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Response Time under Monetary Incentives: the Ultimatum Game*

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Abstract

This paper studies the response times of experimental subjects playing the Ultimatum game in a laboratory setting using monetary incentives. We find that proposals are not significantly correlated with response time, whereas responders' behavior is positively and significantly correlated. Hence, consistent with Rubisntein (forthcoming) we find that response times may capture relevant cognitive processes. However, the use of monetary incentives causes a reversal of his findings. These results have implications for the information about cognitive mechanisms that can be obtained from response times.

Keywords: Monetary incentives, Ultimatum game, response time.

JEL: C72, C91

1 Introduction

This paper explores response time (RT hereafter) of subjects in the UG. The study of RT is motivated by two important issues in experimental economics. On the one hand, the methodological issue of whether to use monetary incentives when conducting experiments. On the other, our understanding about cognitive processes in economic decisions.

From the very beginning, the main discrepancy between Experimental Psychology and Experimental Economics has been the use of monetary incentives.

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Psychologists do not regard this issue as essential, whereas for economists, "*cognitive effort is a scarce resource that people have to allocate strategically*" (Hertwing & Ortmann 2001: 391). When subjects do not receive any reward they are not sufficiently motivated to do any (cognitive) effort. Although Roth (2001) claims that most of the economic experiments are done with monetary incentives, other experiments, like the Kahneman et al. (1990) with "mugs", have provided other salient cases of strong incentives. Despite these differences, Economics and Psychology are becoming closer (Camerer 2003).

With respect to cognitive processes, the emerging field of Neuroeconomics is currently offering new insights on how people make economic decisions. Recent developments in Neuroscience (mainly neuroimaging techniques) have provided evidence of brain activity when subjects face games (see V. Smith 2001). For instance, Sanfey *et al.* (2003) point out that responders in the Ultimatum game face a conflict between cognitive (accept the offer) and emotional (reject it) motives.[1] However, Knoch and Fehr (2007) stress that the role played by the main brain areas noted by Sanfey *et al.* (2003) is much more complex and needs further attention. Moreover, Rubinstein (forthcoming) considers that the use of these new techniques "*are expensive and speculative type of research*" (Rubinstein: 3). In contrast, he proposes the study of RT as a way of understanding cognitive processes in economics.

Rubinstein's recent paper explores differences between instinctive and cognitive reasoning in terms of RT. He use a huge amount of information recorded from subjects who played a number of games through Internet, without monetary rewards. His study shows how subjects decide upon strategies and the time they take in making their decision. His "*natural world*" experiment provides very valuable information with a number of examples where the theoretical prediction is not the most fast (instinctive) response.

This paper attempts to address whether what we learn about cognitive processes differs when monetary payoffs are used. In this sense, we pay attention to both debates: monetary incentives and cognitive processes. We explore the *effect of monetary incentives on response time.*

To do so, we use (in lab conditions) the most well known setting in Experimental Economics: the *Ultimatum Game* (Güth et al. 1982). Our data show that:

- Proposals are not significantly correlated with RT.
- Responders' behavior is positively and significantly correlated with RT, i.e., responders who took more time were more likely to state a higher minimum acceptable offer.

As a robustness test we check RT of proposers in a different setting: the Yes/No game[2] (see Gehrig et al. forthcoming). We do not find any significant correlation between offers and RT.

[1] See also the comment by Camerer (2003) in the same issue of *Science*.

[2] The Y/N game is a variation of the UG were responders are asked to accept or reject the proposal before knowing the size of the offer. Obviously all responders accept.

All in all, following Rubinstein (forthcoming), this paper shows that RT is an important variable that deserves much more attention.

2 Experimental design[3]

The analysis presented in this paper is based on data from an experimental study not designed to explore time responses. The time was just registered as a control variable. Therefore, we avoid any kind of "demand effect". The whole study comprised two different experimental games: the Ultimatum and the Yes/No game. We used a between-subject's design, hence, it is possible to analyze the results from each game independently. The main features of these sessions are presented below.

