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Urs Fischbacher
Gerald Eisenkopf
Franziska Föllmi-Heusi

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Gerald Eisenkopf
Urs Fischbacher
Franziska Föllmi-Heusi

University of Konstanz &
Thurgau Institute of Economics
Post Box 131
78457 Konstanz
Germany
Contact: gerald.eisenkopf@uni-konstanz.de

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Abstract:

There is well established empirical evidence that more redistribution occurs when luck rather than performance determines the earnings. We provide experimental evidence on how unequal access to performance enhancing education affects demand for redistribution. In this experiment, we can control the information about the role of luck and effort. We find that unequal opportunities evoke a preference for redistribution that is comparable to the situation when luck alone determines the allocation rather than performance. Furthermore, unequal opportunities reduce performance incentives.

Keywords: Distribution, Inequality of opportunities, Negotiation, Education, Experiment

JEL-Codes: D03, D31, I20

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1 Introduction

People are more willing to accept inequality in incomes if it results from hard work rather than pure luck[1]. Differences in education account for a substantial share of this inequality but survey studies cannot reveal if and how income differences derived from education transform into a demand for redistribution[2]. First, the roles of luck and hard work are ambiguous with respect to the access to education. Random processes like high innate abilities or a favorable socio-economic environment enhance the chances to get education but the student herself still has to provide effort in order to acquire and improve her skill. Second and perhaps more important, people differ substantially with respect to their beliefs about the impact of luck and effort on the access to education. Moreover, the beliefs often do not reflect the actual inequality in the access to education[3].

We investigate the demand for post-educational redistribution with a real-effort experiment that takes these problems into account. In our experiment, subjects are paired in groups of two. In the real effort-task, a quiz task, they create an output, which they contribute to a common pool. Then, they negotiate how to distribute their joint output. In all treatments, subjects get the opportunity to learn some of the questions of the quiz. Our focus is on the education treatment in which one of the two subjects in a group gets a better education because she can learn more relevant questions. One benchmark is the skill treatment in which a subject's contribution depends mostly on her ex-ante skills. In both treatments, a subject's contribution increased with the number of correctly answered general knowledge questions. Hence, knowledge was the relevant skill in this experiment. Since one randomly chosen subject in each group in the education treatment received additional knowledge it is obvious that luck was more relevant for contributions in this treatment than in the skill treatment. A second benchmark is provided by the luck treatment, in which a lottery only determines the contribution. In each treatment we provided all subjects with identical information.

Compared to survey studies, our experiment has four main advantages. First, in the field, it is unclear which processes create the inequality. This implies in particular that one

[1] See for example the studies by Hoffman et al. (1994) , Burrows and Loomes (1994) , Ruffle (1998) , Konow (2003), or Durante and Putterman (2009).

[2] Educated people earn more money and receive higher nonmonetary rewards as well. Psacharopoulos and Patrinos (2004) provide a survey on the former and Grossman (2006) one on the latter issue.

[3] Alesina and Glaeser (2005) show in a cross-country study that beliefs do not reflect the actual (in)equality of opportunities correctly. Instead, people may base their beliefs on personal experiences rather than on econometric studies (Piketty, 1995) and they may have a biased perception of these experiences (Benabou and Tirole, 2006)

does not know other peoples' beliefs about these processes. In our experiment there is common knowledge about the impact of random processes on allocations. Thus, the subjects in our experiment know the sources of inequality (luck, merit, inequality of opportunity). Second, subjects do not just state preferences for redistribution. They make actual distribution decisions. Third, by devising a rank order payment scheme we assured that the distribution of initial allocations is the same in all three treatments. In this way, we control for the possible confound that egalitarian societies may be less productive as the anticipation of high redistribution discourages contribution to the social output in the first place. Furthermore, the design ensures that participants have a comparable incentive to provide effort in all treatments. Fourth, the random assignment of subjects into treatment groups eliminates possible selection effects that would be present in the field.

Our study takes two principles of distributive justice into account, an egalitarian one and a desert-based one. Strict egalitarianism "advocates the allocation of equal material goods to all members of society" (Lamont and Favor (2007) in the online version of the Stanford Encyclopedia of Philosophy). According to the desert principle, people should be rewarded according to the value of their contribution to the social product[4]. Several studies have shown that people opt for more egalitarian distributions once luck rather than meritocratic criteria determine an outcome

The desert-principle and similar meritocratic ideas include a concept of equality, meaning equality of opportunity rather than equality of outcome. A third fairness ideal, liberal egalitarianism, addresses inequality of outcomes. Similar to the accountability principle (J. Konow, 2000, 1996) liberal egalitarianism demands that distributions should depend on choices and decisions. If two people make the same choice in the same context, both should get the same reward even if the outcomes differ.

Cappelen et al. (2007) investigate distribution decisions after an investment period with unequal rates of returns. They provide evidence for the application of all three fairness norms among their subjects. However, their experiment addresses the question on how inequality of opportunities affects redistribution decisions only in parts. For this question it is important to know whether the different fairness norms also prevail in situations with equal opportunities or purely randomly determined investments[5]. Such a comparison reveals whether people

[4] It is important to distinguish between the desert principle and the provision of incentives. The latter implies a provision on the distribution of outcome before production has taken place while the former considers a distribution after production has taken place.

