When Senior Sophister Played the Ultimatum Game: Investigating the Theory of Rational Choice

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Senior Sophister

A core assumption in many economic models is that humans are rational and seek only to maximise personal utility. In this paper, through the prism of the Ultimatum Game, Iain Snoddy et al examine this assumption and find that it breaks down among Senior Sophister students, coming to the conclusion that what we truly care for is perhaps slightly more complex.

Introduction

This paper attempts to determine whether Senior Sophister economics students adhere to the concept of the rational utility maximizer. To answer this question we played the Ultimatum Game with a subset of our Senior Sophister Economic Theory class. In the first section, literature regarding the Ultimatum Game is reviewed. The second section explains our experimental methodology and in the third section some selected results are presented. The final section shall contain some concluding remarks.

Background and Literature Review

The Ultimatum Game is just one example of an extensive game with perfect information. It is closely related to the Dictator Game and differs only in that it incorporates a sequential element; unlike the dictator game the second player is not passive but can respond to the action of player one. The most basic form of the Ultimatum Game is played out between two participants, player one and player two. Player one is given an initial sum of money and is told to divide this sum between himself and player two where player two may be anonymous or non-anonymous, depending on the structure of the game. On receiving this

proposal from player one, player two must decide whether to accept or reject the offer. The key feature of the ultimatum game is as follows: if player two accepts the offer, the sum is divided between the players according to the proposal of player one, but if player two rejects the offer both players receive nothing.

Given the sequential structure of the Ultimatum Game, the concept of a Nash Equilibrium is not robust and rather the concept of a subgame perfect equilibrium is used to determine the static equilibrium of the game. The subgame perfect equilibrium is defined as "a strategy profile with the property that in no subgame can any player i do better by choosing a strategy different from [it], given that every other player j adheres to" (Osborne, 2004:165). In the ultimatum game with indivisible units[1], there exist two perfect subgame equilibria. The first occurs where player two accepts all offers made by player one, and as a result player one offers 0. The second is found when player two accepts all offers from player one except 0 and as a result player one will offer the smallest possible amount to player two. If player two is acting rationally they would accept this amount no matter how small as to reject it would lead to a payoff of 0 (Thaler, 1988). These are the equilibrium results we would expect if both players adhere to the theory of rational choice. However, experimental evidence finds that the subgame perfect equilibrium is seldom found in practice. The first experimental study of the Ultimatum Game was conducted at the University of Cologne by Güth, Schmittberger and Schwarze (1982). The game they conducted was a relatively simple Ultimatum Game played with a small sample of university students (n=21) with various sums between 4 and 10 DM given to player 1 for division. The authors found that the mean offer of player one amounted to 37% of the initial sum while the modal division was an equal part split of 50%.

A more rigorous experiment was conducted by Kahneman, Knetsch and Thaler (1986). In this paper students not only played a simple version of the Ultimatum Game, but they were also asked which allocations of the sum of $10 they would consider a fair offer, with the value changing in 50c increments. A sample of 115 students was used in this game with the authors taking careful steps to ensure all participants fully understood the rules of the game. They found that the mean offer of player one ranged from $4.21 to $4.76, while the mean minimum acceptable offer ranged from $2.00 to $2.59 (1986). The authors extended the Ultimatum Game in a subsequent experiment. In this experiment if player 2 rejected the initial offer she would become the proposer in another game. Player 2 would then be given two choices; either allocate $10 equally between herself and a fair allocator (some-

1 This means the initial sum given to player one is not infinitely divisible. For example, the smallest possible unit of €10 is €0.01. This sum cannot be further divided.

one who offered $10 out of $20 in round 1) or divide $12 equally between herself and to an unfair allocator in round 1. In this round 74% of participants opted to divide $10 with the fair allocator at a personal cost of $1, in other words participants were willing to 'pay to punish' unfairness (1986).

Further experiments have made great alterations to the Ultimatum Game but have found much the same result: people typically do not act in accordance with the theory of rational choice. An experiment conducted by Ochs and Roth (1989) extended the simple Ultimatum Game to be played over multiple stages. If player two rejected the offer made by player one, then the game would be replayed with player 2 acting as the proposer, but with the initial sum to be allocated diminished. Again they found that participants failed to act in the most rational manner as player 2 often made 'disadvantageous counter-proposals' where they kept less in round two than they were offered by player one in the first round (1989). We shall now turn to an explanation of the methodology used to conduct our in-class experiment of the Ultimatum Game.

Methodology

In our experimental analysis we conducted 4 separate rounds of the Ultimatum Game, with slight alterations in the game structure between each round.

Round 1: In round one each player was given a playing slip and told he had an initial sum of €10 to divide between himself and player two, where player two would be randomly assigned. The anonymity of the game was emphasised. All offers were then collected and randomly distributed back to the class so that each player both made an offer as player one, and then received an offer as player two. As player two, the participants now had the option to accept or reject the offer. At this point the rules of the Ultimatum Game were strongly emphasised: if player two accepts the offer, the sum is divided between the players according to the proposal of player one, but if player two rejects the offer both players receive nothing.