280 undergraduate students were recruited (from different disciplines) at Jena University, using ORSEE 2.0 (Greiner 2004). Nine experimental sessions were conducted, each using a different group of 32 participants (with the only exception of one of the Yes/No game's sessions that involved 24 participants). The experiment was programmed and conducted with the software z-Tree (Fischbacher 2007) at the computer laboratory of the Max Planck Institute of Economics (Jena, Germany). Table 1 reports the main features of the experiment.

Table 1: Experimental Features

	UG	YNG
N^o of sessions	5	4
N^o of participants	160	120
Date	06/21/07	
Treatment	Knowing the co-player's gender and place of birth	
Control variables	Own gender, own place of birth, and semester	
Method	Strategy method[4]	Standard
Average earnings	8.18€	8.73€

Before presenting our main results, it is worth noting that our dependent variables are: *i*) actual offers made by proposers in the Ultimatum Game, *ii*) responders' MAO, i.e., exactly the minimum offer that they accepted[5], and *iii*) proposals in the Yes/No Game.

[3] This is just a summary, the complete experimental procedure it is available upon request.

[4] For responders, the strategy method (Selten 1967) was used. Every responder had to accept or reject every single offer. The offers were presented in a continuum from the most generous offer (90 : 10) to the most unfair (10 : 90). The distribution was truncated to avoid the multiplicity of equilibria. Using this method, we can obtain the "minimum acceptable offer" (MAO), that is, the minimum amount of ECUs (experimental currency units) that the responder was willing to accept.

[5] Fortunately, no responder made a non-monotonic sequence of decisions and we can define one unique threshold for every second-mover.

3 Results

Table 1 below shows the analysis of RT. We use censored regression (Tobit) for the proposers' offer and the responders' MAO.

None of the sociodemographic variables are significant, with the only exception of gender for the proposers. Also the treatment variable is not significant.

The RT is not significant proposers in the Ultimatum game. However, we find a positive correlation between the minimum acceptable offer and the RT of the responders.

We find identical results for the Yes/No game: proposers' behavior is not related to RT. Since all responders accepted any offer we cannot explore differences among them.

Table 2: Estimations

	Proposers UG [Tobit]	MAO [Tobit]	Proposers Y/N [Tobit]
Decision time	*−0.047*	*0.503**	*0.211*
Gender unknown	4.008	2.349	−2.535
Gender proposer	−6.566**	−3.379	−13.810**
Gender responder	−0.021	−4.343	−4.326
Experience	−0.660	1.354	−1.993
Proposer origin	−3.553	−14.006	−20.895
Responder origin	0.922	1.661	−1.232
Constant	47.470*	−10.204	26.449**
$pseudo - R^2$	0.011	0.043	0.025
n	80	80	60

We use $*$ for $\alpha < 1\%$ and $**$ for $\alpha < 5\%$.

Only our data for proposers' decisions are strictly comparable to Rubinstein's, but not for the responders,[6] since in our experiment participants have to accept or reject nine different offers, including the one used by Rubinstein. In sharp contrast with his findings, we find that proposers' decisions are uncorrelated to RT whereas responders' behavior are.

4 Discussion and Extension: Types of subjects

In the following, we provide some conjectures about our main results: the no correlation between proposers' decisions and RT, and the positive correlation between responders' behavior and RT.

For the Proposer, the most simple explanation could be that they face a trade–off between "own" payoff and the fair distribution. Obviously the weight that different subjects give to the latter can be different.

[6] In Rubinstein's study, responder face a particular situation: they have to accept or reject the 10 : 90 (responder : proposer) offer.

Our conjecture is that individuals just propose the division they find optimal. This process seems to be less complex and then, we assume it is uncorrelated to RT. Figure 1 plots the RT of subjects ranked by their offers (along the horizontal axis).[7]

This figure illustrates why we do not find any significant difference in the regression.

