

Is monetary gain the only motivation? Evidence from Diner`s dilemma experiment

Ekaterina Zhukova

February 2010

katerinazhukova@hotmail.com

Abstract: The majority of societal problems arise as it is in a human nature to assign higher priority to own interests than to interests of the others. Economic theory predicts agents to behave maximizing in most situations, being followed by rational and selfish motives. Theory claims economic agents don't take into account interests of the others and expect them to do the same. But is monetary gain the only thing that matters in practice? Numerous experiments and field studies show that it is not always the case: facing a choice between selfish behavior and socially desirable altruism, some agents do choose the last. The research presented in this paper also explores one of the social dilemmas, namely Diner`s dilemma, with a purpose to find evidence against theories based purely on selfish motives and find condition under which participants would cooperate with higher probability.

Professor: Dr. Graf Lambsdorff

Dozent: Manuel Schubert

“Social dilemmas are situations in which individual rationality leads to collective irrationality. That is, individually reasonable behavior leads to a situation in which everyone is worse off than they might have been...”¹

In the recent years there has been substantial interest in determining why there is cooperation in experiments with non-contribution as dominant strategy even in environments that provide all subjects with the incentive to free ride. In such experiments subjects are sensitive to free riding incentives, but nonetheless cooperate at a level that cannot be fully explained by mainstream economic theory. Theories are used to explain such cooperation either by the proposal that subjects are "confused" in the sense that they make errors or do not understand the game's incentives, or that subjects contribute due to social factors such as altruism, reciprocity or fairness.

The experiment presented in this paper, which is called the Unscrupulous Diner's Dilemma, also involves inefficient levels of consumption when externalities are involved. This situation typifies a class of serious, difficult problems that pervade society. Sociologists, economists and political scientists find that this class of social dilemma is central to a wide range of issues, such as protecting the environment, conserving natural resources, eliciting donations to charity. All these issues involve goals that demand collective effort and cooperation. That is why it is most important to find out what does influence human behavior in our self-maximizing world.

1. Underlying economic theory

In order to find evidence against theories based purely on selfish motives and try to find condition under which participants would cooperate with higher probability, it was decided to test social behavior during Dinner's dilemma experiment. In game theory Diner's dilemma is an n-player Prisoner's dilemma, which is a fundamental problem that demonstrates why two people might not cooperate even if collusion is in both their best interests. The Prisoner's dilemma was originally framed by Merrill Flood and Melvin Dresher in 1950.

The unscrupulous diner's dilemma is a problem faced frequently in social settings. The situation imagined is the following: several individuals go out to eat, prior to ordering they agree to split the check equally between all of them. Each individual must now choose whether to order a cheap or expensive dish.

It is presupposed that the expensive dish is better than the cheaper, but not by enough to warrant paying the difference compared to eating alone. Rational player decides for a cheaper food paying individually, because the joy of eating the cheap meal (b) is higher than its cost (l). And joy of eating the expensive food (g) is lower than its cost (h): $h > g > b > l$.

The dilemma appears in case the bill is divided evenly after a dinner. Under these conditions players can feel the intention to free ride, a selfish diner immediately realizes the possibility to enjoy exceptional dinner at bargain price. So what to do you do, to cooperate or not to cooperate? This simple question (and the implicit question of whether to trust, or not), expressed in an extremely simple game, is a crucial issue across a broad range of life.

Whereas a naive approach would suggest that this problem is not likely to be hard to solve, it appears that even the best of friends can sometimes find it rather severe.

Individual rationality suggests a player cheats and breaks the invisible agreement. In fact, each player knows the other player has an incentive to cheat. But even though neither player knows for sure that the other players will play as agreed, group rationality suggests they cooperate.

Economic theory predicts that the most probable scenario is the following: each individual reasons that the expense they add to their bill by ordering the more expensive item is very small,

¹ Peter Kollock. "Social dilemmas: the anatomy of cooperation."

and thus the improved dining experience is worth the money. However, every individual reasons this way and they all end up paying for the cost of the more expensive meal, which is worse for everyone than ordering and paying for the cheaper meal.

