Forward Looking Fairness in Games

Master thesis

Economics of Markets, Organisations, and Policy

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Abstract

This paper tests the existence of peer-induced fairness in ultimatum games. We build on the work of Ho and Su (2009) who developed a model of an ultimatum game with two followers, approached sequentially by the leader, and found that the second follower has fairness concerns towards both the leader and the first follower. We extend their model by allowing the first follower's utility also to depend on the expected offer to the second follower, which dependence we call "forward-looking fairness". We test for the existence of forward-looking fairness by comparing the offers to, and acceptance frequencies of, the first follower in the two-follower game (the treatment group) with those of the only follower in the classical one-follower game (the control group). The experimental data collected from 75 high school students do not immediately support the existence of forward-looking fairness; however, some positive evidence emerges after allowing for the differences in the demand for punishment between the control and treatment groups. Unlike in Ho and Su (2009), the existence of peer-induced fairness is not supported by our data. Overall, our results suggest the importance of contextual factors in shaping the experimental outcomes of ultimatum games.

Keywords: Behavioural economics, ultimatum games, forward looking fairness, peer induced fairness, game theory, spitefulness, risk aversion.

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Table of Contents

1. Introduction

The concept of “Homo Economicus”, who is unboundedly rational, who has unbounded willpower and who only cares about him- or herself, fails to adequately describe the outcomes of individual actions, and even more so of human interactions (Thaler 1991). Herbert A. Simon (1955; 1979) had proposed that economic agents should be viewed as bounded-rational and having other-regarding preferences, for example, altruism, spitefulness or fairness concerns, which is the topic of this work. One way of showing that people do have fairness concerns is by comparing the predicted and actual outcomes of the ultimatum game designed by Guth, Schmittberger, and Schwarze (1982). This game involves two players: the leader and the follower. The leader gets to divide a certain amount between himself and the follower. He offers to the follower a share in this amount, and the follower can either accept or reject this offer. When the follower accepts the offer, both players get a payoff of the proposed division. In case he rejects the offer, both players get a payoff of zero.

Game theoretic models predict the subgame perfect equilibrium offer to be an offer by the leader of the smallest amount possible, which will be accepted by the follower because it is more than zero (which he would get if he rejects the offer). Yet, as the study of Guth et al. (1982) shows, this is not what happens in practice. In their experiment, they show that followers sometimes reject certain offers above zero and that some leaders offer higher than the minimum possible amount to prevent rejection. More specific, Roth (1995), as well as many other trials, found that offers of less than 30 per cent of the amount are very likely to be rejected. Guth et al. (1982) explain this with a theory of fairness concerns, whose basic message is that the follower’s utility is affected not only by the offer he receives but also by the distribution of the initial amount between the leader and himself. Over the years, the effects of various contextual factors on the ultimatum game outcomes have been studied, such as changes in the magnitude of the amount to be divided, cultural differences and age differences (Cameron, 1999; Hoffman, 2003). However, no contextual factor has proved powerful enough to eliminate fairness concerns. Therefore, Guth et al’s (1982) notion of “distributional fairness” has become a cornerstone in modern game theory.

In addition to the distribution of payoffs between the leader and the follower, fairness concerns may also be affected by the relative positions of the leader and follower(s) in some kind of hierarchy. For instance, an employee’s fairness concerns may be stronger towards a fellow employee than to the boss. Ho and Su’s (2009) study was the first to model what they call “peer-induced” fairness together with distributional fairness. To do so, they allowed for a second follower in the ultimatum game. The second follower observes a signal about the offer made to the first follower, which signal affects his behaviour even stronger than the difference in payoffs to the leader and to him. Moreover, the leader appears to be aware of the existence of peer-induced fairness, and makes an offer to the second follower, which is on average higher than the offer to the first follower.

This study builds upon Ho and Su (2009). We expand their work by looking at the possibility that fairness concerns between the followers may exist both ways rather than only from the second follower to the first. We introduce a new concept of "forward-looking fairness", which is closely related to Ho and Su's (2009) peer-induced fairness but describes the behaviour of the *first* follower influenced by the offer that he expects will be made to the second follower. The study of Van Boven and Ashworth (2007) has motivated our interest, because it finds that emotions are in fact stronger when anticipating something than when looking back at the same event. This result, when taken to economics, suggests the necessity of allowing for the existence of forward-looking fairness concerns as well as backward-looking fairness concerns as Ho and Su (2009) did. To do so, we extend their model by allowing the first follower to have fairness concerns towards the leader and the second follower. We predict that, i) compared to the follower in the one-follower ultimatum game, the first follower in the two-follower game will be offered more, and ii) given the magnitude of the offer, the first follower's rejection rate in the two-follower game will be higher than the rejection rate of the follower in the one-follower game.

As Thaler (1988) said in his paper about the ultimatum game: "One conclusion that emerges clearly from this research is that notions of fairness can play a significant role in determining the outcome of negotiations." The knowledge that people are willing to reject offers, which they consider unfair allocations, has implications for economic bargaining theory but also well beyond that. Every time a monopolist or a monopsonist sets a price or a wage, it reflects the conditions of an ultimatum. Many of these situations involve more than just two people. Therefore, it is very important to know whether human beings are capable of conceiving and responding to forward-looking peer induced fairness. If we do find evidence for forward-looking fairness, this might change the optimal mechanism of negotiation compared to the classical one. Then it is better for the followers to negotiate as a group and, on the contrary, for the leaders to negotiate separately without the followers knowing about one another.

An example of a real world situation which can be described as an ultimatum game is for instance to be found on the work floor. A wage negotiation, in which the employer is the leader and the employees are the followers, is in fact a game to divide an amount of surplus. Employing any particular person will create surplus, which is distributed between the employer and the employee. Having multiple possible employees creates the situation of a real world ultimatum game with multiple followers.

We test our theoretical predictions with an experiment, using the setup of the two-stage ultimatum game as described above. The experiment took place at a Dutch high school involving 75 students. The results of the experiment, however, are not in line with the theoretical predictions. To explain these differences, two possible explanations will be discussed. These explanations, the demand for punishment and risk theory seem to fit the gaps between theory and practice quite well. After allowing for differences in the demand for punishment between the one-follower game and the two-follower game, positive evidence emerges on the existence of forward-looking fairness. However, for conclusive findings on behave of risky behaviour influencing the outcomes of the two-follower ultimatum game when allowing for forward-looking fairness, more research needs to be done.

Because the experiment of Ho and Su (2009) is a part of the experimental setting for this study, their theoretical predictions will be tested as well. Our replications of Ho and Su (2009), however, do not find evidence to support their findings on the existence of peer-induced fairness.

The rest of this paper is organized as follows. Chapter 1 formulates the theoretical model. Chapter 2 presents the equilibrium analysis and the theoretical predictions. Chapter 4 and 5 describes the experimental design and procedure, and show descriptive statistics of the data and participants. Chapter 6, 7 and 8 cover the results, the possible explanations and implications and chapter 9 concludes. Chapter 10 gives a brief discussion of the hints of good fortune and the extra hard parts of this research.

2. Theoretical Model

This section will cover the theoretical model of this research. Prior to this thesis, exploring the theoretical model, a preliminary research paper has been written (Roelse 2012). To get the forward-looking peer induced fairness model of the ultimatum game understandable, it will be build up step by step. Since this model is an extended version of the ultimatum game, this section will start with the theoretical model of the classical ultimatum game[1]. Then it will slowly be expanded to the full model used for this research. First, the second follower, including peer-induced fairness, will be added. This reflects the model of Ho and Su (2009), up on which the forward-looking model will be build. At last, the model will be extended with forward-looking fairness to get the complete model used for this study.

2.1 The basic model

The basic model used for this research is the classical ultimatum game. This game describes a situation with one leader and one follower. The leader has to divide a certain amount, π, between himself and the follower. The leader makes a proposition to the follower on how to divide the amount. He offers a part of the amount to the follower, s_1, which implies he offers to keep π-s_1 himself. The follower chooses either to accept this offer, a_1=1, or to reject this offer, a_1=0. If the follower decides to accept the offer, he will get a payoff of the amount offered, s_1, and the leader will get a payoff π-s_1. If he decides to reject the offer, both the follower and the leader will get a payoff of zero.

First, the payoff function of follower 1 will be defined, U_{F1}. This payoff function consists of two components. The first component reflects the material payoff from the game. The second component brings out the disutility of having a lower payoff than the leader. This component thus reflects the distributional fairness concerns between the follower and the leader (Wu et al. 2012).

Payoff function of follower 1:

$$U_{F1}(s_1,a_1) = \begin{cases} s_1 - \delta \max\{0, (\pi - s_1) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \qquad (1)$$

where δ is the measure for the degree of averseness of follower 1 from being distributional behind from the leader.

The leader's payoff function is defined in similar way. One component reflects the material payoff and one component reflects the disutility from being behind with respect to the follower.

[1] For the model with two followers is based on Ho and Su (2009), the basic model, thus the classical ultimatum game, will be worked out in their followence and terminology as well.

$$U_{L,I}(s_1,a_1) = \begin{cases} \pi - s_1 - \delta\max\{0,\ s_1 - (\pi - s_1)\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \qquad (2)$$

The timing of the game is as follows:

1. The leader offers a certain division of the amount to the follower.
2. The follower accepts or rejects this proposition.
3. Payoffs are realized.

Arising from this model is the following. δ is a measure of the degree of averseness of the follower. Originally has been thought that δ did not exist. Without assuming the presence of δ, the model has the following two implications. First, the follower's payoff function only exists of a material component, therefore receiving any amount of the total amount to be divided gives the follower a higher utility then when receiving nothing. The follower should thus accept all positive offers. Leaders will anticipate to this knowledge and are best off making an offer approaching zero, since this leaves the leader himself with the largest amount possible. Several data studies, however, have found otherwise (Nowak et al. 2000; Gale et al. 2005).

Rejection of the offer by the follower signals that his payoff function has non-monetary components. If his payoff function would only exist of monetary components, he would have accepted every offer above zero, since that would have given him more utility in that case. Rejecting the offer thus signals that the follower rather wishes to sacrifice the low amount he got to protest to the unfair distribution of the amount. This is called distributional fairness; fairness concerns between the leader and the follower. The measure of someone experiencing this is called the measure of the degree of averseness of being distributional behind. This is expressed with δ. Therefore, assuming δ to be non-zero, the follower only accepts an offer which is part of a fair distribution is his eyes and the leader has to anticipate to this because wants his offer to be accepted. This leads to the actual offers being far higher than the minimum possible amount.

2..2 A Second Follower

To be able to research what happens if the first follower knows another follower is in line, first the basic model will be extended by adding a second follower to the model, as in Ho and Su (2009). The game with two followers starts the same as with the first three steps of the basic model described above. After the payoffs for the first subgame are realized, the second follower gets a signal about the offer made to the first follower. This noisy signal, $z = s_1 + \varepsilon$, where ε is a random noise term with mean zero and an arbitrary distribution function $F(\cdot)$ and density function $f(\cdot)$. Accompanied by the knowledge of this signal the second follower creates inferences about the offer made to the first follower, which can influence his decision of accepting or rejecting his own offer. The leader gets to know the signal as well before the second subgame starts. In this subgame the leader gets a new pie to divide, again of the amount π. The timing of this second game is the same as for the first game. The leader makes a proposition to the second follower on how to divide the amount. He offers a part of the amount to the follower, s_2, which implies he offers to keep π-s_2 himself. The follower chooses either to accept the offer, a_2=1, or to reject this offer, a_2=0. If the follower decides to accept the offer, he will get a payoff of the amount offered, s_2, and the leader will get a payoff π-s_2. If he decides to reject the offer, both the second follower and the leader will get a payoff of zero.

The payoff function of the second follower consists of the same components as the first follower's payoff function, plus an extra term. This extra term reflects the disutility of the second follower from being behind with respect to the first follower. This term thus arises because follower two will compare himself to a similar person, his peer, the first follower. With the noisy signal, $z = s_1 + \varepsilon$, he can make an inference of the probability that the first follower has accepted the offer $\hat{p}$(z)=P(a_1=1|z) and a conditional expectation of what the first follower got offered $\hat{s}_1$(z)=E(s_1|z,a_1=1). Using this $\hat{p}$ and $\hat{s}_1$ for the inferences about the first subgame, we can define the second follower's payoff function as:

$$U_{F2}(s_2,a_2|z) =$$

$$\begin{cases} s_2 - \delta\max\{0, (\pi - s_2) - s_2\} - \rho\hat{p}(z)\max\{0, \hat{s_1}(z) - s_2\}, & if\ a_2 = 1 \\ 0, & if\ a_2 = 0 \end{cases}, \qquad (3)$$

ρ is the measure of the degree of aversion for being behind in comparison to a peer i.e. the measure of strength of peer-induced fairness. δ is again the measure of the degree of aversion from being distributional behind from the leader.

The payoff function of the first follower stays the same as in the classical ultimatum game:

$$U_{F1}(s_1,a_1) = \begin{cases} s_1 - \delta\max\{0, (\pi - s_1) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \qquad (1)$$

where δ is the measure for the degree of averseness of follower 1 from being distributional behind from the leader.

To complete this two-follower model, the payoff function of the leader is defined. In every subgame the leader can receive a material payoff. In the second subgame the leader's payoff function is defined as follows:

$$U_{L,II}(s_2,a_2|z) = \begin{cases} \pi - s_2 - \delta\max\{0, s_2 - (\pi - s_2)\}, & if\ a_2 = 1 \\ 0, & if\ a_2 = 0 \end{cases}, \qquad (4)$$

where $U_{L,II}(s_2,a_2|z)$ defines the payoff function of the leader in the second game, based on the second offer, s_2, and whether the offer is accepted, a_2, conditional on the signal z. The leader's payoff is dependent on this z in so far the second follower's choices rest upon it.

The first subgame does not have a noisy signal, therefore the payoff function for this subgame is not defined conditionally on z. The payoff function of the leader for the first game consists of a material payoff and a component for the disutility from being behind to the follower, the distributional fairness:

$$U_{L,I}(s_1,a_1) = \begin{cases} \pi - s_1 - \delta\max\{0, s_1 - (\pi - s_1)\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \tag{5}$$

where δ is again the degree of averseness of distributional fairness concerns.

The timing of the model with two followers is:

1. The leader offers a certain division of the pie to follower 1.
2. Follower 1 accepts or rejects this proposition.
3. Payoffs are realized.
4. Follower 2 gets a noisy signal on the offer made to follower 1.
5. The leader also gets to know this signal.
6. The leader offers a certain division of the pie to follower 2.
7. Follower 2 accepts or rejects this proposition.
8. Payoffs are realized.

2.3 Forward looking fairness

Building on the above model, this study tries to find out whether people also experience forward-looking fairness. To recall, where forward-looking fairness is the tendency to compare yourself to someone in a similar situation when looking forward, to asses if you have been treated fairly. Thus after adding a second follower to the classical ultimatum game, now the model will get an extra dimension to capture the possibility that the first follower is anticipating on what he knows is going to happen. As found by Ho and Su (2009), peer induced fairness results in the offer made to the second follower being higher than the offer made to the first follower with non-zero probability. In our forward-looking fairness model is assumed the first follower is rational and thus knows that with non-zero probability the offer made to the second follower will be higher than the offer he will get himself. This means a possibility exists when the difference between his own offer and the offer he thinks is going to be made to the second follower is too big, he will reject his own offer out of fairness concerns. When the pie does not get to be divided, the total payoff is zero instead of π. As any other rejection, rejection due to forward-looking fairness would thus be welfare destroying. It is therefore important to look for the existence of forward-looking fairness and understanding this process.

