Origin of Endowments in Public Good Games: The Impact of Effort on Contributions

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Public good games provide an experimental environment for the study of social dilemmas. Typically, participants receive their endowments for the game from the experimenter. However, what if these endowments were earned rather than given as windfalls? Does the level of effort to earn the endowments influence contributions to the public good? Participants ($n = 83$) in a 2-stage experiment were required to earn their endowments through making either greater or lesser efforts. They were subsequently asked to play a linear public good game with the money. In contrast to the majority of previous studies undertaken, the participants in this experiment were not informed as to the asymmetry of the origin of the endowment. The results showed that contributions to the public good were less if endowments were earned with greater effort rather than with lesser effort.

Keywords: linear public good game, endowment origin, effort, other-regarding behavior

Social dilemmas are inherent in everyday decision making. We may be faced with the dilemma of whether to avoid paying the fare on public transport, whether to choose an expensive meal at a restaurant when a group is sharing the bill, or whether to evade taxes (Dawes & Messick, 2000; Falkinger, Fehr, Gächter, & Winter-Ebmer, 2000; Poppe, 2005). Despite the diversity of their contexts, these examples share the same decision structure: Each individual benefits from behaving selfishly, whereas a group reaps greater rewards if its members cooperate (Dawes, 1980).

The public good game provides an experimental environment for the study of social dilemmas. In a typical linear public good game, players may divide their initial endowments into both a private account and a group account. Whereas the money in the private account solely benefits the individual, the total contribution to the group account is multiplied by an efficiency factor and redistributed equally among all group members.

Although the dominant strategy for a rational player is defection—that is, to contribute nothing to the group account—most participants in public good experiments do cooperate to some extent. The low prevalence of free riders in public good experiments has led to the undertaking of research into those factors that enhance cooperation. Such diverse variables as the payoff structure of the game (Isaac, Walker, & Thomas, 1984), the communication among players (Tazelaar, Van Lange, & Ouwerkerk, 2004), or self-efficacy (De Cremer & van Vugt, 1998) have been found to influence behavior in social dilemmas (for reviews, see Ledyard, 1995; Kollock, 1998; Kopelman, Weber, & Messick, 2002; Van Lange, Liebrand, Messick, & Wilke, 1992).

The present study focuses on the question of whether the effort invested into earning endowments for a public good game affects the participants' levels of contribution. This issue is important in that it helps us to understand social dilemmas that exist both in the real world, where people's income is obtained through different levels of effort, and in experimental research, as participants' endowments are typically provided by the experimenters rather than earned.

Previous evidence of the effect of effort in public good games has not been conclusive. For this reason, we conducted an additional experiment where, in contrast to the majority of previous studies, the participants are given no information on the asymmetry of the effort investments within their groups. Whereas such information provides participants with the opportunity to compare their own effort investments with those of others, the design of the present study allows a test for the "pure" impact of effort on cooperation.

Before we review the existing literature on the origin of endowments in public good games, we outline our theoretical approach. We also propose that two potential mechanisms are caused by the expenditure of effort; namely, source dependence and the "sunk-cost" effect.

Effort and Decisions

From an economic perspective, the origin (or source) of an income should not alter preferences in decisions. Evidence from experimental studies contradicts this assumption of source independence. For example, Loewenstein and Issacharoff (1994) have demonstrated source dependence with regard to the valuation attributed to objects. In their experiments, participants who received a coffee mug for their performance on a task exhibited a stronger endowment effect than those participants who received the same mug by chance. Furthermore, the participants who received their reward for their excellent performance valued the mug more than those who received one despite their poor performance. Complementary findings have been reported by Arkes et al. (1994), who found that people spend windfall gains (e.g., unexpected income from a tax refund) more readily than income that they had expected to receive. The authors propose that this effect is due to the fact that people attribute less value to windfalls than to earned income.

