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Unequal Opportunities and Distributive Justice

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Abstract:

We provide experimental evidence on how unequal access to performance enhancing education affects demand for redistribution. People earn money in a real effort experiment and can then decide how to distribute it among themselves and another subjects. We compare situations in which randomly chosen people get access to performance enhancing education with situations in which either only luck or only performance determines outcome. We find that unequal opportunities evoke a preference for redistribution that is comparable to the situation when luck alone determines the allocation. However, people with unequal access to education are more likely to disagree about the appropriate distribution.

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

JEL-Codes: D03, D31, I20

1 Introduction

How do people redistribute if inequality is caused by unequal access to education? A huge literature shows that people are more willing to accept inequality in incomes if it results from hard work rather than from pure luck.¹ Education is ambiguous in these dimensions. 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. Some students study hard but others relax. Furthermore, distorted beliefs confuse the assessment of distributional preferences. People may argue in favor of redistribution because they prefer equal incomes or because they incorrectly perceive the access to education as unfair. Alesina and Glaeser (2005, p. 5) argue that beliefs do not reflect the actual (in)equality of opportunities correctly. Instead, people base their beliefs on personal experiences rather than on econometric studies (Piketty, 1995) and they have a biased perception of these experiences (Benabou and Tirole, 2006). Therefore, our study uses an experiment to shed light on the question how people evaluate unequal access to education.

We investigate the demand for post-educational redistribution with a real-effort experiment. In our experiment, subjects are paired in groups of two. In 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 treatments in which one of the two subjects in a group gets a better education because she can learn more relevant questions. As the number of correctly answered general knowledge questions determines a subject's contribution, knowledge was the relevant skill in this experiment. However, since one randomly chosen subject in each group in the education treatments received additional knowledge, it is obvious that luck was also relevant for contributions. The two education treatments differed with respect to the learning time. With short education subjects had to concentrate more in order to reap the benefits of the learning advantage. Long education allowed them to learn rather leisurely. We used two benchmark treatments in which we controlled the importance of skill and luck. As one benchmark we use a treatment, the *skill treatment*, in which a subject's contribution depends only on her ex-ante skills. A second benchmark is provided by the *luck treatment*, in which a lottery determines the contribution.

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

The control treatments in our study relate to two principles of distributive justice, the egalitarian one and the 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.² This means that this principle and similar meritocratic ideas have a concept of equality of opportunity rather than equality of outcome. If unequal opportunities exist then it is important to identify if and how far a person is accountable for an outcome. Roemer (1998) argues that accountability requires a comparison of people with the same exogenous characteristics.³ The share that a person gets should only increase in her relative contribution, i.e. the share of an educated person should be measured in relation to her educated peers and the share of an uneducated persons should be measured relative to other uneducated persons. Since education in our experiment is randomly assigned, educated people should, on average, receive the same share as uneducated people even if they contribute more than uneducated people.

As mentioned above, several studies have shown that people opt for more egalitarian distributions once luck rather than meritocratic criteria determine an outcome (see footnote 1). Cappelen et al. (2007) used distribution decisions after an investment period with unequal rates of returns and investigated the importance of different fairness principles. They provide evidence for heterogeneity in the application of fairness principles among their subjects. Konow (2000; 2003) provides detailed positive analyses on the accountability principle.

In our study, we implement unequal access to education, which creates an ambiguous situation with respect to these fairness principles. On the one hand, luck is relevant for the unequal access to education; on the other hand, performance alone determines the outcome after education has been received. Thus, with our study we can assess the importance of different fairness principle in this situation. We can investigate whether the fairness norms that are applied in situations with equal opportunities or purely randomly determined investments prevail in a situation of inequality of opportunities,⁴. Such a comparison reveals whether people make claims for more or less redistribution once they have correct information about the determinants of inequalities in opportunities. This comparison is

² 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.

³ “I say it is morally wrong to hold a person accountable for not doing something that it would have been unreasonable for a person in his circumstances to have done” (p. 18).

⁴ 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.

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. Nevertheless, skill premiums are widely tolerated and meritocratic societies claim that the most able citizens do constitute their elite.

We expected redistribution in the situation of unequal opportunities to be in between the control treatments, in which luck or skill alone determines outcome. Interestingly though, our results reveal that subjects' responses to unequal learning opportunities are similar to their responses when luck alone determines output. This means that if the access to education is saliently due to luck, people apply more egalitarian than desert based fairness principles. We also observe conflicting distribution norms between educated and uneducated participants. 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.

2 Experimental design

We start with an overview of the experiment and, then explain all the steps in detail. The key feature of our design is the generation of unequal access to education. In our experiment, subjects have to solve multiple choice knowledge questions. As a preparation, they can learn some of them. We generate unequal access to education by differentiating how many of the questions are useful, i.e., how many of the questions are relevant in the real effort task. In order to manipulate the importance of the education for performance, we implemented two situations. In one situation, the *long education treatment* subjects could learn for 15 minutes, while in the *short education treatment*, subjects could learn for only 4 minutes. The latter condition creates higher variance within the educated group. Thus, high performance within the educated group is less associated with luck and could be considered as more deserved. The production in the multiple choice question task determined the subject's contribution to a common pool. Subjects were informed about each other's contribution and could bargain how to share the common pool. The control treatments differ in how the contribution to the common pool is determined: In the *skill treatment*, the individual contribution of a subject to the joint output was determined by her skills (more specifically her general knowledge). In the *luck treatment*, luck determined the individual contribution. We will now present the three

phases of the experiment in detail. The phases are, the learning phase, the production and contribution phase, and the 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. The learning phase lasted for 15 minutes. In the short education treatment this time was reduced to 4 minutes.

