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Fast or fair? A study of response times*

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Abstract

This paper uses a modified dictator game to investigate the relationship between response times and social preferences. We find that egoistic subjects make faster decisions than subjects with social preferences. Moreover, our within-analysis reveals that, for a given individual, egoistic payoff maximizing decisions are reached quicker than choices expressing social preferences.

Keywords: Response Times, Social preferences

JEL codes: C72, C91

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1 Introduction

The emerging field of Neuroeconomics seeks a biological foundation of social and economic decisions by studying activity in the neural circuitry.[1] This approach is becoming widely used in economics but it is not without critiques. For instance, Rubinstein (2007) criticizes Neuroeconomics as expensive and speculative. As an alternative, he proposes to follow psychology and explore the deliberation process of decision makers based on their response times (RT). Rubinstein (2007) studies strategic games and finds clear relationships between behaviour and RT.[2] Our work follows a similar path, but differs along two dimensions. First, we study a modified dictator game, which represents a non-strategic situation that isolates the decision of caring for the other's payoffs or not. Second, we observe the same individuals making several repeated choices which yields more precise preference estimates and, more importantly, enables us to study the within-subject relationship between RT and choices.

We find that egoistic subjects make faster decisions than subjects with social preferences. Moreover, our within-analysis reveals that, for a given individual, egoistic payoff maximizing decisions are reached quicker than choices expressing social preferences. Hence, Rubinstein's (2007) idea that fair decision making stems from instinctive and fast responses, whereas more (rational) egoistic decision making requires more time, does not carry over to our non-strategic setting. Egoistic decision making is faster, most likely since it only requires the subject to pick the option with the highest payoff. Caring also about the other necessitates weighting your own payoff against the other's payoff; a process involving tradeoffs between emotions such as guilt, envy and efficiency concerns.

2 The Experiment

The experiment was conducted at the Universidad de Alicante with a total of 72 undergraduate students divided into three sessions. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007).[3]

Participants played a modified dictator game lasting for 24 periods. At the beginning of each period, pairs were formed at random and each participant had to decide how to allocate payoffs within the pair. Participants were restricted to a choice between four pre-specified options, describing the payoffs of both subjects.

In each period, one participant (denoted as "Rich") was randomly selected to have at least as high payoffs as the other player (denoted as "Poor") in all 4 options. Moreover, the options differed in the degree of inequality and the choice set composed of either:

1. four options with low inequality of payoffs (LI),

2. four options with high inequality of payoffs (HI),

3. two LI options and two HI options (MIX).

See Table 1 for a list of the payoffs. The strategy method was used to collect observations for all players in each round; both subjects picked an allocation and one of them was thereafter randomly chosen to be the dictator and the payoffs were distributed according to her choice. The RT is measured for each of the 24 decisions separately and refers to the time (seconds) between the moment the screen with the four options appears and the moment the subject clicks on her preferred option. Average earnings were about 11 euros and the sessions lasted approximately 30 minutes.

Table 1: Payoff options

Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Options	LI	MIX	HI	HI	LI	MIX	LI	MIX	HI	HI	LI	MIX
1	36,36	81,52	89,66	76,53	45,42	77,46	48,46	76,46	74,50	69,34	41,38	70,30
2	35,35	81,52	79,49	77,50	52,47	83,58	48,47	84,64	80,58	70,30	42,41	70,32
3	42,35	42,35	84,54	79,52	46,36	47,38	46,45	49,49	79,54	69,35	41,41	44,44
4	43,43	42,42	82,67	70,30	46,35	47,41	47,45	54,52	70,48	70,34	42,40	40,39
Period	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Options	HI	MIX	LI	MIX	LI	HI	HI	MIX	LI	LI	MIX	HI
1	76,45	91,66	42,37	70,31	42,42	70,30	81,59	80,53	51,48	46,43	71,42	80,51
2	87,63	89,67	42,40	70,30	43,36	69,38	78,52	76,53	44,44	39,39	70,30	70,30
3	81,62	41,41	40,37	41,41	41,37	70,31	86,63	50,48	52,51	41,36	47,37	75,40
4	81,59	36,36	34,34	43,43	43,40	69,35	76,47	51,51	46,45	42,38	39,39	70,32

Note: Numbers in the table gives the payoffs of the two players in Spanish Pesetas (1 Euro ≈ 166 ptas). LI, HI and MIX denote the degree of inequality of the options.