Individuals are said to cooperate if they choose a cheap meal, they defect if expensive. The possible payoff for an n-player experiment is highest if a player defects while the others cooperate, second highest – if all players cooperate, third highest – if all defect. The payoff is lowest if the player cooperates while the others defect.

This proves the expensive meal is strictly dominant and thus the unique Nash equilibrium, but is Pareto dominated than mutual cooperation.

2. Prior experimental evidence

Uri Gneezy, Ernan Haruvy and Hadas Yafe tested these results in a field experiment in 2004. They have observed several groups of diners, who have faced different billing arrangements in groups of six.

Their restaurant findings were consistent with the predictions of economic theory that prescribes consumption to be smallest when the payment is individually made, and largest when the meal is free, with the even split treatment in-between the other two. As predicted, subjects tended to order more expensive, when the bill is split equally than when they have to pay individually, minimizing their individual losses by taking advantage of others, thus resulting in a substantial loss of efficiency.

Average cost of the meal in individual pay game was equal 37.3 Euros, in an even split game – 50.9, in case of a free meal 82.3.

As only a few diner`s dilemma experiments were held, it was decided to conduct the experiment for another time. In order to find evidence against theories prescribing that economic agents don`t take into account the interests of the others, another treatment had been created.

In the two studied treatments, “individual” and “even-split”, the decision to take a cheap item is influenced by the fact that the end-amount will be lower, than if an expensive item is taken. It is true, as the amount a participant pays at the end depends on the decision of the others (in the even-split case), but on his decision also.

In order to avoid such influences another game variation was created, where the end amount doesn`t depend on participant`s decision at all, only on the decision of his colleague, who sits on the right-hand side from him. It is presupposed that the only possible reason for the participant to take a cheap food in this situation is not monetary.

3. Hypotheses

Economic theory predicts individual behaves rationally maximizing. According to this proposition several hypotheses had been made, such as the majority will take cheap food if pay individually afterwards. In case the bill is divided evenly, most of them will tend to take an expensive food. If the dish is paid by the one sitting from the right-hand side, the consumption will be the highest, as the amount participant pays at the end does not depend on his decision at all. That is why economic theory would predict: Individual pay<Even-split pay<Chain pay.

The idea of the experiment is to find out if non-monetary factors such as personal feelings influence an economic agent by making his decision. That is why the hypothesis is the following: Individual pay<Chain pay<Even-split pay. The condition, in which participant`s bill will be paid by his Lefty, provides the additional reason for a player to reveal his feelings, as he knows, he can hurt his neighbor more severe, making him pay higher price than he deserves.

Let us assume maximizing payoff players are influences by personal feelings: sympathy if trusting (believing he will cooperate) and antipathy if not.

Depending on these feelings players would chose particular strategies in the Chain pay case: if player trusts Lefty and Righty – he chooses cheap meal, all players are better off if his feelings are correct.

If he trusts Lefty, but doesn't trust Righty, who he pays for – he chooses expensive meal, if his monetary gain is more important for him, than the Lefty's monetary loss. He chooses cheap, if his sympathy to Lefty and desire not to hurt him is higher than his antipathy to Righty and/or his monetary gain.

In case he doesn't trust Lefty, he chooses expensive, and everyone loses.

4. Design and procedure

The experiment was held in two days (14.01, 20.01), four sessions. The participants were students of different major and age, most of whom were not familiar with game theory. The game was played together with two other experiments in a computer room of the university. All three experimenters were available for the questions during the experiment.

Subjects were recruited through invitations sent in social network, which ensured a sufficient amount for a 15-minute experiment. Players were asked to show up at a specific time.

Before the experiment had started, participants were informed about the general behavioral guidelines, such as to raise the hand in case of a question and not to communication. Players were told about their anonymity (within three-person groups participants did not know, whom exactly they are playing with) and that the game will be played only once.

