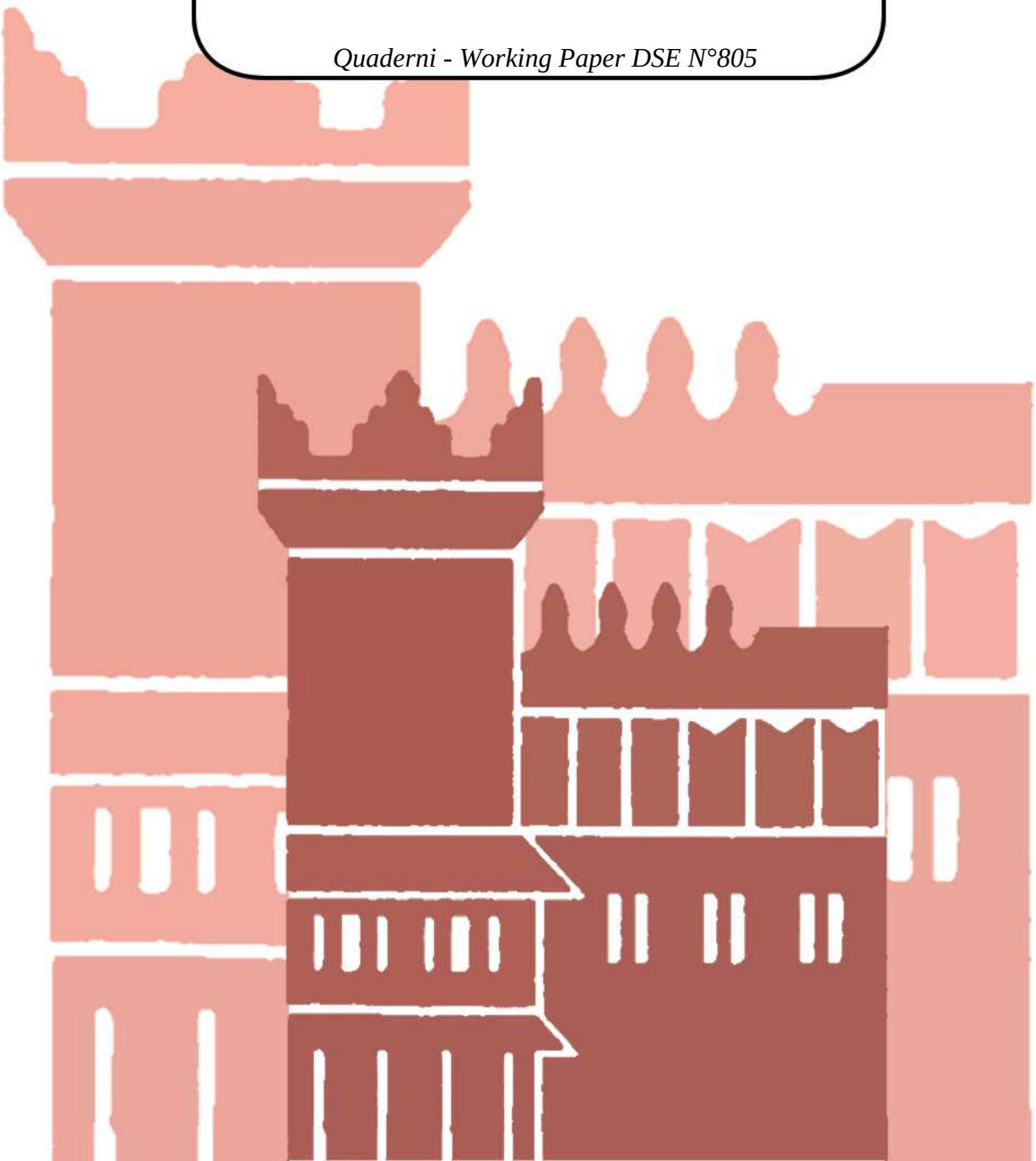

Are Self-regarding Subjects More Strategic?

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Abstract

To investigate the relationship between the depth of strategic thinking and social preferences we ask subjects in an experiment to perform dictator games and a guessing game. The guessing game measures depth of strategic thinking while dictator games control for social preferences. When performing a comparison within the same degree of strategic reasoning, self-regarding subjects show more strategic sophistication than other subjects.

Keywords: guessing game, other-regarding preferences, strategic thinking

1 Introduction

Modeling preferences of economic agents is at the center of a long lasting debate about human behavior. Evidence show that people respond to motivations that go beyond the maximization of personal payoffs (Fehr and Schmidt, 1999). In turn, the discussion about rationality has characterized research in economic behavior for decades (Blume and Easley, 2008).

