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PUBLIC GOOD PROVISION, PUNISHMENT AND THE ENDOWMENT ORIGIN: EXPERIMENTAL EVIDENCE

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Public Good Provision, Punishment and the Endowment Origin: Experimental Evidence

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Abstract

We study contributions and punishment in a linear public goods game, where group members differ in the sources of their endowments. We compare homogenous groups in which subjects are exogenously assigned to the same endowments with heterogeneous groups in which half of the group members invest real effort to earn their endowments, while the other half are granted with a windfall amount of equal size.

We illustrate, that independent of group composition, free-riding becomes the ubiquitous form of behavior over time if group members cannot sanction each other. If punishment opportunity is present, contributions constantly increase over time, albeit we find differences neither in contributions nor in punishment across heterogeneous and homogenous groups. Furthermore, we also manifest that different subject types make similar contributions in heterogeneous groups. We conjecture that effort invested to earn the endowment seems not to cause conflicting normative views on appropriate contributions among subject types.

Nevertheless, within heterogeneous groups subjects, who exert real effort to earn their endowments, punish less severely than those receiving windfall endowments.

Keywords: Endowment Origin, Linear Public Goods Game, Punishment
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1 Introduction

In the society cooperation among entities with differential characteristics is a norm, rather than an exception. A notable example of cooperation among heterogeneous agents is that of Israeli kibbutz, where a common pool of resources created by community members was divided equally, with each member of kibbutz receiving an equal share, regardless her ability and effort (Abramitzky, 2008). In the mentioned example informal social sanctions are the main mechanism to mitigate the social dilemma, as no legal enforcement exists to deter free-riders unwilling to contribute to the public pool of resources. In this vein kibbutzim were effective in implementing peer pressure through negative emotions to stigmatize the shirking members: "Nobody said a word to him. But in the evening, in the dining hall, the atmosphere around him was such that the following morning he got up and left the *kvutza* [kibbutz]" (Near 1992, p. 38, cited in Abramitzky, 2008, p. 1148).

In general, when evaluating her contribution to the public good with those of other group members, an individual may be guided by either *equality* or *equity* norms of contributions (Reuben and Riedl, 2013). In public goods game with homogenous groups and punishment opportunity, where all individuals possess equal windfall endowments and extract the same benefits from the public good, equal contribution rule seems to be the norm, with any (positive or negative) deviation from the equality rule being subject to costly sanctions (e.g. Fehr and Gächter, 2000, Herrmann et al., 2008). In heterogeneous groups, where different subject types interact with each other, it is not obvious what contribution rule will be established (and whether it will be established at all) (Nikiforakis et al., 2012, Reuben and Riedl, 2013). For instance, all other things equal, when individuals differ in the effort exerted to obtain the same endowment, a normative conflict may emerge. In particular, individuals exerting considerable effort to earn the endowment may be guided by equity contribution rules and perceive as genuinely fair that those investing low effort should make larger contributions (e.g. Winter et al., 2012). Meanwhile, low effort individuals may conform to less demanding social norms (e.g. Elster, 1989 and references therein) and contribute according to the equality contribution rule. Hence, which contribution norm will emerge during the interaction (and whether it will emerge at all) may be contingent on how the interested parties will enforce it over time and react to others' behavior.[1]

In this paper, we study the behavior (contributions and punishment) of individuals in a linear public goods game, where (all other things equal) the endowment sources of group members are heterogeneous. For our purposes we design an experiment, with a 2x2 between subjects factorial design. On the one hand we manipulate the endowment source, comparing homogenous treatments (HOM) in which subjects are exogenously assigned to the same endowments with heterogeneous ones (HET) in which half of the group members invest real effort to earn their endowments (henceforth, "effort subjects"), while the other half are granted with a windfall amount of equal size ("windfall subjects"). On the other hand we either allow punishment opportunity (P) or exclude it (NP). The rest of the experiment replicates that proposed by Fehr and Gächter (2000).[2]

In heterogeneous groups without punishment opportunity, similar to Reuben and Riedl (2013), we evidence low and decreasing contribution levels, as "...there is no *a priori* reason to assume that general willingness to comply varies with the type of group heterogeneity...".

[1] In the rest of the paper,when mentioning equity or equality rules of behavior, we refer to differences between subject types.

[2] We only consider groups with partner matching. Moreover, in line with the seminal paper by Fehr and Gächter, in our experiment group members cannot identify each other's type.

In heterogeneous groups with punishment opportunity we document equal contribution levels by effort and windfall subjects. With respect to sanctions, the more an individual negatively deviates from the contributions of her group members the more she gets punished. Comparing contributions and sanctions between homogenous and heterogeneous groups, we manifest non-significant differences. Based on a post-experimental question, we conjecture that such behavior stems from the fact that the subjects do not perceive differences in endowment origins as a source for divergent contribution rules conditional on a subject type.

Analyzing punishing behavior within heterogeneous groups only, we also illustrate that exerting effort in earning the endowment makes the subjects reluctant to sanction less cooperative behaviors: in heterogeneous groups effort subjects punish negative deviations of the peers less severe than windfall subjects (without knowing their type). As earning one's endowment increases its subjective valuation (Muehlbacher and Kirchler, 2009), we presume that an assigned point is more costly for an effort than for a windfall subject, which results in the observed behavior.

The rest of the paper is structured as follows. Section 2 presents a brief literature review. Section 3 depicts the experimental design. Section 4 provides the results and section 5 concludes.

2 Literature Review

Experimental literature evidences that income source can have salient influence on individual behavior. In particular, earning own endowment may create property rights over the latter, which may vanish other-regarding preferences of individuals. For instance, in dictator games, where the allocators exert effort to earn their endowments, the average offer can be in line with the theoretical prediction of the game (e.g. Cherry et al., 2002, Oxoby and Spraggon, 2008).

The issue of "earned *vs.* windfall" endowments has also been considered in the context of public goods game with non-conclusive results, evidencing that "...the role of asset legitimacy in experimental environments is both nuanced and context dependent (Oxoby and Spraggon, 2009, page 102)". In homogenous groups, where all group members have to exert effort to earn their endowments, Clark (2002), Cherry et al. (2005) find no evidence that "the house money effect" alters the contributing behavior of individuals. Re-examining the data by Clark (2002), Harrison (2007) concludes that "the house money effect" changes the propensity to completely free-ride, but has no influence on the extent of the contribution, once the subject has decided to contribute something. Two recent papers study contributions in heterogeneous groups, where group members differ in the sources of their endowments. Muehlbacher and Kirchler (2009) investigate whether the effort invested into earning endowments for a public goods game affects the participants' levels of contributions. The authors illustrate that contributions are in negative correlation with the effort exerted to obtain the endowments: the group members who earned their endowments through a greater amount of effort were less cooperative than the group members who earned the money with relative ease. In contrast, Oxoby and Spraggon (2009) find "inverse found money effect" in two-person public goods game: individuals, who earn their endowments, contribute more when they are matched with those, who receive windfall endowments.