The forward-looking fairness will be captured in ρ_1. The payoff function of the first follower with forward looking fairness will therefore be:

$U_{F1,FF}(s_1,a_1) =$

$$\begin{cases} s_1 - \delta \max\{0, (\pi - s_1) - s_1\} - \rho_1 \hat{p}(z) \max\{0, E(s_2^*) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (6)$$

where FF stands for forward-looking fairness and s_1 is the offer made to follower 1. The second component captures the distributional fairness where δ is a measure for the degree of averseness of being behind from the leader. The third component brings disutility to the first follower from being behind to the second follower and thus captures the forward-looking fairness. ρ_1 is the degree of forward looking fairness, $E(s_2*)$ is the expected equilibrium offer made to the second follower and p_1 is the first followers inference of the probability that the second follower will accept this offer.

The payoff function of the second follower will stay the same as in the model with no forward-looking fairness. This is because a third person does not exist in this model; therefore, it is not possible for the second player to perceive forward-looking fairness concerns. His possible backward-looking fairness concerns will still be captured in his payoff function. To recall:

$U_{F2,FF}(s_2,a_2|z) =$

$$\begin{cases} s_2 - \delta \max\{0, (\pi - s_2) - s_2\} - \rho \hat{p}(z) \max\{0, \widehat{s_1}(z) - s_2\}, & if\ a_2 = 1 \\ 0, & if\ a_2 = 0 \end{cases}, \quad (7)$$

The payoff functions of the leader in this forward-looking fairness model are the same as in the other models. This is due to the fact that the leader has no different payoffs or strategies than before.

$$U_{L,I,FF}(s_1,a_1) = \begin{cases} \pi - s_1 - \delta \max\{0, s_1 - (\pi - s_1)\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (8)$$

$$U_{L,II,FF}(s_2,a_2|z) = \begin{cases} \pi - s_2 - \delta \max\{0, s_2 - (\pi - s_2)\}, & if\ a_2 = 1 \\ 0, & if\ a_2 = 0 \end{cases}, \quad (9)$$

3. Equilibrium Analysis

This section presents the equilibrium analysis and the theoretical predictions of the forward-looking peer induced fairness model of the ultimatum game just described. The model will be worked out with use of backward induction. This means the second subgame, the one with the leader and the second follower is the first one to be solved. Because the payoff function for the second follower is the same in the model with and without forward looking fairness, the derivation will be the same for these two models.

3.1 The second subgame

For easiness, we recall the payoff function of the second follower and the one of the leader:

$U_{F2}(s_2,a_2|z) =$

$$\begin{cases} s_2 - \delta\max\{0, (\pi - s_2) - s_2\} - \rho\hat{p}(z)\max\{0, \widehat{s_1}(z) - s_2\}, & if\ a_2 = 1 \\ 0, & if\ a_2 = 0 \end{cases}, \quad (3)$$

$U_{L,II}(s_2,a_2|z) =$

$$\begin{cases} \pi - s_2 - \delta\max\{0,\ s_2 - (\pi - s_2)\}, & if\ a_2 = 1 \\ 0, & if\ a_2 = 0 \end{cases}, \quad (4)$$

The second follower can either accept or reject the offer made to him. Rejection will leave him with zero utility, therefore he shall be willing to accept the offer if the offer is at least 0 i.e. $U_{F2}(s_2,1|z) \geq 0$.

The offer the leader makes to a follower is the part of the pie he offers to give away. Therefore, the utility of the leader is decreasing as the offer to the follower becomes higher, for then the leader will get a smaller part of the pie. Accordingly, the leader always wants to offer the lowest amount possible. As the second follower has the constraint of accepting described above, the leader will choose to offer the lowest offer possible, but still satisfying $U_{F2}(s_2,1|z) \geq 0$.

The following result shows the solution to this problem, which is the optimal offer, made to the second follower s_2*.

Result 1: The optimal offer from the leader to the second follower, s_2*, as a function of the follower's inferences $\hat{p}_1$(z) and $\hat{s}_1$(z), is:

$$s_2^*\big(\hat{p}(z), \widehat{s_1}(z)\big) = \min\{\max\left\{\frac{\pi\delta}{1+2\delta}, \frac{\pi\delta + \rho\hat{p}(z)\widehat{s_1}}{1+2\delta + \rho\hat{p}(z)}, \frac{\rho\hat{p}(z)\widehat{s_1}}{1+\rho\hat{p}(z)}\right\}, \frac{\pi(1+\delta)}{1+2\delta}\}$$

Proof: See appendix 1, proof of result 1.

The optimal offer is thus, the minimum of two terms: (i) max{(πδ)/(1+2δ), (πδ + ρ$\hat{p}$(z)$\widehat{s_1}$(z)/(1 + 22δ + ρ$\hat{p}$(z)), (ρ$\hat{p}$(z)$\widehat{s_1}$(z))/(1 + ρ$\hat{p}$(z))}; and (ii) π(1 + δ)/(1 + 2δ). The first term yields the leader's preferred option while still satisfying the constraint of the follower. This thus yields the smallest offer he can possible make while making sure the follower will still accept. This term is found by taking the maximum of these three components (note the first component is independent of ρ and the third component is independent of δ). As a result, the first and the third component become relevant when distributional fairness respectively backward-looking peer induced fairness is ascendant. Naturally, the second component becomes relevant if both kinds of fairnesses are of similar importance.

3.2 The first subgame

The equilibrium analysis of the first game is different for the model with and the model without forward-looking peer induced fairness, because the payoff functions of the first followers are different. We will therefore start with the equilibrium analysis of the model without forward-looking fairness.

In the first game, of the model without forward looking fairness, the leader makes an offer to the first follower. To recall, the payoff function of the first follower and the leader in the first subgame are:

$$U_{F1}(s_1,a_1) = \begin{cases} s_1 - \delta\max\{0, (\pi - s_1) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (1)$$

$$U_{L,I}(s_1,a_1) = \begin{cases} \pi - s_1 - \delta\max\{0,\ s_1 - (\pi - s_1)\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (2)$$

As can be seen from the payoff function, the more the leader offers to the first follower, the lower is his own material payoff. Consequently, the leader wants to make an offer as low as possible. Again, as for the second follower, the first follower has the choice to reject or accept the offer. If he rejects, he will get a utility of zero. He will only accept the offer if the utility he will get will be at least zero, which implies $U_{F1}(s_1,1) \geq 0$. This can be shown to be $s_1 \geq (\pi\delta)/(1 + 2\delta)$, see Appendix 1; Rate of rejection of follower 1, which is the constraint capturing the distributional fairness concerns. To be accepted the offer thus has to be at least holding for this constraint, therefore the first follower's acceptance threshold is $A = (\pi\delta)/(1 + 2\delta)$. With this, the optimal offer to the first follower can be derived.

Result 2: The optimal offer from the leader to the first follower, s_1*, is:

$$s_1^* = \frac{\pi\delta}{1+2\delta}$$

Proof: See Appendix 1; proof of result 2.

To be able to compare this situation, the theoretical outcome for the first subgame of the game with forward-looking peer-induced fairness will be computed as well. To recall, the payoff function of the first follower with forward looking peer-induced fairness is:

$U_{F1,FF}(s_1,a_1) =$

$$\begin{cases} s_1 - \delta\max\{0,(\pi - s_1) - s_1\} - \rho_1\hat{p}(z)\max\{0,E(s_2^*) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (6)$$

Also in this game, follower 1 can either accept or reject the offer. As can be seen from the payoff function, the expected second offer and the follower's inferences on the probability that the second follower will accept this offer are taken in consideration with this decision. If the first follower rejects, it will leave both him and the leader with zero utility. He will thus only accept the offer if it leaves him with at least zero utility. This does not mean if the first follower thinks the second player gets a higher offer, he will decline his own. It is possible when the difference is small enough, even if the offer to the second follower is higher, it still leaves him with a higher utility than zero. This can happen for values of ρ_1 below a certain level i.e. the degree of forward looking fairness is not too high. Therefore if $U_{F1,FF}(s_1,1) \geq 0$ he will accept the offer.

The following result shows the solution to this problem which is the optimal offer made to the first follower $s_{1,FF}*$, where FF stands for forward looking fairness.

Result 3: The optimal offer from the leader to the first follower, $s_{1,FF}*$, in the first subgame with forward looking fairness is:

$$s_{1.FF}^*\big(\hat{p}(z),\widehat{s_1}(z)\big) = \min\{\max\left\{\frac{\pi\delta}{1+2\delta},\frac{\pi\delta + \rho_1\widehat{p_1}E(s_2^*)}{1+2\delta + \rho_1\widehat{p_1}},\frac{\rho_1\widehat{p_1}E(s_2^*)}{1+\rho_1\widehat{p_1}}\right\},\frac{\pi(1+\delta)}{1+2\delta}\}$$

Proof: See Appendix 1; proof of result 3.

As both the optimal offer of the game with and without forward-looking fairness are derived, the situations can be compared to each other. Discussed in the models above, the model with one follower and the model with two followers differ from each other in ways and number of fairnesses. The model with one follower, the classical ultimatum game, takes on distributional fairness, fairness between the leader and the follower. The two-follower forward-looking fairness model has another restriction. Both distributional fairness and forward-looking fairness, fairness concerns between the first and the second follower, restrict the offer. Both fairnesses have to be satisfied in the equilibrium offer, while in the model with one follower distributional fairness is the only restriction. This gives the following theoretical prediction:

Theoretical prediction 1: The offer made to the first follower in the model with forward-looking fairness is always weakly higher than the offer in the classical ultimatum game.

Proof: This follows from result 2 and 3.

3.3 Rate of rejection

As discussed earlier on, if the offer from the leader is rejected, this is welfare destroying. It is therefore important to know how the rate of rejection is influenced when allowing for forward-looking fairness.

In this section we will start by looking at the rate of rejection of the first follower in a two-follower ultimatum game without forward-looking fairness. Then the first game of the ultimatum game with forward-looking fairness will be examined. At last, the two situations will be compared. To recall, the first follower's payoff function:

$$U_{F1}(s_1,a_1) = \begin{cases} s_1 - \delta\max\{0,(\pi - s_1) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (1)$$

The first follower will only accept the offer if $U_{F1}(s_1,1) \geq 0$, which is equivalent to the acceptance threshold A_1, therefore,

Result 4: $A_1 = \frac{\pi\delta}{1+2\delta}$

The higher the distributional fairness δ, the higher the acceptance threshold. Derivations of the probability of accepting are to be found in Appendix 1: Rate of rejection of follower 1.

The same derivation is possible for the first game in the model with forward-looking fairness. To recall, the first follower's payoff function:

$$U_{F1,FF}(s_1,a_1) = \begin{cases} s_1 - \delta\max\{0,(\pi - s_1) - s_1\} - \rho_1\hat{p}(z)\max\{0, E(s_2^*) - s_1\}, & if\ a_1 = 1 \\ 0, & if\ a_1 = 0 \end{cases}, \quad (6)$$

The two fairnesses are captured in the payoff function of the second follower, so he will only accept the offer if $U_{F1,FF}(s_1,1|z_1) \geq 0$:

Result 5: $A_{F1,FF} = \frac{\pi\delta + \rho_1\widehat{p_1}E(s_2^*)}{1+2\delta + \rho_1\widehat{p_1}}$

The proof of this result can be found in Appendix 1: Rate of rejection of follower 1 with Forward looking fairness. Comparing A_1 and $A_{1,FF}$ we can see that $A_{1,FF}$ is bigger than A_1 for a large enough $E(s_2^*)$.

Theoretical prediction 2: Given the magnitude of the offer, the rate of rejection of the first offer is higher when allowing for forward-looking fairness compared to the classical ultimatum game.

Proof: follows from result 4 and 5.

The theoretical predictions of the forward-looking peer induced fairness model of the ultimatum game will be tested experimentally. Because parts of this model and therefore the experiment are the same as in the research of Ho and Su (2009), the opportunity to test the theoretical predictions of their model again will be used as well. The next chapter will explain the experimental setting of this research.

4. Experimental Design

75 students from the Dutch high school Calvijn Groene Hart in Barendrecht participated in the experiment. The experiment took place in three sessions in which were around 25 students each. In every session, the students were divided into two groups, a treatment group, which consisted of approximately 15 people, and a control group, which consisted approximately of 10 people. In the control group the students played the standard ultimatum game, the one with one leader and one follower. In the treatment group, the students played the ultimatum game with one leader and two followers. For every session, the school granted a one-hour time span, so every group played as much rounds as the time limit would allow. The control group ended up playing around 5 rounds per session, the treatment group around 4 rounds per session[2]. For every round, the students were randomly classified in pairs, for the control group, and in triplets, for the treatment group. Following, the students per pair or triplet were randomly classified in a certain role. The students never knew the identities of the people who they were playing with and were not allowed to talk to each other or make sounds for duration of the experiment. The students were paid in the possibility of winning a piece of pie in optional flavour. The participants with the top 25% highest cumulative scores in the control group and in the treatment group won the price. It is important to have separate rewardings for both groups because in the treatment group is it more easy to collect a large amount of points than in the control group. Therefore, to get equal chances to win something, in both groups participants with the top 25% cumulative points got rewarded. Before the experiment began, the students had to read the instructions, with at the end the option to ask questions. Only when everybody understood what was asked of him, the experiment started. A copy of the instructions for both groups is given in appendix 2. To be able to cope with the two groups at the same time there were two moderators, one to guide the control group and one to guide the treatment group. The whole experiment was computerized to make it more time efficient and facilitate information passing.

All communication ran through a specially designed chat box. This chat box allowed the moderator to have a private channel with each student. The students only had the possibility to talk to the moderator, which controlled for communication between the students through the chat box. To make it more time efficient and facilitate the information passing a standard template was created. This template contains pre-made sentences for the conversation per role. With these sentences the players were again explained what to do at the moment they had to do this and they were asked to execute it. See appendix 3 for the template used for the communication through the chat box.

The decision task was simplified as much as possible. For what was thought to be the hardest part, the signal in the treatment group, the instructions provided a few examples to really understand how it

[2] Taking into account the age of these kids, more rounds would not be acceptable due to their concentration span, I noticed.

works. The random and anonymous classification of the groups and roles helped to avoid any communication between the students. Because every new round had random role classifications we controlled for collusion, reciprocity, strategic playing and reputation building behaviour. This means that each round can be framed as a one-shot game with new partners.

4.1 Control group

In each round, subjects were randomly grouped in pairs. In each pair the students were randomly assigned the role of RED; the leader, or BLUE; the follower. The pairs played a one shot ultimatum game in which they have to divide 100 points.