We are the first to investigate the relationship existing between strategic rationality and other-regarding preferences: other contributions explored the relationship between cognitive ability and social preferences (Chen et al., 2013). To study social preferences we employ three player dictator games (Engelmann and Strobel, 2004) and to measure strategic thinking we use the guessing game (Nagel, 1995). Dictator games are appropriate for our purpose

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because they are able to disentangle different behaviors related to other-regarding preferences without any strategic considerations. The guessing game allows in turn to explore strategic rationality[1] without concerns for efficiency - because it is a constant sum game - and independently from social concerns - because the equilibrium strategy is the same for self-regarding and for other-regarding preferences.

The paper is structured as follows. Section 2 describes the experimental design, Section 3 reports results, Section 4 discusses results and concludes.

2 Experimental design

Experiments were run at Purdue University. Overall 195 undergraduate students participated in 16 sessions. Each subject participated in only one session. Each session consisted of three parts.[2] In the first part we elicited other-regarding preferences along the lines of Engelmann and Strobel (2004). Subjects had to make a choice related to two dictator games: dictator game 1 represented in Panel 1 of Table 1 and dictator game 2 represented in Panel 2. Each table proposes a choice between alternative allocations of money among a group of three persons. In each dictator game, participants had to choose among the available options as if they were the dictator i.e. they should imagine to be Person 2 and assign to the other two components of the group the income related to Person 1 and Person 3 as reported in the table. After subjects expressed a choice for each of the two dictator games, the experimenter collected the cards, shuffled them and randomly formed groups. In each group, the decision card of one component was randomly selected to be Person 2 and the other two were assigned roles 1 and 3. The card of the subject that was randomly assigned the role of Person 2 was used to define the earnings in the group. Subjects were informed that their decision would be implemented only if their card was randomly selected to take the role of Person 2. The choices of the persons assigned role 1 and 3 had no impact on the outcome.

Half of the groups were paid according to choices made for the first dictator game and the other half to choices related to the second dictator game.

[1] Strategic rationality studies *'whether and how a players mental processing incorporates the thinking process of others in strategic reasoning (Coricelli and Nagel, 2009)'*.

[2] We do not discuss the results of part three. They are presented in Arrunada and Casari (2010) and available upon request to the authors.

The second part of the experiment consisted in a one-shot guessing game. All subjects had to write a real number between 0 and 100 on their personal decision cards. They were informed that groups of three would be randomly formed, and then a target number for each group would be computed by taking two thirds ($p = 2/3$) of the group average. Within each group, the subject closest to her target number received 6 points, evenly split in case of a tie. After everybody made a choice, the experimenter collected all decision cards and wrote the results for both tasks on the cards, and returned to the subjects which learned the results of both tasks at the end of the session. Earnings were paid privately at the end of a session summing the points of all parts of the experiment. A point was worth 0.45 USD.

3 Results

Game theory predicts a solving procedure of the guessing game which implements iterated elimination of weakly dominated strategies (Ochs, 1995), that in infinite steps will allow rational agents to reach the Nash equilibrium (the choice of 0): values larger than 100p - dominated strategies - are initially eliminated (with p being 2/3), then values larger than $100p^2$, and so on and so forth up to the Nash equilibrium in which everyone chooses 0.

However, many contributions have proven how the natural way how humans solve this problem is not through the game theoretical solution but through a a step by step reasoning procedure codified in the literature as the Iterated Best Reply model (IBR), a model that better describes actual behavior in the game (Nagel, 1995; Coricelli and Nagel, 2009). In this model each subject has a uniform prior over other players' choices and applies one level of reasoning deeper than what she believes that the other players will do:*'... a naïve player (level 0) chooses randomly. A level 1 player thinks of others as level 0 reasoning and chooses 33 (=2/3*50), because 50 is the average of randomly chosen numbers from 0 to 100. A more sophisticated player (level 2) supposes that everybody thinks like a level 1 player and therefore he chooses 22 (=(2/3)2 *50)(Coricelli and Nagel, 2009).'* Regarding distribution in the dictator games, the best choices for a rational, self-regarded agent in the dictator games is to choose A over C in dictator game 1, and to choose D over F in dictator game 2.

In Figure 1, we report our results of the choices in the guessing game with the classification according to IBR model and the Game Theoretical solution

(Iterated Dominance model - ID): results are in line with Nagel (1995). Table 1 show aggregate results for the choices in the dictator game.

