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Investment Behavior in a Constrained Dictator Game*

Michael Coenen†　　Dragan Jovanovic‡

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Abstract

We analyze a *constrained dictator game* in which the dictator splits a pie which will be subsequently created through simultaneous investments by herself and the recipient. We consider two treatments by varying the maximum attainable size of the pie leading to either high or low investment incentives. We find that constrained dictators and recipients invest less than a model with self-interested players would predict. While the splitting decisions of constrained dictators correspond to the theoretical predictions when investment incentives are high, they are more selfish when investment incentives are low. Overall, team productivity is negatively affected by lower investment incentives.

JEL-Classification: C72, C91, D01.

Keywords: Bargaining Game, Dictator Game, Investment Incentives, Team Production.

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1 Introduction

In standard dictator games the size of the pie is exogenously given as in, for example, Kahneman et al. (1986). A favored deviation from this is to endogenize the size of the pie. The first alternative is to make the size of the pie dependent on either the dictators' behavior or the recipients' behavior, which may consist of real-effort tasks or investing an endowment. For instance, Cherry et al. (2002) use such a setting with dictators first determining the size of the pie before the splitting decision takes place. Further examples are provided by Berg et al. (1995) and Ruffle (1998). While the former specifies that the pie is created through the investment decisions of the recipients, the latter uses a real-effort task.[1] The second alternative is to make the size of the pie dependent on both the dictator's and the recipient's behavior as in, for example, Konow (2000). However, those papers presume that the recipients and/or dictators determine the size of the pie before the dictators decide on the division. This timing is reversed in Van Huyck et al. (1995), who let the dictators first decide on the division of the pie which is subsequently created by the recipients' investment choices.

In this paper, we analyze situations in which the size of the pie depends on both the dictator's behavior and the recipient's behavior, as in various settings of team production. In contrast to Konow (2000), we let division occur before the pie production takes place. That is, we build on Van Huyck et al. (1995) to account for team production where the recipient may punish the dictator but may not eliminate the whole pie created through simultaneous investment decisions.[2] More precisely, we consider a game in which a strong agent (dictator) first decides on how to split a team product (pie) which is subsequently created by herself and a weak agent (recipient). That is, the dictator in our model will also be involved in the subsequent investment stage instead of solely determining the division of the pie. We thus analyze a simultaneous

[1] More recent examples for real-effort experiments in this context are given by Oxoby and Spraggon (2008) and Heinz et al. (2012).

[2] In their Peasant-Dictator Game Van Huyck et al. (1995) consider two cases with respect to the dictator's decision in stage one: *i)* either the dictator can credibly commit to a tax rate before her peasant has to decide on how many beans to plant in order to generate crops and how many to keep for herself for immediate consumption, or *ii)* the dictator cannot credibly commit and effectively sets the tax rate after production. They find that credible commitments significantly increase efficiency in the experiment, which is in line with the theoretical predictions.

move game in the second stage, rather than a single decision by the recipient. The pie will be maximized if both agents invest their entire endowments, while it is zero if and only if none of them invests. Unilaterally refraining from contribution does not imply that no pie is generated. Thus, on the one hand we do not focus on a standard dictator game in which the weak agent is entirely passive. And, on the other hand the situation also does not reflect the decision structure of a standard ultimatum game, since the weak agent does not have the full means to punish the strong agent by rejecting her proposal.[3] We therefore call the dictator in our game a *constrained dictator*.

We use the *constrained dictator game* to test *i)* whether individual behavior in the lab is predicted by theory, and *ii)* how variations in investment incentives affect the outcome of the constrained dictator game. Regarding the latter, we consider two treatments by varying the maximum attainable size of the pie leading to either high or low investment incentives. We find that both constrained dictators and recipients invest less than a model with self-interested players would predict. Moreover, the deviation of the constrained dictator's investment choice from the theoretical optimum is increased when investment incentives are low, resulting in lower team productivity. In fact, we show that reducing the maximum attainable size of the pie negatively affects the constrained dictator's investment behavior. In conjunction with the finding that the recipients do not alter their behavior when investment incentives are exogenously varied, it is straightforward that lower investment incentives also negatively affect team productivity. We also show that the constrained dictator's splitting decision in stage one is in line with the theoretical prediction when investment incentives are high, while she concedes less than predicted when they are low. Thus, decreasing the maximum attainable size of the pie reduces the constrained dictator's willingness to share, but leaves the recipients' investment behavior unaffected. In that respect, our paper is related to Forsythe et al. (1994) who conversely claim that proposals are not affected by the size of the pie in both standard dictator games and standard ultimatum games.[4] Finally, we demonstrate that welfare is not affected by varying

[3] Van Huyck et al.'s (1995) setup may be interpreted as a modified ultimatum game in which the responder has a "continuous" set of means to punish the proposer, rather than a discrete choice between either accepting or rejecting the proposal.

[4] Forsythe et al. (1994) also (and even more importantly) show that fairness alone does not explain the proposers' behavior in simple bargaining games (i.e., ultimatum games and dictator games). It is rather the exact

investment incentives, although team productivity decreases when investment incentives are low.

The paper is organized as follows. In Section 2, we present our model and derive the theoretical equilibrium. Section 3 discusses the experimental design. In Section 4, we present our results. Section 5 concludes the paper.

2 Theoretical Model and Predictions

We consider two agents, s and w. Agent s (strong) is the constrained dictator, while agent w (weak) represents the recipient. Both agents are initially endowed with D and face a tradeoff between keeping the entire endowment or investing either a part or the whole of the endowment in order to create a pie. Let e_i denote agent i's investment, where $i = s, w$. Thereby, e_i may be interpreted as player i's effort, investment in human capital, or incremental time devoted to work instead of leisure, with $e_i \in [0; D]$. The size of the pie depends on both players' investment levels and is given by $k(e_s + e_w)$, where higher values of $k \geq 1$ reflect, all other things being equal, higher investment incentives and a higher maximum attainable size of the pie, respectively. Notice that e_s and e_w are perfect substitutes.

We analyze a two-stage game in which agent s decides on how to split the pie before both agents simultaneously decide on their respective investment levels, e_s and e_w. In other words, s decides on how much of $k(e_s + e_w)$ to keep and on how much to concede to w. Let p_w and p_s denote the share conceded to w and the share kept by s, respectively, with $p_i \in [0; 1]$ and $p_i = 1 - p_j$ for $i \neq j$. Then, $p_i k(e_s + e_w)$ yields agent i's share of the pie. Welfare is independent of division and can thus be calculated as the sum of the pie and the agents' remaining endowments, i.e., $W = k(e_s + e_w) + (D - e_s) + (D - e_w)$. Note that the crucial difference between our game and Van Huyck et al.'s (1995) is that, given p_i, the pie in our setup is not only shaped by agent w's investment choice, but also by the constrained dictator's behavior, i.e., agent s's investment decision.

type of the bargaining game (dictator game or ultimatum game) and the possibility to incentivize the subjects with money which further explains deviations from the theoretical predictions. Several other papers emerged to deepen the understanding of the deviations found by Forsythe et al. (1994); e.g., Hoffman et al. (1994) focus on the effects of anonymity and property rights, Bolton and Zwick (1995) study the implications of punishments, and Hoffman et al. (1996) study the impact of social distance.