RED was asked to communicate the amount of points he had decided to offer to BLUE via the chat box to the moderator. The moderator communicated this offer to BLUE. Then BLUE had to move by either accepting this offer, which would give him a payoff of OFFER1 and RED a payoff of 100-OFFER1, or to reject the offer which would lead both players to have a payoff of zero in this round. This accepting or rejecting was asked to BLUE to communicate this to the moderator. Then the moderator communicates the payoffs to both players and the round is finished. For the new round the moderator classified the students randomly and all starts at the beginning.

Each player's total points in each round were recorded. At the end of the session, point of all round were summed up and the top 25% people with the most points won a piece of pie in optional flavour.

4.2 Treatment group[3]

In each round, students were randomly grouped in triplets. In each triplet, the three students were randomly assigned the roles of RED: the leader, BLUE1: the first follower, and BLUE2: the second follower. The three players played two independent ultimatum games each with an amount of 100 points to be divided in sequence by the leader.

RED and BLUE1 played stage 1 first. RED moved first and chose the first offer, OFFER1, an integer between 0 and 100, the amount which he chose to offer to the first follower, BLUE1. This results in offering to keep the other part of the total amount, 100 points, himself. The moderator communicated this information on OFFER1 to BLUE1. BLUE1 then decided whether to accept or reject the offer. If BLUE1 chose to accept, RED and BLUE1 received the allocated amount

[3] The experimental design of the treatment group is the same as for the experiment of Ho and Su, therefore the explanation is the same: Ho and su, Peer induced fairness in games, The American Economic Review, 2009, page 11,12

accordingly. If BLUE1 rejected, both students earned zero points. All communication ran via the chat box and the moderator.

To construct the signal, SIGNAL1, a random number was drawn from a discrete uniform distribution of the set {-20,-10,0,10,20} by the moderator and added it to the first offer. This SIGNAL1 was communicated by the moderator via the chat box to BLUE2 and RED. Consequently, given a signal SIGNAL1, the students could infer what the first follower got offered by RED.

Then, RED and BLUE2 played stage 2. RED moved first and made an offer, OFFER2, an offer between 0 and 100 points i.e. the amount which he chose to offer to the second follower, BLUE2, which results in offering to keep the other part of the amount himself. This offer was communicated via the moderator to BLUE2. BLUE2 could either accept or reject this offer. If BLUE2 chose to accept, both players received payoffs as offered to allocate. Otherwise, both received zero payoff. The outcomes were revealed by the moderator only at the end of the round. Each player BLUE received only the outcomes of her own stage.

Each player's total points in each round were recorded. At the end of the session, point of all round were summed up and the top 25% people with the most points won a piece of pie in optionally flavour.

5. Descriptive Statistics

5.1 Participants

In the experiment participated 75 High school students in total. The students were aged between the ages of 14 and 18 years old and were all heading to graduate VWO level high school. The sum of the three sessions of the control group contained 13 boys and 20 girls and so 33 participants in total. The group has an age average of 15.3 years old. The treatment group exists of a total of 42 students of which 19 boys and 23 girls. Similar to the control group, the participants in the treatment group have an age average of 15.3 years old.

The following table gives a summary of the descriptive statistics of the participants in the experiment.

Table 1: descriptive statistics of the participants

	Boys	Girls	Total		Average age
Control group	13	20	33		15,3
Treatment group	19	23	42		15,3
Total	32	43	75		

5.2 Data

Table 2, on the next page, shows the data descriptive statistics. The three sessions of the experiment produced 117 observations for the control group and 64 for both games of the treatment group. Six participants made an offer of either 100 points, the entire amount of points, or 0 points, an offer to give nothing of the amount away[4]. These data observations were removed as outliers which gives a remaining observation set of 113 for the control group and 62 observations for both games each of the treatment group.

[4] The study of Ho and Su (2009) only considers offers of zero points as an outlier, I argued that if 0 is perceived as an outlier, an offer of 100 points should be perceived as an outlier as well.

Table 2: descriptive statistics of the dataset

	Control group		Treatment group			
	Game I		Game I		Game II	
Offer range	Offers(%)	Rejected(%)	Offers(%)	Rejected(%)	Offers(%)	Rejected(%)
00-20	9 (8.0)	9 (100.0)	6 (9.8)	3 (50.0)	12 (19.4)	8 (66.7)
20-25	1 (0.9)	1 (100.0)	3 (4.8)	3 (100.0)	6 (9.8)	2 (33.3)
25-30	4 (3.5)	3 (75.0)	12 (19.4)	8 (66.7)	9 (14.5)	4 (44.4)
30-35	11 (9.7)	7 (63.6)	8 (12.9)	5 (62.5)	6 (9.8)	1 (16.7)
35-40	15 (13.3)	3 (20.0)	11 (17.7)	3 (27.3)	19 (30.6)	5 (26.3)
40-45	23 (20.4)	6 (26.1)	10 (16.1)	2 (20.0)	4 (6.5)	0 (0.0)
45-50	45 (39.8)	6 (13.3)	8 (12.9)	0 (0.0)	5 (8.1)	0 (0.0)
50-55	2 (1.8)	0 (0.0)	3 (4.8)	0 (0.0)	0 (0.0)	0 (0.0)
55-100	3 (2.7)	0 (0.0)	1 (1.6)	0 (0.0)	1 (1.6)	0 (0.0)
Total	113 100.0)	35 (31.0)	62(100.0)	24 (38.7)	62(100.0)	20 (32.3)
Mean offer	42.55		36.68		33.02	
Mean accepted offer	46.95		40.81		36.52	

The data is in line with the predictions of Guth, Schmittberger, and Schwarze (1982) in their study; most offers are well above zero and the higher the offer the higher probability that it will be accepted. As they also concluded, again this data confirms that the theoretical predicted subgame perfect equilibrium of a very low offer is strongly rejected in practice. One participant in this experiment, playing RED in the treatment group, offered the subgame perfect equilibrium offer of 1 point to player BLUE2, who did not accept this.

Only a few offers are above 50 per cent of the pie. In both groups combined, less than 10 per cent of the offers are within this range. The modal offer is the 45-50 range in the control group. The modal offer for the treatment group is the 25-30 range for game I and the 35-40 range for game II. Figure 1 gives a graphic report of the distribution of the offers.

Figure 1: distribution of the offers.

As the offers decrease a clear pattern of a higher rate of rejection is visible. For example, for the offer range 45 – 50 per cent of the pie the rejection rate was only 10 per cent while for the offer range 25 – 30 the rate of rejection ranges from 44.4 per cent to 75 per cent. This result suggest, as found by earlier studies, that subjects are not purely self-interested. In general, terms the results of this study are comparable to those of prior studies.

6. Replicating Ho and Su's (2009) Findings

Due to the overlapping parts of the experiment with the study of Ho and Su (2009), the possibility will be used to retest some of their predictions. First, we will look at their main prediction - the second follower has peer-induced fairness concerns - by testing if the second follower rejects more often when he is behind than otherwise. Following their work, this will be done by running a logistic random effects regression. Due to the need to save valuable time and effort during this experiment the participants playing the role of the second follower were not asked to guess the offer made to the first follower. Therefore, the variable *guess* does not exist and is replaced by the variable *signal*.

$$P(a_2^{it} = 1) = \frac{\exp\{\gamma_0^i + \gamma_1 s_2^{it} + \gamma_2(signal - s_2^{it})^+\}}{1+\exp\{\gamma_0^i + \gamma_1 s_2^{it} + \gamma_2(signal - s_2^{it})^+\}}, \quad (10)$$

where i stands for subject and t stands for round. If the second follower has peer induced preferences, we would expect γ_2 to be negative. The result shows $\hat{\gamma}_2$ = -0,094 with a p-value of 0,404. The sign on the signal, γ_2, is negative, which is consistent with Ho and Su, but the evidence is not strong enough (p-value is >0,05). A possible explanation for this can perhaps be the relatively few observations compared to Ho and Su's 600+. Another important consideration to bear in mind is that in this formula the variable *signal minus offer2* is not identical to Ho and Su's, who used *guess minus offer2*. The difference is that follower two, being intelligent, will not believe in suspiciously high or low signals, and therefore the link between the signal and follower two's decision will not be as strong.

Secondly, Ho and Su test whether the first follower perceives forward-looking fairness. This will be done by looking at the treatment group and regress the first follower's decision against the first offer and the difference between the first offer and the anticipated second offer. To be able to run this regression Ho and Su accept to assume the first follower to be able to predict the second offer perfectly. Though we think this is a far to strong assumption and therefore not the correct way to test for forward looking fairness, for this replication we will accept this assumption as well. Again a random effects logistic regression will be run, giving,

$$P(a_1^{it} = 1) = \frac{\exp\{\gamma_0^i + \gamma_1 s_1^{it} + \gamma_2(s_2^{it} - s_1^{it})^+\}}{1+\exp\{\gamma_0^i + \gamma_1 s_1^{it} + \gamma_2(s_2^{it} - s_1^{it})^+\}}, \quad (11)$$

If the first follower does experience forward-looking fairness, γ_2, is expected to be negative. The result shows $\hat{\gamma}_2$ = -0,107 with a p-value of 0,114. The sign on the difference between the first offer and the second offer is negative, but insignificant (p-value>0,05). This result thus suggests there is not enough evidence to infer forward-looking fairness by the first follower, even if one is prepared to make the strong assumption that the first follower is able to predict the second offer perfectly.

Thirdly, a regression is executed to see if the offer made by the leader is influenced by the signal on the first offer. Figure 1 shows the observed frequencies of the difference between the second offer and the signal, i.e., *offer2 – signal*. In the figure, we see that the difference is centred around zero.

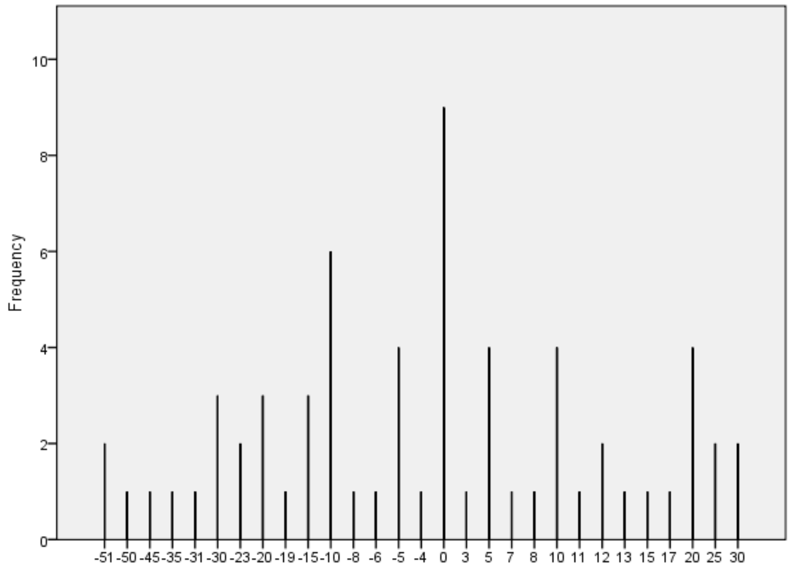

Figure 2: Observed frequencies of the difference between the second offer and the signal

A way to see whether the offer is influenced by the signal is to regress *offer2* against *signal*. The regression is the following:

$$s_2^{it} = \alpha_0^{it} + \alpha_1 signal_1^{it}\,, \qquad (12)$$

where α^i_0 are random effects. If the prediction is correct, α_1 is expected to be positive. The regression results show $\alpha_1 = 0.15$ with a P-value of 0.049. The signal has thus a significant effect on a 5% level on the second offer. This leads to conclude that participants update their beliefs and fit their behaviour to the knowledge they get offered.

The final prediction of Ho and Su is that the leader tends to be more generous to the second follower than to the first follower. Thus due to responding to peer induced fairness, the leader's offer to the second follower, s_2, is predicted to be higher than the leader's offer to the first follower, s_1. The experimental data of our study shows a mean offer of 36,68 point to the first follower in the treatment group and a mean offer of 33,02 to the second follower in the treatment group. The prediction is tested using a Wilcoxon signed rank test. The results indicate that the second offer is not higher than the first offer, but instead the second offer is statistical significantly lower than the first offer (Ha: mean(diff) > 0, p-value = 0.0140).

The result of this section, where the analyses of the predictions of Ho and Su are attempted to replicate lead to conclude that in our data we do not find enough evidence to conclude the existence of peer induced fairness.

7. Results

This section will present the results of testing the hypotheses of this study. The main hypothesis of this paper is that the first follower has forward-looking peer induced fairness concerns. Looking at the first follower's payoff function with forward looking fairness (equation 6), it shows that, assuming ceterus paribus, the first follower will receive a lower utility if her expected believe is that she is behind to the second follower. This implies, when not making best respond decisions, the first follower is less likely to accept the offer made to her if she expects the difference between her offer and the offer made to the second follower to be too high.

The theoretical model of the forward-looking peer induced fairness ultimatum game brought up two theoretical predictions to test the main hypotheses. This section will show the results of the data analysis testing these predictions.

7.1 Theoretical prediction 1

The first theoretical prediction of this study states that the offer made to the first follower in the two followers game is always weakly higher than the offer in the classical ultimatum game. To test this, first a t-test is executed to see if the two offers are significantly different and if so in which direction. $H_0 : \mu_1 = \mu_2$ and $H_a : \mu_1 \neq \mu_2$

Table 3: Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% CI	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
offer E. v. assumed	,567	,453	3,136	173	,002	5,880	1,875	2,179	9,581
E. v. not assumed			3,208	134,178	,002	5,880	1,833	2,254	9,506

Because the Levene's test for equality of variances is insignificant (sig. of 0,453), the t-test for equal variances assumed is the correct one to use. With a significance of 0,002, the zero hypotheses that the two means are equal can be rejected with 95% confidence. The mean first offer in the control group is therefore significantly higher than the mean of the first offer in the treatment group. Assuming our theoretical model is correct, when the first follower does experience forward-looking peer induced fairness, the first offer in the treatment group should be higher than the offer in the control group. The results of the t-test for equality of means thus suggest that the first follower does not perceive forward-looking fairness. The same analysis is done looking at the mean of accepted offers.

Table 4: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% CI	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Offer	E. v. assumed	4,558	,035	3,277	114	,001	6,133	1,872	2,425	9,841
	E. v. not assumed			2,997	59,092	,004	6,133	2,046	2,039	10,227

Because the Levene's test for equality of variances is significant (sig. of 0,035), the t-test for equal variances not assumed is the correct one to use. With a significance of 0,004, the zero hypotheses that the two means are equal can be rejected with 95% confidence. The mean accepted first offer in the control group is therefore significantly higher than the mean of the accepted first offer in the treatment group. This result is consistent with the results on the general mean first offers tested above and thus again this analysis does not show enough evidence to conclude forward looking fairness exists. In fact, these two findings are not simply inconsistent with the theoretical prediction, they are directly opposite to it and statistical significant. Possible explanations for this remarkable finding will be discussed in the next chapter. First, we will see whether the second theoretical prediction is in line with our data.

7.2 Theoretical prediction 2

Theoretical prediction 2 states that given the offer, the rate of rejection of the first offer is higher in the two-follower game compared to the classical ultimatum game. As can be seen in the descriptive statistics, table 2, the rate of rejection is 31,0 per cent in the control group against 38,7 per cent in game I of the treatment group.