The aim of this paper is to search whether a possible relationship between level of sophistication and concerns for equality and efficiency exists. Therefore we reorganize our data subdividing our subjects in groups according to the steps of reasonings in the IBR model and then investigate the values that the subjects in each group expressed in the dictator games. In Table 2 we compared the average guesses of those who cared most for equality (A) with the average guess of those who chose the self-regarding option (C), in each step of reasoning. A similar statistic was computed for D versus F.

Result 1: For subjects with high degree of rational sophistication, the mean guess of subjects who prefer strict equality is significantly larger than the mean guess of those who favor personal gains and the mean guess of subjects who prefers maximum efficiency is larger than the mean guess of those who favor personal gains.

A series of Wilcoxon-Mann-Whitney and Kolmogorov-Smirnov tests reported in Table 2 compare the distributions of the guesses of subjects who chose A vs C and D vs F, classified according to the IBR model. Both tests accept the hypothesis that the distribution of the values of A are significantly larger than C for higher steps of reasoning - for Step 2 and Higher Steps - the same for D versus F for Higher Steps. Results are also visible in Figure 3 where the left panel depicts the mean guess of the participants who chose A normalized by the median calculated for the relative step of reasoning (solid line), compared to the mean value of subjects who chose C again normalized by the median calculated for the relative step of reasoning (dotted line). The right panel of Figure 3, illustrates the choices for D versus F. Moreover, we performed probit regressions where the dependent variable is the choice in the two dictator games separately and where the regressors are the value of the guess and a series of dummy variables that have value 1 for the relative step of reasoning (Table 3): First, the value of the guess is significantly lower for subjects that are of the self-regarding type, in both dictator games. Second, within steps of reasoning, for those with high level of depth of strategic reasoning (Higher Steps) self-regarding subjects exhibit lower values of the guessing game with respect to those preferring equality or efficiency. Subjects with lower level of depth of strategic reasoning (Step 0) in turn present a higher value of the guess on average.

Result 2: The share of subjects who prefer equality over self-regard is similar across steps of reasoning. The share of subjects who prefer efficiency over self-regard is larger for higher steps of reasoning.

From the point of view of the population of subjects of the groups formed according to the steps of reasoning, we found that the share of subjects who prefer equality over self-regard is similar across steps of reasoning: this is shown in Figure 2 where we reported the share of subjects who chose a specific earnings allocation by step of reasoning. Consider for a moment the left panel, which reports choices concerning equality. Line A illustrates the fraction of subjects who preferred strict equality(A), among those that the IBR model classifies as Step 0, Step 1, etc. Similarly, line C illustrates the fraction of subjects who preferred to maximize personal earnings. The shares of choices for the self-regarding option do not increase for higher steps of reasoning, when we compare it with the choices for equality. On the contrary, in the right panel, we report a comparison of efficiency (D), versus self-regard (F): the fraction of subjects that have a higher concern for efficiency increases for higher steps of reasoning. We controlled for this effect in Table 4 where the marginal effects of a series of probit regressions on individual choices for A, C, D, and F, respectively are reported.[3] The regressors are a list of dummy variables that codify the number of steps of reasoning according to the IBR model. The regressions show no significant relationship between the distributional choices with respect to equality concerns. On the contrary, there is a significant relationship between efficiency and the number of steps of reasoning. Subjects who performed more than two steps of reasoning are less likely to have made the self-regarding choice F.

4 Discussion and Conclusion

The behavior of subjects with high level of strategic sophistication is explained by an ability to perform a higher level of complexity in reasoning with respect to those with low steps (Coricelli and Nagel, 2009). In our context, this ability may allow subjects to understand more clearly the non-strategic content of the dictator game and the lack of an individual incentive

[3]The dependent variable takes value 1 when the subject chose A in column 1 and so on.

to sacrifice for others, while taking advantage of the chance of the higher payoff obtainable when choosing the self-regarding option. High level of reasoning subjects would be characterized by less attention towards equal income distribution.

Secondly, the shift in the population of subjects that choose the efficient outcome versus the self-interested outcome in the second dictator games suggests that there is not a fixed characterization of preferences that qualifies univocally the population of rational agents.

Finally, we may ask what explains then the choice of a low guess characterizing subjects with low steps of reasoning. The literature suggests two possible explanations: either these subjects are unable make a jump in reasoning complexity or they believe that not everybody else is able to make this jump (Coricelli and Nagel, 2009). In the latter case, their rational choice would be to make a low guess because she expects that the average subject will not be able to predict the equilibrium predicted by Game Theory. Unfortunately, our results do not allow to make final statements on which of the two explanations is true and how it relates to other-regarding preferences. We leave the question for further research.