Participants played one of two treatments. 15 players took part in an Even-split treatment, 36 – played a Chain-pay treatment. At the end of each treatment participants were asked, how they would behave in case paying individually.

Except providing players with examples in the second treatment, the two treatments differed only in the payment mechanism specified in the instructions: in the individual payment case, subjects were told they would pay for their own meal. In the even split treatment, they were informed the bill will be evenly split between the three of them. In the Chain-pay treatment subjects knew they will not have to pay for themselves, but for the one, sitting from the right-hand side.

4.1. Game explanation. Even-split treatment

In the first treatment of the game participants were placed in a situation, where they had to order either expensive or cheap meal and divide their bill evenly after a dinner. Players were to read the following instructions:

“Dear Participant, imagine you and two of your colleagues² are dining at a fine restaurant. Prior to ordering you agree to split the check equally afterwards. You have two possibilities: to choose an expensive meal or a cheap one. The price of a cheap meal is 8 Euros; the joy of it equals 10 Euros. The price of an expensive meal is 15 Euros; the joy of it equals 13 Euros³. Your

² Participants were said to play with colleagues, not strangers or friends. This difference is critical since with friends the game is repeated. (Nevertheless, one would expect some waste to result even among friends, since monitoring and punishment are imperfect.) As players would not have any particular emotions to strangers, it was also not assumed to be the best option. Colleagues seemed to be a better choice, as one can have different attitude to each of them.

³ In the experiment the price of eating a cheap meal equals 8, whereas the price of eating the expensive one is 15. In case everyone orders the expensive meal each of the diners pays 15 and his total utility is $13 - 15 < 0$. On the other hand if all diners order the cheap meal, the utility of each of them would be $10 - 8 > 0$. So everyone is worse off by playing the unique equilibrium than they would have been if they collectively pursued another strategy.

payoff will be calculated as your joy minus price you pay, which is 1/3 of the total sum. All of you order simultaneously and have no possibility to communicate.”

Then a player was asked to make a proposal and choose what he/she thinks other participants will order. He/she was asked to choose one out of the three possible options: 1) both players will take a cheap meal; 2) both take expensive; 3) one player will choose a cheap dish, another – expensive.

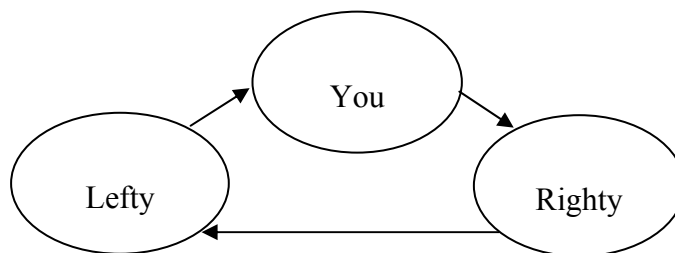
The way participants predicted was important for analysis of their decisions, as the way players feel about others depends on how they expect to be treated.⁴ That is why it was not then surprising, if the one, who thought the others will defect, defected also, having no sympathy to them.

After completing this stage, a participant was asked to make his mind and decide what he will order. When all players made their decision, decision table was disclosed for each of them together with their payoffs.

At the end of the game participants were asked to pick their gender and the food they would choose (cheap/expensive) in case paying individually.

4.2. Chain pay treatment

In a search for conditions under which players would or should make the “cooperative” move with a higher probability, another treatment of dilemma was modified, leaving each player paying not for himself, but for his neighbor. The role division is seen from the scheme below. Arrows mean the payment procedure, explaining paying in a chain order.



The game explanation that the participants could read is the following: “Imagine you and two of your colleagues are dining at a fine restaurant. Prior to ordering a waitress tells you the cash register is out of order. It means each of you will have to pay not for yourself, but for the person sitting next to you from the right hand side. Left-hand sided person pays in turn for you. All of you order simultaneously and have no possibility to communicate.”