[5] Inequity averse people in the sense of Fehr and Schmidt (1999) do not accept inequality in outcomes even if the differences depend on choices only. On the other hand, libertarian thinkers such as Hayek (1960) are reluctant to accept redistribution even if luck has a strong impact on economic outcomes.

make claims for more or less redistribution once they have correct information about the determinants of inequalities in opportunities. This comparison is particularly important in the context of inequalities in the access to education. Educational choices depend on skills (or abilities) which are, at least to a certain degree, exogenous, unobservable and unevenly distributed productivity factors[6]. Nevertheless, skill premiums are widely tolerated and meritocratic societies claim that the most able citizens do constitute their elite.

We also provide a new perspective on the analysis of taxation in economies with unequal opportunities. Bovenberg and Jacobs (2005) claim that governments face a trade-off between equity and efficiency with respect to the financing of education. Subsidized education induces a more efficient labor supply but implies, ceteris paribus, redistribution from less intelligent, relatively poor individuals to smarter, richer ones. As a consequence, most developed economies use progressive taxation to mitigate income inequality in general, but they also subsidize education, even at highly selective universities. As mentioned above, any demand for redistribution depends on the beliefs about the roles of luck and effort in the generation of wealth, whether or not these beliefs are correct. Alesina and La Ferrara (2005) find that, in the United States at least, preferences for redistribution depend crucially on the individual *belief* in equal opportunity. Alesina and Angeletos (2005) show that international differences in beliefs about the source of inequality explain the differences in redistributive characteristics of tax regimes. The more people believe that luck determines income, the higher is the demand for redistribution.

Our results show that subjects' responses to unequal learning opportunities are similar to their responses when luck alone determines output. Nevertheless, we find that the size of a subject's contribution has a significant impact on the allotment of the common pool. Unsurprisingly, these "moral property rights" (as in Gächter and Riedl (2005)) are particularly strong in the skill treatment but they are present even in the luck treatment.. We also observe that the differences in the bargaining behavior have an incentive effect, as subjects in the skill treatment produce more points than comparable subjects in the education treatment. These results suggest that full awareness about inequalities in opportunity makes people less productive and induces stronger claims for redistribution.

The paper is structured as follows. The following section presents the experimental design. Afterwards we provide behavioral predictions. Section 4 presents the results of the experiment. Section 5 summarizes the paper and provides concluding comments.

[6] Therefore, Bovenberg and Jacobs (2005) claim that governments face a trade-off between equity and efficiency with respect to the financing of education. Subsidized education induces a more efficient labor supply but implies, ceteris paribus, a redistribution from less intelligent, relatively poor individuals to smarter, richer ones

2 Experimental design

In all treatments, we examine the negotiation of two group members about how to distribute a jointly owned common pool. There are three treatments, which differ in how the contribution to the common pool is determined: In the first treatment (the *skill treatment*), the individual contribution of a subject to the joint output was determined by her skills (more specifically her general knowledge). Also in the second treatment (the *education treatment*), skill determined output. However, in this treatment one randomly chosen member in the group had the opportunity to enhance her relevant skills relative to the other member. In the third treatment (the *luck treatment*), luck determined the individual contribution. The experiment included three different phases, a learning phase, a production and contribution phase, and a negotiation phase.

Learning

All subjects learned the correct answers for 60 knowledge questions. We used multiple choice versions of questions from the German standard version of the quiz game "Trivial Pursuit" which includes questions on geography, entertainment, history, arts and literature, science and technology as well as sports. Subjects they could display the correct answer of each question with a button.

The treatments differed with respect to the number of questions a subject was familiar with from the learning phase. In the skill treatment, 5% of the questions from the learning period (i.e. 3 out of 60) reappeared in the production period. In the education treatment, one member in each group had learned 5% of the relevant questions while the other one had learned 95% (i.e. 57 out of 60 questions). In the luck treatment, each subject learned 50% of the relevant questions. In the skill and the luck treatment, the subjects were informed about the number of relevant questions at the beginning of the learning period. In the education treatment, the subjects were initially informed about the possible number of relevant questions. The actual assignment of the number of relevant questions and the information of the subjects occurred immediately after the learning period via the throw of a die.

Production and contribution to the common pool

In the production phase each subject had to answer 60 knowledge questions. In the production phase, the subjects could choose between 4 possible answers. Only one of the answers was correct. As Trivial Pursuit provides only the correct answers, the authors of this paper

developed the alternatives on their own. The experiment included two payment components. The first component was dependent on the own absolute performance. A subject received 0.2 points for a correct answer, with one point being the equivalent of 0.15 euro (about 0.23 US dollar at the time of the experiment). A wrong answer implied a loss of 0.2 points. The subjects could also choose to leave a question unanswered. But once the subjects had made their choice for a question they could not return to that question. An unanswered question did not affect the number of points. If more answers were wrong than right, the payment was deducted from the show-up fee of 4 euro. The second payment component was a subjects share from the common pool. The negotiation procedure will be discussed below.

A subject´s contribution to the common pool was determined by the subject's rank among fellow participants in the session. In the skill and the education treatments, performance determined the rank, i.e., a more productive subject contributed more to the common pool. The subject with the lowest productivity in a session contributed 10 points, the subject with the second lowest productivity 20 points and so on. In sessions with 24 participants, the most productive participant contributed 240 points. We did not use the earned points as performance measure since it would be almost impossible to get comparable performance distributions across the treatments.

In the luck treatment, in each session a two-stage random process determined the individual contributions of the 24 subjects to the common pool in their specific group. A die determined high (contribution > 120 points) and low contributors (≤ 120 Punkte). Half of the subjects were in either condition. Then, a lottery specified the actual size of the individual contributions[7]. The realizations were independent of the individual productivity. Hence, subjects in the luck treatment benefited from the production phase only via the income to their private account.