3 Results

Figure 1 displays the evolution of average RT (ART) over time. We note a sharp decrease in ART during the first periods followed by a quite stable level throughout the remaining periods. Quite intuitively, as subjects get familiar with the format of the choice tasks they need less time to make their choice. Interestingly, the width of the confidence interval remains almost constant, indicating that experience does not have a clear effect on the heterogeneity in subjects' RT. There is also substantial variation in RT between different rounds of the experiment. One explanation to this variance may be the differences in inequality of the decision tasks. Figure 2 shows ART across all decision tasks with the same degree of inequality. Overall, we observe faster decisions with MIX. This result is confirmed by comparing ART pairwise at the individual level with the Wilcoxon matched pairs (WMP) test. We reject the hypothesis that ART for the MIX decision tasks are drawn from the same distribution as LI and HI (two-sided p-values < 0.05) but cannot reject the null comparing LI and HI (two-sided p-value $= 0.982$). One way of interpreting this finding is that MIX decision tasks are less cognitively demanding, since subjects may be able to exclude two of the options rather fast and thereafter focus only on their two favorite options. The heterogeneity in RT among players may also be caused by the different relative payoffs

Figure 1: ART over time and 95% confidence intervals

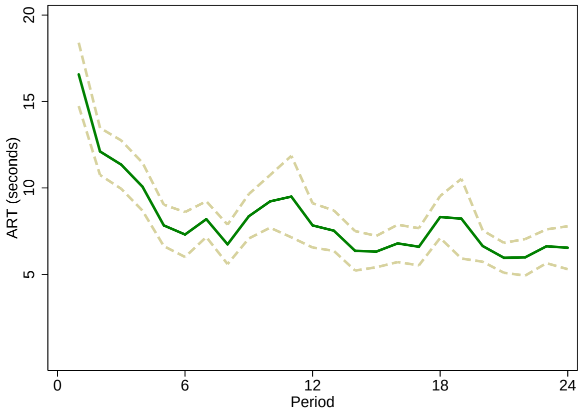
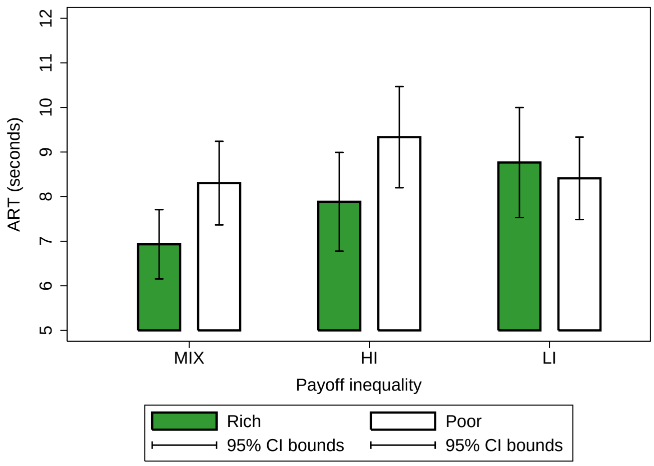


Figure 2: ART by type of question type and relative payoffs



of the players. In Figure 2 ART are broken down by "Rich" and "Poor". The MIX and HI decision tasks have high ART for the "Poor" and low ART for the "Rich", whereas relative payoffs have a smaller impact for the LI decision tasks. Using the WMP test we reject the null hypothesis of equal ART of "Rich" and "Poor" for MIX and for HI options, but not for LI (two-sided p-values; MIX : 0.004, HI : 0.001, LI : 0.79). A possible explanation for these results is that it takes longer time to make a decision in presence of envy. Guided by envy, players with low payoffs look at the payoff of the other in order to choose the pair with lower inequality.