The price and the joy of the both meals is the same as in the first treatment. The payoff was calculated as the player’s joy minus price of his Righty’s meal.

The instructions to this treatment in comparison to the first one involve some examples. Using examples is critical as, from one point of view, they could influence players’ behavior; from the other side, avoiding them could lead to not proper understanding the game. The idea comes from the fact that participants were not placed in real circumstances, so could overlook some possible outcomes of their decisions.

That is why it was decided to make no instructions in the first treatment, where the rules are less complicated, and add them in the second one. In order to avoid inclining players to any particular decision, the examples were given in pairs with opposite effects.

“From one point of view, if you are extravagant, you could enjoy a superlative diner at a lefty’s expense. From the other side if the right-hand-sided person reasons the same as you do, you will also end up with a hefty bill to pay.

⁴ Rabin. Source: Colin F. Camerer. “Behavioral game theory: Experiments in Strategic Interaction” S. 115

If you think the Righty will decide for an expensive meal, why should you settle for a modest chicken entree when he will have lamb chops at your expense? What if the lefty orders a modest meal, not willing to harm his left-hand sided person making him pay much more than he deserves? Choosing an expensive meal in this case you will punish him for being nice.”

After reading the instructions players were asked to propose what they think their neighbors (Lefty and Righty) will choose and make their decision. At the end of the game participants were asked to pick their gender and what they would choose in case they pay individually as in the first treatment.

5. Experimental results and analysis

In the hypothesis it was presupposed that if players behave self-maximizing, the consumption will be the lowest and cheapest in case of individual payment, it will be much higher in the even-split treatment and the highest in case if the Righty pays. But if the non-monetary reasons do influence their decision, the following will be true: Individually < Righty pays < Even-split.

The results of the experiment show, that paying individually 59% of participants have chosen cheap meal. In case Chain pay cheap item was picked in 52% of cases. In the even-split treatment 47% of participants have chosen not expensive food. The outcome of experiment proves that reciprocity and fairness play important role in making economic decisions.

5.1. Gender Differences

Studies have shown that males and females have different propensities for regard to others. In experiments, we find results in dictator games (Eckel and Grossman, 1998) and reward allocation games (Lane and Messe, 1971), which show more generosity in females than in males⁵. Such results would lead us to expect women to not exploit the ability to impose cost on others to the same extent as men.

In the Gneezy, Haruvy, and Yafe (2004) (the prior Diner’s dilemma experiment) men and women did not differ significantly in their consumption choices.

Surprisingly such differences do exist in this experiment. The results show that females, paying individually or 1/3 of the total sum have taken expensive meal two times more often, than male. But in case of Chain Pay, when the neighbor pays for the dinner, 58% of female and 43% of male have chosen cheap.

5.2. Individual payment

In the design of experiment it was presupposed that the expensive dish is better than the cheaper, but not by enough to warrant paying the difference compared to eating alone, but still many participants (41%) were agree to overpay for higher utility paying individually.

The possible reason is that the prices of cheap and expensive food were not high and mentally acceptable. As players were not playing for real money, they didn’t pay much attention to the negative payoff in case choosing expensive. They were concentrated on the prices itself, on the decision if they are ready to pay higher amount for higher quality even though they overpay. Influential was also the fact, that is was hard to explain, what “joy” is and how it is measured, as it is an intangible feeling.

⁵ U. Gneezy, E. Haruvy, and H. Yafe. "The inefficiency of splitting the bill: A lesson in institution design."

The other influential factor could be the given example of cheap and expensive food: “modest chicken entrée” or “a pricey lamb chops”. Even though it was only example, heterogeneity of people’s tastes could play the role.

All this reasons led to the outcome, that even though in case choosing expensive the marginal cost is higher than the marginal utility, 41% of players have decided for it.

Interesting is that only 26% of all male have chosen expensive food, paying individually, whereas females practice it two times more often (52%). One of those females, explaining her choice has noticed, “Buying a Gucci bag you don’t think of its cost price. It’s not rational, it’s emotional”.