Our paper departs from abovementioned references in several directions. First, unlike previous research on homogenous groups (i.e. Clark, 2002, Harrison, 2007), our focus is on heterogeneous ones. Such research agenda brings us close to the studies by Muehlbacher and Kirchler (2009) and Oxoby and Spraggon (2009). Nevertheless, departing from the latter, we i) investigate a multi-

period public goods game, ii) introduce punishment opportunity into our framework and study the interplay between contributions, punishment and the endowment origin. Under these circumstances, we can also understand the connection between effort exerted to earn the endowment and the propensity to punish, which to the best of our knowledge is understudied, despite the extensive literature on public goods games and punishment of free-riders.

The heterogeneity of group composition, the multi-period horizon of the game and the opportunity to sanction free-riders relate our work to the recent research by Nikiforakis et al. (2012) and Reuben and Riedl (2013). The latter study contributing and sanctioning behavior of individuals in heterogeneous groups, where different behavioral rules co-exist, creating a normative conflict among group members.

Reuben and Riedl (2013) consider three sources of heterogeneity: i) differences in endowments (UUE treatment), ii) differences in endowments interacted with differences in contribution capacities (URE treatment) and iii) differences in marginal benefits from the public good (UMB treatment). The authors illustrate that without punishment possibilities group heterogeneity is of no relevance; in all treatments free-riding is common and increases over time. Nevertheless, with punishment opportunity distinct contribution norms are established due to the adopted enforcement strategy. A notable exception is the UMB treatment, where individuals cannot agree on a contribution norm. Similar source of heterogeneity boils the disagreement among group members down to a feud in the framework of Nikiforakis et al. (2012), fully offsetting the efficiency gains from increased cooperation.

In our paper, we introduce a novel source of heterogeneity: differences in effort required to earn the endowments. Half of the group members receive their endowments conditional on succeeding in a real effort task, while the other half receive their endowments as a windfall gift. A point of departure between our study and the abovementioned references (i.e. Reuben and Riedl, 2013, Nikiforakis et al. 2012) is that group members cannot identify each other's type in our framework.

3 The Experiment

3.1 The Experiment

We adopt a 2x2 between subjects factorial design. On the one hand we manipulate the endowment source, comparing homogenous treatments (HOM) in which subjects are exogenously assigned to the same endowments with heterogeneous ones (HET) in which half of the group members invest real effort to earn their endowments (henceforth, "effort subjects"), while the other half are granted with a windfall amount of equal size ("windfall subjects"). On the other hand we either allow punishment opportunity (P) or exclude it (NP). Hence, we end up with 4 treatments: HOM&NP, HOM&P,HET&NP and HET&P. The rest of the experiment replicates that with partner matching proposed by Fehr and Gächter (2000).

3.1.1 Endowment Origin

The main difference between HOM and HET concerns the manipulation of the endowment origin. In particular, at the beginning of the experiment, subjects in HET are randomly partitioned into groups of five, with three effort and two windfall members in each group. While the latter have their

participation to the rest of the experiment assured, the continuation of the former is conditional on succeeding in a real effort, competitive task.[3] The effort task is a 390-second digit-typing contest divided into three equal stages. In each stage, a different list of 56 10-digit numbers in 2 columns and 28 rows is presented to the subjects. The subjects are required to find a number in a row and a column and type it in an input field, with a correct input being worth 1 point. In all groups, the person obtaining the lower score in the real effort task leaves the lab with the show-up fee of 5 Euros. If present, ties are randomly broken.

We have chosen a "tournament" real effort task with the intent to make the differences between effort and windfall subjects sufficiently salient. The former, in contrast to their windfall group members (who are allowed to read a journal meanwhile), have not only to exert effort to obtain their endowments, but also to compete in a tense environment not to be the last in the group and leave the lab. We believe that such a specification is much “sharper” in comparison to a scenario, where competition among effort subjects is absent. Moreover, when taking part in the tournament, the subjects are not informed about the content and rules of the second phase of the experiment. Under these circumstances, "self-selection based on other-regarding preferences" is minimized (Erkal et al., 2011, Nikiforakis et al. 2012).

3.1.2 Punishment Opportunity

In the first stage, each subject chooses how much of an endowment of 20 tokens to invest in a public project that generates a return of 0.4 per invested token to all group members. Whatever not invested in the project is kept by the subject. At the end of the first stage, subjects are informed about the total contribution of the group, the return from the public project as well as their overall earnings in the stage. In the second stage, each subject observes individual contributions in her group. The main difference between P and NP conditions, is the opportunity to punish in the second stage. In particular in the second stage of P, having observed individual contribution in her group, every participant chooses whether and how much to punish each of the other group members. Every punishment point reduces the payoff of the punished subject by 10%. Inflicting punishment points is costly, with the cost of punishment being strictly increasing and convex in the number of inflicted points as shown by the following table.

Table 1: The Monetary Cost of Punishing a Subject

Punishment Points	0	1	2	3	4	5	6	7	8	9	10
Cost of Punishment	0	1	2	4	6	9	12	16	20	25	30

To prevent individual reputation formation, which may interact with the endowment origin in unpredictable ways, we exclude the possibility that the subjects can identify each other (including the types) in line with the previous studies (e.g. Fehr and Gächter, 2000, Nikiforakis, 2010).[4]

[3] There is no conventional wisdom on the nature of the task to be used (see Cherry et al. 2005).

[4] “To prevent the possibility of individual reputation formation across periods in the Partner treatment each subject’s own contribution is always listed in the first column of his her computer screen and the remaining three subjects’

At the end of the second stage in P condition the subjects are provided with feedback on the aggregate cost of assigning points, the number of points inflicted by the other group members and the payoff of the second stage (i.e. income from the round).

4 Results

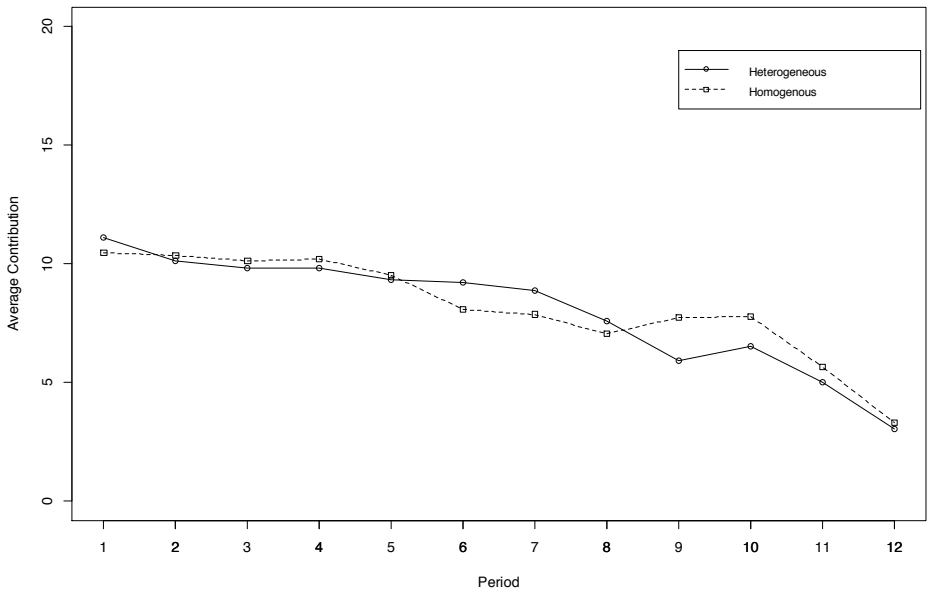
The experiment took place at the University of Innsbruck between December 2012 and January 2013. The experiment was computerized by using z-Tree (Fischbacher, 2007). Overall 216 subjects (48 in HOM treatments, 60 in HET treatments, for a total of 12 independent groups per treatment) participated in the experiment. On average, subjects earned around 16 Euros for sessions lasting about 80 minutes. [5]