We solve the game by backward induction.[5] In the second stage of the game, both agents simultaneously decide on their investment levels, e_s and e_w, maximizing the sum of their respective shares of the pie, $p_i k\,(e_s + e_w)$, and the remainder of their endowments. It follows that agent i's decision problem can be expressed by

$$\underset{e_i \in [0;D]}{Max}\ \pi_i = p_i k\,(e_i + e_j) + (D - e_i).$$

It can immediately be verified that both agents will invest their entire endowment, D, if investment is profitable.[6] Given that both agents choose to invest whenever they are indifferent between investing and keeping D, the (subgame) equilibrium in the second stage satisfies

$$e_i^*(p_i, k) = \begin{cases} D \text{ if } p_i \geq \frac{1}{k}; \\ 0 \text{ otherwise.} \end{cases} \tag{1}$$

According to (1), investing the entire endowment is a dominant strategy, i.e., it is independent of what the other agent does, if and only if $p_i \geq \frac{1}{k}$ holds. As depicted in Figure 1, depending on p_i and k, and given $k \geq 1$, four different outcomes are feasible at this stage of the game: both agents invest, only agent i invests, only agent j invests, or none of the agents invests. The vertical dashed line at $k = 2$ represents the critical value of k which needs to be surpassed for an equilibrium in which both agents invest to exist, i.e., $e_w^* = e_s^* = D$.

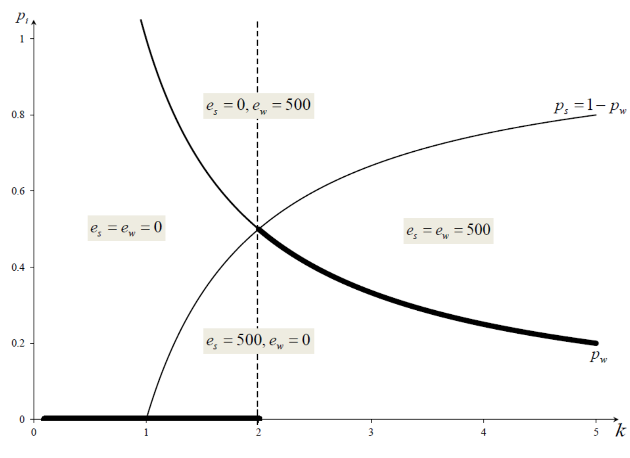

Figure 1: Theoretical (subgame-perfect) equilibrium

[5] See Appendix A for a detailed derivation of the equilibrium.

[6] Note that we may alternatively specify that every agent i faces a linear cost of investing which is denoted by $C(e_i) = e_i$ instead of saying that each agent has an endowment, D.

In the first stage of the game, agent s decides on how much of $k\,(e_s + e_w)$ to concede to w by choosing p_i. It is straightforward to see that s has a strict incentive to induce w to invest whenever $k \geq 2$. Since she is a dictator at this stage of the game and her profit is strictly decreasing in p_w and strictly increasing in p_s, respectively, agent s will choose a share such that w is just indifferent between investing D or keeping D. It follows that s's optimal choice is given by

$$p_w^*(k) = \begin{cases} \frac{1}{k} \text{ if } k \geq 2; \\ 0 \text{ otherwise,} \end{cases} \tag{2}$$

with $p_s^*(k) = 1 - p_w^*(k)$. In equilibrium, given $k \geq 2$, both agents invest their entire endowment and their profits are $\pi_w = 2D$ and $\pi_s = 2(k-1)kD$. If, however, $k < 2$ holds, then only s invests and keeps the entire profit for herself, i.e., $p_w^* = 0$. Thereby, agent w realizes $\pi_w = D$, while agent s's profit is $\pi_s = kD$. We depict the equilibrium share conceded to w, $p_w^*(k)$, by the bold black line in Figure 1. In the following sections, this theoretical equilibrium will serve as a reference.

3 Experimental Design

In our experiment, each subject played 10 rounds of the same treatment. Every round consisted of two stages. In the first stage, the computer randomly assigned a role to each subject after a random matching. Agent s first had to decide on the division of the pie which was generated in the second stage of the game by both agents investing non-cooperatively and simultaneously. Each subject received an initial endowment of 500 experimental currency units (ECU, called "Taler" during the course of the experiment) of which the players could invest any discrete amount. After investments were chosen, earnings were calculated and information about the player's own behavior and the other player's behavior were given out to the subjects. In addition, we provided information about players' decisions and earnings in the particular round as well as the player's own history of decisions and outcomes of all previous rounds. Then, the next round started with a new random matching of subjects.

Instructions were kept in a neutral language.[7] Agents were labeled "participants" and the amounts chosen by the subjects in the second stage were called "investments". Instructions were

[7] See Appendix B for a transcript of the instructions.

distributed prior to the first round and read in silence by the participants who could then ask questions in private. In addition, they had to correctly answer a number of control questions which addressed the structure of the stages in the game, the decision order for the players, and the calculation of profits. Once the experimenters had ensured that everyone had understood the game, the first computer screen was displayed and subjects could submit their decisions.[8] In each stage, subjects could use a profit calculator for simulation purposes. Therefore, it would have been possible for any participant to establish rational responses conditional on any expectation of the other player's behavior.

After the final round, the individual profits of each round were summed up and converted to payoffs by a treatment specific exchange rate. The exchange rates were chosen to keep the expected earnings from the treatments similar while still helping to induce a relative distance between the treatments regarding the weight of the endowment and the size of the pie, respectively. In the first treatment, the exchange rate was set to 10 units of the ECU equaling 0.01 €. The size of the pie in the first treatment was determined by $k = 2.5$ times the sum of both players' investments in the second stage. In the second treatment, the exchange rate was set to 20 units of ECU equaling 0.01 €. Thus, as their nominal value in ECU remained unchanged, the relative value of the initial endowments was virtually reduced by half between treatments. Besides, the productivity factor of investments was increased to $k = 4$. All other things being equal, we are convinced that this parameter specification induces a higher initial investment incentive in the second stage.[9] Correspondingly, we call the treatment with the smaller (bigger) maximum attainable size of the pie and investment incentive, respectively, that is $k = 2.5$ ($k = 4$), L-treatment (H-treatment).

The experiments were conducted in the DICE Laboratory for Experimental Economics between May 2011 and January 2012. Random matching took place in matching groups of eight subjects each which remained unchanged over the course of a session. Thus, for the econometric analysis independent observations are given on the matching group level rather than on an individual level. We ran eight sessions with 16 subjects in each session, thus totaling 64 subjects per

[8] See Appendix C for an overview of the computer screens used in the course of the experiment.

[9] Notice that both in terms of nominal values and real values the investment incentive, i.e., the marginal gain of investing, is strictly larger for $k = 4$ given $p_i > 0$ and $p_j > 0$, respectively, with $i \neq j$.

treatment and 80 independent observations in each.[10] Subjects were recruited from all faculties using the Online Recruitment System for Economic Experiments (ORSEE, see Greiner, 2004). 25 percent of the subjects declared to study courses affiliated to the Faculty of Business and Economics.[11,12] Forty-one percent of the subjects declared to be female. The experimental software was developed in z-Tree (see Fischbacher, 2007). One session lasted about 50 minutes on average. Average earnings were 9.60 € in the L-treatment and 7.61 € in the H-treatment. In addition to their individual earnings, subjects received an obligatory show-up payment of 4 €.

4 Results

4.1 Theory vs. Experiment

We begin by asking whether our experimental data confirm the theoretical predictions of our model in Section 2. Therefore, we formulate the following hypothesis.

Hypothesis 1 (SPE). *Agent s first chooses $p_w^* = 1/k$, and both agents subsequently respond*

[10] The results of a preliminary session with 18 subjects conducted on May 17, 2011, were dropped as a precautionary measure. Matching groups in this session contained six subjects only. Participants would therefore, though told otherwise in the instructions, have encountered the same subject twice on average during the course of the experiment. Such a setting might be too prone to potential reputation effects. Hence, we neglected the results from this session for the following descriptions and estimations.