Another principle that underlies many economic theories and that is frequently challenged in behavioral experiments is that only incremental outcomes should affect decision making. In this way, previous gains or losses should be irrelevant (Thaler, 1980). With regard to previous gains, Thaler and Johnson (1990) have studied the "house money" effect on risky decisions, a phenomenon closely related to the notion of windfall gains. The authors found a stronger tendency to take risks in two-stage gambles, which involved previous gains, than when the same decisions were made in one-stage gambles. According to their quasi-hedonic editing hypothesis, a previous gain causes an individual to regard subsequent negative outcomes as a reduction of this gain rather than as a loss. Thus, without impact of loss aversion, decision makers may gamble until their previous winnings are fully eliminated, "as if losing some of 'their money' doesn't hurt as much as losing one's own cash" (Thaler & Johnson 1990, p. 657). Research on sunk-cost effects reveals that previous losses such as investments of money, effort, or time are also taken into account when making decisions. Thaler (1980) argued that sunk costs affect risk-taking behavior because of failure to adapt to these previous losses. Consequently, decision makers who face large sunk costs may accept gambles that they would otherwise reject. Despite this, Thaler and Johnson (1990) have demonstrated that, if a safe option gives someone the opportunity to break even with previous investments, then the sunk-cost effect can be reversed. Accordingly, previous investments can lead to risk-averse behavior in certain circumstances. Furthermore, Zeelenberg and van Dijk (1997) have expressed criticism of the fact that most research that has been conducted on sunk-cost effects primarily addresses previous investments of a financial nature. In their questionnaire studies, Zeelenberg and van Dijk manipulated previous investments of effort and found that participants were more inclined to make risk-averse choices when behavioral sunk-costs were present than when no sunk costs were involved. The experimenters argued that investments of effort evoke levels of aspiration for financial compensation; that is, a subjective break-even point. If the aspiration level is met with a safe option, then additional gains from a risky alternative are forgone because of the risk of falling below one's aspiration level and consequently "experiencing the feeling of having worked for nothing" (Zeelenberg & van Dijk, 1997, p. 682).

In the context of endowment origin in public good experiments, the findings highlighted in the previous paragraphs lead us to draw two conclusions. The first is that the valuation of endowments is assumed to be source dependent. Therefore, the amount of effort made to earn

one's endowments should increase its subjective value. Consequently, this decreases the participants' propensity to spend. The second conclusion is that endowments may be perceived as compensation for one's investments of effort. The option to contribute to the group account, where the participant is in danger of losing this compensation, is therefore perceived to be riskier than the option to not cooperate and to retain the endowments. Accordingly, contributions to a public good are predicted to be lower if the endowments are earned through a greater level of effort than if they are earned through lesser effort.

Previous Research

The idea that behavioral investments, such as effort, could be a relevant determinant of cooperation in social dilemmas was first implied in studies on the effects of wealth. In typical experiments, participants' endowments were distributed asymmetrically among a group to discover whether "rich" participants will contribute more than "poor" participants (e.g., Rapoport, 1988; van Dijk & Grodzka, 1992). Wit, Wilke, and Oppewal (1992) investigated fairness issues that are implicit in such asymmetries and concluded that the differences in the level of contributions made because of the greater or lesser resources of the participants may be reduced if "positions would be assigned on the basis of merit rather than chance" (Wit et al., 1992, p.195). Their conclusion highlights the importance of effort in asymmetric public good dilemmas; a previous investment of time and effort may justify a better initial wealth position (or unequal profit distributions; cf. van Dijk & Wilke 1993). Therefore, in accordance with equity theory (Adams, 1965), this reduces the impact of wealth on contributions (Joireman, Kuhlman, & Okuda, 1994; van Dijk & Wilke, 1994). Similar results have been obtained from an experiment with slightly different rules from those that are applied in linear public good games: In a "best-shot" public good game, only the highest contribution (instead of the total of all contributions) is multiplied and redistributed among the group. Any contributions that are lower than the best shot are in vain. With regard to initial wealth levels, in heterogeneous groups it would be fair if the richest of the participants placed the best shots. However, if endowments were earned rather than given as windfalls, those with higher endowments may feel less obliged to make the highest contributions. In fact, participants with the highest endowments contributed less when they had earned their endowments through answering quiz questions than those who had been given endowments as a windfall (Kroll, Cherry, & Shogren, 2007).