4.1 No Punishment Condition

Without punishment opportunity, over time full free-riding emerges as the common social norm, irrespective of the group composition.

Figure 1 depicts average per period contributions in HOM&NP and HET&NP.

Figure 1: Average Contributions in No Punishment Condition



Note. Average contributions in each period of HOM&NP and HET&NP treatments.

contributions are *randomly* listed in the second, third or forth column, respectively. Thus subject *i* does not have the information to construct a link between individual contributions of subject *j* across periods. Therefore subject *j* cannot develop a reputation for a particular individual contribution behavior. This design feature also rules out that *i* punishes *j* in period *t* for contribution decisions taken in period *t'<t* (Fehr and Gächter, 2000, page 983)".

[5]The data is available upon request.

In both treatments the game starts with an approximate contribution of 10 tokens and ends with that of 3 tokens. A non-parametric Mann-Whitney U test (W=69, p=0.887) does not find significant differences across treatments.[6] Consistent results emerge by performing formal parametric analysis.

Table 2: Contributions in HOM&NP and HET&NP

	(1) HOM&NP and HET&NP	(2) HOM&NP and HET&NP	(3) HET&NP	(4) HET&NP
Intercept	12.055***	11.759***	12.468***	12.293***
	(1.441)	(1.468)	(1.510)	(1.552)
Time	-0.595***	-0.550***	-0.641***	-0.614***
	(0.043)	(0.061)	(0.055)	(0.078)
HET	-0.146	0.447		
	(1.999)	(2.076)		
Effort			-0.524	-0.175
			(0.686)	(0.994)
Het*Time		-0.091		
		(0.086)		
Effort*Time				-0.054
				(0.111)
llr	-3581.933	-3582.905	-1737.862	-1739.026
Wald-χ^2	191.91	193.06	134.94	134.98
Prob.>χ^2	0.000	0.000	0.000	0.000
Obs.	1152	1152	576	576

Note. Two-way linear random effect model (standard errors in parentheses) accounting for both potential individual dependency over time and dependency within each matching group. Dependent variable: Subject's contribution to the public account. Independent variables: Time- Linear time trend; HET- treatment dummy which equals 1 in HET, 0 otherwise. Effort- dummy variable which equals 1 for effort subjects, 0 otherwise. Significance levels: * p<10%, ** p<5%, *** p<1%

As it can be inferred from *HET* dummy in the first two regressions of Table 2, there are no differences between treatments with respect to contributions. Moreover, the insignificant coefficient of *Effort* in regressions 3 and 4 illustrates that endowment source does not affect contributing behavior of individuals in heterogeneous groups. Contributions decrease over time, which is reflected in negative and significant coefficient of *Time*.

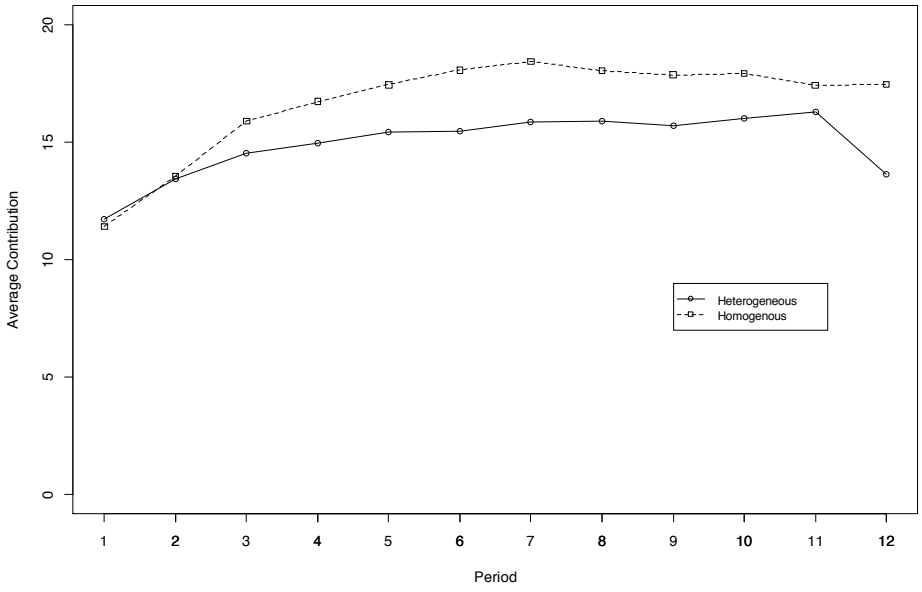
[6]In all non-parametric tests observations are average contributions of the groups over the entire time horizon. As we have 12 groups per treatment, we end up with 12 independent observations for each treatment.

4.2 Punishment Condition

Despite the presence or absence of heterogeneity in the group, punishment is an effective tool to deter free-riding.

As depicted in Figure 2, contributions increase over time in both HOM&P and HET&P.[7]

Figure 2: Average Contributions in Punishment Condition



Note. Average contributions in each period of HOM&P and HET&P treatments.

Mann-Whitney U test detects significant differences between HOM&P and HOM&NP (W=130, p=0) and HET&P and HET&NP (W=121, p=0). In contrary, there is no significant difference between HOM&P and HET&P (Mann-Whitney U test, W=49, p=0.198). Consistent result emerges by performing formal parametric analysis as well.

[7]The contribution level in the first period is approximately 10 tokens, which steadily increases over time, reaching to 13.625 and 17.458 tokens in the terminal round of HET&P and HOM&P, respectively.

Table 3: Contributions in HOM&P and HET&P

	(1) HOM&P and HET&P	(2) HOM&P and HET&P	(3) HET&P	(4) HET&P
Intercept	14.572***	13.875***	13.583***	13.488
	(1.118)	(1.139)	(1.372)	(1.414)
Time	0.325***	0.432***	0.217***	0.232***
	(0.033)	(0.047)	(0.052)	(0.074)
HET	-1.776	-0.382		
	(1.551)	(1.610)		
Effort			-0.180	0.009
			(0.677)	(0.962)
Het*Time		-0.214***		
		(0.066)		
Effort*Time				-0.029
				(0.105)
llr	-3291.094	-3287.723	-1708.930	-1710.226
Wald-χ^2	95.58	106.78	17.23	17.28
Prob.>χ^2	0.000	0.000	0.000	0.000
Obs.	1152	1152	576	576

Note. The same remarks of Table 2 apply.