[11] That is, they declared in a non-incentivized standard questionnaire that they were students of either the B.Sc. or M.Sc. programs in Economics, Business Administration or Business Chemistry. Some of the subjects did not answer these questions as completing the questionnaire was not compulsory. Therefore, the number has to be regarded as a lower bound for the actual fraction of economists in the room. An upper bound for the actual fraction of economists in the experiment might be 37.5 percent as 62.5 percent of the participants declared that they studied courses in faculties other than the Faculty of Business and Economics.

[12] Fehr et al. (2006) and Engelmann and Strobel (2006) discuss whether economics majors may behave differently in simple distribution experiments. We decided to include economics students into the subject pool. This approach is appropriate since (a) the majority of students in the pool consisted of undergraduates (who might not yet be influenced by strategic thinking in the same way as graduate students are), and (b) we find eliminating economics students from experiments is overly artificial and biasing in itself because a reasonable part of social interaction in reality is influenced by explicit economic thinking and economic education.

by setting $e_i^*(p_i, k) = \begin{cases} D \text{ if } p_i \geq \frac{1}{k}; \\ 0 \text{ otherwise.} \end{cases}$, *with* $i = s, w$.

If the conditions of a subgame perfect equilibrium (SPE) are met, agent s should concede just as much as to make agent w indifferent between investing and keeping D. The equilibrium shares are 40 percent and 25 percent in the L-treatment and in the H-treatment, respectively. Then, both agents should always invest 500 ECU. Thereby, s would earn $1,500$ ECU ($3,000$ ECU), while w would earn $1,000$ ECU ($1,000$ ECU) in the L-treatment (H-treatment).

Recall that our observations are given on the matching group level. We present some descriptive statistics in Table 1.

variable	**mean**	**std. dev.**	**min**	**max**
L-treatment				
p_w	.2934	.1413	.025	.65
e_s	420.3125	85.2335	190	500
e_w	192.7375	125.515	0	500
H-treatment				
p_w	.2567	.0991	.065	.49
e_s	474.6156	43.8024	337.5	500
e_w	206.1406	123.2065	0	500

Table 1: Descriptive statistics per matching group

In the L-treatment, the mean share conceded to w is .2934 and is thus well below the optimal offer, $p_w^*(L) = .4$, predicted by the theoretical equilibrium. In the H-treatment, the theoretical optimum is almost reached, though only on average. The average share conceded by s is .2567, and is thus close to the optimal proposal of $p_w^*(H) = .25$. This observation is confirmed by a t-test to check for statistically significant differences between our experimental data and the theoretical predictions. The p-values are .00 and .5461 for the L-treatment and the H-treatment, respectively.[13] Thus, we find evidence that the predicted equilibrium share is chosen on average

[13] The t-test may only be applied if the respective variables follow a normal distribution. For the shares chosen by the strong agents a normality test shows that the null hypothesis cannot be rejected.

in the H-treatment, whereas the average share falls short of the equilibrium values in the L-treatment. Figure 2 depicts the sorted average shares per treatment, $p_w(m)$, with $m = L, H$.

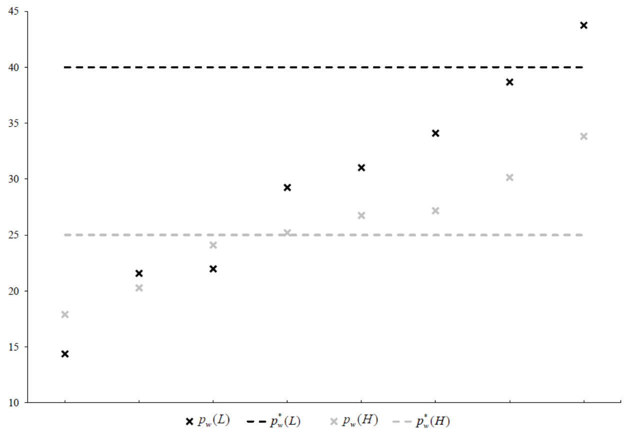

Figure 2: Average splitting decisions per matching group

While the average shares conceded to agent w in the H-treatment oscillate near their corresponding theoretical optimum, indicated by the dashed grey line, the average shares in the L-treatment are almost constantly below the theoretical prediction, $p_w^*(L) = .4$, given by the dashed black line.

We have controlled for possible learning effects over the course of the experiment by comparing clusters of earlier rounds to those of later rounds both on the average matching group level and on the individual matching group level. Wilcoxon signed-rank tests reveal no significant differences between clusters in the H-treatment, whereas statistically significant differences are found for the L-treatment.[14] The persistence of these findings for the L-treatment over time, however, indicates a negative trend rather than initial learning. Hence, in both treatments the elimination of first and/or last round data is not appropriate.

Strong agents invested more on average than weak agents. Weak agents invested $\overline{e}_w(L) = 192.74$ ECU and $\overline{e}_w(H) = 206.14$ ECU in the L-treatment and in the H-treatment, respectively, where the upper bar indicates the average values. Strong agents invested $\overline{e}_s(L) = 420.31$ ECU

[14] For this decision pattern mental accounting on behalf of the constrained dictators may be responsible. In particular, we cannot reject that the subjects' propensity to propose riskier, that is lower shares, which put investments by weak agents at danger, does not increase in the sum of earnings from past periods.

and $\overline{e}_s(H) = 474.62$ ECU in the respective treatments. Recall that equilibrium investments would have implied that all agents invest their entire endowments in both treatments given optimal division, $p_w^*(m)$. However, from our analysis of the decisions on p_w, we know that p_w has not been chosen optimally in the L-treatment, whereas the average share comes close to the optimal value in the H-treatment. Therefore, we need to examine the theoretical best responses for each agent and for each treatment, given the divisions from stage one, and compare them to the investment decisions taken in the lab. It is straightforward that the theoretical best responses do not simply state that both agents should invest 500 ECU in both treatments. This is illustrated by the following figures in which both agents' theoretical best responses for each matching group, e_w^* and e_s^*, and average investment decisions for each matching group, e_w and e_s, are depicted by the dashed lines and by the solid lines, respectively. Figure 3 (a) represents the L-treatment and figure 3 (b) represents the H-treatment. Note that the black lines depict agent s, while the grey lines depict agent w.

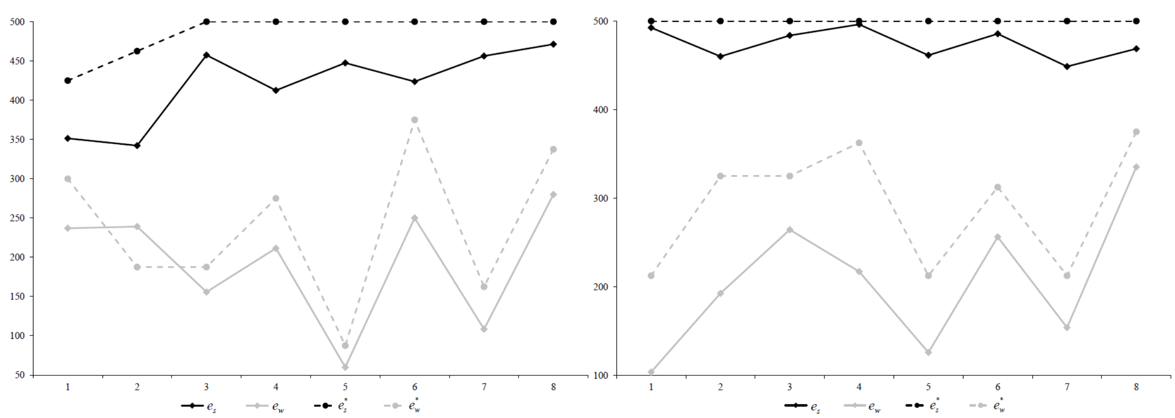

Figure 3: (a) Average investment decisions per matching group in the L-treatment; (b) Average investment decisions per matching group in the H-treatment

It can immediately be seen that both agents invest well below their optimal values in both treatments most of the time. This observation is further confirmed by a Kolmogorov-Smirnov test on the equality of the average investment decisions in the lab and the corresponding theoretical best responses. Both agents invest significantly less than they should from a theoretical point of view (given p_w from stage one).