(Un)equal investments of effort also have the potential to affect a member's identification with the group. This, in turn, may affect his or her contributions to the group account. Student participants in two of Jackson's (2001) experiments were led to believe either that all of the participants in their group had received the same endowments because they had achieved the same grades at university or that the equal distribution was due to chance. In the former treatment, the participants were more likely to contribute to the public good and to exhibit stronger identification with the group than were the participants in the latter group. However, it is important to note that the increase in contributions made by those in the same-grades treatment seems to be an effect of group identity that arose from highlighting the similarities within the group, rather than an effect of the effort that students had invested to obtain their grades.

Although asymmetries in participants' effort investments and wealth levels have the potential to affect fairness judgments and group identification, in reality, members of a community are often not aware of such differences. Taxes have to be paid and public transport tickets have to be bought, without (exact) information on how hard fellow citizens have worked to earn their income. Therefore, to answer the question of whether effort alone affects cooperation, without the possibility to compare each other's endeavors, participants in public good experiments must not be informed as to how much effort others had made to earn their endowments.

Cherry, Kroll, and Shogren (2005) conducted such an experiment by comparing the contributions made by participants who had received windfall money with the contributions of those participants who had earned their endowments by taking a quiz of 17 questions. No differences were found in the levels of contributions. Actually, in an experiment conducted by Oxoby and Spraggon (2006), the effects of group heterogeneity on contribution levels were investigated.

This experiment, however, included two treatments relevant to our research purpose. Participants were asked to play a public good game either in homo- or heterogeneous groups regarding the source of endowments (viz., windfall or earned income, respectively). In the two homogeneous group conditions, all 4 participants within the group either received windfall endowments or had to earn the endowments by taking an exam containing 12 questions. However, contribution levels in these two conditions were approximately the same. The aforementioned best-shot public good experiment by Kroll et al. (2007) included two treatments that are relevant to our study as well. Among the homogenous groups, no difference was observed in the levels of contributions made between participants who had earned their endowments and those who were provided with windfall endowments. Only Clark's (2002) experiment revealed significant differences that can be clearly attributed to the origin of endowments rather than to fairness considerations or related issues that come into play when participants are informed of the effort investments of others. Clark (2002) compared the levels of contribution between two separate treatments. Participants were either provided with windfall endowments or were asked to play the public good game with their own money. We can assume that the latter group had made at least some effort to earn their money before bringing it along to the experiment. Although Clark reported no differences between the average contributions that were made, Harrison (2007) re-analyzed the same data set and found that the fraction of free riders (those who contributed nothing to the group account) was lower in the treatment in which participants played the game with their own money.

Although evidence for the impact of effort on cooperation seems quite clear, if it is possible to compare with others, findings on the "pure" impact of effort (viz., higher or lower cooperation due to an individual's sunk investments) are more puzzling. A significant change in contributions was observed in only one out of four of the public good experiments. This is surprising, as violations of the source independence of endowments have been found in nearly all other economic games; for example, the dictator game (Cherry, Frykblom, & Shogren, 2002), the ultimatum game (Ruffle, 1998), and the power-to-take game (Bosman, Sutter, & van Winden, 2005). Therefore, we conducted a study in addition to those already conducted, in which participants earn endowments by completing either an easy or an effortful task. Subsequently, they play a public good game without being informed of the effort investments of others. We then report the findings of this experiment.

Method

Experimental design and procedure. We conducted our experiment in two stages. In the first stage, participants had to earn their endowments with a lesser or greater effort, depending on the respective condition. In the second stage, a linear public good game was played in groups of four, which contained two participants from each effort condition. Thus, a one-factorial (effort: low vs. high) research design was implemented.

The experiment took place in a laboratory containing 12 computers. The computers were arranged in three subgroups for 4 participants. The three subgroups were separated by wooden panels and were marked by a sign that displayed each group number. Participants were informed that they were to earn their initial endowments for a game that they would subsequently play within their respective subgroups. The experimenter explained that the payoff in the experiment depended on the participants' behavior in the game. The experimenter also announced that 1 euro was equal to 42 experimental currency units (ECU). Participants were asked to not communicate with each other. All further instructions were given by means of the computers.