After controlling for other determinants, the treatment effect is not significant (the first two regressions in Table 3).

Regarding relative contribution rules, there are no significant differences in contributions of effort and windfall subjects, as shown by the coefficient of *Effort* (the last two regressions in Table 3). Hence, equality contribution rule seems to prevail between subject types in HET&P.

As a next step we analyze the use of punishment to deter free-riding. Table 4 reports parametric results on the determinants of the received points in the two treatments.

Table 4: Received Points in HET and HOM

	(1)	(2)
Intercept	1.972***	1.681***
	(0.334)	(0.330)
Time	-0.038***	-0.037***
	(0.010)	(0.010)
Others' Average	-0.060***	-0.050***
	(0.015)	(0.015)
Abs.negative dev.	0.279***	0.373***
	(0.011)	(0.018)
Positive dev.	-0.009	-0.002
	(0.017)	(0.017)
HET	-0.468	-0.273
	(0.319)	(0.315)
Abs. negative dev. *HET		-0.140***
		(0.022)
llr	-1777.188	-1760.172
Wald-χ^2	802.01	873.42
Prob >χ^2	0.000	0.000
Observations	1152	1152

Note. Two-way linear random effect model (standard errors in parentheses) accounting for both potential individual dependency over time and dependency within each matching group. Dependent variable: Received Points of a subject in each period. Independent variables: Abs. negative dev.-difference between mean contribution of group members and subject's contribution. Only defined if positive, otherwise 0. Positive dev.-difference between subject's contribution and the mean contribution of group members. Only defined if positive, otherwise 0. Others' Average- The average contribution of individual's group members in a given period. Significance levels: * p<10%, ** p<5%, *** p<1%

In both treatments, sanctions seem to follow the logic of equality contribution rule. First, the insignificant coefficient of *HET* suggests that there are no differences between treatments. Second, an individual is sanctioned, if she contributes less than her group members, which is captured by the significant and positive coefficient of *Abs. negative dev.*[8] Finally, received points decrease over time.

To understand how different subject types use punishment (i.e. punish), we fix our attention on HET&P treatment only. For our purposes we change the metric of analysis from received points

[8]Interestingly, the intensity of punishment of deviant behavior is less in HET&P than in HOM&P, as illustrated by the significant negative coefficient of *Abs. Negative dev.*HET*.

to assigned points.[9] Following Nikiforakis (2010) we estimate a hurdle model where the decision to punish (Punishment Decision) is modeled separately from the decision of how much to punish (Assigned Points). Table 5 reports the results of the two-stage estimation.

Table 5: Punishing Behavior in HET&P: Windfall vs. Effort Subjects

	Punishment Decision	Assigned Points
Intercept	-1.252***	1.248***
	(0.347)	(0.277)
Time	-0.005	-0.052***
	(0.010)	(0.019)
Others' Average	0.006	0.035*
	(0.024)	(0.019)
Abs. negative dev.	0.028*	0.007
	(0.016)	(0.018)
Positive dev.	0.088***	0.100***
	(0.023)	(0.015)
Effort	-0.044	-0.157***
	(0.121)	(0.080)
llr	-1054.043	
Wald-χ^2	25.20	61.36
Prob >χ^2	0.000	0.000
Observations	1728	277

Note. Hurdle model. Dependent variable: punishing points assigned by a subject to each of the 3 group members. "Punishment Decision" is a probit with standard errors clustered at the group level. "Assigned Points" is a truncated linear regression with standard errors clustered at group level. The two parts are estimated separately and the likelihood function of the hurdle model is given by the products of the two separate likelihoods. The same remakrs of tables 2,3 and 4 apply.

We do not observe any difference in the decision to punish between effort and windfall subjects, as captured by the non-significant coefficient of the *Effort* dummy in the first column. Nevertheless, as shown in the second column, effort subjects, who cross the hurdle, punish less severely than windfall punishers.

[9]Given that subject types cannot be identified in our framework, we cannot analyze how subjects get punished according to their type.

5 Concluding remarks

We study the behavior of individuals in a linear public goods game, where, all other things equal, the endowment sources of group members are heterogeneous. In particular, two individuals in each group have to succeed in a real effort task in order to obtain their endowments (effort subjects), while the other two are given a windfall gift of equal size (windfall subjects). In light of the literature dealing with heterogeneous populations (i.e. Reuben and Riedl, 2013, Nikiforakis et al. 2012), such setting is of great interest to us, as it is not obvious ex-ante how group members will behave.

In heterogeneous groups without punishment we evidence low and decreasing contribution levels. Following the discussion by Reuben and Riedl (2013), the emergence of a contribution norm is conditional on sufficiently many people's compliance with the norm. Whenever free-riding cannot be sanctioned, a positive contribution norm will be followed if it is fully internalized. Nevertheless, if a fully internalized contribution norm is absent and it is not possible to punish defectors, non-cooperation will emerge as an ubiquitous form of behavior. Given that "... there is no a priori reason to assume that the general willingness to comply varies with the type of group heterogeneity... (page 128)", contributions follow a declining trend, with (almost full) free-riding in the terminal periods.

In heterogeneous groups with punishment opportunity we could not find differences between contributions of effort and windfall subjects. With respect to sanctions, the more a participant negatively deviates from the contributions of her group members, the more she gets punished.[10] Comparing contributions and sanctions between homogenous and heterogeneous groups, we manifest non-significant differences.

To explain our results, we hypothesize, that manipulation of the endowment origin does not trigger conflicting contribution rules between the subject types, resulting in behavior in line with the equality rule. Our conjecture is motivated by a post-experimental question, eliciting the fairness perceptions of participants regarding the experimental setting on a 7-point Likert scale. The mean responses of effort and windfall subjects are 4.04 and 4.087 respectively, with the difference being statistically non-significant according to a non-parametric Mann-Whitney U test (W=270, p=0.715, 48 observations at the subject level).[11]Given that both subject types not only make similar contributions throughout the whole experiment but also perceive the manipulation of the endowment source as fair, we conclude that heterogeneous endowment origins do not create conflicting normative views on appropriate contributions among subject types.[12]

[10]A derivative finding is that punishment is an efficient device to increase the level of cooperation not only in homogenous, but also in heterogeneous groups.

[11]Subjects answered to the following question: "*You and 2 other group members of yours had to participate in the 'Contest Task' (the loser was leaving the experiment) to be allowed to participate in the 'Investment task', while the other 2 group members were not required to take part in the 'Contest Task' and directly participated in the 'Investment Task'. Please indicate how fair you consider the situation to be?*" (for windfall subjects the question was the same, albeit the role was reversed)

[12]According to Equity Theory (Adams, 1963), individuals compare their input-to-output ratio with that of a reference person or a group and suffer utility loss in case of differences. Equity theory would predict, that in our scenario effort subjects should earn more, for the situation to be fair. Nevertheless, in our experiment equal contributions imply equal earnings. Hence, if effort subjects are motivated by equity contribution rules*, equality* contribution rule should be perceived as unfair at least by effort subjects, as under these circumstances they are in an unfavorable situation *vs.* windfall subjects.