At first, it looks as if the prediction is true and the rejection rate in the treatment group is higher than the rejection rate in the control group. However, since the prediction is stated given the offer, it is not possible to check this prediction by simply looking at the percentages. To test this prediction formally a regression is run. The probability of accepting will be regression on *offer1*, which is the offer made to the first follower in the treatment group, and on a dummy, which is 1 if the participant is in the two followers game. We have:

$$\mathrm{P}(a_1^{it} = 1) = \frac{\exp\{\alpha_0^i + \alpha_1 Offer1_1^{it} + a_2 Dummy\}}{1 + \exp\{\alpha_0^i + \alpha_1 Offer1_1^{it} + a_2 Dummy\}}, \tag{13}$$

where i stands for subject and t stands for the number of the round. If our theoretical prediction is true, the coefficient on dummy should be positive. The results show the coefficient on dummy is -0,435 with a p-value of 0.307. The sign of the coefficient of ‘dummy’ negative. This result thus suggest that our theoretical prediction is false. The theoretical prediction states that first followers in the model with forward-looking fairness accept their offer less frequently than the first follower in the classical ultimatum game. But in fact the results say the opposite might be true, because the coefficient on the dummy variable, which is 1 if you are in the control group, is negative and thus suggest that if you are in the control group you are less likely to accept the offer instead of more likely. However, this result is not of statistical significance, therefore this does not give enough evidence to draw a conclusion. These results are robust among several regressions and controlling for demographic variables.

8. Alternative Explanations

Because the experimental outcomes of this study are different than predicted in the theoretical part, this section will look for possible explanations of these differences. Game theoretical situations and human behaviour are very complicated field of expertise. The next two paragraphs try to fill in a missing piece of the puzzle. The two possible explanations of behaviour in this experiment are the followers' demand for punishing the leader and the leader's increasingly risky behaviour, as he gets richer.

8.1 The demand for punishment

The demand for punishment comes from an emotion called spitefulness. Spitefulness is a human emotion that gives rise to the feeling of need to see others suffer. This need to punish can come from all sorts of behaviour done to you by another person, which makes you feel spiteful and therefore willing to punish this other person. Classical economist assume that people are entirely selfish and thus do not care about the payoffs of others. However, very soon this assumption was thought to be not entirely true because they found out that people are not selfish but have other-regarding preferences. Ledyard found out that spitefulness plays a very important role in this (Ledyard 1995). In the notion of spitefulness, Jensen (2010) said "…harm, and the threat of it, can be powerful inducements for cooperation. ...I will suggest that spiteful competition allows humans to compete on scales not seen in other animals..." In 1956 H. L. Mencken quoted "Men are the only animals who devote themselves assiduously to making one another unhappy."

However, with the correct definition of the emotion spitefulness states also that the person that feels the need to punish will get a higher utility doing so. In our study we are not assuming that the person who is punishing someone will get a higher utility from it himself; above all he just wants to punish i.e. decrease the utility of the leader. Therefore, this alternative explanation is named the demand to punish.

When a follower in this experiment feels that the offer made to him is too low, it is possible he wants to punish the leader by rejecting the offer, which will leave them both with a payoff of zero. This means that the punishment comes at a cost for the player, it is not free, he sacrifices his offered points to be able to punish the leader to leave him with zero points as well. In the classic version of the ultimatum game, the player can cause the leader to have no point at all in a round by rejecting his offer. Because the game only exists of one round and thus one offer and therefore only one chance to get a payoff for both the leader and the player, the power of punishment is very big.

In the two-follower game a player has also the option to punish the leader if he feels that the offer made to him is too low. When the follower rejects the offer he will punish the leader for the low offer by leaving him with zero payoff in that round, at the cost of having zero payoff himself. The costs of punishment for the followers in a two-follower game are therefore the same as for the followers in the classic ultimatum game. The difference between the two games looking at punishment lies in the power of punishment. In the two-follower game, the leader plays two subgames. In each subgame the leader has a chance to receive a payoff. A player can thus punish the leader in his own subgame but then the leader always has another subgame to gain some payoff. The power of punishment is therefore smaller, approximately half, in the game with two followers than in the classical ultimatum game while the cost of punishment is the same for every follower, in every subgame and in both games.

The above will possibly result in differences in the rejection rates between both ultimatum games. Because the cost of punishment are the same for everyone in every game but the power of punishment is lower for the two-follower ultimatum game, the demand for the need to punish will be lower in the this game. This will possibly result in lower rates of rejection in the two-follower game.

As we have seen in the section results, theoretical prediction two is proven to be false. Instead, given the data the opposite has been found: Given the magnitude of the offer, the rejection rate is lower in the two-follower model with forward-looking fairness than in the classic ultimatum game. This is thus in conformity with the theory on spitefulness presented above. However, this result is insignificant looking only at both first followers and thus only at first offers. To see if evidence exists to believe that our alternative explanation, the demand for punishment is less in the two-follower game due to spitefulness, is true, the regression has to be run on the total sample. In other words, this regression tests the prediction that the rejection rate is lower in the two-follower game. Using the total sample the following regression will be run:

$$\mathrm{P}(a^{it} = 1) = \frac{\exp\{\alpha_0^i + \alpha_1 Offer^{it} + a_2 Treatment + \alpha_3 Diff^{it}\}}{1 + \exp\{\alpha_0^i + \alpha_1 Offer^{it} + a_2 Treatment + \alpha_3 Diff^{it}\}}, \qquad (14)$$

where *i* stands for subject and t stands for the number of the round, *offer* is the total set of offers, *treatment* is a dummy variable which takes on the value of 1 if the participant is in the treatment group and takes on a value of 0 if the participant is in the control group. The variable *diff* is the difference between the signal observed by follower 2 and his own offer, switched on if positive, which allows controlling for peer-induced fairness. When it is true that, given the magnitude of the offer, the demand for punishment is less in a two-follower game we would expect the coefficient on α_2 to be positive. The result shows that this is true. The coefficient of α_2 takes on the value of 0,709 with a p-value of 0.053. Working with the total sample this result is thus of greater magnitude and of significant influence, implying that the followers in the treatment group are more likely to accept the offer of a given magnitude and given their perceptions of peer-induced fairness. These results are robust among several optional regressions and controlling for demographic variables.

The propensity of the followers to accept their offer is influenced by two factors: fairness and the demand for punishment. Fairness comes in three forms: distributive fairness, which all players have, forward looking fairness, which the first followers possible have, and backward looking fairness, which the second followers possibly have. Given the magnitude of the offer, fairness reduces the probability to accept the offer. Therefore, since fairness concerns are greater in the two-follower game, the probability of accepting the offer in this group should be lower than in the classical ultimatum game holding all else constant. Then there is the demand for punishment. As explained above, a rejection in the classical ultimatum game strips the leader of all his points that round while a rejection in the two-follower game the leader gets stripped of approximately half of his points that round. Thus because the costs of punishment are the same for all followers in all groups, whereas the effect of the punishment is lower in the two-follower game, the demand for punishment and therefore the rejection rate will be lower in the two-follower game than in the classical ultimatum game. The implication of this can be seen in the regression, the coefficient on the 'treatment' dummy in the regressions above is the sum of two conflicting factors and is therefore biased downwards.

A way to solve this problem is to allow for the variables that measure the strength of fairness concerns different followers have. A measure for peer related fairness is the *diff* variable, already included in the variable above, which is the difference between the observed signal by follower 2 and his offer, switched on if the difference is positive. A way to measure the possible existing forward-looking fairness is the new created variable *diff21*, which is the offer made to follower 2 minus the offer made to follower 1, switched on when this difference is positive. This is not a perfect measure of forward looking fairness, because the offer made to follower 2 is influenced by the signal.

$$\mathrm{P}(a^{it}=1)=\frac{\exp\{\alpha_0^i+\alpha_1 Offer^{it}+a_2F1^{it}+\alpha_3F2^{it}+\alpha_4Diff^{it}\}}{1+\exp\{\alpha_0^i+\alpha_1 Offer^{it}+a_2F1^{it}+\alpha_3F2^{it}+\alpha_4Diff^{it}\}}, \qquad (15)$$

where *offer* is the total set of offers, *F1* is the variable for follower 1, *F2* is the variable for follower 2, which allow for group fixed effects separate for control, follower 1 and follower 2. D*iff* is again the is the difference between the signal observed by follower 2 and his own offer, switched on if positive, which allows to control for peer induced fairness. The results show α_2 to be 0.356 with a p-value of 0.0382 and α_3 to be 1.271 with a p-value of 0.010. But this regression does not control for forward-looking fairness by follower 1, therefore the variable *diff21*, , which is the offer made to follower 2 minus the offer made to follower 1, switched on when this difference is positive, is added to the regression:

$$\mathrm{P}(a^{it}=1)=\frac{\exp\{\alpha_0^i+\alpha_1 Offer^{it}+a_2F1^{it}+\alpha_3F2^{it}+\alpha_4Diff^{it}+\alpha_5Diff21^{it}\}}{1+\exp\{\alpha_0^i+\alpha_1 Offer^{it}+a_2F1^{it}+\alpha_3F2^{it}+\alpha_4Diff^{it}+\alpha_5Diff21^{it}\}}, \quad (16)$$

Looking at the results it shows that once the variable *diff21* is added, the coefficient on the follower 1 dummy has increased in his magnitude, from 0.356 to 0.642 (with a p-value of 0.169). We have now isolated a negative influence on the propensity to accept the offer by follower 1. Given our theory this is the effect of forward-looking fairness concerns. However, both coefficients are insignificant, so it cannot be said for sure whether the forward-looking fairness really is present but this is a weak indication in this direction. These results are robust among several optional regressions and controlling for demographic variables.

Controlling for these extra factors, still, the results show a difference between the coefficients on follower 1 and follower 2, which should not be there, the theory of this alternative explanation implies that the demand for punishment by follower 1 and follower 2 should be the same. Testing these differences with a t-test however, shows that this difference is not significant and therefore the coefficients can be restricted to be the same as the theory on the demand for punishment suggests. Imposing this restriction, no separate variables controlling for follower 1 and follower 2 but just one ‘treatment’ dummy, along with extra controls and controlled for age and sex:

$$\mathrm{P}(a^{it} = 1) = \frac{\exp\{\alpha_0^i + \alpha_1 Offer^{it} + a_2 Treatment^{it} + \alpha_3 Diff^{it} + \alpha_4 Diff21^{it}\}}{1 + \exp\{\alpha_0^i + \alpha_1 Offer^{it} + a_2 Treatment^{it} + \alpha_3 Diff^{it} + \alpha_4 Diff21^{it}\}}, \tag{17}$$

The result show now that the coefficient on treatment is 1.092 is statistical significant with a p-value of 0.032. This leads to conclude that in our data differences in the demand for punishment exists because the data show that in comparison to the participants in the classic ultimatum game the participants in the two-follower game are, given the offer, likely to have a lower rate of rejection.

Furthermore, the coefficient on forward looking fairness, *diff21,* is -0.145 and, near statistical, significant with a p-value of 0.052.Which therefore we can conclude that serious evidence points out the existence of forward-looking fairness.

The table below summarizes the previous discussed regressions and their results.

Number	Probability of accepting on	Specification	Variable of interest	Variable of interest2	Coefficient	Coefficient 2	P-value	P-value 2
(14)	Offer Treatment Diff	Controlled for peer induced fairness by diff	Treatment	-	0,709	-	0,053	-
(15)	Offer F1 F2 Diff	Controlled for group fixed effects by F1 and F2	F1	F2	0,356	1,271	0,038	0,01
(16)	Offer F1 F2 Diff Diff21	Controlled for forward looking fairness with diff21	F1	-	0,642	-	0,169	-
(17)	Offer Treatment Diff Diff21	F1 and F2 restricted to be the same by treatment	Treatment	Diff21	1,092	-0,145	0,032	0,052

Table 5: Summary regressions of paragraph 'The demand for Punishment'

While the explanation of demand for punishment can plausible fix the puzzle of the counter theoretical result that the rejection rate in the two-follower game is lower than in the classical ultimatum game, cannot explain the differences in the height of offers. The offers in the two-follower game are found to be lower than in the classical ultimatum game, which is also going against the basic theory of this study. A possible alternative explanation for this difference will be discussed in the next paragraph.

8.2 Increasingly risky behaviour

The theory of this study predicts that due to forward-looking fairness, the first offer in the model with forward-looking fairness will be higher than the offer in the classical ultimatum game. The experimental results of this study have found otherwise, the offer in the two-follower game is found to be lower than the offer in the classical ultimatum game. A possible explanation for this difference between theory and practice might be increasingly risky behaviour of the leader as his wealth increases. The next paragraphs will enlighten this theory.

Risk aversion states that people behave along the preference of avoiding risk. It implies people are willing to have a lower expected payoff to decrease the amount of risk on the expected payoff. Bowles (2003) provides a clear explanation of the behaviour of people in the face of risk introducing a framework using the concavity of the payoff function. As presented the basic idea of this framework is to represent expected income as a positive thing and the variance of income as a negative thing, which are expressed in components of the individual's payoff function. This framework and several figures lead to conclude that less wealthy and hence risk averse individuals will choose to be involved in projects with lower expected incomes, as so they have less exposure to risk. Levy (1994) studied the risk averseness of subjects with varying levels of wealth. He found that his subjects were willing to risk more as they became wealthier.

These theoretical frameworks and empirical studies lead to believe in a possibility that the leaders in the experiment of this study to forward-looking fairness will take more risk while becoming wealthier, due to accumulative points in previous rounds. More risky behaviour implies making a lower offer i.e. more risk due to a higher possibility of rejection, which will be explained further in the section below. This risky behaviour explanation would thus possible explain our results of observing a lower offer in the treatment group.

The leader in the classical ultimatum game plays one game per round; with the only follower. The leader in the two-follower game plays two games per round; with both the followers. The possible initial expected wealth of the leader in the two-follower game is therefore bigger than the possible initial expected wealth in the classical ultimatum game. According risk theory and CRRA, the initial expected wealth a person has the more risk they are willing to take. Taking more risk in this situation, the leader will bid a lower offer to the follower. This is taking on more risk for the leader than a higher offer because it can lead the follower to reject the offer, leaving him with nothing. Having a higher possible initial expected wealth in the two followers game, leads thus to more risky behaviour and therefore lower offers. As the result section already showed, see tables 3 and 4, this prediction is true; in our data, the offer in the two-follower game is lower than the offer in the classical ultimatum game. Below will be tried to find evidence whether or not increasingly risky behaviour fits as alternative explanation for our results. To see if evidence exists, we will use the data of our experiment to perform analyses.

As explained above, more wealth increases risky behaviour. We will therefore test the prediction that the higher cumulative wealth the leader has, the lower his next offer is. First, we will regress the offer made at time t on the cumulative wealth of the leader at time t-1. This gives:

$$\text{Offer} = \alpha_1 + \alpha_2 \text{Cumulative wealth}_{t-1} \qquad (18)$$

If the alternative explanation is correct, cumulative wealth at t-1 should have a negative influence on the offer at moment t. We find α_2 to be -0.008 and insignificant. While the sign of the coefficient thus shows a little support for our prediction, this regression on our data thus provides no significant evidence that there is a reason to believe that cumulative wealth has an influence on the offer.