Though our findings suggest that the theoretical model is not particularly well-suited to predict the observed behavior in the lab, we show that at least the relationship between investments, e_s and e_w, and shares, p_w (p_s), is as the theory predicts. Table 2 presents Spearman's rank correlation coefficients for the constrained dictators' proposals in stage one and the corresponding investment decisions in stage two.

	L-treatment		H-treatment	
	p_w and e_w	p_w and e_s	p_w and e_w	p_w and e_s
Spearman's rho	0.7312***	−0.4498***	0.7544***	−0.0991

Table 2: Spearman's rank correlation coefficient test

We find that e_w and p_w are significantly correlated with a positive sign. Though negative (−0.3810 in the L-treatment and −0.0714 in the H-treatment), thus pointing in the presumed direction, the correlation between agent s's investment decision, e_s, and the share of the pie conceded to w, p_w, is only significant in the L-treatment. This result must, however, be seen with caution. Since, in most of the cases, p_w is chosen such that it is profitable for s to invest, we rarely observe a sufficiently high p_w to explain (from a theoretical point of view, at least) why agent s would refrain from investing D. The same problem prevails in terms of causality. We ran fixed effects panel regressions, in which we controlled for unobserved heterogeneity between the matching groups to check whether the level of p_w explained the investment decisions taken by both agents. We report the results in the following table.

	Agent s				Agent w			
	L-treatment		H-treatment		L-treatment		H-treatment	
	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.
p_w	-2.728***	.718	-.422	.554	5.6***	.912	7.679***	1.002
const.	500.351***	22.427	485.456***	15.012	28.421	28.473	9.017	27.128

Table 3: Panel regression (fixed effects) on individual (group) level

Whereas agent w's investment choice is significantly and positively affected by her profit-share, p_w, in both treatments, the result for agent s is ambiguous. In the L-treatment, p_w exerts a significantly negative effect on e_s. However, in the H-treatment, the coefficient is negative, but insignificant. Again, we claim that this result is explained by the small number of observations on p_w which suggests that agent s should not invest, rather than by the absence of a significantly negative relationship between e_s and p_w.

4.2 Varying Investment Incentives

We analyze whether the participants' behavior differs across treatments to check for treatment effects. It is important to note that we interpret differences in k as indicative of varying investment incentives. That is, we resort to the common understanding that, all other things being equal, a higher maximum attainable size of the pie generally increases the agents' incentives to invest.

In theory, both treatments differ substantially, as optimal division, $p_w^*(m)$, is .25 in the H-treatment and .40 in the L-treatment. From that we derive Hypothesis 2, by which we postulate higher values of $p_w(m)$ for the treatment with lower investment incentives.

Hypothesis 2. *Lower investment incentives lead to larger proposals by the constrained dictators, i.e.,* $p_w(L) > p_w(H)$ *holds on average per matching group.*

From Figure 2 the validity of Hypothesis 2 could be expected. At least with respect to those five matching group clusters with the highest average proposals on the right, it is obvious that proposals in the L-treatment are greater than those in the H-treatment. However, this impression is not unambiguously confirmed by statistical tests. A Wilcoxon rank-sum (Mann-Whitney) test returns a p-value of .1024. That is, with respect to the share of the pie conceded to w, p_w, the identity of both treatments may be, though with caution, rejected.

Next, we ask whether there is any treatment effect on both agents' investment decisions. From theory we would not expect a treatment effect; in either treatment, strong agents decide on the division of the pie such that incentives for strong and weak agents to fully invest are provided. Therefore, we derive Hypothesis 3.

Hypothesis 3. *There is no treatment effect on investment decisions, i.e.,* $e_w(L) = e_w(H)$ *and* $e_s(L) = e_s(H)$ *hold on average per matching group.*

We performed Wilcoxon rank-sum (Mann-Whitney) tests to check for possible differences between investment decisions. With respect to the strong agents' investment decisions identity in the L-treatment and in the H-treatment may be rejected (p-value: .00), whereas it may not be rejected with respect to the weak agents' decisions (p-value: .6132).[15] That is, we find statistical evidence of a clear treatment effect on strong agents' investment behavior, but none with respect to weak agents' investment behavior. On average, strong agents invested less when investment incentives were low, i.e., $k = 2.5$. This treatment effect is illustrated in Figure 4, in which black dots and diamonds depict the matching group average investment decisions by strong agents and grey dots and diamonds show those taken by the weak agents.[16]

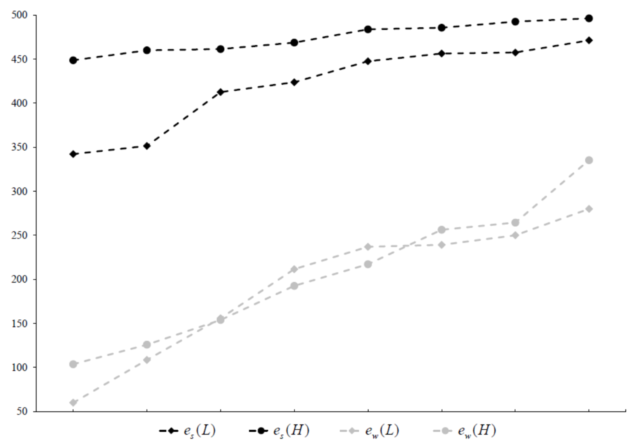

Figure 4: The impact of varying investment incentives on average investment decisions per matching group

We turn to the size of the pie and welfare as measures for team productivity and efficiency, respectively. Pie size, $C_{g,t}(m) = k(e_{s,g,t} + e_{w,g,t})$, determines team productivity for each matching group $g = 1, ..., 8$ in period $t = 1, ..., 10$. When both agents fully invest, then the pie size takes on the values $2,500$ and $4,000$ in the L-treatment and in the H-treatment, respectively. It is straightforward that the treatments cannot be compared in terms of absolute values. We therefore focus on relative pie size deviations from their theoretical benchmarks. We use the

[15] Alternatively, one could use the Kolmogorov-Smirnov test to check for treatment effects on the agents' investment behavior and on the constrained dictators' splitting decisions. The results confirm our findings based on the Wilcoxon rank-sum (Mann-Whitney) test.

[16] For the sake of comparison, in Figure 4, Figure 5, and in Figure 6 matching groups are sorted by the extent of the average deviation from the optimum.

measure

$$\widetilde{C}_{g,t}\left(m\right)=\frac{C_{g,t}\left(m\right)}{C\left(m\right)^{*}}, \tag{3}$$

where $C\left(m\right)^{*}$ is the (optimum) productivity level, with $m=H,L$, predicted by our theoretical benchmark. $C_{g,t}\left(m\right)$ denotes the pie size realized in period t by matching group i in treatment m. $\widetilde{C}_{g,t}\left(m\right)$ is equal to one if matching group g's team productivity at time t corresponds to the theoretical optimum and is less than one if it is below optimum. It can immediately be verified that the higher (3), the lower the (negative) deviation from optimal pie size, $C\left(m\right)^{*}$.

