Introduction to Neuro-economics Paper Presentation

Pratham Gupta(2020101080) • Siddh Jain(2020101082)
[Team-money matters]

Time as a medium of reward in three social preference experiments

Charles N. Noussair • Jan Stoop
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Introduction and motivation of study

- The researchers are essentially trying to understand how does the value of two most essential resources in an economic system, i.e. money and time compare to each other.
- The paper uses time, rather than money, as the salient component of subjects' incentives in three workhorse experimental paradigms, namely dictator game, the ultimatum game and the trust game. Decisions that are associated with greater own payoff translate into the right to depart earlier.
- The use of waiting time can be interpreted as a special type of real effort condition, in which it is particularly straightforward to achieve experimental control over incentives. All subjects in a session earn the same participation fee, but their choices affect the time at which they are permitted to leave the laboratory.

Experiment Design

There are three games: a dictator game, an ultimatum game and a trust game. Each subject played only one of the three games. The experiment consisted of two waves. In the first wave, subjects played one of the three games with time as a medium of reward in a one-shot setting. In the second wave, conducted a year later, participants played one of the three games once for monetary payments. Immediately thereafter, they played the same game one more time, in the same role, with time as the reward medium.

Treatment	Obs.	Show-up fee
Dictator game, 30 min (DG30)	31	7
Dictator game, 60 min (DG60)	30	14
Ultimatum game, 30 min (UG30)	30	7
Ultimatum game, 60 min (UG60)	28	14
Trust game, 30 min (TG30)	26	7
Trust game, 60 min (TG60)	30	14
Dictator game, € 10 and 60 min (DG € 10–60)	32	14
Ultimatum game, € 10 and 60 min (UG € 10–60)	30	14
Trust game, € 10 and 60 min (TG€10–60)	29	14

The Dictator game

In the dictator game sessions, one half of the subjects were randomly designated with the role of proposer, and the other half with the role of responder. Proposers and responders were paired randomly. Individuals were never informed of the identity of the player they were matched with. In games played for monetary stakes, the proposers made a proposal about how to divide € 10. In games played for time, the proposer made an offer about how long each member of the pair had to wait in her cubicle. The proposal was then implemented. The total waiting time of the two players was required to sum to either thirty or 60 min, depending on the treatment.

The Ultimatum game

In the ultimatum game sessions, one half of the subjects were randomly assigned to be proposers, and the other half were responders. In the games played for money, the proposer had to make a proposal about how to divide € 10. In those played for time, the proposal indicated how long, out of the total of thirty (in UG30) or sixty (in UG60) minutes each member of the pair had to wait in his or her cubicle. The responder then received the proposal and had the opportunity to accept or reject it. Acceptance of the proposal meant that the division of the proposer was carried out. A rejection meant that both the proposer and the responder received € 0 in games played for money. In games played for time, a rejection meant that both players had to wait for 30 (in UG30) or 60 (in UG60) minutes.

The Trust game

In the trust games played for time, each subject was randomly given the role of either proposer or responder, and each proposer was randomly paired with a responder. Initially, the proposer and the responder each faced the prospect of waiting for either 30 (in TG30) or 60 (in TG60) minutes. The proposer could choose to stay longer than this baseline length of time. In the TG30 treatment, proposers could choose to stay longer up to a maximum of 10 min beyond the baseline duration. This maximum was 20 min in the TG60 treatment. For each minute that the proposer agreed to stay longer, the responder could leave 3 min earlier. The responder, after receiving the decision of the proposer she was matched with, could then choose to stay longer than her current requirement, which was equal to the baseline amount minus three times the gift she received from the proposer. For each minute that the responder chose to stay longer, the proposer could leave one minute earlier. A responder could not choose to return more minutes than he gained from the earlier transfer from the proposer.

In the trust games played for money, each subject was randomly given the role of either proposer or responder, and each proposer was paired with a responder. The proposer was given an endowment of € 10 and could send any part of it to the responder. Each euro that the proposer sent, yielded three euros to the recipient. After observing the choice of the proposer, the responder could decide to send money back. Each one euro that was returned by the recipient yielded one euro to the proposer.

Results
Comparing stakes
(after wave 1)

Result 1: There are no stake effects in the dictator and ultimatum games played for waiting time.

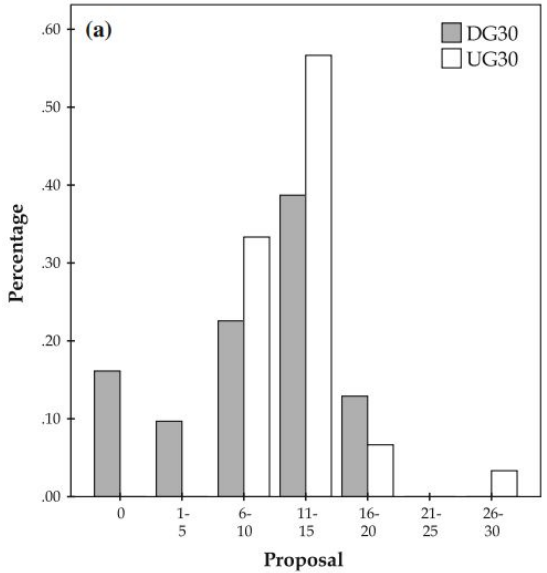
It is given by a Mann-Whitney test, taking each subject's decision as an independent observation. Observations are divided by the maximum proposal possible, to make the two treatments comparable. Comparing DG30 with DG60, we find no significant difference in minutes proposed by the proposer (N1 = 31, N2 = 30, p = 0.18). Similarly, comparing UG30 with UG60, we find no significant difference between minutes proposed (N1 = 30, N2 = 28, p = 0.19).