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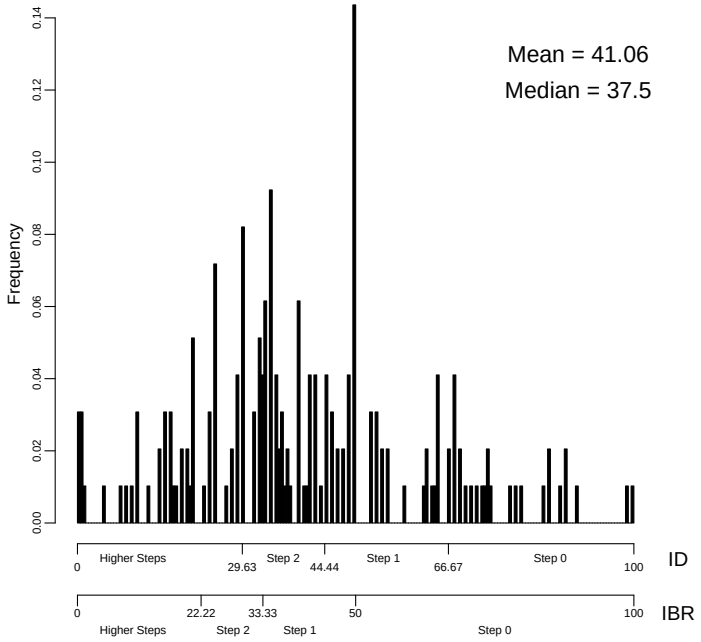
5 Tables and Figures

Table 1: Three person dictator games

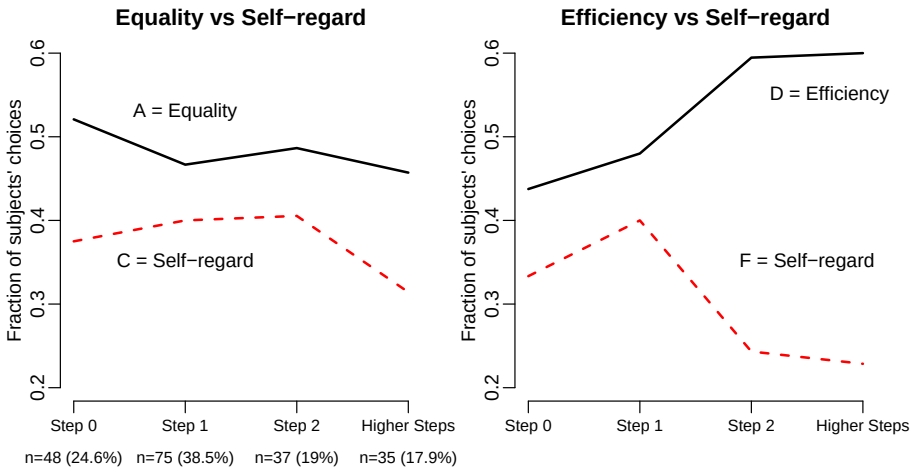
	Panel 1 Equality vs self-regard			Panel 2 Efficiency vs self-regard		
	A	B	C	D	E	F
Person 1	8	11	12	20.5	12	7.5
Person 2 (dictator)	8	8.5	9	6.5	7	7.5
Person 3	8	4.5	3	5	5	5
Total	24	24	24	32	24	20
Average earning of 1, 3	8	7.75	7.5	12.75	8.5	6.25
Experimental Choices	N=195			N=195		
N of subjects	94	27	74	100	32	63
Percentage	48.2	13.8	37.9	51.3	16.4	32.3
Mean guess	42.7	39.0	39.7	39.6	44.6	41.6
Median guess	38.0	36.0	37.5	35.5	41.6	42.0
Predictions						
Self-regarding			C			F
Efficiency	-	-	-	D		
Bolton and Ockenfels	A					F
Fehr and Schmidt	A					F

Figure 1: Distribution of choices in the guessing game



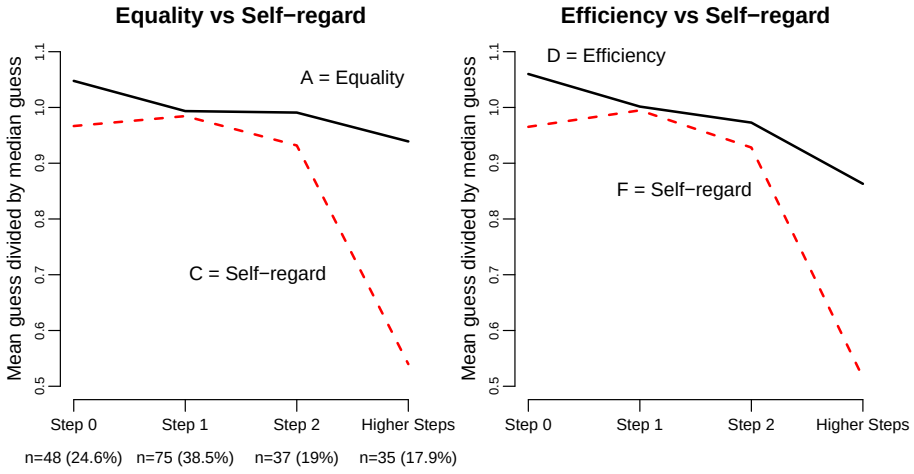
Distribution of choices in the guessing game with reference points of the ID and IBR models. Step 1 for IBR model includes the value 50.