To further look for possible evidence this regression is extended by also adding the accept decision by the follower at t-1 as independent variable.

$$\text{Offer} = \alpha_1 + \alpha_2 \text{Cumulative wealth}_{t-1} + \alpha_3 \text{Accept}_{t-1} \qquad (19)$$

Both α_2 and α_3 are negative coefficients, -0.0075 and -0.1013, but both are insignificant. The sign on the coefficient tells thus there is some evidence to believe that the alternative explanation might be true. The random effects logistic regression of *offer* on *cumulative wealth* at t minus 1 and *accept* at t minus 1, which thus controls for leader specific effects, gives the same result. However, the logistic regression with leader fixed effects does show a significant result. In this regression, the lagged acceptance decision gives a coefficient of -4.427 with a p-value of 0.024. This result is robust for several optional regressions. Thus, the acceptance decision in the previous round has a significant negative effect on the leader's next offer. If the last offer got accepted, the leader earned points and thus has a higher cumulative wealth and will therefore take more risk in making the next offer, which is lower.

Another way to see if evidence exists to believe the risky behaviour explanation is true is to look at the reaction of the leader to a rejected offer. If the offer made by the leader to the first follower is rejected, his expected wealth immediately decreases by half. Therefore, after rejection the leader should be willing to take less risk if this theory is true and thus should the second offer be higher than his first offer. We have:

$$\text{Diff} = \alpha_1 + \alpha_2\text{Accept1} \tag{20}$$

where *diff* is the difference between the second offer and the first offer in the two followers game, switched on if the difference if positive. The result shows that $\alpha_2 = -3.65$ with a p-value of 0.02. So *accept1* is of significant influence on the difference between offer2 and offer1, which becomes higher if accept1 is zero. This result is robust among several optional regressions.

The results of this section in search of possible evidence for the alternative explanation of increasingly risky behaviour do provides us with a little, however, not enough evidence to conclude the existence of risky behaviour. The theory opposing result, that the offer is lower in the two-follower game than in the classical ultimatum game, thus does need more research to draw conclusive remarks which makes this a possible path for further research.

9. Conclusion

This paper is aspires to make an addition to the existing knowledge in the field of economics by studying fairness. As Thaler (1988) already said in his study to fairness: “One conclusion that emerges clearly from this research is that notions of fairness can play a significant role in determining the outcome of negotiations.” In this thesis we have used the classical ultimatum game by Guth, Schmittberger and Schwarze (1982) to construct a basic theoretical model. This game is a rather good example that people are not totally selfish as traditional economists claim.

This work builds upon the work of Ho and Su (2009) and explores the possible existence of forward looking peer-induced fairness. In 2007, Van Boven and Ashworth have found evidence for difference in strength of emotions when either looking backward or anticipating something. The last one seems much stronger. This study builds a theoretical model of the ultimatum game with a leader and two followers, incorporating forward-looking fairness. The theoretical model predicts that the offer to the first follower is weakly higher in the model with forward-looking fairness than in the classical ultimatum game. Next to that, the model predicts that, given the offer, the rate of rejection of the first offer is higher in the model with forward-looking fairness.

The theoretical predictions are tested experimentally. The experiment took place at a Dutch high school and involved 75 students. The results of the experiment, however, are not in line with the theoretical predictions. Opposite to the prediction, the offer in the two-follower game with forward-looking fairness is lower than in the classical ultimatum game. Furthermore, the rejection rate, predicted to be higher in the two-follower game with forward-looking fairness, is lower in the two-follower game than in the classical ultimatum game.

These differences between our theory and the experiment are tried to be reconciled by alternative explanations. For the lower offer in the two-follower game this is tried to explain by notions of risk aversion of the leader. The leader has an expected payoff and makes decisions based on the height of this expected payoff. Since the expected payoff is higher in the two-follower game, the leader in that game has the possibility of taking more risk compared to the leader in the classical ultimatum game and therefore offers a lower offer.

The lower rate of rejection in the two-follower game is tried to be explained by notions of the demand for punishment. Since all players have the same cost for punishing the leader by not accepting the offer if they find it too low, but the power of punishment is much smaller in a two-follower game. The demand for punishment, and therefore the rate of rejection is thus smaller in the two-follower game. These possible explanations are tested by running regressions on the data to see if evidence exists to verify if these explanations can be true.

Weak evidence is found on behalf of the alternative explanation 'risk aversion' to try and explain the lower offer in the two followers game with forward-looking fairness. For conclusive findings, this might be a truthful direction for further research.

Strong evidence is found to accept that the demand for punishment is a way to explain the lower rate of rejection in the two-follower game. Also with these regressions we were able to isolate the effect of forward-looking peer induces fairness which was found to be significant. This gives thus also strong evidence to believe that forward-looking fairness, next to the demand for punishment, exists.

10. Discussion

10.1 The Experiment

The experiment was one of the main elements of this study. Since I got a high school who wanted to cooperate with me really fast and the end of the school year was nearly there, not enough time was left to design a computer game to execute the experiment. This created a serious problem at first because the experiment involved a lot of students per session who were tied to strict game playing and communication rules. The solution was found in performing the preparations of the experiment by hand, like for instance the random division in groups and roles. For the experiment itself, a chat box was designed which only allowed communication from the moderator to the students personally and from the students only to the moderator. With this chat box and thus a bit more work manually the problem was thus solved.

The experiment had one other downside. When the students made very low or high offers, the signal sometimes became a problem. The second player, BLUE2, gets a noisy signal on the offer made by the first follower, BLUE1. This signal was: $s_1 + \varepsilon$, where ε is a random drawn number from the distribution [-20,-10,0,10,20]. If a player BLUE1 made a very high or low offer, for instance 10 or 90, the signal sometimes had a negative value of a value above 100. This creates a problem because then sometimes you can know the almost exact offer made. This situation was solved by changing the signal less than zero or above 100 to zero or 100.

Lastly, on the part of the experiment, due to the payoff structure it was possible to perform this experiment with 75 participants for the total amount of only 35 euro's. This was thus a piece of good fortune.

10.2 The results

To replicate some of the results of Ho and Su (2009) it was the most convenient to use the computer program Stata. This was a program that took quite some time getting acquainted with, but in the end the effort paid off.

The last remarkable point was that the results did not match the theoretical predictions. This took time to review, explain and test whether alternative explanations could be found. However, it is believed that these alternative explanations form a major result of research undertaken as part of this thesis.

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12. Appendix

12.1 Appendix 1

Prior to this thesis, exploring the theoretical model, a preliminary research paper has been written, which is used for the theoretical model of this research (Roelse, 2012).

Proof of result 1

The leader has two possible choices. Either, he can offer zero to the follower, which will induce the follower to reject, which will leave the leader with zero utility as well. Or, he can choose to offer the optimal offer, among all the offers that are acceptable to the second follower. In mathematical terms the leader thus faces this problem:

$$\text{Max}_{s2} \quad U_{l\,II}\,(s_2,\, 1|z)$$

$$\text{s.t.} \quad U_{F2}\,(s_2,\, 1\,|z) \geq 0$$

Because the leader's payoff function $U_{L,II}$ $(s_2, 1|z)$ is increasing as s_2 is decreasing, this problem is similar to the following:

$$\text{Min}_{s2} \quad s_2$$

$$\text{S.t.} \quad U_{F2}\,(s_2,\, 1|z) \geq 0$$

If we introduce the variables $w_1 = \max\{\pi - 2s_2, 0\}$ and $w_2 = \max\{\hat{s}_2 - s_{2,}\, 0\}$, the problem can be rewritten to:

$$\text{Min}_{s2,w1,w2} \quad s_2$$

$$\text{s.t.} \quad s_2 - \delta w1 - \rho\hat{p}w2 \geq 0$$
$$w_1 \geq 0$$
$$w_2 \geq 0$$
$$w_1, w_2 \geq 0$$

$$s_2 - \delta(\pi - 2s2) - \rho\hat{p}(\hat{s}_1 - s_2) \geq 0$$
$$s_2 - \delta\pi + \delta 2s2 - \rho\hat{p}\hat{s}_1 + \rho\hat{p}\hat{s}_2 \geq 0$$
$$s_2(1 + 2\delta + - \rho\hat{p}) \geq \delta\pi + \rho\hat{p}\hat{s}_1$$
$$s_2 \geq \delta\pi + \rho\hat{p}\hat{s}_1 / (1+2\delta + \rho\hat{p})$$

$$s_2 - \delta(\pi - 2s_2) \geq 0$$
$$s_2 - \delta\pi + \delta 2s_s \geq 0$$

$s_2 + \delta 2 s_2 \geq \delta\pi$

$s_2 \geq \delta\pi / (1 + 2\delta)$

$s_2 - \rho\hat{p}(\hat{s}_1 - s_2) \geq 0$

$s_2 - \rho\hat{p}\hat{s}_1 + \rho\hat{p}s_2 \geq 0$

$s_2 + \rho\hat{p}s_2 \geq \rho\hat{p}\hat{s}_1$

$s_2 \geq \rho\hat{p}\hat{s}_1 / (1 + \rho\hat{p})$

Thus, among all offers that are acceptable to the second follower, the offer that maximizes the leaders utility $U_{L,II}$ (s_2, 1|z) is: $s_2^0 = \max\left\{\frac{\pi\delta}{1+2\delta}, \frac{\pi\delta + \rho\hat{p}\widehat{s_1}}{1+2\delta + \rho\hat{p}}, \frac{\rho\hat{p}\widehat{s_1}}{1+\rho\hat{p}}\right\}, 0\}$.

The offer that leaves the leader with zero utility, s_2^1 is another constraint.

$s_2^1 = \pi - \frac{\pi\delta}{1+2\delta} = \frac{\pi(1+\delta)}{1+2\delta}$

Therefore, the leaders equilibrium offer in the second game must be min{ $s_2^{0,}$ s_2^1} as given in result 1.

Proof of result 2: First follower

Again, as for the offer to the second follower, the leader has two choices. He can either offer zero(and the first follower will reject) or he can offer the optimal offer among all the offers that are acceptable to the second follower. Thus, the leader solves the following problem:

Max_{s2} $U_{L,I}$ (s_1, 1)

s.t. U_{F1} (s_1, 1) ≥ 0

Since the follower had an acceptance constraint we will first see what that is. To accept the offer, the utility of the follower must be at least zero (as explained in Appendix 4; rate of rejection)

$s_1 - \delta(\pi - s_1) - s_1 \geq 0$

$s_1 - \delta(\pi - 2s_1) \geq 0$

$s_1 - \delta\pi + \delta 2 s_1 \geq 0$

$s_1 + \delta 2 s_1 \geq \delta\pi$

$s_1 \geq \delta\pi / 1 + 2\delta$

Since $U_{L,I}$ (s_1, 1) is decresing in s_1 the leader wants to make an offer as low as possible but one that will still be accepted by the follower. Therefore, the optimal offer of the leader to the first follower is:

$$s_1^* = \frac{\pi\delta}{1 + 2\delta}$$

Proof of result 3: First follower with forward looking fairness.

As for the begore coming two offer derivations, the same story applies here. The leader can either offer zero of the optimal offer among all acceptable offer to the follower. Mathematically written the leader is facing the following problem:

$\text{Max}_{s1,FF}$ $\quad U_{l\,I}\,(s_1,\, 1|z_1)$

s.t. $\quad U_{F1,FF}\quad (s_2,\, 1\,|z) \geq 0$

Because the leader's payoff function is increasing as $s_{1,FF}$ is decreasing is decreasing, this problem is similar to the following:

$\text{Min}_{1,FF}$ $\quad s_2$

s.t. $\quad U_{F1,FF}\,(s_1,\, 1|z_1) \geq 0$

As we introduce the variables $w_1 = \max\{\pi - 2s_1, 0\}$ and $w_2 = \max\{E(s_2^*) - s_{1,}0\}$, the problem can be rewritten to:

$\text{Min}_{s1,w1,w2}$ $\quad s_1$

s.t. $\quad s_1 - \delta w1 - \rho_1\hat{p}w2 \geq 0$

$w_1 \geq 0$

$w_2 \geq 0$

$w_1, w_2 \geq 0$

This can be rewritten in terms of only s_1 which yields:

$\text{Min}_{s1,w1,w2}$ $\quad s_1$

s.t. $\quad s_1 - \delta(\pi - 2s_1) - \rho_1\hat{p}_1\,(E(s_2^*) - s_1\,) \geq 0$

$s_1 - \delta\pi + \delta 2s_1 - \rho_1\hat{p}_1 E(s_2^*) + \rho_1\hat{p}_1\, s_1 \geq 0$

$s_1(1 + 2\delta + \rho_1\hat{p}_1) \geq \delta\pi + \rho_1\hat{p}_1 E(s_2^*)$

$s_1 \geq \delta\pi + \rho_1\hat{p}_1 E(s_2^*)/\,(1+2\delta + \rho_1\hat{p}_1)$

$s_1 - \delta(\pi - 2s_1) \geq 0$

$s_1 - \delta\pi + \delta 2s_1 \geq 0$

$s_1 + \delta 2s_1 \geq \delta\pi$

$s_1 \geq \delta\pi\,/\,(1 + 2\delta)$

$s_1 - \rho_1\hat{p}_1\,(E(s_2^*) - s_1) \geq 0$

$s_1 - \rho_1\hat{p}_1 E(s_2^*) + \rho_1\hat{p}_1 s_1 \geq 0$

$s_1 + \rho_1\hat{p}_1 \geq \rho_1\hat{p}_1 E(s_2^*)$

$s_1 \geq \rho_1\hat{p}_1 E(s_2^*) / (1 + \rho_1\hat{p}_1)$

Thus, among all offers that are acceptable to the second follower, the offer that maximizes the leaders utility $U_{L,I}$ (s_1, 1|z_1) is: $s_1^0 = \max\left\{\frac{\pi\delta}{1+2\delta}, \frac{\pi\delta + \rho_1\widehat{p_1}E(s_2^*)}{1+2\delta+\rho_1\widehat{p_1}}, \frac{\rho_1\widehat{p_1}E(s_2^*)}{1+\rho_1\widehat{p_1}}\right\}, 0\}$

The offer that leaves the leader with zero utility, s_2^1 is another constraint.

$$s_2^1 = \pi - \frac{\pi\delta}{1+2\delta} = \frac{\pi(1+\delta)}{1+2\delta}$$

Therefore, the leader's equilibrium offer in the second first game with forward looking peer induced fairness must be min{ $s_2^{0,}$ s_2^1} as given in result 2.

Rate of rejection of follower 1

The follower can either accept or reject the offer from the leader. If he rejects, his utility will be zero. To accept, the utility of the follower, $U_{F1}(s_{1,}1|z)$, must become at least zero by the offer:

$U_{F1}(s_{1,}1|z) \geq 0$

$s_1 - \delta\max(\pi - s_1) - s_1 \geq 0$

To write this easier the following variable is introduced, $w_1 = \max\{\pi - 2s_1, 0\}$,

$s_1 - \delta w_1 \geq 0$

$s_1 - \delta(\pi\text{-}2s_1) \geq 0$

$s_1 - \delta\pi + \delta 2s_1 \geq 0$

$s_1 + \delta 2s_1 \geq \delta\pi$

$s_1 \geq \delta\pi / 1 + 2\delta = A_1$,

where A1 is acceptance threshold of follower 1.