This outcome makes us think males to be more often modest and rational. Females, in turn, behave more often extravagant and emotional.

5.3. Even-split game

In the even-split treatment five groups of three players took part. In this treatment the majority, 53% of all participants, have chosen an expensive meal.

In this treatment there are three main reasons for participants to take an expensive item that are worth mentioning. Sometimes it is only one reason that influences, sometimes all of them.

The first reason is the following: some people would have taken expensive anyway (37% of those who have chosen expensive item in even-split case, have also chosen expensive paying individually).

Others reasoned that the expense they add to their bill by ordering an expensive meal is very small, so it is worth to take. They minimized their individual losses by taking advantage of others. 53% of participants in this treatment have taken expensive item, whereas paying individually the same decision will be made less often – in 41% of cases.

The other possible reason appeared due to negative reciprocity. Participants have taken expensive in order not to be “used” by free-riders. They have chosen expensive because they thought the others (at least one in the group of three) will take expensive. 43% of the players thought at least one colleague will take expensive meal and have also decided for expensive.

23% of participants believed both other players would take a cheap item, choosing Pareto-optimal strategy, and have also decided to cooperate, reasoning it to be fair and being led by reciprocal and altruistic feelings. Unfortunately it did not worth off in the most cases, as in 4 out of 5 groups at least one player has chosen an expensive food.

27% have decided for a cheap food even though they thought 1 will order expensive.

One player supposed the others to take a cheap meal, but have chosen an expensive item anyway. It shows a complete disregard for the costs imposed on others or for social efficiency and makes us classify his behavior as purely selfish.

Another participant has taken cheap even though he thought others both will take expensive items. Interesting is, he would have taken an expensive meal in case paying individually. The probable reason could be that not depending what the others do, he wanted to be the one, who behaved fairly, that shows pure altruism. The other possible reason could be improper understanding of the game.

The fact, that errors by subjects in the laboratory are not uncommon, is shown in a concern of Kim and Walker (1984) that misunderstanding of the unfamiliar task could result in cooperation, and the concern of Andreoni (1995) that some cooperation could be due to confusion and lack of experience with the task.⁶

⁶ James Andreoni. “Cooperation in Public-Goods Experiments: Kindness or Confusion?”

5.4. Chain pay game

In the Chain treatment twelve groups of three players took part. In this game a cheap item was chosen by 52% of participants.

The previous hypothesis was: if player trusts Lefty and Righty – he chooses cheap meal, all players are better off, if his feelings are correct.

The experiment revealed that 30% of the participants trusted both of their colleagues, 83% of them have chosen cheap meal, being influenced by positive reciprocity. Interesting is that 17% of those, who have chosen cheap meal trusting others and being ready to cooperate, would have taken expensive food, paying individually.

One of possible reasons given: “In case paying for myself, I have chosen expensive, as the joy is more important for me, than the price, but in case my colleague pays for me, I would feel ashamed to let him down and think others will reason the same”. The other participant commented it as: “One doesn’t have to make his neighbor pay expensive for him”.

The next hypothesis was: in case participant doesn’t trust his Lefty, he chooses expensive, being partly influenced by inequality aversion. He thinks if the Lefty (the one who pays for him) takes expensive, he will not hurt him taking expensive also. So this decision will be fair and monetary advantageous.

In this experiment 60% of the participants didn’t trust Lefty. But only 65% of them have chosen expensive. 31% of them have chosen cheap even though they didn’t trust both of their colleagues (19% of all participants), behaving purely altruistic.

It was also supposed, that if the player trusts Lefty, but doesn’t trust Righty, who he pays for – he chooses expensive meal, if his monetary gain is more important for him, than the Lefty’s monetary loss. He chooses cheap, if his sympathy to Lefty and desire not to hurt him is higher than his antipathy to Righty and/or his monetary gain.

8 % of all players believed Lefty takes cheap and Righty – expensive. 68% of them have decided to take cheap, being followed by altruistic motives.