Figure 2: Fraction of subjects' choices



Fraction of subjects' choices choosing A(C) or D(F) on the total number of subjects in the same step. n reports number of subjects per step and total percentage of subjects in the step in the total sample(195).

Figure 3: Mean guess divided by median guess



Mean guess of subjects choosing A(C) (or D(F)) divided by the median guess in the same step.

Table 2: Mean Guesses within steps of reasoning and distributional choices

Equality		Mean guess			Equality vs Self-regard	
		Equality		Self-regard	$A > C$	
Steps	guess ranges	A	B	C	MW	KS
Step 0	$(50, 100)$	71.24	76.60	65.73	0.19	0.15
Step 1	$(33.33, 50]$	41.73	44.03	41.35	0.34	0.23
Step 2	$(22.22, 33.33]$	29.72	28.61	27.95	0.03**	0.08*
Higher Steps	$(0, 22.22]$	15.03	14.32	8.64	0.09*	0.02**
Efficiency		Mean guess			Efficiency vs Self-regard	
		Efficiency		Self-regard	$D > F$	
Steps	guess ranges	D	E	F	MW	KS
Step 0	$(50, 100)$	72.08	71.21	65.64	0.11	0.15
Step 1	$(33.33, 50]$	42.07	41.48	41.78	0.35	0.52
Step 2	$(22.22, 33.33]$	29.18	29.36	27.84	0.15	0.30
Higher Steps	$(0, 22.22]$	13.81	15.67	8.25	0.06*	0.06*

Mean value of the guessing game subdivided per steps of reasoning and choices in the distribution games. Mann Whitney and Kolmogorov Smirnov tests performed on guesses separately for levels of reasoning. Significance: *** 99%, ** 95%, * 90%.

Table 3: Steps of reasoning and concerns for efficiency and equality

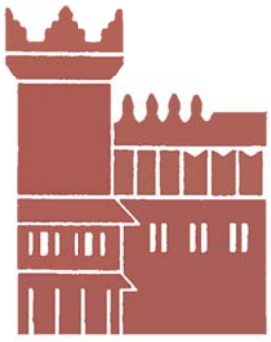
	Dictator game 1		Dictator game 2	
Dependent Variable:	A (equality)	C (self-regard)	D(efficiency)	F(self-regard)
Guess	0.007	-0.01***	0.007	-0.01**
	(0.004)	(0.004	(0.004)	(0.004)
Step 0	-0.14	0.34**	-0.24	0.21
	(0.15	(0.15)	(0.16)	(0.14)
Step 2	0.11	-0.17	0.20*	-0.29***
	(0.11)	(0.11)	(0.11)	(0.11)
Higher Steps	0.19	-0.48***	0.32**	-0.48***
	(0.16)	(0.17)	(0.17)	(0.16)

Significance: *** 99%, ** 95%, * 90%. Probit model with dependent variables the choices A(C) and D(F)and independent variables, the value of the guess of each subject, "guess", and dummy variables corresponding to the Steps of reasoning in the IBR model. Standard errors in parenthesis.

Table 4: Steps of reasoning and concern for efficiency and equality

	Dictator game 1		Dictator game 2	
Dependent Variable:	A (equality)	C (self-regard)	D(efficiency)	F(self-regard)
Step 0	0.13	-0.08	0.01	-0.08
	(0.09)	(0.08)	(0.09)	(0.07)
Step 2	0.04	-0.01	0.12	-0.15
	(0.10)	(0.09)	(0.10)	(0.08)
Higher Steps	0.02	-0.11	0.13	-0.16**
	(0.10)	(0.09)	(0.10)	(0.08)

Significance: *** 99%, ** 95%, * 90%. Probit model with dependent variables the choices A(C) and D(F) and as regressors dummy variables for the Steps of reasoning of the IBR model. Marginal effects evaluated at the mean are reported with relative standard errors in parenthesis.



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