One can argue that equality contribution rule is established only because group members cannot identify each other's types. Otherwise, it would be plausible to expect a normative conflict, with effort and windfall subjects following equity and equality rules of contributions, respectively. However, had the effort subjects considered the experimental setting less fair than windfall subjects in the post-experimental questionnaire, the argument would have hold. Such a result would signal that effort subjects were induced to comply with the equality rule because of peculiarities of the experimental design, though they would like to adhere to the equity norm, as they invested effort to obtain their endowments in contrast to windfall subjects.

Finally, we also illustrate that investing effort in earning the endowment makes individuals reluctant to sanction free-riders. In heterogeneous groups, effort subjects punish less severely than windfall subjects. As the subjective valuation of the endowment increases in the effort exerted to earn the endowment (Muehlbacher and Kirchler, 2009), baring the monetary cost of punishing is relatively more demanding for effort subjects than for windfall ones, which perhaps makes the former punish less severely than the latter.

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1 Appendix (Not Intended for Publication)

We provide the instructions for the HET&P treatment, which consists of the "Contest Task" and the "Investment Task" for reference. The instructions of the other treatments are similar, with treatment specific changes. The instructions were originally written in German. For the linear public goods game we used the instructions of Fehr and Gächter (2000).

2 Experimental Instructions

Hello and thank you for your participation in the study!

Please do not communicate with each other!

Overall, the study consists of two phases: a "Contest Task" and an "Investment Task". Some of you will directly participate in the "Investment Task", while the others have to participate in the "Contest Task" first, in order to be allowed to participate in the "Investment Task" and get paid. A random generator will determine who has to participate in the "Contest Task" and who can start directly with the "Investment Task". You will receive detailed instructions for each phase before the corresponding phase starts. If you have questions, please raise your hand we will assist you individually.

Those who have the worst result in the "Contest Task" will be granted with a consolatory fee of 5 Euros and will leave the lab. The other participants of the "Contest Task" can proceed with the "Investment Task".

The study unfolds as follows: a. The participants of the study, who are those sitting in the lab, are divided into groups of 5. Please note that you will never learn the identity of your other group members and your other group members will never learn your identity. Therefore, it is not possible to associate your decisions to your person. b. In each group 3 individuals will participate in the "Contest Task" in order to gain right to participate in the "Investment Task". c. Only 2 individuals out of 3 taking part in the "Contest Task" will be allowed to participate in the "Investment Task". The individual, who has the worst result in the contest, will be given a consolatory fee of 5 Euros and leave the lab. If there are ties, a random draw will define the loser. d. The other 2 members of the group, who do not participate in the "Contest Task" and have their place assured in the "Investment Task", are allowed to read a magazine, while the three individuals participate in the contest. The magazines are already on all the experimental tables.

If you agree with the procedure we will move forward to the "Contest Task". Otherwise, if you do not agree with the procedure please raise your hand, as soon as we ask you to do so. Please, note that if you object, you will be expelled from the experiment and have to leave the lab, without getting paid anything.

The Contest Task

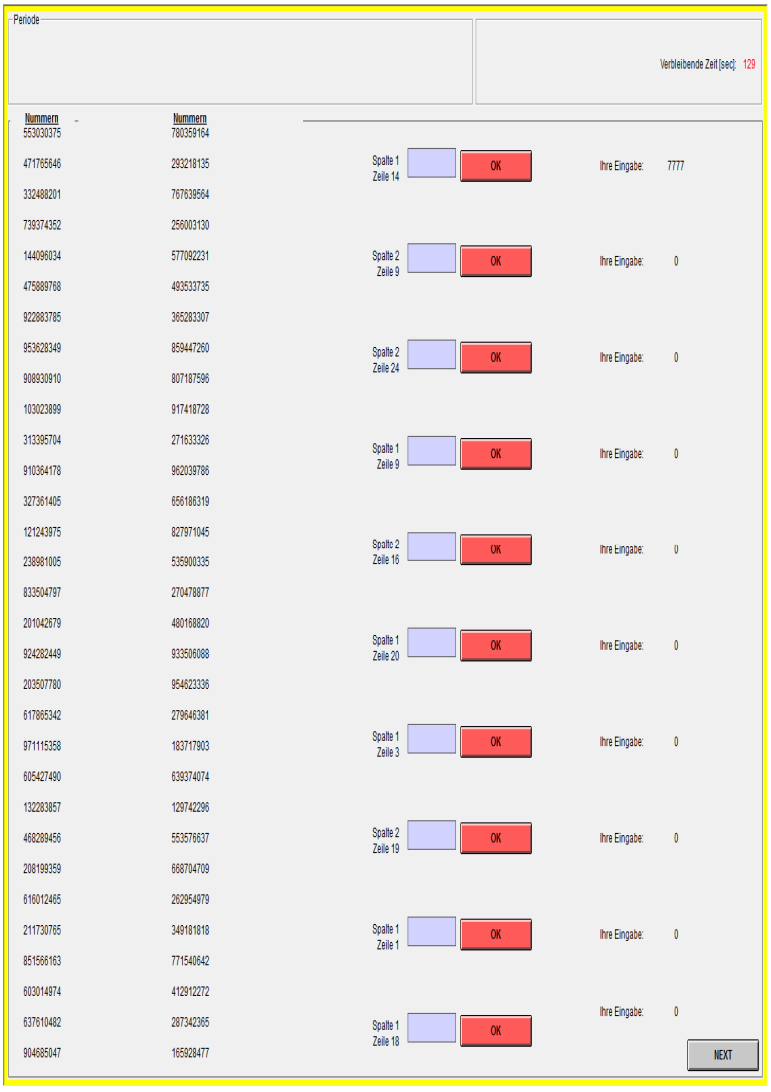
As already mentioned 3 members of each group have to participate in the "Contest Task" in order to gain right to participate in the "Investment Task" while the other 2 group members can read a magazine meanwhile and are allowed to participate in the "Investment Task" directly.

In the "Contest Task" you have to find the right numbers and tip them into the computer. You will receive a list with 56 numbers and you will be asked to tip 10 of the 56 numbers into specific

input boxes (see screenshot 1). Your time limit for this task is 130 seconds. If you have tipped numbers into all input boxes before the 130 seconds are over you can click on the "Next" button and you will receive the second list with 56 numbers. If you have not tipped numbers into all the input boxes after 130 seconds the next list will appear automatically. All in all you will receive 3 lists with 56 numbers and 10 input boxes each and you have 130 seconds per list to tip numbers into the input boxes.

In this "Contest Task" you compete against two other members of your group. All participants of the "Contest Task" will get identical lists and have to tip identical numbers into the input boxes.