After production, the subjects were matched into groups of two. In the skill treatment, the matching occurred at random. In the luck treatment, each group included one high contributor to the common pool and one low contributor. In the education treatment, one educated person was always matched with one uneducated person. The high differences in learned questions in this treatment ensured that all educated subjects were also high contributors. These groups now negotiated about the distribution of the common pool (see below). Table 1 summarizes the different treatments with respect to their characteristics in the learning and production phases.

[7] 120 points or less in the case of low contributors, 130 points or more in the case of high contributors. The possible contributions were ranked in steps of 10 points, with 10 as the lowest possible contribution and 240 as the highest possible one.

Table 1: The phases of the experiment and the experimental treatments

<table>
<tr><th colspan="2">Phases</th><th>Skill Treatment</th><th>Education Treatment</th><th>Luck Treatment</th></tr>
<tr><td colspan="2">Learning
(60 questions)</td><td>5% are relevant for production</td><td>5% are relevant for one group member
95% are relevant for the other group member</td><td>50% are relevant for production</td></tr>
<tr><td rowspan="3">Production</td><td>Private Benefit</td><td colspan="3">60 questions to be answered
0.2 points reward for a correct answer.
0.2 points deduction for a wrong answer.</td></tr>
<tr><td>Contribution to common pool</td><td colspan="2">The number of earned points influences the contribution
Actual contribution between 10 and 240 according to a subject's productivity rank among the other subjects in the session</td><td>Actual contribution between 10 and 240 according to a random process</td></tr>
<tr><td>Matching into groups</td><td>Random.
We analyze groups with one high contributor (>120 points) and one low contributor (≤ 120 points)</td><td>One educated person and one uneducated person.</td><td>One high contributor (>120 points) and one low contributor (≤ 120 points)</td></tr>
<tr><td colspan="2">Negotiation</td><td colspan="3">Each group member makes a proposal and a minimum demand.
One of the two proposals is selected.
The proposal is accepted if it exceeds the other person's minimum demand.</td></tr>
</table>

Negotiation

The negotiation procedure was identical in all treatments. At the beginning of the phase all subjects were informed about the size of the common pool and the share they contributed to it. After that, each subject decided as a proposer and as a demander. In the former role, the subject proposed how to distribute the common pool by allocating percentage points to herself and the other group member. As a demander, the subject stated the minimum share for herself for accepting the proposal of the other player. A random mechanism determined which player in the group was the proposer. If the allotted share to the demander matched or exceeded the stated minimum, the proposal was accepted and the pool divided accordingly. If the allotted share was below the demand the negotiation failed in this round. This also happened when the proposal of the other player would have been accepted.

If the negotiation failed, the procedure was repeated with a smaller common pool. Six points were deducted from the common pool after each round with a failed negotiation. Again a random mechanism decided whose proposal and whose demand was to be considered. All negotiations finished after a proposal had been accepted. No group exhausted their pool in the negotiations.

3 Behavioral predictions

Let us first consider standard prediction in the negotiation stage. Before knowing their type, subjects have the same bargaining power and therefore they can and will enforce to get get half of the pie. Thus, if the cake size equals c, a rational and selfish subjects accepts a proposal of least c/2-3. Therefore, this offer will be made. This implies that proposals and demands should not differ within and across the treatment groups. However, we expect that principles of distributive justice shape offers and minimum demands in specific ways within each treatment.

Several experimental studies have shown how luck and merit influence distribution preferences and negotiation outcomes (see for example Hoffman et al. (1994), Burrows and Loomes (1994), Ruffle (1998), Konow (2003), or Durante and Putterman (2009)). These studies suggest that distributional norms differ between the luck and the skill treatment. Hence, we expect the following empirical results in our experiment. First, low (high) contributors make higher (lower) minimum demands in the luck treatment than in the skill treatment. Second, low (high) contributors propose less (more) generous distributions to the other group member in the luck treatment than in the skill treatment. These distributions

imply that, in the skill treatment, the correlation between proposals/demands and a subject's contributions to the common pool is significantly larger than in the luck treatment.

The focus of our paper is on the education treatment. The egalitarian and the desert principles conflict in this treatment. The assignment of productivity-enhancing education occurs at random and supports the application of the egalitarian principle. However, each subject still has to produce and contribute to the common pool. Moreover, the size of the individual contribution of each group member depends also on her productivity relative to the performance of the fellow (un-)educated participants. Therefore, each individual has an impact on the size of the common pool. This impact provides a motive for the application of the desert principle.

The experimental setup provides a clean environment for testing whether subjects consider a higher contribution via randomly assigned education as luck or as merit. We expect that demands and proposals in the education treatment are between those of the skill treatment and those of the luck treatment. It is an open question if the tendency is towards the former or the latter treatment.

4 Procedure and Results

The experiment was conducted at the *lakelab* at the University of Konstanz. We programmed the experiment with z-Tree (Fischbacher, 2007) and recruited 190 participants among the students of the University using ORSEE (Greiner, 2004). All subjects received a show up-fee of 4 euros (about 5.75 US-dollars at the time of the experiment (Autumn 2009 and Spring 2010)) and additionally 0.15 euros per experimental point. In each treatment, all subjects received identical instructions, including comprehension questions. Once all subjects had answered the questions correctly, the conductor of the experiment summarized the experiment in a standardized text again. All instructions were framed in a neutral way, they are attached in the appendix. We conducted 12 sessions in total, eleven with 24 subjects per session. One session in the skill treatment included only 22 participants. Subjects earned on average 22.93 euros, including the show up fee.