Conclusion

The problem of cooperation is central to many different field studies. The Diner’s Dilemma, studied in this paper, presents a typical class of social problems in which individuals must choose between cooperating with the group or defecting for personal gain. The dilemma makes an age-old question to arise of whether unforced cooperation is ever possible, whether it can emerge in a world of self-seeking.

Many influential economists, including Adam Smith, Gary Becker, Kenneth Arrow, Paul Samuelson and Amartya Sen, pointed out that people often do care for the well-being of others and that this may have important economic consequences. However, most economists still routinely assume that material self-interest is the *sole* motivation of *all* people. This practice contrasts sharply with a large body of evidence gathered by experimental economists and psychologists during the last two decades. This evidence indicates that a substantial percentage of the people are strongly motivated by other-regarding preferences and that concerns for the well-being of others, for fairness and for reciprocity, cannot be ignored in social interactions.

The main purpose of this research was to review this evidence. The situations, in which participants were placed, were created to examine whether human agents tend to actually ignore costs imposed on others when reaching economic decisions.

The results from the experiment are consistent with the hypothesis that paying individually is the most effective model and leads to the lowest consumption. Even though an average price tends to be the highest in case the bill is evenly split, a great amount of participants have decided for cheap, i.e. for cooperation.

In a Chain pay treatment participants have taken cheap more often, than if paying equally, as was predicted in hypothesis. This outcome can not be explained by economic theories, as the amount a participant pays in this case doesn't depend on the food he orders, so the only probable result would be taking expensive. Moreover the quarter of all participants in this treatment behaved purely altruistic, much more often than in the other treatment.

To conclude it is to say that the experiment presented here, has shown to arrive closer to the socially efficient level than models of selfish behavior would. The participants did free ride, but not to the extent economic theory predicts. That means expectations, beliefs and social preferences, such as reciprocity, inequality aversion and altruism, did influence their decisions.

References

1. Andreoni, James. (1995) Cooperation in Public-Goods Experiments: Kindness or Confusion? *The American Economic Review*.
2. Camerer, Colin F. (2003) Behavioral game theory: Experiments in Strategic Interaction. Princeton University Press, Princeton, New Jersey, 101-115.
3. Gance, Huberman. (1994) "The dynamics of social dilemmas." *Scientific American*.
4. Gneezy, U., Haruvy, E., and Yafe, H. (2004) "The inefficiency of splitting the bill: A lesson in institution design" *The Economic Journal* 114, 265-280.
5. Houser, Daniel, Kurzban, Robert. (2002) "Revisiting Kindness and Confusion in Public Goods Experiments" *American Economic Review*.
6. Kollock, Peter. (1998) "Social dilemmas: the anatomy of cooperation." *Annual Review of Sociology*.

Appendix

Table 1 Percentage of players who have chosen cheap/expensive meal in each situation

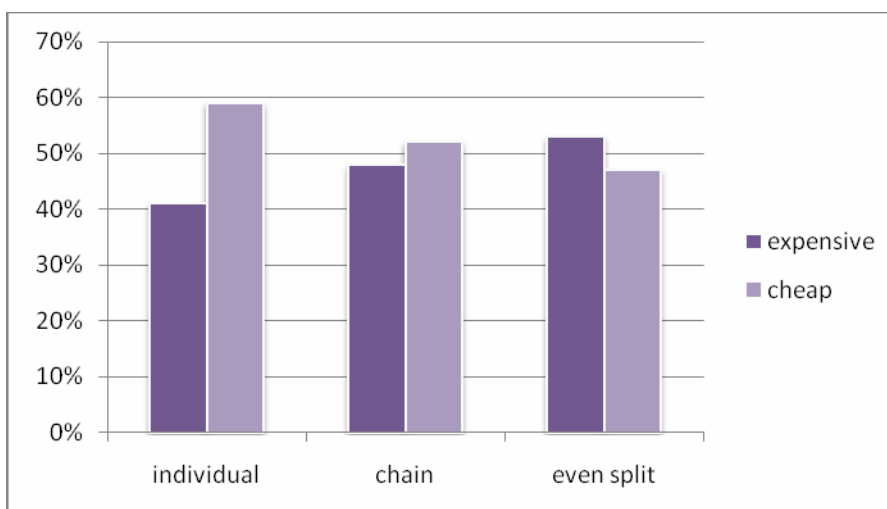


Table 2 Percentage of male/female who have chosen *expensive* meal in each situation