In the first stage, participants were randomly assigned to the low- or high-effort condition. They were subsequently informed that they would be shown an episode from a TV cartoon series and would be questioned on the episode while watching the program. The participants were encouraged to answer as many questions as possible so as to earn an endowment of 50 ECU. After being presented with pictures and voices of the relevant cartoon characters, participants in the low-effort condition watched a 6-min episode of the cartoon while simultaneously answering five multiple choice questions on its plot. Participants in the high-effort

condition were shown pictures from the same episode but were asked to listen to a soundtrack from a different episode. During the time that the participants in the latter condition were watching the episode, they answered a total of 42 multiple choice questions relating both to the plot of the visual images and to the plot of the soundtrack. The seating arrangements and the presentation (through headphones) of the soundtracks assured that the participants were not aware of the differences in tasks. After the movie, participants in both treatments received feedback on their performance and were endowed with 50 ECU. We conducted a manipulation check to complete the first stage: ("Did you feel that the task you have just completed required a high degree of effort?" [1 = *no effort at all*; 6 = *very high effort*]; "Did you earn the 50 ECU easily?" [1 = *very easy*; 6 = *very hard*]; Spearman ρ = .86, p < .01).

In the second stage, participants were asked to play a linear public good game within their subgroups (this part of the experiment was programmed and conducted with the software z-Tree; Fischbacher, 2007). Each subgroup consisted of 2 participants who earned their endowments through a greater amount of effort and 2 participants who earned the same endowment through a lesser amount of effort. The participants were not informed of this asymmetry. Two to three subgroups were tested simultaneously in each experimental session. Instructions on the rules and payoff structure of a standard linear public good game were presented through the computer monitors. Participants were asked to allocate their 50 ECU to a private account, to a group account, or to both. The participants would retain the money in the private account, whereas in the group account, each ECU would be doubled by the experimenter and returned to all 4 group members in equal shares (marginal per capita return = .5). The public good game was played in a single period for two main reasons: First, the effort condition was likely to have the strongest effect in the first decision round, and second, in further periods, other factors have been known to influence contributions in repeated public good games (viz., experience and learning; Andreoni, 1998).

Once the public good game was complete, we conducted a survey to test validity of the decision-making processes caused by the effort put

into endowment origin (as proposed in the previous section). We asked participants to indicate on a 6-point scale, first, how much of a risk they perceived the option of contributing to the group account to be ("Did you think it would be risky to contribute something to the group account?" [1 = *not risky at all*; 6 = *very risky*]) and, second, how difficult it was to decide whether to contribute ("Was it difficult for you to decide how much you would contribute to the group account?" [1 = *very easy*; 6 = *very difficult*]). The first item, perceived risk, was measured to examine whether risk perceptions are affected by different levels of effort. The latter item was interpreted as proxy for the subjective value of endowments by assuming that the cognitive effort in decision making partly depends on how much is at stake. If evaluations are source dependent, then the value of the endowments will be proportional to the level of effort put into earning them.

After the experiment, the participants were debriefed and paid their earnings in cash. They were subsequently allowed to select a small present from a variety of personal hygiene products, such as beauty products and books. Each experimental session took approximately 25 min.

Participants. In total, 84 students from the University of Vienna participated in the experiment. The age of the 52 female and 32 male students who participated ranged from 18 to 37 years (M = 23.6, SD = 3.9).

Results

Manipulation check. Median ratings in the manipulation check (1 = *no effort at all*; 6 = *very high effort*) were 1 (interquartile range [IR] = 0.5) in the low-effort condition and 4 (IR = 1.5) in the high-effort condition. Thus, the manipulation of effort was highly successful (Mann–Whitney U = 44.50; Z = −7.67; p < .01, one tailed).