Overall the findings suggest that inequality and relative payoffs matters for ART, which motivates a more thorough investigation of the relationship between social preferences and ART.

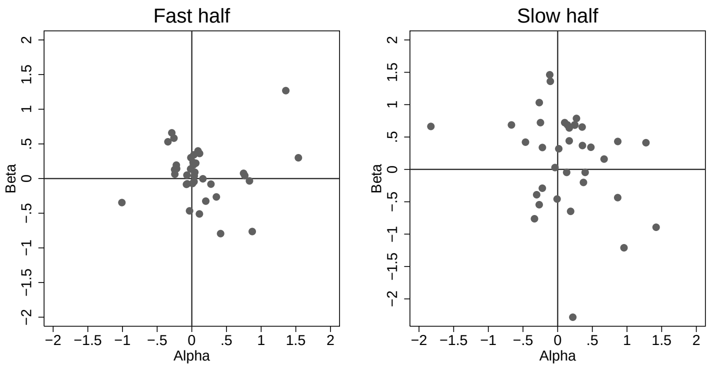
3.1 Social Preferences

We use the estimates of social preferences obtained by Cabrales et al. (2008) to categorize the players according to their type of preferences. The estimations are based on Fehr and Schmidt's (1999) model, which uses the following utility function:[4]

$$u_i(\pi_i, \pi_j) = \pi_i - \alpha_i \max[\pi_j - \pi_i, 0] - \beta_i \max[\pi_i - \pi_j, 0]. \quad (1)$$

We obtain individual level estimates of α and β and we use the standard errors of these estimates to calculate confidence sets. Individuals whose 95% confidence sets include $(\alpha, \beta) = (0, 0)$ are considered to have Egoistic Preferences (EP).[5] The remaining subjects, are said to have Inequality-Averse Preferences (IAP) if α and β are positive, Status-Seeking Preferences (SSP) if α is positive and β is negative and Efficiency-Seeking Preferences (ESP) if α is negative and β is positive. Finally, we define Inequality-Seeking Preferences (ISP) such that α and β are both negative.

Figure 3: Plotted α and β for the slow and fast subjects



In Figure 3 the preferences of the subjects are plotted in the (α, β)-plane. The sample is divided into two halves according to their ART across the 24 periods. Preferences are clearly related to ART as there are considerably more observations close to the origin among the faster subjects, indicating that egoistic subjects make faster decisions. Using the definition of EP given above, we conclude that out of 16 subjects with EP in our sample, 13 are in the fastest group, but only 3 in the slowest one.

Table 2 describes ART by preference type and the number of subjects falling into each preference category. The ART is considerably higher for the EP subjects than for the other preference types. IAP subjects have the highest ART followed by SSP subjects. Comparing the ART of the EP subjects to all other subjects using the Mann-Whitney (MW) test we reject the null hypothesis of equal distributions (two-sided p-value = 0.0156).[6] We consider this finding, that egoistic subjects are the faster than subjects with social preferences, to be the main result of the paper.

Table 2: Number of subjects and ART by preference type

Preference type	N	ART
Egoistic (EP)	16	6.48
Inequality Averse (IAP)	22	9.2
Status Seeking (SSP)	14	8.4
Efficiency Seeking (ESP)	15	8.18
Inequality Seeking (ISP)	5	8.93

Note: ART are measured in seconds per decision task. 95% confidence intervals are used to define preference types.

3.2 Within-Subject Relationship between Egoistic Choices and RT

The analysis above leaves open the possibility that the relationships between ART and types of preferences are driven by some individual unobserved characteristic that is correlated with ART and preference types. To exclude this explanation, we now take a closer look at the within-subject relationship between choices and RT.

Table 3 summarizes results from fixed effects regressions that exploits the panel structure of our data. In specification (1), RT is regressed on the variable egoistic choice, a time trend and a dummy variable for the first six periods.[7] The variable egoistic choice is a dummy variable taking value one if the subject chose the egotistic payoff maximizing choice and value zero otherwise. The time variables are significant, which reflects the decline in response time shown in Figure 1. Importantly, we note that RT is negatively related to making an egoistic payoff maximizing choice.