Pie size is always maximized in the theoretical optimum of our model regardless of the agents' actual investment incentives. Therefore, we derive Hypothesis 4.

Hypothesis 4. *There is no treatment effect regarding team productivity. That is, normalized pie sizes are equal in the L-treatment and in the H-treatment, i.e.,* $\widetilde{C}_{g,t}\left(L\right)=\widetilde{C}_{g,t}\left(H\right)$ *holds.*

In Figure 5, we provide the average relative pie size deviations per matching group for both treatments. Instead of accounting for each period, t, we use average deviations per matching group, $\overline{C}_g(m)$, which are calculated using $\overline{C}_g(m)=\sum_t \widetilde{C}_{g,t}(m)/10$.

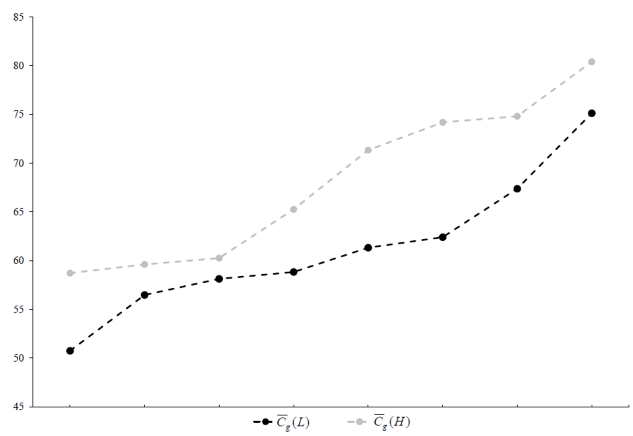

Figure 5: The impact of varying investment incentives on the average pie size per matching group

Figure 5 shows that average deviations are higher when investment incentives are low. The black line, which depicts average deviations per matching group in the L-treatment, is constantly below the grey line, which depicts the average deviations per matching group in the H-treatment.

This observation seems a plausible consequence of the constrained dictators' investment behavior in the lab; they invest less when investment incentives are low, while recipients' investments are identical on average across treatments. The observation is confirmed by a Wilcoxon rank-sum (Mann-Whitney) test. The identity of average deviations, $\widetilde{C}_{g,t}(m)$, in the L-treatment and in the H-treatment has to be rejected (p-value: .0017). Thus, in our setting lower investment incentives have a detrimental effect on team productivity.

We have to treat the results with caution, as a similar analysis may be performed with respect to averaged welfare, $\overline{W}_g(m)$, which is derived from the pie size plus the respective remainder of the endowments. As before, we make use of the normalized welfare measure

$$\widetilde{W}_{g,t}(m) = \frac{W_{g,t}(m)}{W(m)^*}. \tag{4}$$

$W_{g,t}(m)$ is the agents' (partial) welfare for each matching group, $g = 1, ..., 8$, and period, $t = 1, ..., 10$. $W(m)^*$ is welfare in the theoretical benchmark for treatment m, with $m = L, H$. $\widetilde{W}_{g,t}(m)$ is equal to one if matching group g's welfare at time t corresponds to the theoretical optimum and is less than one if welfare is below optimum. In the theoretical benchmark, welfare and pie size are equal, since both agents fully invest regardless of k. Because of the latter, again, we do not expect differences between treatments. We may therefore state Hypothesis 5 in analogy to Hypothesis 4.

Hypothesis 5. *There is no treatment effect regarding welfare. That is, normalized welfare is equal in the* L*-treatment and in the* H*-treatment, i.e.,* $\widetilde{W}_{g,t}(L) = \widetilde{W}_{g,t}(H)$ holds.

Again, we inspect some descriptive statistics to compare the treatments. Figure 6 offers an illustration of the average welfare deviations per matching group, $\overline{W}_g(m)$, which are calculated by $\overline{W}_g(m) = \sum_t \widetilde{W}_{g,t}(m)/10$.

For the four matching groups with the highest deviations (matching groups 1-4 on the left in Figure 6) the averaged normalized welfare deviation is lower when investment incentives are low, as the black line for the L-treatment is running above the grey line for the H-treatment. For the four matching groups with lowest deviations (matching groups 5-8 on the right in Figure 6) the ordering is reversed. Here, lower investment incentives induce lower averaged normalized welfare deviations. A Wilcoxon rank-sum (Mann-Whitney) test confirms this impression so that the identity of $\widetilde{W}_{g,t}(m)$ may not be rejected across treatments (p-value: .6400).[17]

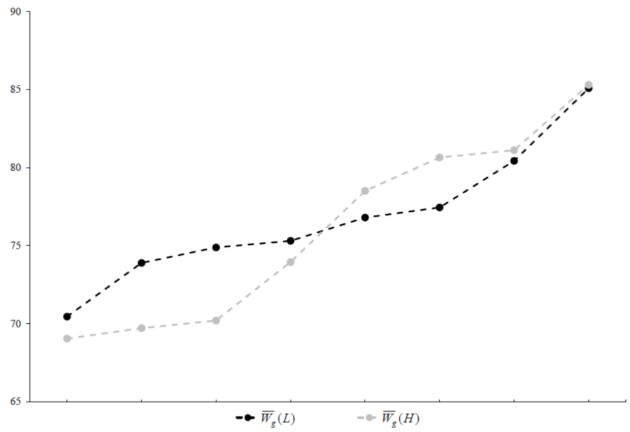

Figure 6: The impact of varying investment incentives on average welfare per matching group

5 Concluding Remarks

We have shown that both constrained dictators and recipients invest less in the laboratory than a model with self-interested players would predict. While constrained dictators' proposals correspond to the theoretical predictions when investment incentives are high, i.e., the maximum attainable size of the pie is high, they are lower with low investment incentives. It is worthwhile to note the inconsistency of the constrained dictators' investment behavior: although their own proposals predominantly suggested that investment of their whole endowment would have been rational in both treatments, they invested significantly less.

Across treatments investment levels should not differ according to our theoretical predictions, whereas the constrained dictators' proposals should be higher when investment incentives are low. Though with caution, we find evidence for the latter hypothesis, i.e., identity of the constrained dictators' proposals may not be rejected. Further, we find a clear treatment effect with respect to the constrained dictators' investment decisions in stage two. That is, constrained dictators invested significantly less when investment incentives were low. Recipients, however, do not change their investment behavior on average across treatments.

[17] This result is also confirmed for both $\widetilde{C}_{g,t}(m)$ and $\widetilde{W}_{g,t}(m)$ using a Kolmogorov-Smirnov test.

Finally, we asked whether increasing the maximum attainable size of the pie and, thereby, investment incentives have an impact on team productivity and welfare. Instead of using absolute values for both team productivity and welfare, we computed relative measures of deviation from the theoretical optima. On the one hand, we find evidence that team productivity is higher when investment incentives are high. On the other hand, we do not find that varying the investment incentives makes a statistically significant difference in terms of welfare. This is easily explained when one keeps in mind that welfare, in contrast to team productivity, accounts for the players' residual endowment and, thereby, for the amount of money not invested.