Rate of rejection follower 1 with forward looking fairness

Follower one can either accept or reject this offer from the leader. If he rejects, his utility will be zero. To accept the offer, the utility of the follower, , $U_{F1,FF}(s_{1,}1|z)$, must become at least zero by the offer:

$U_{F1,FF}(s_{1,}1|z) \geq 0$

$s_{1,FF} - \delta\max(0, \pi - 2s_{1,FF}) - \rho_1\hat{p}_1\ (E(s_2^*) - s_{1,FF} \geq 0$

To write this easier the following variables are introduced:

$w_1 = \max\{\pi - 2s_1, 0\}$

$w_2 = \max\{E(s_2^*) - s_{1,FF}\ ; 0\}$

Which yields:

$s_1 - \delta w_1 - \rho_1 \hat{p}_1 w_2 \geq 0$

$s_1 - \delta(\pi - 2s_1) - \rho_1 \hat{p}_1 (E(s_2^*) - s_1) \geq 0$

$s_1 - \delta\pi + \delta 2s_1 - \rho_1 \hat{p}_1 E(s_2^*) + \rho_1 \hat{p}_1 s_1 \geq 0$

$s_1(1 + 2\delta + \rho_1 \hat{p}_1) \geq \delta\pi + \rho_1 \hat{p}_1 E(s_2^*)$

$s_{1,FF} \geq \delta\pi + \rho_1 \hat{p}_1 E(s_2^*) / (1 + 2\delta + \rho_1 \hat{p}_1) = A_{1,FF}$,

where $A_{1,FF}$ is acceptance threshold of follower 1 with forward looking peer induced fairness.

12.2 Appendix 2

Instructies

Groep 1

Leeftijd:

Geslacht:

Beste deelnemer,

Dit is een experiment over het economische keuze proces. De instructies zijn simpel en als je ze goed volgt en goede keuzes maakt, maak je kans op een stuk taart naar keuze, die je later vandaag zult ontvangen. Of je wat wint hangt deels af van je eigen keuzes, deels van de keuzes van anderen en deels van kans. Dit experiment bestaat uit 2 groepen. In beide groepen zitten 15 mensen. Elke groep speelt 10 rondes van dit experiment.

Jullie mogen bij dit experiment niet praten, geen andere geluiden maken en niet bij de buren kijken. Ook mogen jullie in het chat scherm niks veranderen en echt alleen maar met Sophie of Roos chatten. Je chat scherm is ingesteld zoals het moet zijn, daar hoef je zelf dus niks aan te doen. Wij kunnen precies zien wat jullie doen op je scherm. Overtreding van een van deze regels zal ertoe leiden dat je uit het experiment gezet wordt. Ik heb zoveel mogelijk data nodig dus ik zou het heel erg fijn vinden als iedereen zich hieraan houdt.

Alle communicatie verloopt via het chatscherm op de computer. Je krijgt ook via daar te lezen welke rol je toegewezen krijgt in iedere ronde.

<u>Speluitleg</u>

Dit spel bestaat uit een rode speler ROOD en een blauwe speler BLAUW. In elke ronde worden willekeurig tweetallen gevormd door de begeleider. Jullie krijgen niet te horen met wie je in een 2-tal zit. Daarna wordt er door de begeleider willekeurig toegewezen welke van de twee spelers ROOD is en welke speler BLAUW. Jullie horen alleen welke rol je zelf hebt. Dit alles krijg je van Roos te horen via de chat die op je computer open staat. De taak van elke speler wordt hieronder uitgelegd.

In elke ronde verloopt het beslissingsproces in 2 fases, namelijk fase I en fase II. De toewijzing van de rollen wordt willekeurig gedaan, zodat iedereen in het 2-tal evenveel kans heeft om ROOD of BLAUW te worden. Omdat dit alles willekeurig gebeurd heeft iedereen evenveel kans op de prijs. De speler ROOD en de blauwe speler BLAUW spelen het spel als volgt.

Fase I: ROOD en BLAUW hebben samen 100 punten te verdelen. ROOD maakt een bod BOD1, lopend van 0 tot 100 punten, wat hij aan BLAUW zou willen geven. Dit bod geeft hij via de chat door aan Roos. Dit chatscherm is al voor je geopend.

Dit bod wordt dan door de begeleider doorgestuurd naar bijbehorende speler BLAUW.

Fase II: Nadat BLAUW het aanbod in zijn chatscherm gelezen heeft moet hij kiezen of hij dit bod accepteert of weigert. Als BLAUW dit bod accepteert, zal ROOD: 100 – BOD1 punten krijgen en speler BLAUW zal BOD1 punten krijgen. Als speler BLAUW het bod weigert zullen beide spelers ROOD en BLAUW geen punten ontvangen in die ronde.

Aan het einde van fase II, worden spelers ROOD en BLAUW geïnformeerd over hun respectievelijke keuze uitkomsten en verdiende punten. Het bovenstaande keuze spel wordt 10 rondes herhaald. Nadat je je verdiende punten hebt te horen gekregen in de ronde, moet je even wachten tot je opnieuw wordt ingedeeld en begint alles weer opnieuw. In elke ronde worden er nieuwe 2-tallen gevormd door de begeleider. Er is dus geen ruimte voor strategisch handelen.

Alle handelingen die jullie moeten doen worden op het moment dat je ze moet uitvoeren, via de chat nog een keer aan je verteld. Je mag per handeling die je moet doen maar 1 keer iets doorsturen wat je gevraagd wordt, als je eenmaal je keuze hebt doorgestuurd kun je het niet meer veranderen, denk er dus goed over na voordat je iets stuurt.

Beloning

Je mogelijke kans op een prijs wordt als volgt bepaald. De klas is in tweeën gesplitst voor het experiment, in elke helft wordt de volgende prijs uitgereikt: De spelers met het 25% hoogste aantal punten, opgeteld van al je rondes, zullen een stuk taart naar keuze ontvangen. Omdat iedereen elke keer willekeurig wordt ingedeeld in beide rollen heeft iedereen evenveel kans op de prijs.

Instructies

Groep 2

Leeftijd:

Geslacht:

Beste deelnemer,

Dit is een experiment over het economische keuze proces. De instructies zijn simpel en als je ze goed volgt en goede keuzes maakt, kun je een stuk taart naar keuze winnen, dat je later vandaag zult ontvangen. Of je wat wint hangt deels af van je eigen keuzes, deels van de keuzes van anderen en deels van kans. Dit experiment bestaat uit 2 groepen. In beide groepen zitten 15 mensen. Elke groep speelt 10 rondes van dit experiment.

Jullie mogen bij dit experiment niet praten, geen andere geluiden maken en niet bij de buren kijken. Ook mogen jullie in het chat scherm niks veranderen en echt alleen maar met Sophie of Roos chatten. Je chat scherm is ingesteld zoals het moet zijn, daar hoef je zelf dus niks aan te doen. Wij kunnen precies zien wat jullie doen op je scherm. Overtreding van een van deze regels zal ertoe leiden dat je uit het experiment gezet wordt. Ik heb zoveel mogelijk data nodig dus ik zou het heel erg fijn vinden als iedereen zich hieraan houdt.

Alle communicatie verloopt via het chatscherm op de computer. Je krijgt ook via daar te lezen welke rol je toegewezen krijgt in iedere ronde.

Speluitleg

Dit spel bestaat uit een rode speler ROOD en twee BLAUWE spelers. In elke ronde worden willekeurig drietallen gevormd door de begeleider. Jullie krijgen niet te horen met wie je in een 3-tal zit. Daarna wordt er door de begeleider willekeurig toegewezen wie van de drie spelers ROOD is, wie speler BLAUW1 en wie speler BLAUW2 . Jullie horen alleen welke rol je zelf hebt. Dit alles krijg je van Sophie te horen via de chat die op je computer open staat. De taak van elke speler wordt hieronder uitgelegd.

In elke ronde verloopt het beslissingsproces in 3 fases, namelijk fase I, fase II en fase III. De toewijzing van de rollen gebeurt willekeurig, zodat iedereen in het 3-tal evenveel kans heeft om ROOD, BLAUW1 of BLAUW2 te worden. Omdat dit alles willekeurig gebeurd heeft iedereen evenveel kans op de prijs. Elke speler ROOD en de 2 blauwe spelers (BLAUW1 en BLAUW2) spelen het spel als volgt.

Fase I: ROOD en BLAUW1 hebben samen 100 punten te verdelen (BLAUW2 doet niks in fase I). ROOD maakt een bod BOD1, lopend van 0 tot 100 punten, wat hij aan BLAUW1 zou willen geven. Dit bod geeft hij via de chat door aan Sophie. Dit chatscherm is al voor je geopend.

Dit bod wordt dan door de begeleider via de chat doorgestuurd naar bijbehorende speler BLAUW1.

Fase II: Nadat BLAUW1 in het chatscherm het aanbod gelezen heeft moet hij kiezen of hij dit bod accepteert of weigert. Dit geeft hij via de chat door aan Sophie. Als BLAUW1 dit bod accepteert, zal speler ROOD: 100 – BOD1 punten krijgen en speler BLAUW1 zal BOD1 punten krijgen. Als speler BLAUW1 het bod weigert zullen beide spelers ROOD en BLAUW1 geen punten ontvangen in die ronde. Let op, de uitkomst van fase I (dus of BLAUW1 het bod heeft geaccepteerd of geweigerd en het behaalde punten aantal) zal bekend worden gemaakt aan ROOD en BLAUW1 aan het einde van fase III.

Na fase II wordt er door de begeleider willekeurig een nummer getrokken uit een set van 5 nummers: -20, -10, 0, 10, 20. Dit betekend dat elk nummer evenveel kans heeft om getrokken te worden. Het nummer wat getrokken wordt noemen we X. We creëren daarmee een signaal dat we SIGNAAL1 noemen. SIGNAAL1 ontstaat als volgt: SIGNAAL1 = BOD1 + X. Dit signaal zal jullie een indicatie geven van BOD1. Dit SIGNAAL1 zullen jullie in fase III te horen krijgen om het spel mee verder te spelen.

Laten we naar 2 voorbeelden kijken om te zien hoe het maken van zo’n signaal werkt. Bijvoorbeeld, als SIGNAAL1 = 30, dan zijn er 5 mogelijke scenario’s:

SIGNAAL1 X	BOD1	
30	50	-20
30	40	-10
30	30	0
30	20	10
30	10	20

Merk op, als SIGNAAL1=30, dan kan BOD1 lopen van 10 tot 50 punten, afhankelijk van de waarde van het random getrokken nummer X.

Voorbeeld 2, als SIGNAAL1=70 hebben we de volgende 5 scenario’s:

SIGNAAL1 X	BOD1	
70	90	-20
70	80	-10
70	70	0
70	60	10

70	50	20

Dus BOD1 kan variëren van 50 tot 90 punten als SIGNAAL1 = 70.

Let op, de twee bovenstaande voorbeelden zijn alleen maar bedoeld als voorbeelden ter verduidelijking, op geen enkele manier geven ze een indicatie van optimale keuze mogelijkheden.

Fase III: ROOD en BLAUW2 hebben samen 100 punten te verdelen (BLAUW1 doet niks). Voordat ROOD het bod maakt, worden beide spelers ROOD en BLAUW2 geïnformeerd over de waarde van SIGNAAL1. Merk op dat SIGNAAL1 is gemaakt door de willekeurig getrokken X, hierboven beschreven, toe te voegen aan BOD1 gemaakt van ROOD aan BLAUW1 in fase I. BLAUW2 krijgt door dit signaal dus een indicatie van het bod dat door ROOD aan BLAUW1 is gemaakt. ROOD krijgt dit signaal ook te horen omdat hij hiermee leert welke indicatie BLAUW2 heeft gekregen. Vervolgens maakt ROOD een bod BOD2, lopend van 0 tot 100 punten, wat hij aan BLAUW2 wil geven. Dit bod geeft hij via de chat door aan Sophie.

Dit bod wordt dan door de begeleider via de chat doorgestuurd naar bijbehorende speler BLAUW2.

Fase IV: Nadat BLAUW2 zijn aanbod op de chat gelezen heeft moet hij kiezen of hij dit bod accepteert of weigert. Dit geeft hij via de chat door aan Sophie. Als BLAUW2 dit bod accepteert, zal speler ROOD: 100 – BOD2 punten krijgen en speler BLAUW2 zal BOD2 punten krijgen. Als speler BLAUW2 het bod weigert zullen beide spelers ROOD en BLAUW2 geen punten ontvangen in die ronde.

Aan het einde van fase IV, worden spelers ROOD, BLAUW1 en BLAUW2 geïnformeerd over hun respectievelijke keuze uitkomsten en verdiende punten. Het bovenstaande keuze spel wordt 10 rondes herhaald. Nadat je je verdiende punten hebt te horen gekregen in de ronde, moet je even wachten tot je opnieuw wordt ingedeeld en begint alles weer opnieuw. In elke ronde worden er nieuwe 3 tallen gevormd door de begeleider. Er is dus geen ruimte voor strategisch handelen.

Alle handelingen die jullie moeten doen worden op het moment dat je ze moet uitvoeren, via de chat nog een keer aan je verteld. Je mag per handeling die je moet doen maar 1 keer iets doorsturen wat je gevraagd wordt, als je eenmaal je keuze hebt doorgestuurd kun je het niet meer veranderen, denk er dus goed over na voordat je iets stuurt.

<u>Beloning</u>

Je mogelijke kans op een prijs wordt als volgt bepaald. De klas is in tweeën gesplitst voor het experiment, in elke helft wordt de volgende prijs uitgereikt: De spelers met het 25% hoogste aantal punten, opgeteld van al je rondes, zullen een stuk taart naar keuze ontvangen. Omdat iedereen elke keer willekeurig wordt ingedeeld in drie rollen heeft iedereen evenveel kans op de prijs.

12.3 Appendix 3

Templates Contol group

ROOD:

Beste deelnemer, in deze ronde ben je speler ROOD, stuur alstublieft een bod naar Roos met de hoeveelheid punten van de 100 die je aan BLAUW aanbiedt.

BLAUW:

Beste deelnemer, in deze ronde ben je speler BLAUW, je kunt nu wachten tot je het aanbod ontvangt.

ROOD:

Bedankt. Wacht tot je ontvangt of het bod is geaccepteerd of geweigerd.

BLAUW:

BLAUW, u hebt [ ] punten aangeboden gekregen van ROOD. Geef door aan Roos of je dit bod accepteert of weigert.

BLAUW:

Bedankt, je hebt in deze ronde [ ] punten verdiend. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

ROOD:

BLAUW heeft uw bod geweigerd, u hebt deze ronde dus [0] punten verdiend. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

BLAUW heeft uw bod geaccepteerd, u heeft deze ronde dus [ ] punten verdiend. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

Template treatment group

ROOD:

Beste deelnemer, in deze ronde ben je speler ROOD, stuur alstublieft een bod naar Sophie met de hoeveelheid punten van de 100 die je aan BLAUW1 aanbiedt.