Round 2: The game played in round 2 was exactly the same as that conducted in round 1. However, between rounds the results of round 1 were put into a Microsoft excel spreadsheet and shown to the class. The spreadsheet showed the average offer made, the numbers of accepted and rejected offers, the frequency of offers made and the conditional rejection frequency amongst other information. A game was also selected at random and a real payoff (delicious chocolate eggs) was made to the two participants. All of this was done to show players the results of their actions and to increase their knowledge of the game's structure.

Round 3: This round was played non-anonymously. Player one was

given a play slip and told to write down their name, assigned number and favourite colour. They then has to pass their form to the player on their immediate left; this player would now act as player one and divide the initial sum of €10. Player one in this case now knows the name of the player to whom they are making an offer, and some trivial information regarding the player. Player one was instructed to make an offer and also to write their name and assigned number on the play slip. The play slips were now passed back to player two who decided whether to accept or reject the offer. Note that player two now also knows the name of the person making the offer.

Round 4: The game in this round was not only played non-anonymously but was also conducted in public. In this case we paired players and assigned them as player one and player two. Those playing the game were then instructed to stand and face each other and play the game as before, with player one instructed to make an offer and player two deciding whether to accept or reject the offer.

It is important to note that, before and during each round, the rules of the game were stressed to participants, namely that if player two accepts the offer, the sum is divided between the players according to the proposal of player one, but if player two rejects the offer both players receive nothing.

Experimental Results

General Results

In looking at the initial results presented in Table 1 below it is already clear that the participants in our experiment did not act in accordance with the theory of rational choice. The most common offer in all rounds was a 50-50 split of the €10. Furthermore, the lowest average offer in any round was €3.80, made in rounds 1 and 2; this is a far cry from the €1 offer we would expect to see, given completely rational actors. We would also expect to see all positive offers accepted by player 2, as a rejected offer leads to a zero payoff. However, our experiment also fails to observe this result: the lowest average rejected offer in any round was €2.10, suggesting that responders typically rejected small but positive offers.

Observing the pattern of the results presented in Table 1 is also interesting. It suggests that not only are all offers significantly greater than the rational optimum, but that offers, on average, increased in the non-anonymous game and increased even further in the publicly played non-anonymous game in round 4. In fact in round 4 the average offer was greater than a perfectly equal 50-50 split. The average rejected offer also increased in the non-anonymous game. This result is interesting as it suggests that when some detail is known about the proposer, player 2 expects the offer to be more eq-

uitable. The large difference between round 3 and round 4 further suggests that players expect individuals whom they have seen and with whom they have interacted verbally to act much more generously and are indeed willing to 'punish' those individuals more severely through rejecting the offer.

Table 1: Overview of Results

	Round 1	Round 2	Round 3	Round 4
Average Offer	3.8	3.8	4.8	5.1
Modal Offer	5.0	5.0	5.0	5.0
Average Rejected Offer	2.3	2.1	2.6	3.8

Figure 1 presents the frequency of offers made in each round. What is most noticeable is the relative lack of very low offers and of very high offers. When the shift is made from anonymous to non-anonymous there is a huge jump in what we may call 'ludicrously irrational' offers, those greater than a 50-50 payoff of €5. In all rounds there is sufficient proof to suggest that our Senior Sophister economics class are motivated by factors other than rational utility maximisation as only 10% of students chose the rational option of 1 in rounds 1 and 3, and only 5% acted rationally in rounds 2 and 4. Turning to the actions of player 2, Table 2 shows the frequency with which offers were rejected in each round. Typically low offers were rejected, with offers of 1 being rejected in all rounds, and 2 being rejected in all rounds except round 1. Surprisingly, all offers of 0 were accepted in round 3, although this accounts for only one observation. Conversely, few 50-50 allocations were rejected with only 14% rejecting 50-50 divisions in round 3, while such divisions were accepted on all occasions in the remaining rounds. The rather high rejection rate observed for an offer of 4 in all rounds is interesting, and suggests that many participants consider an offer of 5 as the sole equitable possibility.

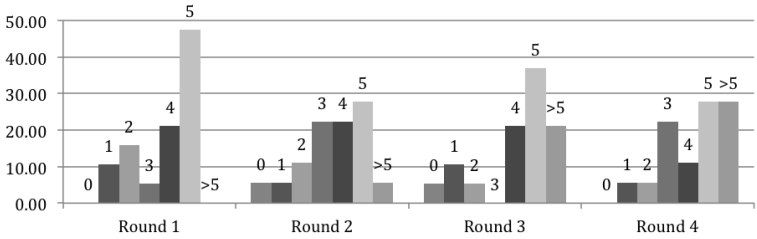
Table 2: Conditional Rejection Frequencies

Offer	Round 1	Round 2	Round 3	Round 4
0	*	100	0	*
1	100	100	100	100
2	67	100	100	100
3	0	50	*	50
4	50	25	25	50