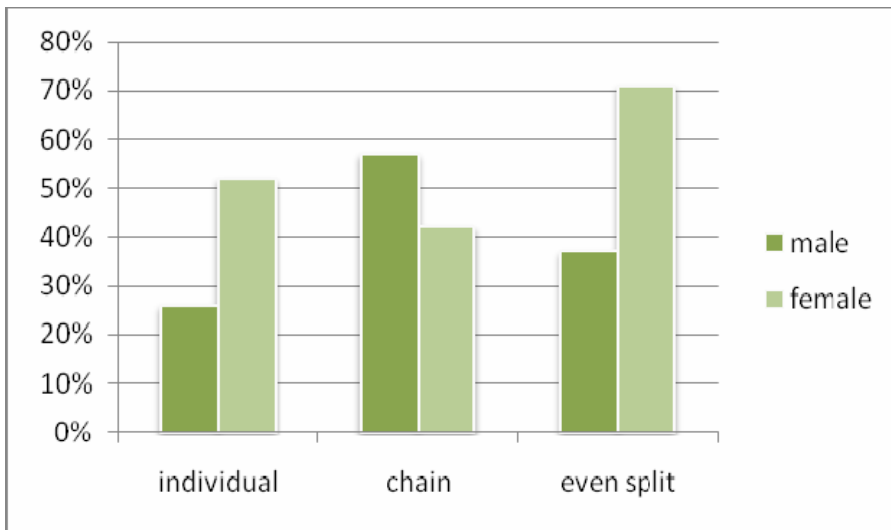


Table 3 Ordering according to expectations in an even-split case

“e” means expensive, “ch” means cheap. “Min 1 e=e” means a participant thought at least one player will take expensive and has chosen expensive also.