Contributions. As predicted, participants who earned endowments through a high level of effort contributed less to the public good than those participants who received their endowments more easily: the median contributions (in absolute amounts) were 42.5 ECU (IR = 25) in the low-effort condition and 30.0 (IR = 30) in the high-effort condition (Mann-Whitney U = 666.50; Z = −1.99; p = .02, one-tailed). Frequency distributions of contributions for the
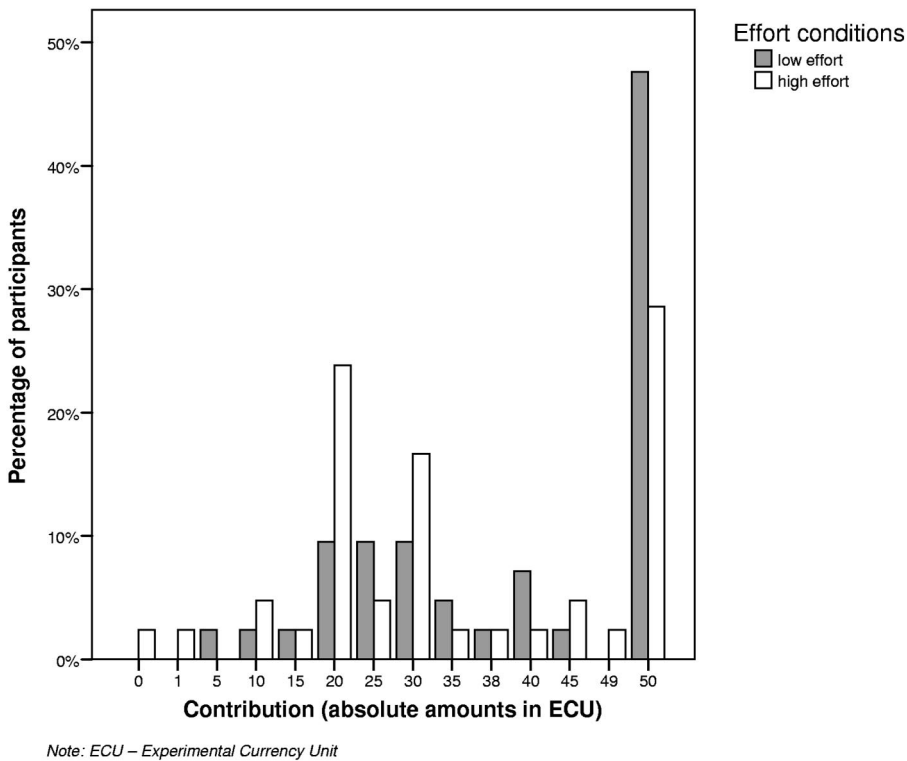
Note: ECU – Experimental Currency Unit

Figure 1. Frequency distribution of contributions.

two experimental conditions are displayed in Figure 1.

Perceived risk and subjective value. Sunk-costs research suggests that investments of effort results in risk-averse choices if the risky option leads to the loss of one's hard-earned money. As a result, it was expected that the option of contributing something to the group account was perceived to be riskier if the endowments were earned through a greater amount of effort. Accordingly, ratings on the survey's perceived risk item (1 = *not risky at all*; 6 = *very risky*) were lower in the low-effort condition (*Mdn* = 2, IR = 3) than in the high-effort condition (*Mdn* = 3.5, IR = 2; Mann–Whitney U = 686.50; Z = -1.79; p = .04, one-tailed). Furthermore, perceived risk was negatively related to contributions (Spearman ρ = $-.25$, p = .02).

The notion of source dependence suggests that subjective value of an object is proportional to the effort involved in obtaining it. As expected, the ratings on the proxy item for sub-jective value (viz., the difficulty of the decision task [1 = *very easy*; 6 = *very difficult*]) were lower in the low-effort condition (*Mdn* = 1, IR = 1) than in the high-effort condition (*Mdn* = 2, IR = 2; Mann-Whitney U = 651.00; Z = -2.25; p = .01, one-tailed). The proxy for the subjective value of the endowments was negatively related to contributions, Spearman ρ = $-.55$, p < .01. Perceived risk and subjective value were positively related, Spearman ρ = .37, p < .01.

Discussion

The origin of the endowments affected contribution levels in the linear public good game. Participants who earned their endowments through a greater amount of effort were less cooperative than those participants who had earned the money with relative ease. In contrast to the majority of previous studies, the participants in our experiment were not informed as to the amount of effort the other group members

had made. Whereas the effect of effort seems reasonably stable when such information is provided, the empirical evidence is less clear when it is not. Our findings contribute to solving the puzzles of previous studies.