5	0	0	14	0
>5	*	0	0	20

*No offers were made at this value

Diagram 1: Offer Frequencies



Given these descriptive results, it is clear thus far that Senior Sophister economics students are not representative of Homo Economicus; they fail to adhere to the theory of rational choice. In the case of player 1 (the proposer), offers are significantly greater than the optimal offer of 1. Similar conclusions can be made about participants in the role of player 2 (the responder) as non-zero offers are frequently rejected. As such it must be concluded that these participants are concerned with factors other than utility maximisation. One such factor may be distributional fairness (Thaler, 1988). In particular individuals may feel it is unfair to keep most of a sum that they did nothing to earn. Similarly students may feel they ought to punish individuals who keep a large portion of this sum for themselves. Asking proposers to allocate a sum for which they have exerted effort could therefore greatly change the results of the game. A further explanation is that proposers are neither altruistic nor concerned about fairness, but rather they have a 'fear of rejection' and so make offers that are typically much higher than what is rationally optimal. As explained by Thaler (1988), a proposer may fear rejection if she does not believe in the rationality of other participants: she does not believe that other participants will realise that accepting all non-zero offers is their optimal action.

Selected Results

By using data gathered on participants we were able to make some further statistical observations. As is shown in Figure 2 there is very little variation in the average offer made by different gender groups. Both groupings offered results much higher than would be expected under assumptions of perfect rationality. Figure 3, however, shows that on average, males were more likely

to accept a low offer than were females, suggesting perhaps that females have a heightened sense of fairness.

Diagram 2: Average Offer Made by Gender

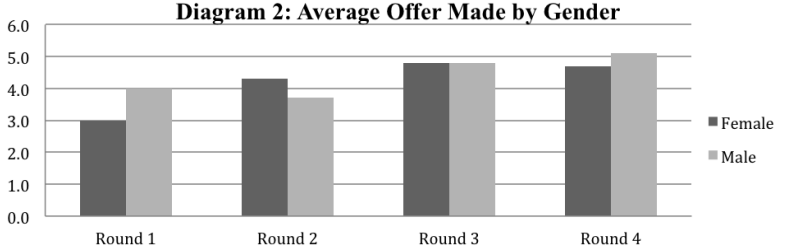
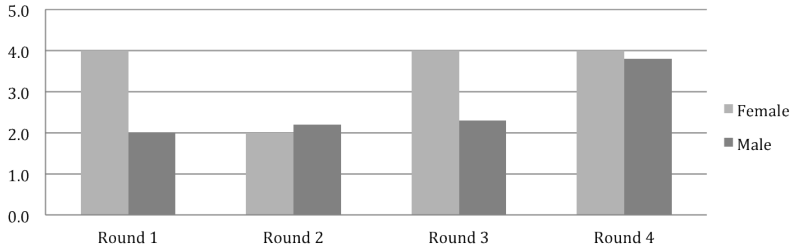


Diagram 3: Average Offer Rejected by Gender



Looking at Figures 4 and 5, we can also observe the difference between the actions of students studying single honours economics, and those taking economics as part of a joint degree. Perhaps surprisingly, single honours economics students offered higher amounts on average in each round. In could therefore be concluded that joint honours economics students are more likely to act as rational optimisers than are single honours students[2]. Figure 5, however, calls this result into question as joint honours students reject higher offers than do single honours students. Nevertheless, the variation in the actions of both groups is very slight, and as a result no firm conclusions can be drawn. What is most perplexing is the observed trend reversal found in round 4 in both diagrams.

2 One cannot but wonder if this greater rationality influenced their choice of joint rather than single honours economics.

Diagram 4: Average Offer Made by Degree Programme

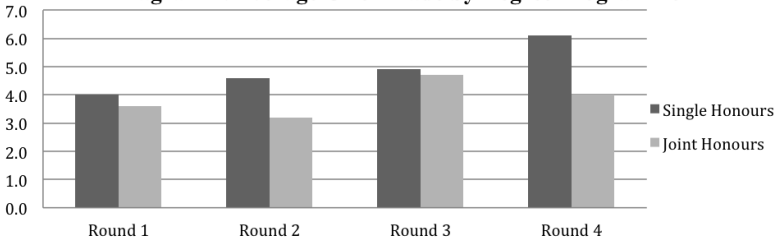
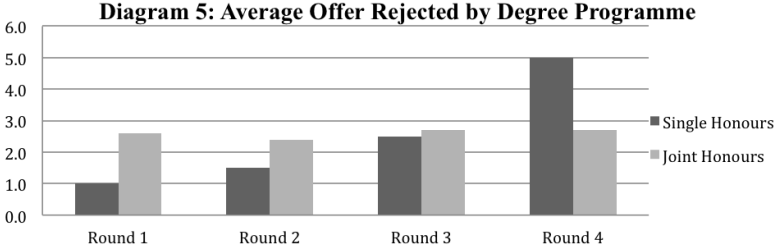


Diagram 5: Average Offer Rejected by Degree Programme



Conclusion

In conducting a relatively simple experiment using the Ultimatum Game we have found that our Senior Sophister class of economic students do not readily adhere to the theory of rational choice. This result is supported by various other experiments using the Ultimatum game, found in the economic literature. Our finding that Senior Sophister economic students care about factors other than rational utility maximisation will come as a surprise to some, and a relief to many.

References

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