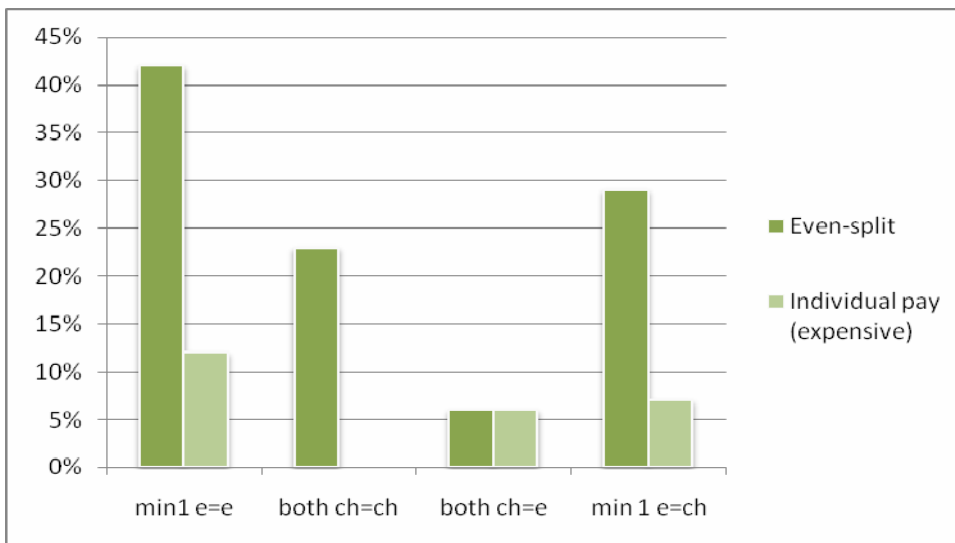
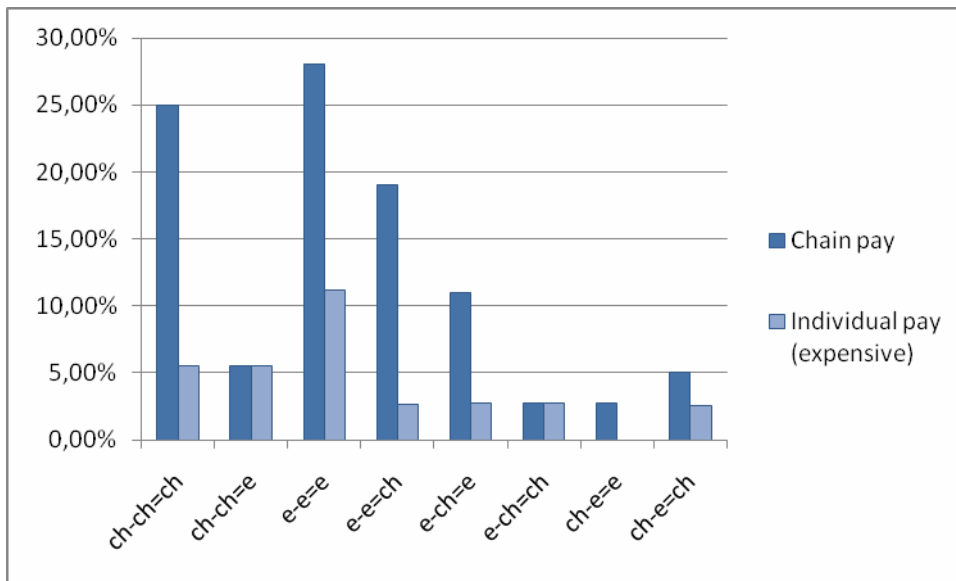


Table 4 Ordering according to expectations in case paying for the Righty
 “e-ch=e” means a participant thought his Lefty takes expensive, his Righty takes cheap; and has decided for expensive.



Instructions

Even-split treatment

“Dear participant! Welcome to the Diner’s Dilemma game!

Imagine you and two of your colleagues are dining at a fine restaurant. Prior to ordering you agree to split the check equally afterwards. You have two possibilities: to choose an expensive meal or a cheap one.

The price of a cheap meal is 8 Euros. The joy of it equals 10 Euros. The price of an expensive meal is 15 Euros. The joy of it equals 13 Euros.

Your payoff will be calculated as your joy minus price you pay, which is 1/3 of the total sum. All of you order simultaneously and have no possibility to communicate.”

Chain pay treatment

“Dear participant! Welcome to the Diner’s Dilemma game!

Imagine you and two of your colleagues are dining at a fine restaurant. Prior to ordering a waitress tells you the cash register is out of order. It means each of you will have to pay not for yourself, but for the person sitting next to you from the right hand side. Left-hand sided person pays in turn for you.

All of you order simultaneously and have no possibility to communicate.

You have two possibilities: to choose an expensive meal or a cheap one. The price of a cheap meal is 8 Euros. The joy of it equals 10 Euros. The price of an expensive meal is 15 Euros. The joy of it equals 13 Euros.

Your payoff will be calculated as your joy minus price of the righty’s meal.

Will you choose the modest chicken entree or a pricey lamb chops, knowing that the sum you pay does not depend on your decision, but solely on the decision of the right-hand sided person?

- From one point of view, if you are extravagant, you could enjoy a superlative diner at a lefty's expense.

- From the other side if the right-hand-sided person reasons the same as you do, you will also end up with a hefty bill to pay.

- If you think the righty will decide for an expensive meal, why should you settle for a modest chicken entree when he will have lamb chops at your expense?

- What if the lefty orders a modest meal, not willing to harm his left-hand sided person making him pay much more than he deserves? Choosing an expensive meal in this case you will punish him for being nice.

...But you can never be sure what will your neighbors order..."