As suggested by our theoretical approach, measures for subjective valuation and risk perceptions included in the postexperimental survey were significantly affected by the manipulation of effort. Furthermore, both variables were correlated with contributions. What is limiting is that these are only proxy variables for the proposed mechanisms; therefore, these findings are of exploratory use only. Our proxy for subjective value may be questioned in particular, with regard to the difficulty of the decision task. We decided to use a proxy variable, as it seemed more appropriate than asking the participants directly for a subjective valuation of the money they received as endowments. The assumption behind this proxy variable was that the more that is at stake subjectively in the decision-making task, the more thoroughly the possible outcomes should be considered and the harder it should be to make one's decision. It may be criticized, however, if our participants interpreted this questionnaire item accordingly. The change in the proxy for risk perceptions is interesting. The game-theoretical solution to the public good game is defection; and in presence of a dominant strategy, risk attitudes should be irrelevant. Nevertheless, if defection was not recognized or not chosen for any reasons other than financial (e.g., altruism), then the option to contribute is "riskier" than the option to retain the money. The higher the contribution, the higher the risk that others will contribute less. Our main results conflict with earlier findings. Therefore, it seems reasonable to compare our design with previous experiments.

Cherry et al. (2005), Kroll et al. (2007), and Oxoby and Spraggon (2006) found no differences in contributions due to the origin of endowments. These authors used a manipulation of effort similar to ours. Participants earned their endowments by answering general knowledge questions. However, in all three studies, contributions from earned endowments were compared with a control treatment in which endowments were provided by the experimenters. Note that these two treatments are not exactly parallel. Participants in the earned-

endowments treatment spent more time in the laboratory than those participants in the windfall-endowment treatment. The former participants also completed a task that could have activated cognitive processes relevant to making choices in the subsequent game. Furthermore, Jackson's (2001) findings suggest that group identity is stronger if all the participants work at the same tasks than if the only similarity within the group is that they are lucky enough to be in the windfall-endowment treatment. Stronger identification would result in higher contributions (in contrast to the effect of effort we have observed). Hence, the possibility that the effects of time, priming, or group identity would confound the impact of effort cannot be completely ruled out in such experimental designs.

Another difference in the manipulation of effort in these studies is that the level of endowments that the participants earned depended on their performance in the task. The amount earned (and forgone) could be considered as feedback on their skills and may have evoked psychological processes (e.g., counterfactual thinking, feelings of pride, regret, or rejoicing) that affected their contribution decisions. However, limitations in our manipulation of effort are that watching the cartoon series with the correct soundtrack could have been more entertaining than being confronted with two completely different plots as in the high-effort treatment. This would mean that mood effects account for our findings.

Even stronger discrepancies arise from Clark's (2002) experiment. Average contributions in his study were substantially the same, regardless of whether the participants played the game with their own money or were provided with endowments by the experimenter. In conjunction with our results, the contributions made by participants who used their own money were slightly (but not significantly) lower in the first period. However, Harrison's (2007) analysis revealed that the percentage of free riders (over all 10 periods) was lower when participants played with their own money. In our experiment, only 1 participant contributed no money at all to the group account; therefore, it is not possible to make a comparison between the two treatments. The unusually low percentage of free riders in our data set could be due to either demographic characteristics of our sample population or to the small amount of incen-

tives that we used. The participants in our study were mainly psychology or humanities students; only 7 of those participants have had some form of economic education, which is assumed to promote noncooperative behavior (Marwell & Ames, 1981). Regarding the incentives that we provided, the stakes in our experiment were relatively low. Thus, the extra money gained by free riding was probably less attractive than the socially desirable option to be cooperative.

Consistent with our findings are those results from public good games in which the participants were given information about any asymmetries in endowment origin (Joireman et al., 1994; Kroll et al., 2007; van Dijk & Wilke, 1994). Consideration of fairness seems to be an important mechanism should such information be given. This should be irrelevant with our experimental design. However, an alternative explanation for our findings could be that participants compared their effort investments with previous experiences or guessed at how much sunk costs other participants in their group had. Our results are also consistent with studies on endowment origin in the context of other economic games. Cherry (2001), for example, found less generosity in the dictator game when endowments were earned rather than received as windfalls. Nonetheless, because of the presence of contradicting results in public good games, more research is needed to clarify the significance of the amount of effort that is made to earn the endowments.

It is too early to draw valid practical conclusions from our study. However, if the effects are the same on repeating the experiment, then these findings will be crucial for experimental studies involving monetary incentives. The origin of endowments might affect participants' behavior and confound effects of the experimental manipulation. For future experiments, a great deal of consideration needs to be placed on whether the endowments are provided by the experimenters or whether they have to be earned by participants.

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