Table 2 Average, median, and mode of proposals in the dictator (DG30 and DG60), and ultimatum games (UG30 and UG60)

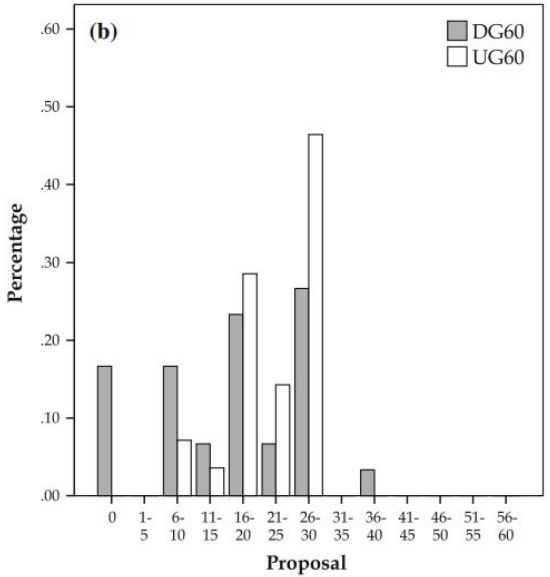
	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
DG30	31	37	50	50
DG60	30	31	33	50
UG30	30	46	50	50
UG60	28	40	42	50

Result 2: Proposals are significantly smaller in DG60 than in UG60. However, there is no significant difference in proposals between DG30 and UG30.

A Mann-Whitney test, taking one proposer's decision as an independent observation, shows an insignificant difference in the 30 min treatments between the two games (N1 = 31, N2 = 30, p = 0.26). However, there is a significant difference between the two games in the 60-min conditions (N1 = 30, N2 = 28, p = 0.05).



a. Histogram of proposals made in DG30 and UG30.



b. Histogram of proposals in DG60 and UG60

Result 3: Proposers in TG30 propose relatively more of their endowment than proposers in TG60, but responders in TG30 return relatively less of their endowment than responders in TG60.

A Mann-Whitney test, taking each individual decision as an independent observation, establishes that the behavior of proposers is marginally significantly different between TG30 and TG60 ($N1 = 26$, $N2 = 30$, $p = 0.10$), with proposers proposing a greater share under TG30. Responders in TG30 give back less of their endowment than responders in TG60 ($N1 = 19$, $N2 = 24$, $p = 0.09$).

Table 3 Summary of the data in the trust game treatments (TG30 and TG60)

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
TG30 (proposers)	26	40	50	50
TG30 (responder)	26	93	100	100
TG60 (proposers)	30	30	25	25
TG60 (responders)	30	142	200	200

Result 4: Responders in TG60 behave reciprocally. The more minutes they receive, the more minutes they give back. There is no evidence of reciprocal behavior in TG30.

The Pearson's correlation coefficient between amount sent and amount returned is 0.18 in TG30 (N = 19, p = 0.46). This coefficient is 0.82 in TG60 (N = 24, p = 0.01). The Pearson's correlation coefficient between the amount sent and percentage of the maximum possible amount that is returned is 0.15 (N = 19, p = 0.54). In TG60, this coefficient is equal to 0.10 (N = 24, p = 0.65)

Table 3 Summary of the data in the trust game treatments (TG30 and TG60)

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
TG30 (proposers)	26	40	50	50
TG30 (responder)	26	93	100	100
TG60 (proposers)	30	30	25	25
TG60 (responders)	30	142	200	200

Results

Comparing money with time

(after wave 2)

Result 5: There is no order effect in any of the three games. Playing the dictator game, ultimatum game, or trust game for money prior to playing the games for waiting time does not affect the allocation decisions over waiting time.

A series of Mann-Whitney tests shows that proposer behavior in the first wave is no different than behavior in the second part of the sessions of the second wave. Comparing average time proposals in DG60 to the time proposals of DG€10–60 yields a p value of 0.27 (N1 = 30, N2 = 32). Average time proposals in UG60 are no different than average time proposals in UG€10–60 (N1 = 28, N2 = 30, p = 0.57). Average time proposals in the trust game are similar in TG60 and TG€10–60 (N1 = 30, N2 = 29, p = 0.16). Similarly, the average recipient sends back the same amount of minutes in TG60 and TG€10–60 (N1 = 24, N2 = 17, p = 0.22).