Screenshot 1: The Contest Task



Right to the input box you see the number you already tipped. You can change your entries as often as you want to. If you tip the correct number in the corresponding input box you will receive onetime a point. Therefore, it is not possible to increase your points by tipping the same number

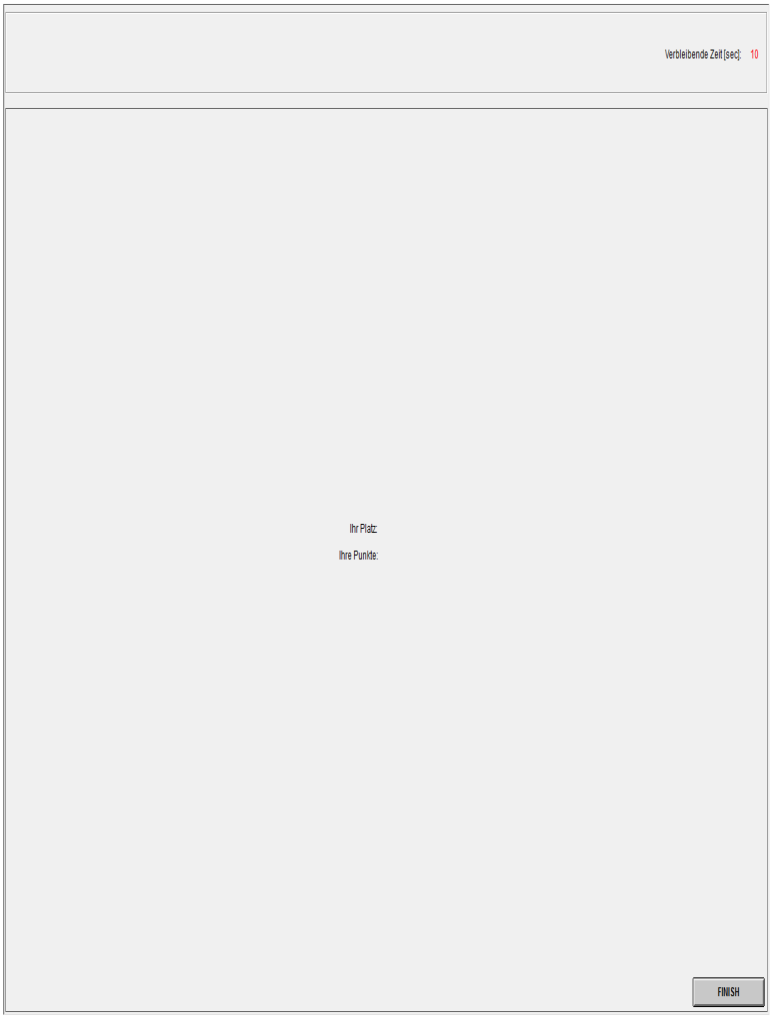
into the same input box several times. Please do not forget to confirm your entry with a click on the "OK" button. In the first two columns ("Numbers") you see the 56 numbers. Right to the numbers you see the input boxes with the corresponding requests (for example: Column 1, Row 14). You are asked to tip the numbers corresponding to the requests into the input boxes.

"Column 1" is the first column with numbers and "Column 2" is the second column with numbers (the columns are counted from left to right). The "rows" are the rows of the corresponding column. The rows are counted without the headline ("numbers"). As an example, let us consider the first request of screenshot 1. In this example ("column 1, row 14") you are asked to tip the 14th number of the first column into the input box. To confirm your entry you have to click the "OK" button. After this your entry will be displayed right to the "OK" button. Our entry in the first input box of screenshot 1 was "77777". You can change this entry by tipping another number into the input box and confirming the new entry with the "OK" button.

IT IS NOT NECESSARY TO DEAL WITH THE INPUT BOXES IN SEQUENCE. YOU CAN START WITH AN ARBITRARY INPUT BOX AND THEN PROCEED WITH AN ARBITRARY INPUT BOX.

At the end of the "Contest Task" you will learn your achieved points and your rank. The corresponding screen looks like screenshot 2:

Screenshot 2: Results of the Contest Task



Click the "Finish" button after you have learned your points and your rank. Otherwise the screen will disappear after 10 seconds.

Subsequently, you will see one of the following screens:

a. In case you achieved the highest or the second highest score in your group, a screen identical to screenshot 3 will appear and you get a right to participate in the "Investment Task".

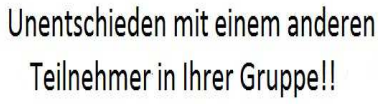
Screenshot 3: You Won

b. In case you achieved the third highest score in your group, a screen identical to screenshot 4 will appear and you have to leave the experiment with a consolatory fee of 5 Euros.

Screenshot 4: You Lost

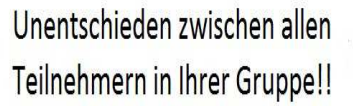
c. In case you achieved the second highest score together with another group member, a screen identical to screenshot 5 will appear. In this case a random generator will determine who has to leave the experiment with a consolatory fee of 5 Euros and who gets a right to participate in the "Investment Task".

Screenshot 5: A Draw Between Two Group Members



d. In case that all three of your group achieved the same score, a screen identical to screenshot 6 will appear and once again a random generator will determine who has to leave the experiment with a consolatory fee of 5 Euros and who gets a right to participate in the "Investment Task".

Screenshot 6: A Draw Among All Group Members



After you have red these instructions once again individually, you will learn if you have to participate in the "Contest Task" or not.

The Investment Task

During the "Investment Task" we shall not speak of Euros but rather of Tokens. At the end of the study the total amount of tokens you have earned will be converted to Euros at the following rate:

1 Token = 3.5 Euro Cent

Each participant receives a lump sum payment of 20 tokens at the beginning of the "Investment Task". This one-off payment can be used to pay for eventual losses during the "Investment Task". However, you can always evade losses with certainty through your own decisions. At the end of the "Investment Task" your entire earnings from the "Investment Task" plus the lump sum payment and the show-up fee (5 Euros) will be immediately paid to you in cash.

As already told before, you were a member of a 5-member group. The group member, who obtained the lowest score in the "Investment Task", left the study. Hence, in the "Investment Task" you are left with a 4-member group, two members of which participated in the "Contest Task", while the other two did not. Please note that the composition of your group will remain the same throughout the "Investment Task". Please note that you will never learn the identity of your other group members and your other group members will never learn your identity. Therefore, it is not possible to associate your decisions to your person.