Table 2 shows the number of subjects and the average contribution of the high contributor in each treatment. A high contributor is a person who contributed 130 points or more to the common pool. Note that the number of subjects in the skill treatment is almost twice as large as in each of the other treatments. In this treatment, we consider only subjects in those groups as relevant in which one subject contributed 120 points or less and the other subject contributed 130 or more points. This provision ensures that the size of the common

pool is comparable across all treatments[8]. Therefore, we can denote the contribution in percentage points. The difference in mean contribution of high contributors between the skill and the education treatment is not significant (p = .323, according to the Wilcoxon rank sum test).

Table 2:

Number of subjects, common pool sizes and mean contribution of high contributors (in percentages) across the treatments

Treatment	**Subjects**	**Groups**	**Common pool size**		**Contribution of the high contributor***	
			Mean	St.Dev	Mean	St. Dev
Skill						
All obs.	142	71	246.90	100.10	68.26%	12.35
Relevant**	72	36	254.44	43.52	72.35%	10.86
Education	72	36	250	60.62	75.48%	9.74
Luck	72	36	250	52.92	75.21%	11.11

*The high contributor are the subjects whose contribution was in the upper half within the session.
**In the skill treatment, the relevant observations are the subjects in groups with one high and one low contributor. These groups are comparable with the other treatments.

First we investigate whether treatments differ with respect to the minimum demands. Table 3 provides the minimum demands of high and low contributors and their proposed share for themselves in each treatment.

[8] Hence, it is also not a problem that in one session only 22 subjects participated. The reduction in subjects just implies that the expected number of relevant observations is smaller in this session than in the other ones.

Table 3:

Minimum demands and proposals of high and low contributors across the treatments

Treatment	Subjects	Minimum demand of the high contributors		Proposal of the high contributors for herself	
		Mean	St. Dev	Mean	St. Dev
Skill	36	65.69%	9.66	67.56%	11.79
Education	36	61.42%	11.76	66.42%	11.09
Luck	36	59.39%	10.48	63.33%	11.21

		Minimum demand of the low contributor		Proposal of the low contributor	
		Mean	St. Dev	Mean	St. Dev
Skill	36	34.5%	9.91	37.97%	10.80
Education	36	40.25%	10.57	41.69%	9.95
Luck	36	37.67%	10.25	42.47%	11.16

Minimum Demand: Minimum share of the common pool for the demanding subject.
Proposal: Proposed share of the common pool for herself (i.e. not for the other group member).

We find a significant difference in minimum demands between high contributors in the skill and in the luck treatment (Wilcoxon rank sum test, $p = .010$). The difference between the low contributors in those treatments is not significant ($p = .107$). The demands of low contributors in the skill and in the education treatment differ significantly (Wilcoxon rank sum test, $p = .020$). The proposals of the high contributors differ between the luck and the skill treatment ($p = 0.069$; according to the Wilcoxon rank-sum test). Low contributors in the skill treatment do not make significantly more generous proposals than those in the other treatments.

The relationship between proposals (demands) and the contribution to the common pool provides more specific information about differences in distribution norms between the three treatments. We derive the role of individual contributions via OLS estimations of the proposed share for the other player (own minimum demand) in each treatment, with the own share of production as the single independent variable. Table 4 shows the relationship in the three treatments. Note that we subtract 50% from proposals, demands and production shares. Thus the constant term in the regression output shows how proposals and demands deviate from an equal sharing of the common pool.

Table 4:

OLS estimations of first round proposals and demands in the different treatments (in %)

Dependent Variable	Proposed Share for herself (-50%)	Minimum Demand (-50%)
	Skill Treatment	
Share of Production (-50%)	.671 (.039)***	.680 (.035)***
Constant	2.764 (.973)***	.097 (.863)
Adjusted R^2	.804	.843
	Education Treatment	
Share of Production (-50%)	.485 (.041)***	.418 (.045)***
Constant	4.056 (1.110)***	.833 (1.220)
Adjusted R^2	.665	.548
	Luck Treatment	
Share of Production (-50%)	.408 (.045)***	.428 (.040)***
Constant	2.903 (1.224)**	-1.472 (1.094)
Adjusted R^2	.538	.618

*** significance level p<.01; ** p<.05; N = 72 in each OLS estimation, standard errors in parentheses

The results confirm the existence of "moral property rights" (Gächter and Riedl, 2002), as they show a strong relationship between contributions and proposals (demands) even in the luck treatment. Most subjects accept that a randomly determined large contribution implies an entitlement to a rather high share of the common pool, even if the other player was luckier in her contribution. The production coefficients for proposals and demands are remarkably similar within each treatment.

We then estimate if the impact of production shares on demands and proposals differs across the treatments. Here we exploit the interaction terms between the treatment variables (*luck* and *skill*) and a subject's share of production (see table 5).

Table 5: OLS estimations of first round proposals and demands across all treatments. (in %), Reference: Education Treatment

Dependent Variable:	**Proposed Share for herself (-50%)**	**Minimum Demand (-50%)**
Share of Production (-50%)	.485 (.041)***	.418 (.039)***
Luck	-1.153 (1.565)	-2.306 (1.512)
Luck × Share of Production (-50%)	-.077 (.057)	.011 (.055)
Skill	-1.292 (1.565)	-.736 (1.512)
Skill × Share of Production (-50%)	.186 (.060)***	.262 (.058)***
Constant	4.056 (1.107)***	.833 (1.069)
Adjusted R^2	.685	.691

*** significance level p<.01; N = 216 in each OLS estimation, standard errors in parentheses
The interaction terms (Luck × Share of Production and Merit × Share of Production) indicate if the impact of production shares on demands and proposals differs significantly across the treatments.