The relationship between RT and egoistic choices is robust to changes in the set of regressors. In specification (2), RT is regressed on a more extensive set of variables including dummy variables for relative payoffs, degree of payoff inequality and interaction terms. To address the concern that the egoistic choice is salient in some decision tasks we include the variable fairness efficiency, which is obtained by dividing the amount the opponent would gain by the amount the subject would lose if the subject does not choose the egoistic option. Hence, the variable describes how much the other subject will gain if the player gives up one unit of payoff.

In short, this regression exercise confirms the above results concerning the degree of inequality and relative payoffs. In addition, we observe a positive and significant relationship between how cheap it is to increase the other's payoffs and RT. This indicates that decisions are reached more promptly if it is costly or impossible to increase the other player's payoff. Finally, the relationship between RT and egoistic choices holds also in this specification. Hence, we can rather confidently conclude that there exists a relationship between the degree of social concerns taken into consideration and RT, not only between subjects, but also within subjects.

Table 3: Within subject analysis of response times

	(1)		(2)	
	Coef.	Std. Err.	Coef.	Std. Err.
Constant	11.511***	0.342	10.183***	0.571
Period	-0.164***	0.026	-0.16***	0.026
Period 1-6	1.258***	0.413	1.26***	0.409
Egoistic Choice	-1.948***	0.497	-1.892***	0.342
"Poor"			0.93**	0.419
LI			1.375***	0.41
"Poor" * LI			-0.978*	0.592
HI			0.904**	0.415
"Poor" * HI			0.268	0.587
Fairness efficiency			0.194**	0.083
Constant			10.183***	0.571
Number of obs.	1728 ($N = 72, T = 24$)		1728 ($N = 72, T = 24$)	
R^2, Overall	0.121		0.130	

Note: Results are obtained by fixed effects within regressions using response time as dependent variable. Period takes values 1 to 24 according to the period of the experiment. Period 1-6 is a dummy variable for the first six periods of the experiment. Egoistic choice is a dummy variable taking value one if the subject choose the option that maximized his/her payoffs. LI is a dummy variable for options with low inequality and HI is a dummy variable for options with high inequality. "Poor" is a dummy variable taking value one if the player has the low payoffs. Fairness efficiency is obtained, for each of the non-payoff maximizing options, by dividing the other player's gains with the costs for the subject. The highest of these gains-to-cost ratios are included in the regression. In case the egoistic payoff maximizing option is also payoff maximizing for the other subject, the variable is set to zero. The variables "Poor"* LI (HI) are interaction terms. *** denotes significance at the the 1% level and ** at the 5% level.

4 Conclusions

We find that subjects with social preferences make slower decisions than subjects with egoistic preferences in a non-strategic setting. Using a within-subject analysis we rule out that this is a mere reflection of social subjects being slow decision makers. Our results point out that, for a given individual, egoistic payoff maximizing decisions are reached quicker than choices expressing social preferences. We believe this finding manifests a relationship between RT and the level of complexity of the decision task and that the perceived complexity will depend on the preferences of the decision makers. Using the framework of Loewenstein and O'Donoghue (2004) our result may be interpreted as if egoistic subjects have no conflict between affective and deliberative reactions and therefore make fast decisions. On the contrary, social subjects do have such conflicts that implies an extra "cognitive load". This interpretation is supported by a recent Neuroeconomic study of the ultimatum game (Knoch et al., 2006). They find that overriding or weakening self-interested impulses necessitates the activation of a particular brain area (dorsolateral prefrontal cortex), which slows down decision making.