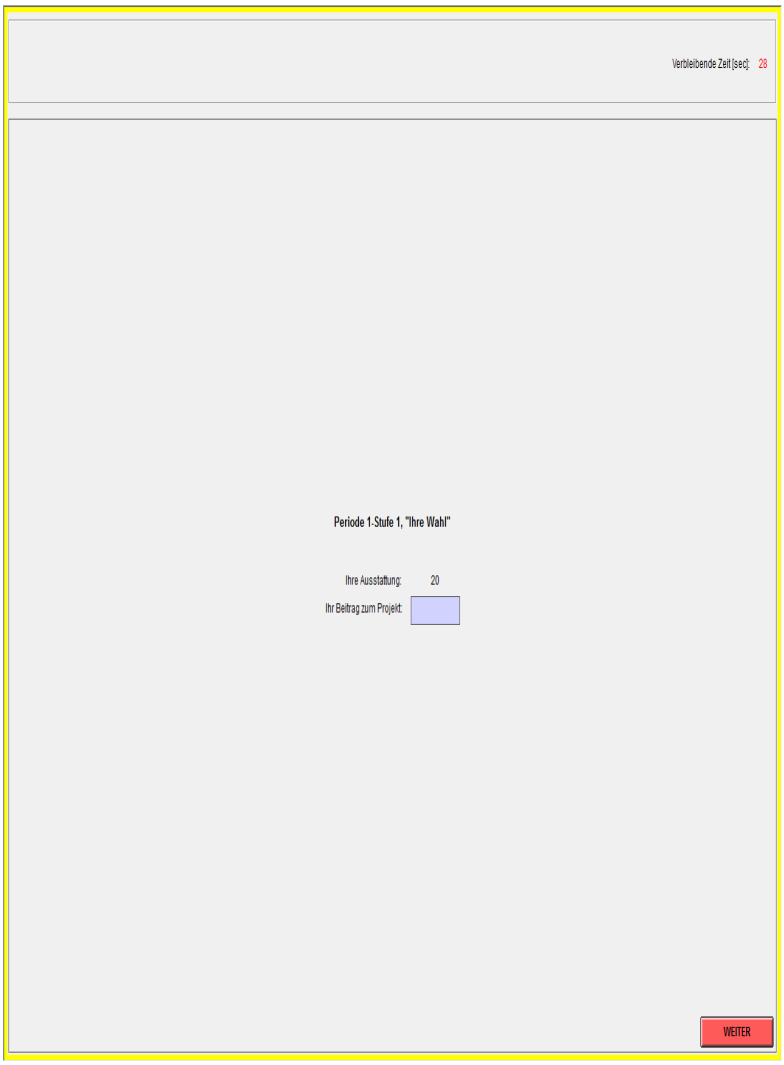
The "Investment Task" is divided into different periods. In all, the "Investment Task" consists of 12 periods. There are two stages in each period. At the first stage you have to decide how many tokens you would like to contribute to a project. At the second stage you are informed on the contributions of the other three group members to the project. You can then decide whether or how much to reduce the earnings from the 1st stage by distributing points to them.

The following pages describe the course of the "Investment Task" in detail.

First Stage

At the beginning of each period each participant receives 20 tokens. In the following we will refer to this amount as the "endowment". Your task is to decide how many of the 20 tokens of your endowment to contribute to a project and how many of them to keep for yourself (see screenshot 1).

Screenshot 1: Decision in Stage 1



In the top right corner you can see how many more seconds remain for you to decide on the distribution of your tokens. Your decision must be made before the time displayed is 0 seconds.

You have to decide how many tokens from your endowment (= 20 Tokens) you want to contribute to the project by typing a number between 0 and 20 in the input field. As soon as you have decided how many tokens to contribute to the project, you have also decided how many tokens to keep for yourself: This is (20 – "your contribution") tokens. After entering your contribution you must press the OK button). Once you have done this your decision can no longer be revised.

After all members of your group have made their decision a screen like in screenshot 2 will appear. This screen shows you:

- how many Tokens you have contributed to the project
- the total amount of Tokens contributed by all four group members
- how many Tokens you have earned at the first stage because of the tokens kept
- how many Tokens you have earned at the first stage because of the contributions to the project

• how many Tokens you have earned at the first stage in total

Screenshot 2: Results of Stage 1

Your income in stage 1consists of two parts:

1) The tokens which you have kept for yourself (“Income from tokens kept”).

2) The “income from the project” (“Your Income from the Project”).

Your income through the project is calculated as follows:

= Your income from the project = 0.4 x (the total contribution of all 4 group members to the project)

Your income in Tokens at the first stage of a period is therefore:

= (20 - Your contribution to the project) + 0.4*(total contributions to the project)

The income of each group member from the project is calculated in the same way; this means that each group member receives the same income from the project. Suppose the sum of the

contributions of all group members is 60 tokens. In this case each member of the group receives an income of 0.4*60 = 24 tokens from the project. If the total contribution to the project is 9 tokens, then each member of the group receives an income of 0.4*9 = 3.6 tokens from the project.

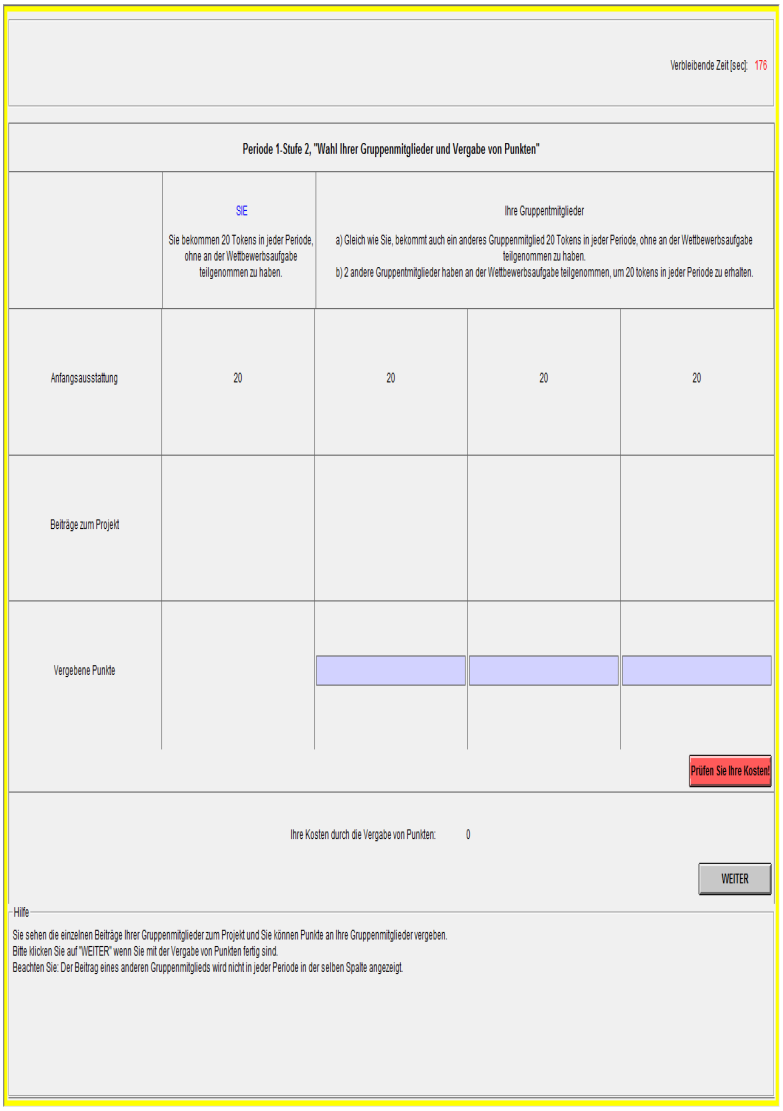
For each token, which you keep for yourself you earn an income of 1 token. Supposing you contributed this token to the project instead, the total contribution to the project would rise by one token. Your income from the project would rise by 0.4*1=0.4 tokens. However the income of the other group members would also rise by 0.4 tokens each, so that the total income of the group from the project would rise by 1.6 tokens. Your contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each token contributed by the other members to the project. For each token contributed by any member you earn 0.4*1=0.4 tokens.