The results show that individual contributions are more relevant for proposals and demands in the skill treatment than in the other two treatments[9]. Distributional preferences in the education are remarkably similar to those in the luck treatment. This result implies that subjects consider only the random access to education but not the differences in performance within each educational group when they make their proposals and demands in the education treatment.

Finally we focus on the adjusted R^2 for the OLS estimations in table 3. They are larger in the skill treatment than in the other two treatments. We calculated the residuals for each of these OLS estimations. An F-test reveals that the variance of these residuals in the skill treatment is much lower than in the other two treatments (The p-values for the differences in demand are all smaller than .01; for the differences in proposals they are smaller than .1). These differences indicate that there is a larger conflict of norms in the education and the luck treatment than in the skill treatment. Note however that actual acceptance rates of first round proposals were similar in the skill and in the luck treatment (52.8% and 55.6%, respectively) but significantly lower in the education treatment (37.5%, p = .067, in comparison with the skill treatment, and p = .030 in comparison with the luck treatment). Furthermore the actual

[9] A more detailed analysis and the descriptive statistics in table 3 show that this difference in relevance of contributions between the skill and the other two treatments derives in particularly from differences among high contributors. The descriptive statistics in table 3 suggest the same. However, due to the limited number of observations, significant results of such a detailed analysis obtain only for differences in demands but not proposals.

number of bargaining rounds required to find an acceptable proposal did not differ across the treatments. About 75% of the groups find an agreement in round 1 or 2.

Apparently, the anticipation of differences in bargaining behavior across the treatments affects behavior in the production period. The reader may recall that we standardized the contributions to the common pool in all treatments. In the skill as well as in the education treatment, the size of the contribution depended on the number of correctly answered questions. In the education treatment half of the subjects had learned 5% of the relevant questions, as did all subjects in the skill. Because of the random assignment into the different treatment groups and into the specific role, the earnings in the production period (i.e. the responses to the questions) should not differ for these subjects. However, this is not the case. Table 6 shows the average performance in the production period[10] across the treatments. The difference between the skill treatment and the "uneducated" subjects in the production period is significant at the 10% level[11]. This difference suggests that subjects in the skill treatment have a stronger incentive to provide correct answers. One plausible explanation for this behavior is the expectation among subjects that individual performance is more relevant in the skill treatment than in the education treatment. Moral property rights provide another explanation. Uneducated subjects in the education treatment anticipate that they can contribute only up to 120 points. Participants in the skill treatment can contribute up to 240 points. Since the notion of moral property rights assigns higher shares to higher contributors they induce lower incentives for uneducated subjects in the education treatment.

[10] The difference between correct and wrong answers.
[11] $p = .095$ (Wilcoxon rank-sum test). For the relevant observations, the p-value is .046.

Table 6:

Number of subjects, share of learned answers and performance in the production period across the treatments

Treatment	Subjects	Share of learned answers	Performance in the production period	St.Dev
Skill				
All obs.	142	5%	12.11	8.06
Relevant obs.	72	5%	13.01	7.78
Education	36	5%	9.81	10.50
	36	95%	55.94	3.47
Luck	72	50%	36.06	4.67

The difference between correct and wrong answers determines the performance in the production period.

5 Summary and Conclusion

In this paper, we investigate how people respond to one of the most important sources of inequality, unequal access to education. In a real-effort experiment, subjects provide an effort, which determines their contribution to a common pool. In the subsequent negotiation stage, we assess how people distribute the contribution. Depending on the treatment, luck, skill or random access to skill-enhancing education determined the size of the individual contributions. Our subjects received clear information about these determinants of contribution. Due to the experimental design, the size of individual contributions and the common pool did not vary systematically across the treatments. Therefore, we could eliminate crucial confounds that restrict the analysis of inequalities of opportunities in previous survey and experimental studies.

In all treatments, proposals and demands are correlated with individual contributions to the common pool, even if luck rather than innate or acquired skills determine the size of these contributions. Individual contributions matter more when innate skill rather than luck determines outcomes. Random access to skill-enhancing education turns out to be perceived similarly as the luck situation. Subjects without access to such education make similar demands and proposals as those subjects with a randomly determined contribution. This similarity reveals that when the inequality in educational opportunities is salient, meritocratic criteria get out of focus. Our results show that redistribution of outputs that are produced by

saliently unequal opportunities is similar to redistribution after output created by luck alone.

Unequal opportunities increase redistribution and, therefore, reduce the incentives to provide high output. Thus, public investments in education are less effective if there is not equal access to education. This implies that improved access to education can reduce inequality and increase social welfare.

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Appendix A

General Instructions for all participants (translated from German)

Welcome to this economic experiment. If you read the following instructions carefully you will receive money in addition to the 4 euro show-up fee. Your earnings depend on your decisions and the decisions of other participants. Hence, please read the instructions carefully. If you have any questions please contact us before the actual experiment starts.

During the experiment, it is forbidden to talk with the other participants. We will exclude you from this experiment and any payment if you violate this rule.

During the experiment we use points instead of euros. We calculate all your earnings in points and exchange them into Euros at the end of the experiment. The exchange rate is

1 point = 0,15 euro

At the end of the experiment, we will pay you all your points and the show-up fee of 4 euros in cash.