A Appendix

A.1 Instructions

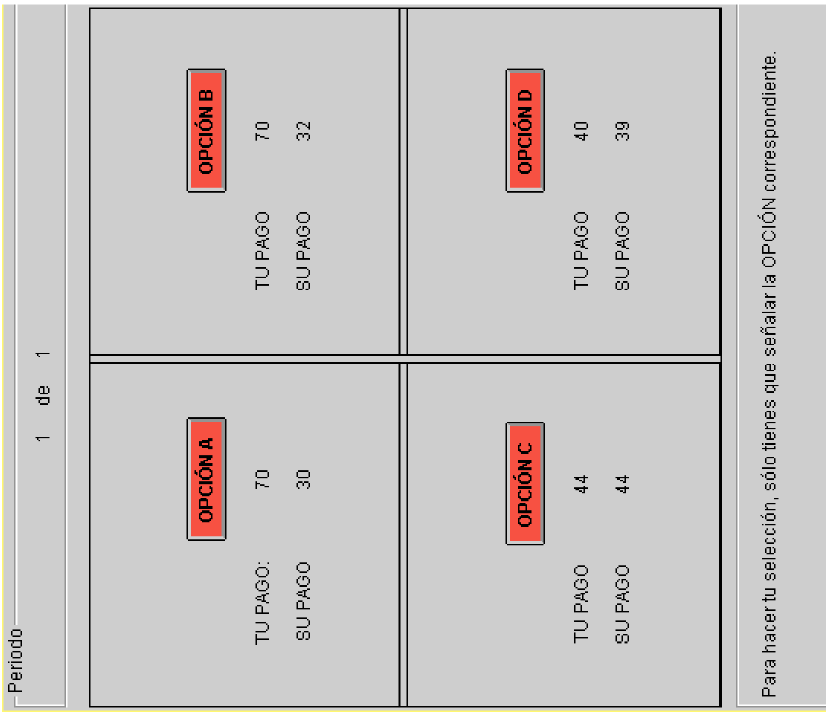
WELCOME TO THE EXPERIMENT!

- This is an experiment to study how people make decisions. We are only interested in what people do on average.
- Please, do not think we expect a particular behavior from you. On the other hand, keep in mind that your behavior will affect the amount of money you can win.
- In what follows you will find the instructions explaining how this experiment runs and how to use the computer during the experiment.
- Please do not bother the other participants during the experiment. If you need help, raise your hand and wait in silence. We will help you as soon as possible.