Only one part of our results may be explained by the characteristics we have deliberately chosen in the experiment. While nominal parameter and outcome settings differed by obvious margins, we have also used different exchange rates, which make treatments similar in real terms. In the low investment incentives treatment, endowments were 0.50 € per agent and per round, whereas they were just 0.25 € per agent and per round in the high investment incentives treatment.[18] Show-up fees amounted to a real value of 4 € in both treatments, while maximum attainable pie sizes were 2.50 € in the L-treatment and 2 € in the H-treatment. Focusing on the theoretical optimum though, differences between treatments are not obvious when real values rather than nominal values are considered. More specifically, suppose that the constrained dictator chose the equilibrium offer, $p_w^*(k)$, and both agents responded accordingly by investing their whole endowments, then the constrained dictators would have earned 1.50 € in real terms irrespective of the treatment. However, a strictly larger incentive to invest is preserved in the high investment incentive treatment, since the marginal gain from investing is, all other things being equal, higher regardless of the differences between nominal and real values.

We are convinced that the *constrained dictator game* covers various examples of economic actions. For instance, our setup is well suited to examine the effects of so-called occupational unions in labor conflicts. Recall that, in contrast to trade unions and industrial unions, occupational unions are job-specific and typically represent the interests of those parts of a firm's workforce which are characterized by high skill levels and sit in pivotal positions of the production process. As they are not easy to be substituted, they own strong bargaining power

[18]This difference between endowments in real terms could constitute an endowment effect, which might also explain one part of the subjects' behavior in the lab (see Kahneman et al. (1990)).

relative to other worker groups. In Germany, for instance, major examples are the unions of train drivers, civil aviation pilots, and hospital physicians. In our setup, the occupational union would be represented by the constrained dictator. Though the occupational union could fully appropriate a firm's available rent for her members through higher wages, it will crucially depend on the remaining workforce's action, since the appropriable rent is a team product rather than the consequence of a sole action by one part of the workforce. Hence, the crucial question is whether or not occupational unions would make excessive use of their bargaining power, so that the team's productivity is negatively affected. As a further example may serve R&D cooperations of a dominant organization and a minor firm, in which the former might have the power to appropriate the whole joint surplus generated by R&D in the product market. Nonetheless, the surplus would be positively affected by the small firm's behavior, since the R&D cooperation would yield maximum results only if both firms fully contribute. Finally, the typical principal agent problems in small- and medium-sized owner-led enterprises may serve as an example. The owner of the firm is not only the administrator of the business, but is also involved in the production of the firm's final team product. Thus, such an owner would also be a dictator limited by her employees' behavior, i.e., she is a constrained dictator.

Appendix A

Theoretical Prediction. It is straightforward to see that π_i is linear and monotone in e_i, i.e., $\partial\pi_i/\partial e_i \neq 0$ if $p_i \neq 1/k$ and $\partial^2\pi_i/\partial e_i^2 = 0$. More precisely, π_i is monotonically increasing (decreasing) in e_i if $p_i > 1/k$ ($p_i < 1/k$). This is true irrespective of the other agent's decision, e_j, with $j \neq i$. Hence, depending on p_i, it is optimal for agent i either to invest her entire endowment, D, or not to invest at all, i.e., $e_i = 0$. Note that each agent's decision is a discrete (binary) choice due to π_i's properties, although e_i is a continuous variable. Therefore, the game may be be reduced to a normal form representation as in Table 4. s is the column player, whereas w is the row player.

	$e_s = D$	$e_s = 0$
$e_w = D$	$p_w k2D$; $p_s k2D$	$p_w kD$; $D + p_s kD$
$e_w = 0$	$D + p_w kD$; $p_s kD$	D ; D

Table 4: The agents' investment choice in stage two

It can be immediately inferred that it is each agent's dominant strategy to invest D if $p_i \geq 1/k$ and to keep the entire endowment, i.e., $e_i = 0$, if $p_i < 1/k$. This is reflected by (1). Thus, the second stage equilibrium decisions, (e_w^*, e_s^*), are: $(0, D)$ if $p_w < 1/k$, (D, D) if $1/k \leq p_w \leq (k-1)/k$, and $(D, 0)$ if $p_w > (k-1)/k$.

In the first stage, agent s decides on how to split $k(e_w + e_s)$ between herself and agent w maximizing $\pi_s = p_s k(e_s^* + e_w^*) + (D - e_s^*)$. It is important to note that s acts as a constrained dictator at this stage of the game: although she has all the bargaining power to decide on p_w and p_s, respectively, the size of the pie, $k(e_w + e_s)$, also depends on the weak agent's decision. It is never rational for s to keep the entire pie for herself if $k \geq 2$. Rather, it is optimal to set $p_w = 1/k$ which triggers w to invest assuming that she prefers investing whenever she is indifferent between investing and keeping D, i.e., $p_w = 1/k$ holds.

Appendix B

[Insert Transscript of Instructions here]

Appendix C

[Insert Screenshots here]

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Transcript of L-Treatment Instructions

Welcome to this decision experiment!

Basic Information

Please read these instructions very carefully! At the end of these instructions you will find some control questions. The control questions will give you and the experimenters the final chance to check whether you have fully understood the rules of the experiment. Your decisions during the control questions will have no effect on your earnings from the experiment.

After you have answered the control questions correctly the experiment will start.

During the experiment you will make decisions by which you can earn money. How much money you will earn depends on the decisions you take and on the decisions the other participants take. ECU is the currency used during the experiment.[1] At the end of the experiment, the amount of ECU earned will be converted to Euro according to an exchange rate of

10 ECU = 1 Cent.

Your earnings will then be paid to you. In addition to your earnings from the experiment, you will receive a secure show-up payment of 4 EUR.

You will start the experiment with an initial endowment of 500 ECU (50 cents). This amount will be increased by your earnings and decreased by your losses. You may always exclude losses by your own decisions.

After the experiment has been concluded, the sum of your earnings in the rounds will be converted into Euro and paid to you. That is, every decision you take will affect your payment. In addition to your earnings you will get a decision independent payment of 4 € (show-up payment). Apart from the experimenters no one else will get to know your earnings from the experiment and the amount of money that is paid to you.

The experiment takes place anonymously, that is, you will not know which of the other participants you are interacting with.

Please note that you are not allowed to talk to any other participant throughout the experiment! Should this happen, we will be forced to abandon the experiment. If you have any question, please hold your hand up and an experimenter will come to you!

Course of the Experiment

Decision Structure

In the experiment an agent "A" encounters an agent "B". Each round of the experiment consists of two stages. In the first stage agent A decides on how the earnings from the subsequent second stage will be

[1] In German the expression "Taler" was used instead of Experimental Currency Unit (ECU).

divided between himself and agent B. In the second stage agent A and agent B choose simultaneously and independently which amount of ECU they want to invest.

At the beginning of each round it will be randomly determined whether you are an agent of type A or type B. Your type will then be displayed on top of the screen.

The experiment will last for 10 rounds. In each round, pairings will be drawn, each consisting of an agent A and an agent B. For each new round a new pairing will be randomly drawn. Information about your decisions and your performance will only be communicated to the respective other agent in that round. All the other agents will not learn anything about your choices!

In the following, we explain choice alternatives and their consequences for the respective agent's earnings.

Stage 1

In the first stage agent A decides on how the earnings from the subsequent second stage will be divided between himself and agent B. To do so agent A has to choose an integer value from 0 to 100, indicating the share of the total earnings obtained in the second stage which he will concede to agent B.

If he chooses 20, for instance, 20 percent of the earnings in the second stage are left with agent B, if he chooses 63, for instance, then 63 percent of the earnings in the second stage are left with agent B.

Agent A has an on-screen calculator at his disposal. He can enter his own planned investment, the expected second stage investment by agent B, and proposals for the division of the total earnings to be decided by himself in the first stage. The on-screen calculator then determines the earnings for both agents from the proposed decisions.