BLAUW1:

Beste deelnemer, in deze ronde ben je speler BLAUW1, je kunt nu wachten tot je het aanbod ontvangt.

BLAUW2:

Beste deelnemer, in deze ronde ben je speler BLAUW2, je kunt nu wachten tot je het SIGNAAL1 en verdere instructie ontvangt. Houd je scherm in de gaten.

ROOD:

Bedankt, wacht totdat je het SIGNAAL1 ontvangt en een nieuw bod moet plaatsen.

BLAUW1:

BLAUW1, u hebt [ ] punten aangeboden gekregen van ROOD. Geef door aan Sophie of je dit bod accepteert of weigert.

BLAUW1:

Bedankt, wacht nu tot het deel tussen ROOD en BLAUW2 gespeeld is en u hoort hoeveel punten u heeft ontvangen.

BLAUW2:

SIGNAAL1 heeft de volgende waarde: [ ]. Je kunt nu wachten tot je jou aanbod ontvangt.

ROOD:

SIGNAAL1 heeft de volgende waarde: [ ]. Stuur alstublieft een bod naar Sophie met de hoeveelheid punten van de 100 die je aan BLAUW2 aanbiedt.

ROOD:

Bedankt, wacht totdat je ontvangt of je boden zijn geaccepteerd of geweigerd.

BLAUW2:

BLAUW2, u hebt [ ] punten aangeboden gekregen van ROOD. Geef door aan Sophie of je dit bod accepteert of weigert.

BLAUW1:

Je hebt in deze ronde [ ] punten verdiend. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

BLAUW2:

Bedankt, je hebt in deze ronde [ ] punten verdiend. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

ROOD:

BLAUW1 heeft uw bod geaccepteerd, BLAUW2 heeft uw bod geweigerd, u heeft deze ronde dus het volgende aantal punten verdiend: [ ] + [0] = [ ]. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

BLAUW1 heeft uw bod geweigerd, BLAUW2 heeft uw bod geaccepteerd, u heeft deze ronde dus het volgende aantal punten verdiend: [0] + [] = [ ]. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

Beide spelers BLAUW1 en BLAUW2 hebben uw bod geweigerd, u heeft deze ronde dus het volgende aantal punten verdiend: [0] + [0] = [0]. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

Beide spelers BLAUW1 en BLAUW2 hebben uw bod geaccepteerd, u heeft deze ronde dus het volgende aantal punten verdiend: [] + [] = []. Wacht tot je opnieuw wordt ingedeeld in een van de rollen en de volgende ronde dus begint.

12.4 Appendix 4

Retesting ho and su

Output for regression (10) $P(a_2^{it} = 1) = \frac{\exp\{\gamma 0i + \gamma 1 s2it + \gamma 2(signal - s2it)+\}}{1+\exp\{\gamma 0i + \gamma 1 s2it + \gamma 2(signal - s2it)+\}}$,

```
Logistic regression                               Number of obs   =         62
                                                  LR chi2(2)      =      14.06
                                                  Prob > chi2     =     0.0009
Log likelihood = -31.955406                       Pseudo R2       =     0.1803
```

accept2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer2	.0954364	.0344364	2.77	0.006	.0279422	.1629306
d1	-.0127209	.0226813	-0.56	0.575	-.0571755	.0317338
_cons	-2.124996	1.199735	-1.77	0.077	-4.476434	.226442

Where d1=signal – offer2, replaced d1=0 if d1<0

```
Random-effects logistic regression                Number of obs      =        62
Group variable: id2                               Number of groups   =        33

Random effects u_i ~ Gaussian                     Obs per group: min =         1
                                                                 avg =       1.9
                                                                 max =         4

                                                  Wald chi2(2)       =      6.00
Log likelihood  = -28.477273                      Prob > chi2        =    0.0498
```

accept2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer2	.5602813	.2649525	2.11	0.034	.0409839	1.079579
d1	.0200777	.072979	0.28	0.783	-.1229584	.1631139
_cons	-14.64651	9.152227	-1.60	0.110	-32.58455	3.291523
/lnsig2u	4.113854	.8841837			2.380886	5.846823
sigma_u	7.821898	3.457997			3.288538	18.60465
rho	.9489721	.0428158			.766748	.9905848

Likelihood-ratio test of rho=0: chibar2(01) = 6.96 Prob >= chibar2 = 0.004

Where d1=signal – offer2, replaced d1=0 if d1<0

```
Logistic regression                               Number of obs   =         62
                                                  LR chi2(2)      =      14.27
                                                  Prob > chi2     =     0.0008
Log likelihood = -31.852604                       Pseudo R2       =     0.1830
```

accept2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer2	.0900586	.0361835	2.49	0.013	.0191403	.1609769
d2	-.0253974	.0354161	-0.72	0.473	-.0948117	.0440169
_cons	-1.904988	1.284756	-1.48	0.138	-4.423063	.6130875

Where d2= offer1-offer2, replaced d2=0 if d2<0

```
Random-effects logistic regression              Number of obs      =        62
Group variable: id2                             Number of groups   =        33

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       1.9
                                                               max =         4

                                                Wald chi2(2)       =      4.37
Log likelihood  = -28.14347                     Prob > chi2        =    0.1125
```

accept2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer2	.3678802	.2157841	1.70	0.088	-.0550488	.7908092
d2	-.0946076	.1134055	-0.83	0.404	-.3168782	.127663
_cons	-8.230008	6.755212	-1.22	0.223	-21.46998	5.009964
/lnsig2u	3.605364	1.035487			1.575848	5.634881
sigma_u	6.065895	3.140577			2.198827	16.73396
rho	.9179276	.07801			.5950786	.988388

Likelihood-ratio test of rho=0: chibar2(01) =   7.42 Prob >= chibar2 = 0.003

Where d2= offer1-offer2, replaced d2=0 if d2<0

Output for regression (11) $P(a_1^{it} = 1) = \frac{\exp\{\gamma 0i + \gamma 1 s1it + \gamma 2(s2it - s1it)+\}}{1+\exp\{\gamma 0i + \gamma 1 s1it + \gamma 2(s2it - s1it)+\}}$

```
Logistic regression                               Number of obs   =         62
                                                  LR chi2(2)      =      17.33
                                                  Prob > chi2     =     0.0002
Log likelihood = -32.714682                       Pseudo R2       =     0.2094
```

accept1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer1	.0871116	.0336678	2.59	0.010	.0211239	.1530993
diff	-.107118	.0678293	-1.58	0.114	-.240061	.0258251
_cons	-2.311569	1.297151	-1.78	0.075	-4.853938	.2308001

Where diff= offer2-offer1, replaced diff=0 if diff<0

```
Random-effects logistic regression              Number of obs      =        62
Group variable: id1                             Number of groups   =        32

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       1.9
                                                               max =         4

                                                Wald chi2(2)       =     12.41
Log likelihood  = -32.714683                    Prob > chi2        =    0.0020
```

accept1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer1	.0871299	.0336709	2.59	0.010	.0211362	.1531235
diff	-.1071272	.0678305	-1.58	0.114	-.2400727	.0258182
_cons	-2.312074	1.297237	-1.78	0.075	-4.854612	.2304639
/lnsig2u	-15.12693	818.3598			-1619.083	1588.829
sigma_u	.0005191	.2123941			0	.
rho	8.19e-08	.000067			0	.

Likelihood-ratio test of rho=0: chibar2(01) =   0.00 Prob >= chibar2 = 1.000

Where diff= offer2-offer1, replaced diff=0 if diff<0

Output for regression (12) $S_2^{it} = \alpha^i_0 + \alpha_1 Signal_1^{it}$

```
      Source |       SS       df       MS              Number of obs =      62
-------------+------------------------------           F(  1,    60) =    4.02
       Model |  487.065154     1  487.065154           Prob > F      =  0.0495
    Residual |  7267.91872    60  121.131979           R-squared     =  0.0628
-------------+------------------------------           Adj R-squared =  0.0472
       Total |  7754.98387    61  127.130883           Root MSE      =  11.006

------------------------------------------------------------------------------
      offer2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      signal |    .149699   .0746543     2.01   0.049     .0003682    .2990299
       _cons |   27.42173   3.120466     8.79   0.000     21.17987    33.66359
------------------------------------------------------------------------------
```

```
Random-effects GLS regression                   Number of obs      =        62
Group variable: id1                             Number of groups   =        35

R-sq:  within  = 0.0562                         Obs per group: min =         1
       between = 0.0907                                        avg =       1.8
       overall = 0.0628                                        max =         3

                                                Wald chi2(1)       =      4.11
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0426

------------------------------------------------------------------------------
      offer2 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      signal |   .1493606   .0736726     2.03   0.043     .0049649    .2937562
       _cons |   27.30663   3.187396     8.57   0.000     21.05945    33.55381
-------------+----------------------------------------------------------------
     sigma_u |  5.3687486
     sigma_e |  9.2726634
         rho |  .25106288   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
Random-effects GLS regression                   Number of obs      =        62
Group variable: id1                             Number of groups   =        35

R-sq:  within  = 0.0494                         Obs per group: min =         1
       between = 0.1048                                        avg =       1.8
       overall = 0.0705                                        max =         3

                                                Wald chi2(2)       =      4.41
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.1105

------------------------------------------------------------------------------
      offer2 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      signal |   .1411832   .0754238     1.87   0.061    -.0066448    .2890112
     accept1 |   1.696868   2.882394     0.59   0.556    -3.952521    7.346257
       _cons |   26.57344   3.438162     7.73   0.000     19.83477    33.31212
-------------+----------------------------------------------------------------
     sigma_u |   5.253768
     sigma_e |  9.4559219
         rho |  .23588186   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Controlled for acceptance of the first offer

Output t-test and Wilcoxon test

Paired t test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
offer1	62	36.67742	1.431269	11.26983	33.81542	39.53942
offer2	62	33.01613	1.431956	11.27523	30.15276	35.8795
diff	62	3.66129	1.626549	12.80746	.4088054	6.913775

mean(diff) = mean(offer1 - offer2) t = 2.2510
Ho: mean(diff) = 0 degrees of freedom = 61

Ha: mean(diff) < 0 Pr(T < t) = 0.9860
Ha: mean(diff) != 0 Pr(|T| > |t|) = 0.0280
Ha: mean(diff) > 0 Pr(T > t) = 0.0140

Wilcoxon signed-rank test

sign	obs	sum ranks	expected
positive	28	1164	943.5
negative	23	723	943.5
zero	11	66	66
all	62	1953	1953

unadjusted variance 20343.75
adjustment for ties -113.75
adjustment for zeros -126.50

adjusted variance 20103.50

Ho: offer1 = offer2
z = 1.555
Prob > |z| = 0.1199

Theoretical prediction 2

Output for regression (13) $P(a_1^{it} = 1) = \alpha^i_0 + \alpha_1 \text{Offer one}_1^{it} + \alpha_2 \text{Dummy},$

Logistic regression

Number of obs	=	175
LR chi2(2)	=	56.40
Prob > chi2	=	0.0000
Pseudo R2	=	0.2521

Log likelihood = -83.646288

accept1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer1	.1382364	.0245812	5.62	0.000	.0900581	.1864146
control	-.4356367	.4262283	-1.02	0.307	-1.271029	.3997554
_cons	-4.475081	.9209376	-4.86	0.000	-6.280085	-2.670076

```
Random-effects logistic regression              Number of obs      =       175
Group variable: id1                             Number of groups   =        65

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       2.7
                                                               max =         7

                                                Wald chi2(2)       =     25.86
Log likelihood  = -83.177869                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
     accept1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      offer1 |   .1502793   .0299698     5.01   0.000     .0915396     .209019
     control |  -.4657214   .4837385    -0.96   0.336    -1.413831    .4823885
       _cons |  -4.847857   1.087003    -4.46   0.000    -6.978343    -2.71737
-------------+----------------------------------------------------------------
    /lnsig2u |  -.8267762   1.296377                     -3.367628    1.714075
-------------+----------------------------------------------------------------
     sigma_u |   .6614055   .4287154                      .1856645    2.356171
         rho |   .1173649   .1342922                      .0103694    .6279023
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =     0.94 Prob >= chibar2 = 0.167
```

```
Random-effects logistic regression              Number of obs      =       175
Group variable: id1                             Number of groups   =        65

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       2.7
                                                               max =         7

                                                Wald chi2(4)       =     28.77
Log likelihood  = -80.694179                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
     accept1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      offer1 |   .1473511   .0288895     5.10   0.000     .0907286    .2039735
   treatment |   .3660693   .4575955     0.80   0.424    -.5308014     1.26294
       f1age |   .4300029    .201823     2.13   0.033     .0344371    .8255686
       f1sex |   .0126018   .4537541     0.03   0.978      -.87674    .9019436
       _cons |  -11.71293   3.372063    -3.47   0.001    -18.32205   -5.103806
-------------+----------------------------------------------------------------
    /lnsig2u |  -1.666627   2.469966                     -6.507671    3.174417
-------------+----------------------------------------------------------------
     sigma_u |   .4346067   .5367319                      .0386258    4.890078
         rho |   .0542962   .1268281                      .0004533    .8790611
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =     0.21 Prob >= chibar2 = 0.324
```

12.5 Appendix 5

<u>Need for punishment</u>

Output for regression (14) $P(a_1^{it} = 1) = \alpha^i_0 + \alpha_1 Offer_1^{it} + \alpha_2 Treatment + \alpha_3 Diff$

Logistic regression — Number of obs = 237; LR chi2(3) = 66.11; Prob > chi2 = 0.0000; Pseudo R2 = 0.2191

Log likelihood = -117.79642

accept	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer	.123812	.0195765	6.32	0.000	.0854429	.1621812
treatment	.7093836	.3671419	1.93	0.053	-.0102013	1.428968
diff	.011363	.0193912	0.59	0.558	-.026643	.0493689
_cons	-4.310977	.8466465	-5.09	0.000	-5.970374	-2.651581

Where diff= signal observed by follower 2 and his own offer. Replaced diff=0 if diff<0

Random-effects logistic regression — Number of obs = 237
Group variable: id — Number of groups = 74

Random effects u_i ~ Gaussian — Obs per group: min = 1; avg = 3.2; max = 7

Wald chi2(3) = 31.74

Log likelihood = -115.64416 — Prob > chi2 = 0.0000

accept	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer	.1481692	.026746	5.54	0.000	.095748	.2005903
treatment	.8364312	.4872806	1.72	0.086	-.1186213	1.791484
diff	.0109163	.0223068	0.49	0.625	-.0328043	.0546368
_cons	-5.123692	1.107212	-4.63	0.000	-7.293788	-2.953596
/lnsig2u	-.0092738	.7168642			-1.414302	1.395754
sigma_u	.9953739	.356774			.4930469	2.009482
rho	.2314536	.1275179			.0688078	.5510482

Likelihood-ratio test of rho=0: chibar2(01) = 4.30 Prob >= chibar2 = 0.019

Random-effects logistic regression — Number of obs = 237
Group variable: id — Number of groups = 74

Random effects u_i ~ Gaussian — Obs per group: min = 1; avg = 3.2; max = 7

Wald chi2(5) = 31.85

Log likelihood = -115.51457 — Prob > chi2 = 0.0000

accept	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
offer	.1497312	.0272612	5.49	0.000	.0963002	.2031621
treatment	.8463818	.4875185	1.74	0.083	-.1091368	1.801901
diff	.0128128	.0226229	0.57	0.571	-.0315272	.0571529
f1age	.0074307	.1280827	0.06	0.954	-.2436069	.2584682
f1sex	.2234379	.4586867	0.49	0.626	-.6755715	1.122447
_cons	-5.443306	2.14836	-2.53	0.011	-9.654014	-1.232597
/lnsig2u	-.0278749	.7254168			-1.449666	1.393916
sigma_u	.9861592	.3576882			.4844055	2.007636
rho	.2281614	.1277486			.0665761	.5505934

Likelihood-ratio test of rho=0: chibar2(01) = 4.15 Prob >= chibar2 = 0.021

Output for regression (15) $P(a_1^{it} = 1) = \alpha^i_0 + \alpha_1 Offer_1^{it} + \alpha_2 F1 + \alpha_3 F2 + \alpha_4 Diff$

```
Logistic regression                               Number of obs   =        237
                                                  LR chi2(3)      =      69.46
                                                  Prob > chi2     =     0.0000
Log likelihood = -116.12543                       Pseudo R2       =     0.2302

------------------------------------------------------------------------------
      accept |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       offer |   .1266624   .0194202     6.52   0.000     .0885996    .1647253
          f1 |   .3623774   .4070198     0.89   0.373    -.4353668    1.160122
          f2 |   1.222812   .4565855     2.68   0.007     .3279208    2.117703
       _cons |  -4.429373   .8411299    -5.27   0.000    -6.077958   -2.780789
------------------------------------------------------------------------------
```

Where f1=follower12==1&control==0 f2=follower12==2&control==0. Now control for backward looking fairness with diff ,which =difference between the signal observed by follower2 and his own offer.