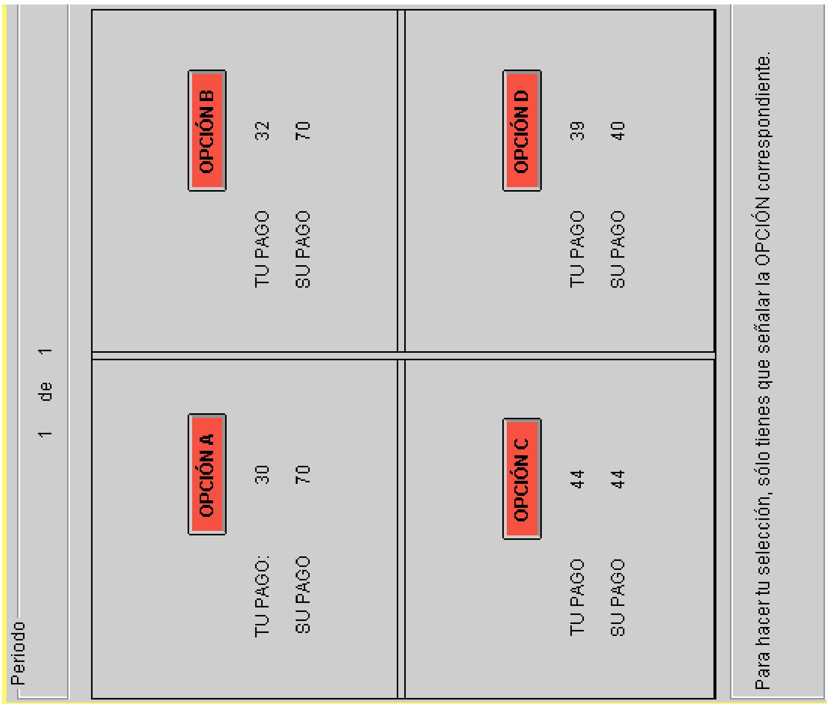
THE EXPERIMENT

- In this experiment, you will play for 24 rounds.
- In each of the 24 rounds, you will play with ANOTHER PLAYER in this room.
- The identity of this person will change one round after the other. You will never know if you interacted with the OTHER PLAYER in the past, nor the OTHER PLAYER will ever know if he has interacted with you. This means your choices will always remain anonymous.
- In each round, first the computer will randomly choose 4 different OPTIONS, that is, four monetary payoff pairs, one for you and one for the OTHER PLAYER. Every OPTION will always appear on the left of the screen.
- Then, you and the OTHER PLAYER have to choose, simultaneously, your favorite OPTION.
- Once you and the OTHER PLAYER have made your decision, the computer will randomly determine who (either you or the OTHER PLAYER) will decide the OPTION for the pair.
- We will call this player the CHOOSER of the game.
- The identity of the CHOOSER will be randomly determined in each round.
- **On average half of the times you will be the CHOOSER and half of the time the OTHER PLAYER will be the CHOOSER.**
- Thus, in each round, the monetary payoffs that both players receive will be determined by the choice of the CHOOSER.

A.2 Example Screens



Player 1 **Round 12**



Player 2 **Round 12**

A.3 Estimation of α and β

We use the estimates of social preferences obtained by Cabrales et al. (2008).

In each round t, let L_{st} be a dummy variable which is equal to 1 if subject s is the lower paid agent and 0 otherwise. Assuming that each subject s is characterized by her own parameters α_s and β_s, her utility from choosing option k at round t can be written as

$$u_{st}^k = (1 - L_{st}) \left[\pi_{1t}^k - \beta_s \left(\pi_{1t}^k - \pi_{2t}^k\right)\right] + L_{st} \left[\pi_{2t}^k - \alpha_s \left(\pi_{1t}^k - \pi_{2t}^k\right)\right] + \varepsilon_{st}^k \tag{2}$$

where ε_{st}^k is the stochastic term iid and with an extreme value distribution. According to this notation, subject s chooses option k at round t if

$$u_{st}^k = \max\left(u_{st}^1, \ldots, u_{st}^4\right). \tag{3}$$

It follows that the probability that individual s chooses the option k at round t is

$$\begin{aligned} & \Pr\left(y_{stk} = 1 | \pi_1(.), \pi_2(.)\right) \\ = & \frac{\exp\left((1 - L_{st}) \left[\pi_{1t}^k - \beta_s \left(\pi_{1t}^k - \pi_{2t}^k\right)\right] + L_{st} \left[\pi_{2t}^k - \alpha_s \left(\pi_{1t}^k - \pi_{2t}^k\right)\right]\right)}{\sum_{k=1}^4 \exp\left((1 - L_{st}) \left[\pi_{1t}^k - \beta_s \left(\pi_{1t}^k - \pi_{2t}^k\right)\right] + L_{st} \left[\pi_{2t}^k - \alpha_s \left(\pi_{1t}^k - \pi_{2t}^k\right)\right]\right)} \end{aligned} \tag{4}$$

Note that we allow for parameter heterogeneity across subjects. Thus, the iid assumption does not stem from neglected individual unobserved heterogeneity, and it is consistent with the random order of the four options in the choice set.

Notes

[1]See Camerer, Loewenstein, and Prelec (2005) for a survey of Neuroeconomic research.

[2]Another related study is Brañas-Garza, León-Mejía, and Miller (2007) who investigate RT in an incentivized ultimatum game.

[3]A translation of the instructions and example screens are available in the appendix.

[4]The estimation procedure is described in the appendix.

[5]The results do not change dramatically if we instead consider 90% or 99% confidence sets or if we define EP on the grounds of the distance to the origin.

[6]Comparing the preference categories pairwise with the MW test, we reject the null hypothesis of equal distribution of ART, when comparing EP with IAP (two-sides p-values = 0.0166), and EP with ISP (two-sided p-values = 0.0390). Moreover, we find a borderline significant difference between EP and ESP subjects (two-sided p-values = 0.0631). All other pairwise comparisons between preference categories are insignificant (two-sided p-values > 0.25).

[7]The results reported here are not sensitve to the choice of cutoff point. We chose period six since subjects experience two of each type of decision task (HI, LI, MIX) during the first six periods.

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