Table 4 Average, median, and mode of proposer's proposals in the Dictator Games (DG€10–60), Ultimatum Games (UG€10–60), and Trust Games (TG€10–60)

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
DG€10–60				
Money	32	34	33	50
Time	32	35	33	50
UG€10–60				
Money	30	40	40	50
Time	30	42	46	50
TG€10–60, proposers				
Money	29	31	30	0
Time	29	22	25	0
TG€10–60, responders				
Money	29	49	0	0
Time	29	108	100	0

Result 6: In the dictator game, subjects propose an equal share of the total endowment when the game is played for € 10 or for 60 min.

The proposal as a percentage of the maximum possible is taken as the unit of observation. A Wilcoxon-test, comparing the same subject's decisions over money and waiting time in the DG€10–60 treatment, shows no significant difference (N1 = N2 = 32, p = 0.36). Furthermore, comparing the time proposals of subjects in DG60 to the money proposals of the subjects in DG€10–60 shows a p value of 0.61 (Mann-Whitney test, N1 = 30, N2 = 32).

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
DG€10–60				
Money	32	34	33	50
Time	32	35	33	50

Result 7: In the ultimatum game, subjects propose an equal share of the endowment when the game is played for € 10 or for 60 min.

Again, a proposal as a percentage of the maximum feasible proposal is the unit of observation. A Wilcoxon-test, comparing the same subject's proposal over money and time in the UG€10–60 treatment, yields no significant difference (N1 = N2 = 30, p = 0.21). Alternatively, comparing the time proposals of subjects in UG60 to the money proposals of the subjects in UG€10–60 shows a p value of 0.66 (Mann-Whitney test, N1 = 30, N2 = 32).

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
UG€10–60				
Money	30	40	40	50
Time	30	42	46	50

Result 8: In the trust game, proposer behavior is not significantly different when the game is played for € 10 or for 60 min

A Wilcoxon-test, comparing the same proposer's proposal over money and time in the TG€10–60 treatment, shows no significant difference (N1 = N2 = 29, p = 0.40). Alternatively, comparing the time proposals of proposers in TG60 to the money proposals of the proposers in TG€10–60 results in a p-value of 0.90 (Mann-Whitney test, N1 = 30, N2 = 29).

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
TG€10–60, proposers				
Money	29	31	30	0
Time	29	22	25	0

Result 9: In the trust game, we find mixed results on responder behavior when the game is played for € 10 or for 60 min.

The average amount returned as a percentage of the maximum feasible given the prior transfer received is taken as a unit of observation. A Wilcoxon-test, comparing the same responder's decision over money and time in the TG€10–60 treatment, shows no significant difference (N1 = N2 = 12, p = 0.33).5 However, comparing the time proposals of responders in TG60 to the money proposals of the responders in TG€10–60 shows a significantly larger percentage returned for waiting time (Mann-Whitney test, p=0:01, N1 = 22, N2 = 24).

	Obs.	Average (% of endowment)	Median (% of endowment)	Mode (% of endowment)
TG€10–60, responders				
Money	29	49	0	0
Time	29	108	100	0

Conclusions

1. They **do not find any significant effects of stake size** in either the ultimatum or the dictator games. ***[R1]***
2. Social preferences, in the forms of **altruism**, and positive as well as negative **reciprocity**, are apparent. ***[R2, R3]***
3. Subjects exhibit a considerable degree of **trust**, sending 30 percent of their endowment to the responder on average, and trustees tend to reciprocate generous transfers. ***[R4]***
4. Perception on time and money as a reward is similar **but independent as one does not anchor another**. ***[R5]***
5. Methodology of inducing incentives with monetary payments yield results that are robust to a different reward medium. Overall, **behavior in the games played for time exhibits the same broad patterns that are present when they are played for money**. (The results suggest that the same could be true for other reward media. Once one accepts the assumption that the particular paradigms we have studied measure social preferences, then the results indicate that social preferences have some stability across reward media, at least in terms of median and modal behavior.) ***[R6, R7, R8]***

Other conclusions:

1. Average proposals in ultimatum and dictator games are much greater than zero, reaching 40 and 31 percent of endowment in the two games respectively which contradicts classical RCT.
2. The modal proposal in both the dictator and ultimatum games is an equal split of the waiting time. In the trust game, there is substantial trust and reciprocity.

Limitations and Future work

- There are a few differences between time and money that may be an inevitable consequence of making a large number of comparisons.
- Under low stakes, the trust game does not generate reciprocal behavior. Further research is required to establish whether these results hold up with replication.
- The focus is on one-shot games here, and these results may or may not apply to repeated interaction.

Future Work:

The games we have studied are characterized by distinctive patterns of dynamic behavior when they are repeated under monetary incentives. In the ultimatum game, for example, *Cooper and Dutcher (2011)* document that small proposals are rejected more often as subjects gain more experience, while relatively large proposals are rejected less frequently. It remains to be seen whether such subtle patterns would also be observed when waiting time is at stake.

Thank you

Pratham Gupta(2020101080) • Siddh jain(2020101082)

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