```
Logistic regression                               Number of obs   =        237
                                                  LR chi2(4)      =      69.52
                                                  Prob > chi2     =     0.0000
Log likelihood = -116.09249                       Pseudo R2       =     0.2304

------------------------------------------------------------------------------
      accept |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       offer |   .1255974   .0198047     6.34   0.000     .0867809    .1644138
          f1 |   .3557231   .4069911     0.87   0.382    -.4419649    1.153411
          f2 |   1.270952   .4950382     2.57   0.010     .3006948    2.241209
        diff |  -.0057094   .0224212    -0.25   0.799    -.0496542    .0382353
       _cons |  -4.385127   .8562013    -5.12   0.000     -6.06325   -2.707003
------------------------------------------------------------------------------
```

Output for regression (16) $P(a_1^{it} = 1) = \alpha^i_0 + \alpha_1 Offer_1^{it} + \alpha_2 F1 + \alpha_3 F2 + \alpha_4 Diff + \alpha_5 Diff21$

```
Logistic regression                               Number of obs   =        237
                                                  LR chi2(5)      =      71.47
                                                  Prob > chi2     =     0.0000
Log likelihood = -115.12049                       Pseudo R2       =     0.2369

------------------------------------------------------------------------------
      accept |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       offer |   .1212777   .0199676     6.07   0.000     .0821418    .1604135
          f1 |   .6420463    .466769     1.38   0.169    -.2728042    1.556897
          f2 |   1.232355   .4920205     2.50   0.012     .2680122    2.196697
        diff |  -.0066876   .0223115    -0.30   0.764    -.0504173    .0370422
      diff21 |  -.0908073   .0668207    -1.36   0.174    -.2217735    .0401589
       _cons |  -4.205764   .8615957    -4.88   0.000     -5.89446   -2.517067
------------------------------------------------------------------------------
```

Where diff 12 = difference between offers to follower2 and follower1

```
Random-effects logistic regression              Number of obs      =       237
Group variable: id                              Number of groups   =        74

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       3.2
                                                               max =         7

                                                Wald chi2(5)       =     33.38
Log likelihood  = -113.12868                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
      accept |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       offer |   .1440066   .0268914     5.36   0.000     .0913005    .1967126
          f1 |   .7541036   .5836961     1.29   0.196    -.3899197    1.898127
          f2 |   1.395858   .6114437     2.28   0.022       .19745    2.594265
        diff |  -.0081242   .0251551    -0.32   0.747    -.0574273    .0411789
      diff21 |  -.1050947   .0788029    -1.33   0.182    -.2595455    .0493562
       _cons |  -4.952684   1.113258    -4.45   0.000    -7.134629   -2.770739
-------------+----------------------------------------------------------------
    /lnsig2u |  -.0272795   .7354432                     -1.468722    1.414163
-------------+----------------------------------------------------------------
     sigma_u |   .9864528     .36274                       .479812    2.028063
         rho |   .2282662   .1295562                      .0654017     .555598
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =     3.98 Prob >= chibar2 = 0.023
```

```
Random-effects logistic regression              Number of obs      =       237
Group variable: id                              Number of groups   =        74

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       3.2
                                                               max =         7

                                                Wald chi2(7)       =     33.77
Log likelihood  = -112.86168                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
      accept |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       offer |   .1445993   .0272207     5.31   0.000     .0912477     .197951
          f1 |   .7671128   .5820196     1.32   0.187    -.3736248     1.90785
          f2 |   1.426091   .6131432     2.33   0.020     .2243526     2.62783
        diff |  -.0070291    .025497    -0.28   0.783    -.0570022    .0429441
      diff21 |  -.1103905   .0794235    -1.39   0.165    -.2660577    .0452767
       f1age |   .0556768   .1296326     0.43   0.668    -.1983985     .309752
       f1sex |    .234232   .4586227     0.51   0.610     -.664652    1.133116
       _cons |   -5.97453   2.184931    -2.73   0.006    -10.25692   -1.692143
-------------+----------------------------------------------------------------
    /lnsig2u |  -.0700463   .7559995                     -1.551778    1.411685
-------------+----------------------------------------------------------------
     sigma_u |    .965583   .3649901                      .4602944    2.025553
         rho |   .2208201   .1300762                      .0605045    .5549862
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =     3.67 Prob >= chibar2 = 0.028
```

t-test of de twee groepen, f1 and f2, significant van elkaar verschillen

```
.
. test f1=f2

 ( 1)  [accept]f1 - [accept]f2 = 0

           chi2(  1) =    1.08
         Prob > chi2 =    0.2995
```

Output for regression (17) $P(a_1^{it} = 1) = \alpha^i_0 + \alpha_1 Offer_1^{it} + \alpha_2 Treatment + \alpha_3 Diff + \alpha_5 Diff21$

```
Random-effects logistic regression               Number of obs      =       237
Group variable: id                               Number of groups   =        74

Random effects u_i ~ Gaussian                    Obs per group: min =         1
                                                                avg =       3.2
                                                                max =         7

                                                 Wald chi2(6)       =     33.29
Log likelihood  = -113.40452                     Prob > chi2        =    0.0000

      accept       Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

       offer    .1427533   .0270324     5.28   0.000     .0897706    .1957359
   treatment    1.091882   .5078541     2.15   0.032     .0965066    2.087258
        diff    .0022651   .0233075     0.10   0.923    -.0434168    .0479469
      diff21   -.1445118   .0743594    -1.94   0.052    -.2902536      .00123
       f1age    .0465402   .1296994     0.36   0.720    -.2076659    .3007464
       f1sex     .240736   .4599602     0.52   0.601    -.6607694    1.142241
       _cons   -5.760778   2.171548    -2.65   0.008    -10.01693   -1.504622

    /lnsig2u   -.0571047   .7483302                     -1.523805    1.409595

     sigma_u    .9718514   .3636329                      .4667776    2.023437
         rho    .2230548   .1296866                      .0621143      .55447

Likelihood-ratio test of rho=0: chibar2(01) =     3.79 Prob >= chibar2 = 0.026
```

Increasingly risky behavior

Output for regression (18) Offer = $\alpha_1 + \alpha_2$Cumulative wealth$_{t-1}$

```
      Source        SS       df       MS              Number of obs =      245
                                                      F(  1,   243) =     0.42
       Model   88.7385035     1  88.7385035           Prob > F      =   0.5197
    Residual   51881.5717   243   213.50441           R-squared     =   0.0017
                                                      Adj R-squared =  -0.0024
       Total   51970.3102   244  212.993075           Root MSE      =   14.612

       offer       Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

  cum_points   -.0076208   .0118208    -0.64   0.520     -.030905    .0156635
       _cons    39.41691    1.39693    28.22   0.000     36.66528    42.16855
```

Output for regression (19) Offer = $\alpha_1 + \alpha_2$Cumulative wealth$_{t-1}$ + α_3Accept$_{t-1}$

```
      Source        SS       df       MS              Number of obs =      245
                                                      F(  2,   242) =     0.21
       Model   89.3012225     2  44.6506113           Prob > F      =   0.8121
    Residual   51881.009    242  214.384335           R-squared     =   0.0017
                                                      Adj R-squared =  -0.0065
       Total   51970.3102   244  212.993075           Root MSE      =   14.642

       offer       Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

  cum_points   -.0075908   .0118596    -0.64   0.523    -.0309519    .0157704
        lag2   -.1013823    1.97885    -0.05   0.959    -3.999352    3.796587
       _cons    39.44862   1.530524    25.77   0.000     36.43377    42.46347
```

```
. xtreg offer cum_points lag2 if leader==1

Random-effects GLS regression                   Number of obs      =       245
Group variable: pers                            Number of groups   =        69

R-sq:  within  = 0.0365                         Obs per group: min =         1
       between = 0.0477                                        avg =       3.6
       overall = 0.0011                                        max =         7

                                                Wald chi2(2)       =      1.63
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.4431

------------------------------------------------------------------------------
       offer |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  cum_points |  -.0103127   .0112522    -0.92   0.359    -.0323665    .0117412
        lag2 |  -1.597015   1.866223    -0.86   0.392    -5.254744    2.060715
       _cons |   40.10168   1.576764    25.43   0.000     37.01128    43.19208
-------------+----------------------------------------------------------------
     sigma_u |  5.2214226
     sigma_e |   12.75594
         rho |  .14350798   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
. xi: xtreg offer cum_points lag2 i.group if leader==1, fe
i.group           _Igroup_1-2         (_Igroup_1 for group==control omitted)
note: _Igroup_2 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       245
Group variable: pers                            Number of groups   =        69

R-sq:  within  = 0.0393                         Obs per group: min =         1
       between = 0.0739                                        avg =       3.6
       overall = 0.0007                                        max =         7

                                                F(2,174)           =      3.56
corr(u_i, Xb)  = -0.2128                        Prob > F           =    0.0307

------------------------------------------------------------------------------
       offer |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  cum_points |  -.0162819    .011828    -1.38   0.170    -.0396268    .0070629
        lag2 |  -4.426921   1.943994    -2.28   0.024    -8.263765   -.5900773
   _Igroup_2 |  (omitted)
       _cons |   41.67809   1.473964    28.28   0.000     38.76894    44.58724
-------------+----------------------------------------------------------------
     sigma_u |  10.158773
     sigma_e |   12.75594
         rho |  .38809693   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(68, 174) =     1.88             Prob > F = 0.0006
```

```
. xi: xtreg offer signal cum_points lag2 i.group if leader==1, fe
i.group           _Igroup_1-2         (_Igroup_1 for group==control omitted)
note: _Igroup_2 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       245
Group variable: pers                            Number of groups   =        69

R-sq:  within  = 0.1093                         Obs per group: min =         1
       between = 0.0108                                        avg =       3.6
       overall = 0.0023                                        max =         7

                                                F(3,173)           =      7.08
corr(u_i, Xb)  = -0.5780                        Prob > F           =    0.0002

------------------------------------------------------------------------------
       offer |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      signal |   .3325751   .0901413     3.69   0.000     .1546567    .5104934
  cum_points |  -.0089242   .0115941    -0.77   0.443    -.0318084    .0139599
        lag2 |  -4.767441   1.879419    -2.54   0.012    -8.476985   -1.057897
   _Igroup_2 |  (omitted)
       _cons |   34.55754   2.398013    14.41   0.000     29.82441    39.29067
-------------+----------------------------------------------------------------
     sigma_u |  12.752755
     sigma_e |  12.317341
         rho |  .51736261   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(68, 173) =     1.53             Prob > F = 0.0143
```

Now with offer = log offer

```
. xi: xtreg offer signal cum_points lag2 i.group if leader==1, fe
i.group           _Igroup_1-2         (_Igroup_1 for group==control omitted)
note: _Igroup_2 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       241
Group variable: pers                            Number of groups   =        69

R-sq:  within  = 0.0738                         Obs per group: min =         1
       between = 0.0069                                        avg =       3.5
       overall = 0.0011                                        max =         7

                                                F(3,169)           =      4.49
corr(u_i, Xb)  = -0.4305                        Prob > F           =    0.0047

------------------------------------------------------------------------------
       offer |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      signal |   .0074544   .0028826     2.59   0.011     .0017638     .013145
  cum_points |  -.0004265   .0003664    -1.16   0.246    -.0011498    .0002969
        lag2 |   -.125015   .0591822    -2.11   0.036    -.2418466   -.0081835
   _Igroup_2 |  (omitted)
       _cons |   3.520282   .0766402    45.93   0.000     3.368987    3.671578
-------------+----------------------------------------------------------------
     sigma_u |  .39847785
     sigma_e |  .38472419
         rho |  .51755539   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(68, 169) =     2.06             Prob > F = 0.0001
```

Output for regression (20) Diff = $\alpha_1 + \alpha_2$Accept1

```
. reg diff accept1

      Source |       SS       df       MS              Number of obs =      62
-------------+------------------------------           F(  1,    60) =   10.24
       Model |  196.582414     1  196.582414           Prob > F      =  0.0022
    Residual |  1151.35307    60  19.1892178           R-squared     =  0.1458
-------------+------------------------------           Adj R-squared =  0.1316
       Total |  1347.93548    61   22.097303           Root MSE      =  4.3805

------------------------------------------------------------------------------
        diff |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     accept1 |  -3.655702    1.14216    -3.20   0.002    -5.940363   -1.371041
       _cons |   5.208333    .894176     5.82   0.000     3.419715    6.996952
------------------------------------------------------------------------------
```

where diff is the difference between the second offer and the first offer in the two followers game, switched on if the difference if positive.

```
. xtreg diff accept1, re

Random-effects GLS regression                   Number of obs      =        62
Group variable: idleader                        Number of groups   =        35

R-sq:  within  = 0.3093                         Obs per group: min =         1
       between = 0.0606                                        avg =       1.8
       overall = 0.1458                                        max =         3

Random effects u_i ~ Gaussian                   Wald chi2(1)       =     11.14
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0008

------------------------------------------------------------------------------
        diff |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     accept1 |  -3.843656   1.151686    -3.34   0.001    -6.100919   -1.586394
       _cons |   5.269759   .9227928     5.71   0.000     3.461118      7.0784
-------------+----------------------------------------------------------------
     sigma_u |  1.4901851
     sigma_e |  4.1260886
         rho |  .11538695   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```