The on-screen calculator returns information on the division entered, the investments entered, and the earnings resulting from these inputs. The information on earnings is differentiated into earnings from investment and division in the second stage and total earnings for each agent, which also includes the residuum of the initial endowment.

The earnings in the second stage, which will be split between the agents, will be calculated as follows: $2.5 \cdot (\mathrm{i}_A + \mathrm{i}_B)$. i_A refers to the amount of investment of agent A and i_B is the investment of agent B. Thus, the sum of the investments by both agents will be multiplied by 2.5 in order to determine their earnings from investment in the second stage.

Stage 2

In the second stage agent B finds out about agent A's decision in the first stage.

Subsequently, agent A and agent B invest an amount of money simultaneously and independently. That is, they do not know of the investment decision of the respective other. In each round, each of the agents has a maximum of 500 ECU (50 cents) at his disposal. Everyone may therefore invest an integer value from 0 to 500 ECU. Residual money which has not been invested may be kept by the agent. In particular this means that the total earnings of an agent who invests 0 ECU is 500 ECU (50 cents).

Apart from their investments, agents do not have to bear any costs.

Again, both agents have an on-screen-calculator at their disposal for informative purposes. Subjects may enter their own planned investment and the expected investment of the other agent. The on-screen calculator then determines the expected earnings for both agents while taking the decision on the division from the first stage into account. The on-screen calculator returns information on the investment decisions entered and the resulting earnings for the agents, both as earnings from the investment in the second stage and as total earnings including the residuum of the initial endowment.

At the end of each round, the agents will also be fully informed about the actual decisions taken. On the screen they will get information on the division agent A has chosen in the first stage and the investment decisions of agent A and agent B in the second stage. In accordance to the division and investments, the earnings of the agents will be calculated and displayed.

Example

Agent A decides to concede, for instance, 15 percent of the earnings from the second stage of the experiment to agent B, thus keeping 85 percent for himself. If both invest 100 ECU of their initial endowment, agent A yields (2.5 * (100 + 100) * 0.85) as earnings from the second stage, that is 425 ECU, and agent B yields 75 ECU. Adding their retained initial endowments agent A would therefore yield total earnings of 825 ECU in this round of the experiment and agent B 475 ECU.

After reading and confirming the displayed information on the results the next round of the experiment is going to commence.

Conclusion and Payment

After 10 rounds the experiment ends. Before making the pay-outs we will ask you to answer a final questionnaire. Your answers to the final questionnaire will not have any effect on your payments. Please press the confirm-button after you have completed the questionnaire!

When the experiment is concluded, the Euro-equivalent of the sum of your earnings over the rounds of the experiment will be paid to you. 10 ECU are equal to 1 cent. In addition to your earnings you will get a decision independent payoff of 4 € (show-up payment).

Please wait in your cabin until you are called by the experimenters to come forward and collect your payment! Please hand back all the documentation you have received! Apart from the experimenters you will be the only one to know your earnings from the experiment and the amount of money that is paid to you.

Transcript of L-Treatment Control Questions

Question 1: Please tick the correct conclusions! Multiple correct conclusions are possible.

(a) agent A decides in stage 1 first, which proportion of the earnings from stage 2 agent B will get, and then decides over his investment in stage 2
(b) agent B decides in stage 1 first, which proportion of the earnings from stage 2 agent A will get, and then decides over his investment in stage 2
(c) only agent B invests in stage 2
(d) only agent A invests in stage 2
(e) both agents invest in stage 2
(f) agent B does not take a decision in stage 1

Question 2: Assume that agent A has set 25 as the share to be conceded to agent B. Earnings of the second stage are 1,000 ECU, with both agents A and B having invested 200 ECU of their initial endowments each.

(a) How many ECU does agent A get from the earnings of the second stage?
(b) How many ECU does agent B get from the earnings of the second stage?
(c) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent A?
(d) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent B?

Question 3: Assume that agent A has set 60 as the share to be conceded to agent B. Earnings of the second stage are 1,000 ECU, with agent A having invested 300 ECU and agent B having invested 100 ECU of their initial endowments.

(a) How many ECU does agent A get from the earnings of the second stage?
(b) How many ECU does agent B get from the earnings of the second stage?
(c) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent A?
(d) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent B?

Thank you!

Transcript of H-Treatment Instructions

Welcome to this decision experiment!

Basic Information

Please read these instructions very carefully! At the end of these instructions you will find some control questions. The control questions will give you and the experimenters the final chance to check whether you have fully understood the rules of the experiment. Your decisions during the control questions will have no effect on your earnings from the experiment.

After you have answered the control questions correctly the experiment will start.

During the experiment you will make decisions by which you can earn money. How much money you will earn depends on the decisions you take and on the decisions the other participants take. ECU is the currency used during the experiment.[2] At the end of the experiment, the amount of ECU earned will be converted to Euro according to an exchange rate of

$$20 \text{ ECU} = 1 \text{ Cent.}$$

Your earnings will then be paid to you. In addition to your earnings from the experiment, you will receive a secure show-up payment of 4 EUR.

You will start the experiment with an initial endowment of 500 ECU (25 cents). This amount will be increased by your earnings and decreased by your losses. You may always exclude losses by your own decisions.

After the experiment has been concluded, the sum of your earnings in the rounds will be converted into Euro and paid to you. That is, every decision you take will affect your payment. In addition to your earnings you will get a decision independent payment of 4 € (show-up payment). Apart from the experimenters no one else will get to know your earnings from the experiment and the amount of money that is paid to you.

The experiment takes place anonymously, that is, you will not know which of the other participants you are interacting with.

Please note that you are not allowed to talk to any other participant throughout the experiment! Should this happen, we will be forced to abandon the experiment. If you have any question, please hold your hand up and an experimenter will come to you!

Course of the Experiment

Decision Structure

In the experiment an agent “A” encounters an agent “B”. Each round of the experiment consists of two stages. In the first stage agent A decides on how the earnings from the subsequent second stage will be

[2] In German the expression “Taler” was used instead of Experimental Currency Unit (ECU).

divided between himself and agent B. In the second stage agent A and agent B choose simultaneously and independently which amount of ECU they want to invest.

At the beginning of each round it will be randomly determined whether you are an agent of type A or type B. Your type will then be displayed on top of the screen.

The experiment will last for 10 rounds. In each round, pairings will be drawn, each consisting of an agent A and an agent B. For each new round a new pairing will be randomly drawn. Information about your decisions and your performance will only be communicated to the respective other agent in that round. All the other agents will not learn anything about your choices!

In the following, we explain choice alternatives and their consequences for the respective agent's earnings.

Stage 1

In the first stage agent A decides on how the earnings from the subsequent second stage will be divided between himself and agent B. To do so agent A has to choose an integer value from 0 to 100, indicating the share of the total earnings obtained in the second stage which he will concede to agent B.

If he chooses 20, for instance, 20 percent of the earnings in the second stage are left with agent B, if he chooses 63, for instance, then 63 percent of the earnings in the second stage are left with agent B.

Agent A has an on-screen calculator at his disposal. He can enter his own planned investment, the expected second stage investment by agent B, and proposals for the division of the total earnings to be decided by himself in the first stage. The on-screen calculator then determines the earnings for both agents from the proposed decisions.

The on-screen calculator returns information on the division entered, the investments entered, and the earnings resulting from these inputs. The information on earnings is differentiated into earnings from investment and division in the second stage and total earnings for each agent, which also includes the residuum of the initial endowment.