In all periods you have 35 seconds to view the income screen. If you are finished with it before the time is up, please press the NEXT button. The first stage is then over and the second stage commences.

Second Stage

At the second stage you now see how much each of the other group members contributed to the project. At this stage you can also reduce or leave the same the income of each group member by distributing points. The other group members can also reduce your income if they wish to. This is apparent from the input screen at the second stage:

Screenshot 3: Input Screen at the Second Stage



Besides the period and time display, you see here how much each group member contributed to the project at the first stage.

Your contribution is displayed in the first column (below the label "YOU", which is marked with blue), while the contributions of the other group members are shown in the remaining three columns (below the label "Your Group Members"). Please note that the order of the columns shuffles in each period (except the first column, which shows your contributions). For instance if the contribution of Member 2 is in column 3 in Period 1, it can move to column 4 in Period 2. Hence you can never guess how much Member 2 contributed in each period. The same refers to the other members as well.

You must now decide how many points to give to each of the other three group members. You must enter a number for each of them. If you do not wish to change the income of a specific group member then you must enter 0. If you distribute points, you have costs in tokens which depend on the amount of points you distribute.

You can distribute between 0 and 10 points to each group member. The more points you give to any group member, the higher your costs. Your total costs are equal to the sum of the costs of distributing points to each of the other three group members. The following table illustrates the relation between distributed points to each group member and the costs of doing so in tokens.

Points	0	1	2	3	4	5	6	7	8	9	10
Cost of These Points in Tokens	0	1	2	4	6	9	12	16	20	25	30

Supposing you give 2 points to one member this costs you 2 tokens; if you give 9 points to another member this costs you further 25 tokens; and if you give the last group member 0 points this has no costs for you. In this case your total costs of distributing points would be 27 tokens (2+25+0).

Every time you assign points to all group members you can check your cost by pressing the button "Check the Cost". Unless you press the button "OK" you can revise the assigned points and check the costs again.

If you choose 0 points for a particular group member, you do not change his or her income. However if you give a member 1 point (by choosing 1) you reduce his or her income from the first stage by 10 percent. If you give 2 points to a member (by choosing 2) you reduce his or her income by 20 percent, etc. The amount of points you distribute to each member determines therefore how much you reduce their income from the first stage. Whether or by how much the income from the first stage is totally reduced depends on the total of the received points. If somebody received a total of 3 points (from all other group members in this period) his or her income would be reduced by 30 percent. If somebody received a total of 4 points his or her income would be reduced by 40 percent. If anybody receives 10 or more points his/her income from the first stage will be reduced by 100 percent. The income from the first stage for this member would in this case be reduced to zero.

Your total income from the two stages is therefore calculated as follows:

Total income (in tokens) at the end of the 2nd stage = period income =

In case you receive less than 10 punishment points:

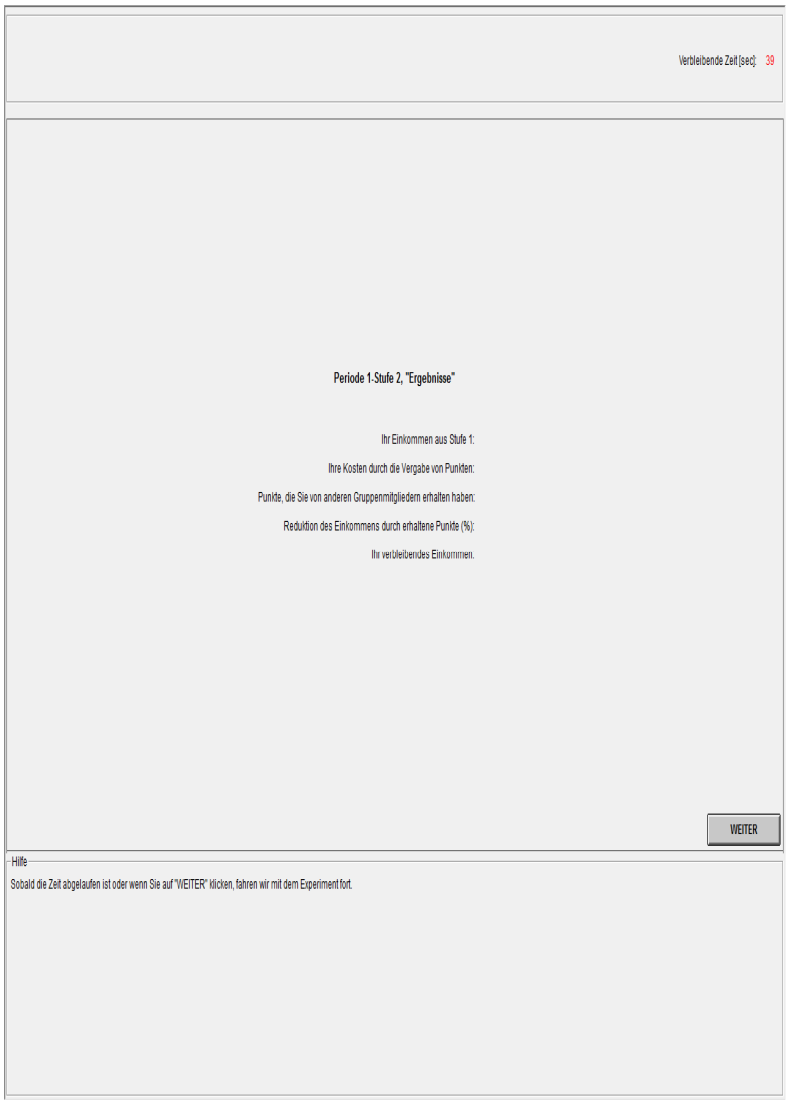
= (income from the 1st stage)*(10 - received points)/10 – (costs of your distributed points)

In case you receive 10 or more punishment points:

= 0 – (costs of your distributed points)

Please note that your income in tokens at the end of the second stage can be negative, if the costs of your points distributed exceeds your (possibly reduced) income from the first stage. You can however evade such losses with certainty through your own decisions. After all participants have made their decision, your income from the period will be displayed in screenshot 4. Your total income from the investment task will be the sum of all 12 period incomes.

Screenshot 4: Income Screen at the End of the Second Stage



You will have 40 seconds to review the screen. If you are done before the time expires, please click OK.