Now we will explain the precise procedure of the experiment.

Summary

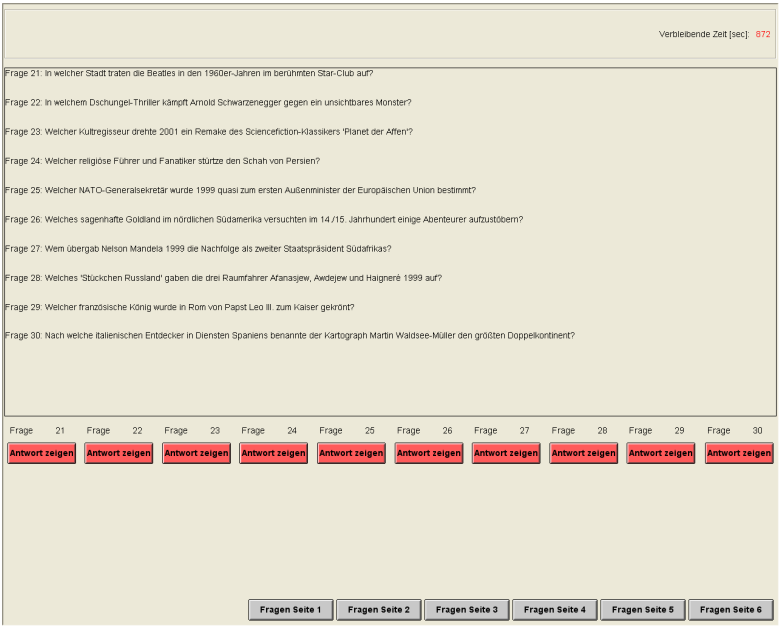
In this experiment you are a member in a group of 2 persons. The experiment has three phases. First comes a learning phase in which you can acquire knowledge. In the following production phase both members of the group can earn points by using their knowledge.

Skill Treatment	*Education Treatment*	*Luck Treatment*
Each person gets 10% of his produced points into a private account. Each person earns additional rank points which depend on the production of this person in comparison with all other participants.	The group members differ with respect to the benefit they receive from the learning period. A die determines how much each member benefits. Each person gets 10% of his produced points in a private account. Each person earns additional rank points which depend on the production of this person in comparison with all other participants.	The remaining points will be substituted by points that you draw from an urn and which you have to pay into a group account. There is an urn with high point scores and an urn with low ones. A die decides from which urn you can draw.

Each person has to pay these rank points into a group account. In the third phase, the bargaining phase, the two group members negotiate about the distribution of this group account.

Learning phase

In the learning phase you can prepare for the production phase. In the production phase your earnings increase in the number of correctly answered knowledge questions. In the learning phase you can learn some of these correct answers.
We derived the questions from the game “trivial pursuit” and transformed them into multiple choice questions with four possible answers. You can also choose the option “I do not know”. We chose the questions randomly; they cover all areas of knowledge. In the learning phase, you can learn 60 questions and their corresponding correct answers.
The screen is structured as follows:



There are 6 pages with 10 questions each on your screen. You can go from one page to another as you wish. The red buttons show you the correct answer for a specific question. In the top right corner you can see the remaining time. You have 15 minutes time (900 sec.). Note that the questions in the production phase show up in a random sequence.
You may not take notes, if you do we will exclude you from the experiment. After 15 minutes you will move automatically into the production phase.

Lottery (only in the education treatment)

At the beginning of the production phase, a die determines which group member benefits more strongly from the learning period. In each group, one member has learned 95% of the correct answers, the other member learns only 5% of them.

A randomly chosen person in this room will throw a six sided die and type into her computer whether the number is odd or even. You will see on your screen how many answers you will learn with an odd number and how many with an even one.

Production phase

The production phase lasts 15 minutes. You can earn points by answering 60 knowledge points correctly during this time.

Skill Treatment	*Education Treatment*	*Luck Treatment*
You have learned 5% of these questions.	The die has determined whether you have learned 5% or 95% of these questions.	You have learned 50% of these questions.

- The sequence of the questions is randomly determined.
- For a correct answer, you earn 2 points.
- For an incorrect answer, you lose 2 points.
- The option “I do not know” does not influence your score.

You give your answer on a screen like this: On the top you see the number of answered questions. In the middle you see the question. Below the questions you find buttons for the 4 provided answers and the option “I do not know”. In the top right corner you can see the remaining time.

Private account and group account (in the skill and education treatments)

At the end of the 15 minutes the computer calculates how many points are in your private account and how many go into your group account.

- 10% of the produced points go into your private income. If your score is negative, we deduct the 10% from your show-up fee.
- We substitute the remaining points with rank points, which depend on your score and the score of the other participants. The computer ranks the participants according to the number of points they have produced. Note that we rank all subjects (*added in the education treatment:* independent of the number of questions they have learned in the learning phase). The person with the lowest number of points receives 10 rank points, the person with the second lowest number 20 points, the person the third lowest number 30 points and so on. The person with the highest number will receive 240 points, if 24 persons are in the lab. If 2 or more persons have the same number of points, the computer assigns the rank points randomly. These assigned rank points go into the group account.

Information about the received rank points:

If your point score is negative this has an impact on your private account but not on your group account. You will contribute at least 10 rank points to your group account.

Example 1: You have answered 45 questions correctly and 5 incorrectly. You earned 80 points. The other group member has 35 correct answers and 10 wrong ones. She earned 50 points. In comparison with the other participants you have earned the seventh lowest number of points, the other member the third lowest number.