The earnings in the second stage, which will be split between the agents, will be calculated as follows: $4 \cdot (\mathrm{i}_A + \mathrm{i}_B)$. i_A refers to the amount of investment of agent A and i_B is the investment of agent B. Thus, the sum of the investments by both agents will be multiplied by 4 in order to determine their earnings from investment in the second stage.

Stage 2

In the second stage agent B finds out about agent A's decision in the first stage.

Subsequently, agent A and agent B invest an amount of money simultaneously and independently. That is, they do not know of the investment decision of the respective other. In each round, each of the agents has a maximum of 500 ECU (25 cents) at his disposal. Everyone may therefore invest an integer value from 0 to 500 ECU. Residual money which has not been invested may be kept by the agent. In particular this means that the total earnings of an agent who invests 0 ECU is 500 ECU (25 cents).

Apart from their investments, agents do not have to bear any costs.

Again, both agents have an on-screen-calculator at their disposal for informative purposes. Subjects may enter their own planned investment and the expected investment of the other agent. The on-screen calculator then determines the expected earnings for both agents while taking the decision on the division from the first stage into account. The on-screen calculator returns information on the investment decisions entered and the resulting earnings for the agents, both as earnings from the investment in the second stage and as total earnings including the residuum of the initial endowment.

At the end of each round, the agents will also be fully informed about the actual decisions taken. On the screen they will get information on the division agent A has chosen in the first stage and the investment decisions of agent A and agent B in the second stage. In accordance to the division and investments, the earnings of the agents will be calculated and displayed.

Example

Agent A decides to concede, for instance, 20 percent of the earnings from the second stage of the experiment to agent B, thus keeping 80 percent for himself. If both invest 200 ECU of their initial endowment, agent A yields (4 * (200 + 200) * 0.80) as earnings from the second stage, that is 1,280 ECU, and agent B yields 320 ECU. Adding their retained initial endowments agent A would therefore yield total earnings of 1,580 ECU in this round of the experiment and agent B 620 ECU.

After reading and confirming the displayed information on the results the next round of the experiment is going to commence.

Conclusion and Payment

After 10 rounds the experiment ends. Before making the pay-outs we will ask you to answer a final questionnaire. Your answers to the final questionnaire will not have any effect on your payments. Please press the confirm-button after you have completed the questionnaire!

When the experiment is concluded, the Euro-equivalent of the sum of your earnings over the rounds of the experiment will be paid to you. 20 ECU are equal to 1 cent. In addition to your earnings you will get a decision independent payoff of 4 € (show-up payment).

Please wait in your cabin until you are called by the experimenters to come forward and collect your payment! Please hand back all the documentation you have received! Apart from the experimenters you will be the only one to know your earnings from the experiment and the amount of money that is paid to you.

Transcript of H-Treatment Control Questions

Question 1: Please tick the correct conclusions! Multiple correct conclusions are possible.

(g) agent A decides in stage 1 first, which proportion of the earnings from stage 2 agent B will get, and then decides over his investment in stage 2
(h) agent B decides in stage 1 first, which proportion of the earnings from stage 2 agent A will get, and then decides over his investment in stage 2
(i) only agent B invests in stage 2
(j) only agent A invests in stage 2
(k) both agents invest in stage 2
(l) agent B does not take a decision in stage 1

Question 2: Assume that agent A has set 25 as the share to be conceded to agent B. Earnings of the second stage are 1,600 ECU, with both agents A and B having invested 200 ECU of their initial endowments each.

(e) How many ECU does agent A get from the earnings of the second stage?
(f) How many ECU does agent B get from the earnings of the second stage?
(g) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent A?
(h) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent B?

Question 3: Assume that agent A has set 60 as the share to be conceded to agent B. Earnings of the second stage are 1,600 ECU, with agent A having invested 300 ECU and agent B having invested 100 ECU of their initial endowments.

(e) How many ECU does agent A get from the earnings of the second stage?
(f) How many ECU does agent B get from the earnings of the second stage?
(g) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent A?
(h) What are the total earnings (that is, share of the earning of the second stage + remainder of the initial endowment) of agent B?

Thank you!

Runde 1: Sie sind Akteur A.

In dieser Stufe entscheiden Sie wieviel Prozent des Verdienstes der zweiten Stufe Sie dem anderen Akteur überlassen.

Mit diesem Profit Kalkulator können Sie das Spiel simulieren

Anteil des Verdienstes, den der andere Akteur erhalten soll (in Prozent): 45

Ihre Investition: 500

Investition des anderen Akteurs: 250

Berechnen

Prozentualer Anteil des anderen Akteurs	Ihre Investition	Investition des anderen Akteurs	Ihr Verdienst	Verdienst des anderen Akteurs
25	500	250	2250.00	1000.00
35	500	250	1950.00	1300.00
45	500	250	1650.00	1600.00

Bitte geben Sie hier Ihre tasächliche Entscheidung ein

Wieviel Prozent der Verdienste aus Stufe 2 soll der andere Akteur erhalten: 45

OK

Runde 1: Sie sind Akteur B.

In dieser Runde erhalten Sie 45 Prozent des Verdienstes der 2. Stufe.

Mit diesem Profit Kalkulator können Sie das Spiel simulieren

Ihre Investition: 300

Investition des anderen Akteurs: 500

Berechnen

Ihre Investition	Investition des anderen Akteurs	Ihr Verdienst	Verdienst des anderen Akteurs
100	300	1120.00	1080.00
200	300	1200.00	1300.00
300	300	1280.00	1520.00
300	200	1100.00	1400.00
300	400	1460.00	1640.00
300	500	1640.00	1760.00

Bitte geben Sie hier Ihre tasächliche Entscheidung ein

Wieviel möchten Sie investieren: 400

OK

Runde 1: Sie sind Akteur A.

In dieser Runde erhalten Sie 55 Prozent des Verdienstes der 2. Stufe.

Ihre Investition	Investition des anderen Akteurs	Ihr Verdienst	Verdienst des anderen Akteurs
100	500	1720.00	1080.00
200	500	1840.00	1260.00
300	500	1960.00	1440.00
400	500	2080.00	1620.00
500	500	2200.00	1800.00

Mit diesem Profit Kalkulator können Sie das Spiel simulieren

Ihre Investition:

500

Investition des anderen Akteurs:

500

Berechnen

Bitte geben Sie hier Ihre tasächliche Entscheidung ein

Wieviel möchten Sie investieren: 500

OK

Runde 1: Sie sind Akteur B.

Hier sehen Sie eine Zusammenfassung der Ergebnisse dieser Runde.

Der Gesamtverdienst der zweiten Stufe beträgt in dieser Runde: **3600.00**

Anteil am Verdienst, den Sie erhalten haben	**45 Prozent**	Anteil am Verdienst, den der andere Akteur behalten hat	**55 Prozent**
Ihre Anfangsaustattung	**500 Taler**	Anfangsaustattung des anderen Akteurs	**500 Taler**
Ihre Investition	**400 Taler**	Investition des anderen Akteurs	**500 Taler**
Ihr Anteil am Verdienst der zweiten Stufe	**1620.00 Taler**	Anteil des anderen Akteurs am Verdienst der zweiten Stufe	**1980.00 Taler**
Ihr Verdienst in dieser Runde	**1720.00 Taler**	Verdienst des anderen Akteurs in dieser Runde	**1980.00 Taler**

Ihr Prozentualer Anteil	Ihre Investition	Investition des anderen Akteurs	Gesamtverdienst von Stufe 2	Ihr Verdienst	Verdienst des anderen Akteurs
45	400	500	3600.00	1720.00	1980.00

OK

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