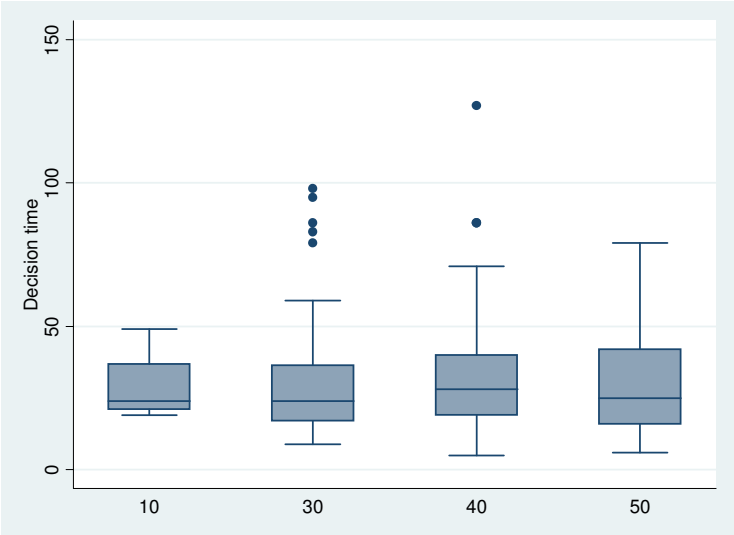

Figure 1: Types of Proposer and Time Response

This conjecture seems to be supported by the results obtained in the Yes/No game. Observe that no risk is attached to this game since acceptance/rejection is given. Table 2 does not show any RT effect for the Yes/No game. Thus, the only explanation is that subjects divide the pie in the manner they wish.

For the Responders the decision task involves much more complexity:

i) they are asked to accept or reject. However the task is not identical for all "types" of subjects: in fact, those endowed with selfish preferences would accept any positive amount, whereas fair–minded individuals need to evaluate every single offer.

ii) those fair-minded individuals would also consider the possibility of punishing unfair offers. The latter possibility makes no sense for any selfish individual.

[7] Proposals of 20:80, 60:40, 70:30 and 90:10 are not included since there are respectively 1, 1, 2 and 1 subjects in each case. In sharp contrast we found that the other proposals are much more common:

- 30:70 - 14 individuals
- 40:60 - 27 individuals
- 50:50 - 30 individuals

We also included the 10:90 (with only 4 individuals) because this is the theoretical prediction.

Thus, we expect that fair–minded responders take more time to make their accept/reject decision.

To explore this conjecture, we first show the complete distribution of MAO's:

- $MAO = 10$ (38 subjects).
- $MAO = 20$ (2 subjects).
- $MAO = 30$ (23 subject).
- $MAO = 40$ (15 subjects).
- $MAO = 50$ (2 subjects).

Figure 2 shows the boxplots for each case. We have only considered the three larger groups, that is, we have not included the two subjects who state a $MAO = 20$ (time = 62 and 70 respectively) and those who state a $MAO = 50$ (time = 42 and 53 respectively).

Results are clear: *those subjects who accepted the minimal offer did not take too much time in making the decision and also the variance seems to be lower.*

On the contrary, *fair*-minded subjects (who asked for a $MAO = 30, 40$) *needed much more time to make the (negative) final decision.*

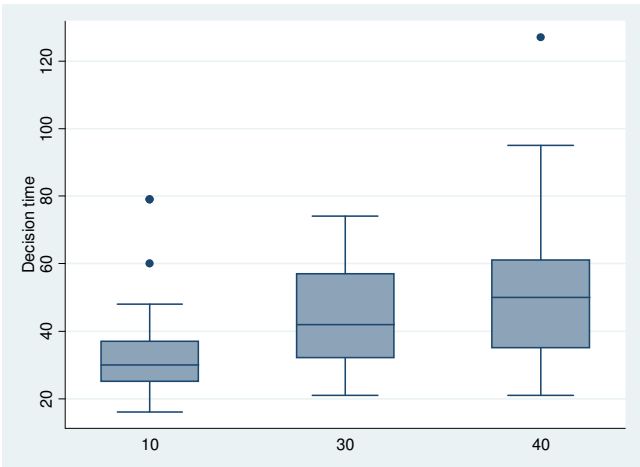

Figure 2: Types of Responders and Time Response

Responders' behavior is much simpler in the Y/N game. They are not required to define any threshold about fairness. They are only asked to accept or reject whatever the offer.

Consequently, responders in the Y/N game take significantly less time than responders in the UG ($Z_{Mann-Whitney} = 9.416; p < 0.001$). Hence, the definition of the threshold (by responders) makes a difference.

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