Your private income: 10% of 80 = 8 points
Private income of the other member: 10% of 50 = 5 points
Your income in rank points
the seventh lowest point score: = 70 rank points
The income of the other member in rank points
the third lowest point score: = 30 rank points
Your group's account: 70 rank points + 30 rank points = 100 points
Example 2: You have answered 15 questions correctly and 20 incorrectly. You earned -10 points. The other group member has 35 correct answers and 0 wrong ones. She earned 70 points. In comparison with the other participants you have earned the lowest number of points, the other member the eighth lowest number.

Your private income: 10% of -10 = -1 point
Private income of the other member: 10% of 70 = 7 points
Your income in rank points
the lowest point score: = 10 rank points
The income of the other member in rank points
the eigth lowest point score: = 80 rank points
Your group's account: 10 rank points + 80 rank points = 90 points

This calculation is identical for all subjects. You will see it on your screen. You will receive information about your private account and how much each group member has contributed to the group account (in rank points as well as in shares (%)). You keep your private earnings. You will bargain with the other group member about the distribution of the group account in the next phase.

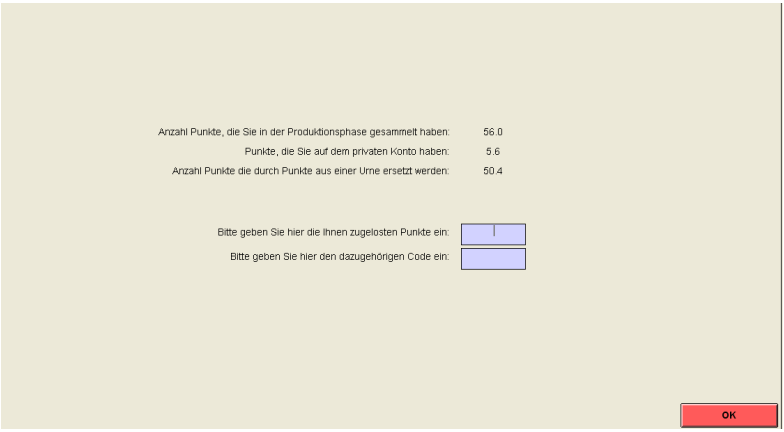
Private account and group account (in the Luck treatment)

At the end of the 15 minutes the computer calculates how many points are in your private account and how many go into your group account.

- 10% of the produced points go into your private income. If your score is negative, we deduct the 10% from your show-up fee.
- We substitute the remaining points with points you have drawn from an urn.

Points from the Urn and the group account

Your draw from the urn depends on the urn you draw from. There are two different urns. In the LOW urn you can draw between 10 and 120 points. In the HIGH urn, you can draw between 130 and 240 points. A die decides from which urn you may draw.
A randomly chosen person in the lab throws a six-sided die and types into his computer whether the resulting number is odd or even. Your screen shows you from which urn you may draw in case of an odd number and from which in case of an even one. In each group of two persons, one person can draw from the high urn and one from the low urn.
The conductors of the experiment will go around with the urn and you can make your draw. You will type the drawn number of points into the following screen. These points substitute your remaining points from the production phase.



In the first line is the number of points you collected in the production phase. Below you see the number of points in your private account and the number of points which will be substituted with points from the urn.

The points from the urn go into a group account. Since the potential draws are distributed between 10 and 240 points, you contribute at least 10 points into the group account.

Example 1: You have answered 45 questions correctly and 5 incorrectly. You earned 80 points. The other group member has 35 correct answers and 10 wrong ones. She earned 50 points.

Your private income: 10% of 80 = 8 points
Private income of the other member: 10% of 50 = 5 points
You were able to draw from the high urn and drew 150 points. The other group member had to draw from the low urn and drew 20 points. These points substitute the remaining points from the production phase.
Your group's account: 150 urn points + 20 urn points = 170 points

This calculation is identical for all subjects. You will see it on your screen. You receive information about your private account and how much each group member has contributed to the group account (in rank points as well as in shares (%)). You keep your private earnings. You bargain with the other group member about the distribution of the group account in the next phase.

Bargaining Phase

In the bargaining phase both group members bargain about the distribution of the points in the group account. Negotiations proceed as follows. There exists a role A and a role B. The group member with role A proposes a distribution of the points in the group account. The member with role B makes a claim for a minimum share of the group account that she wants to

receive. If the proposed share of A for B is equal to or exceeds the minimum share demanded by B, the proposal of A is accepted and the negotiation ends. Negotiation fails if the proposed share is smaller than the minimum demand. In this case, 6 points are withdrawn from the group account and a new bargaining round starts. The bargaining phase can go on for several rounds until an agreement or until the group account is empty. In each round, roles A and B are assigned randomly to the group members.

Detailed Procedure of a Bargaining Round

1. Decision as A: First both group members make a proposal about the distribution of the group account by stating a share (in percentages) for themselves and a share for the other group member.
2. Decision as B: In this second step, both group members state the minimum share of the group account they want to receive.
3. Afterwards, a lottery decides which member has role A and which member has role B.
4. The computer compares the proposal of A with the minimum demand of B:
    a. An agreement is reached if the proposal of A is equal to or larger than B's minimum demand. In this case the points in the group account are distributed according to A's proposal.
    b. There is no agreement if A's proposal is smaller than B's minimum demand. In this case the group account is reduced by 6 points and a new bargaining round starts.
5. In the next bargaining round both group members make a proposal for the distribution of the group account and a minimum demand.
6. Again, a lottery decides the assignment of roles A and B.
7. The computer compares the proposal of A with the minimum demand of B:

The experiment ends once the group members reach an agreement or the group account is empty. In the latter case, no one receives a payment from the group account.

Example 1: There are 100 points on the group account – 70 from you and 30 from the other group member. Both group members bargain about the distribution of this group account by making a proposal and a minimum demand.

Your distribution proposal (for role A): 80% for you and 20% for the other group member
Your minimum demand (for role B): at least 70% for you
The distribution proposal of the other member(for role A): 40% for herself and 60% for you.
Her minimum demand (for role B): at least 40% for herself
A lottery decides that you are in role A and the other group member in role B. A comparison between your proposal and the minimum demand of the other group member shows that there is no agreement in this bargaining round. You proposed 20% to the other member, but she demanded at least 40%.

Example 2: There are, again, 100 points on the group account – 70 from you and 30 from the other group member. Both group members bargain about the distribution of this group account by making a proposal and a minimum demand.

Your distribution proposal (for role A): *60% for you and 40% for the other group member*

Your minimum demand (for role B): at least 60% for you

The distribution proposal of the other member(for role A):
40% for herself and 60% for you.

Her minimum demand (for role B B): *at least 35% for herself*

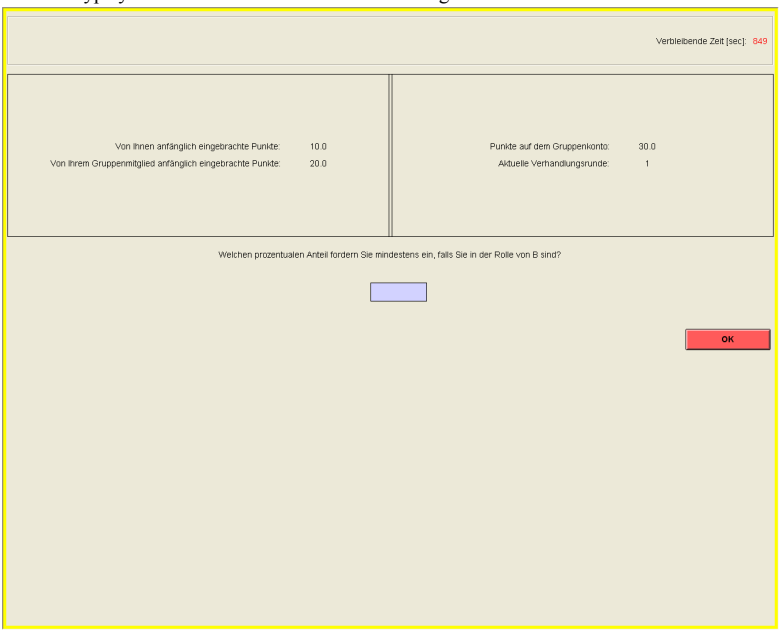
A lottery decides that you are in role A and the other group member in role B. A comparison between your proposal and the minimum demand of the other group member shows that there is an agreement in this bargaining round. You proposed 40% to the other member, and she demanded at least 35%.

The bargaining procedure on your screen.

You type your proposal in the following screen.

In the top left corner you see the contribution of each group member into the group account (in points). In the top right corner you see the current number of points in the group account and the current bargaining round. Below this information, you can make your proposal for role A.

You will type your minimum demand in the following screen.



In the top left corner is the contribution of each group member into the group account (in points). In the top right corner is the current number of points in the group account and the current bargaining round. Below this information, you can make your minimum demand for role B.

A lottery decides which member has role A and which member has role B. The computer compares the proposal of A with the minimum demand of B: The bargaining ends once the group members reach an agreement or the group account is empty. At the end of the bargaining, you can see your income and the experiment ends.

Training Questions

(From the education treatment: we adapted the questions for the other treatments)
Please answer the following questions. They do not affect your final payment. Please signal if you have questions or once you have completed the answers.

1) In the production phase, you knew 95% of the questions from the learning phase. You have answered 45 questions correctly and 10 incorrectly. The other group member knew 5% of the questions and has answered 20 questions correctly and 25 incorrectly.

    a. How many points are in your private account? _____

    b. How many points are in the private account of the other group member? _____

2) You earned 60 points in the production period, the other group member 40. In comparison with the other participants, you have the fifth lowest score and the other member the second lowest.

    a. How many rank points do you get? _____

    b. How many rank points does the other group member get? _____

    c. How many points are in the group account? _____

3) After the production phase, your group has 100 points in its account. You propose a share of 80% for yourself and 20% for the other group member and the lottery assigns role A to you. The other group member demands at least 10% for herself.

    a. Is there an agreement? _____

    b. If yes, how many points will you get? _____

    c. If yes, how many points will the other group member get? _____

4) At the beginning of the third bargaining round, there are 138 points on your group account. You have been assigned to role A and you proposed 50% of the group account for yourself and 50% for the other group member. This member demanded (in role B) at least 60% for herself. Therefore, bargaining fails and a new bargaining round starts.

    a. How many points are on the group account at the beginning of the fourth bargaining round? _____

THURGAU INSTITUTE
OF ECONOMICS
at the University of Konstanz

Hauptstr. 90
CH-8280 Kreuzlingen 2

Telefon: +41 (0)71 677 05 10
Telefax: +41 (0)71 677 05 11

info@twi-kreuzlingen.ch
www.twi-kreuzlingen.ch