In the learning phase, subjects could learn the correct answer to 60 questions. In this phase only the correct answer was displayed. The treatments differed in how many of the learned questions were relevant in the production 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 both education treatments, 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 treatments, 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 lasted for 15 minutes in all treatments. Each subject had to answer 60 knowledge questions by choosing 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 points). Half of the subjects were in either condition. Then, a lottery specified the actual size of the individual contributions⁵. 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 the long education treatment ensured that all educated subjects were also high contributors. In the short education, 18 out of 24 groups included one educated high contributor and one uneducated low contributor. We only use these groups for our analysis. 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.

⁵ 120 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

Phases		Skill Treatment	Education Treatments	Luck Treatment
Learning (60 questions)		5% are relevant for production 15 minutes	5% are relevant for one group member 95% are relevant for the other group member Long ed.: 15 minutes Short Ed: 4 minutes	50% are relevant for production 15 minutes
Production	Private Benefit	60 questions to be answered 0.2 points reward for a correct answer. 0.2 points deduction for a wrong answer. 15 minutes time		
	Contribution to common pool	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		Actual contribution between 10 and 240 according to a random process
	Matching into groups	Random. We analyze groups with one high contributor and one low contributor,	We analyze groups with one educated high contributor and one uneducated low contributor.	One high contributor (>120 points) and one low contributor (\leq 120 points)
Negotiation		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.		

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 half of the pie. Thus, if the cake size equals c , rational and selfish subjects accept 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 skill 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, in particular more redistribution in the luck than in 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. This implies that the correlation between

proposals/demands and a subject's contributions to the common pool is significantly higher in the skill treatment than in the luck treatment.

In the education treatments it is ambiguous whether the egalitarian or the desert principles has to be applied. The assignment of productivity-enhancing education occurs at random and supports the application of the egalitarian principle. However, the subject's production determines her contribution to the common pool. This means that each individual has an impact on the size of the common pool which could provide a motive for the application of the desert principle. Thus, our 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 treatments are between those of the skill treatment and those of the luck treatment. Because skills and effort are more important in the short education treatment, we expect the results from this treatment to be closer to the results in the skill treatment than the results from the long education treatment. It is an open question whether behavior in the education treatments is closer to the luck or to the skill treatment. If subject apply the fairness principle in a self-serving way (as observed in Kagel, Kim, and Moser (1996)), then high contributors would apply the desert principle and their behavior would be comparable to the skill treatment, and the low contributors would apply the egalitarian principle and their behavior would be comparable to the luck treatment. Thus, in the education treatments conflicts between the two parties should be more frequent and agreement more difficult than in the other two treatments.

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 experimenter summarized the experiment using a standardized text. 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 whose contribution is in the higher half of the contribution, the others contributors are low contributors. In the luck treatment, we ensured by design that all groups included one high and one low contributor. In the skill treatments, we consider only subjects in those groups that included one high and one low contributor. In the education treatments the high contributor also had to be the educated one for our analysis. In order to keep the number of relevant observations comparable across treatments, we recruited twice as many subjects in the skill treatment and one third more subjects in the short education treatment compared to the other treatments. The assignment of the contribution based on the rank ensures that the size of the common pool is comparable across all treatments. 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	35	254.00	44.07	72.83%	10.62
Short Education						
All obs.	96	48	250	66.75	74.01%	11.24
Relevant**	76	38	252.89	51.67	76.33%	9.92
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 and short education treatments, 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. The treatments are ordered according to our hypotheses with respect to the importance of the meritocratic principle in the distribution.

Table 3:

First round 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	35	66.14%	9.41	68.06%	11.57
Short Education	38	64.00%	10.90	66.11%	13.93
Long 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 for herself	
		Mean	St. Dev	Mean	St. Dev
Skill	35	34.20%	9.89	37.62%	10.75
Short Education	38	40.76%	11.83	45.26%	15.89
Long 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 that purely egalitarian motives do not apply in any context. In all treatments, demands and proposals differ significantly from an equal split (Wilcoxon signed-rank test, $p < .001$ for demands in all treatments, $p < .016$ for proposals in all treatments). This means that low contributors demand and propose smaller shares for themselves than high contributors do. The results confirm the existence of “moral property rights” (Gächter and Riedl, 2005). Most subjects accept that a randomly determined large contribution implies an entitlement to a rather high share of the common pool, even if luck determined contributions. This result also reveals that subjects do not consider Roemer’s (1998) accountability criterion. Educated group members receive higher shares even though they got their training only by chance.

We also find no evidence for purely meritocratic distributions. Low contributors demand a higher share than they actually contributed while high contributors demands are lower than their contributions (Wilcoxon signed-rank test, $p < .001$ for demands in all

treatments, the same results apply for proposals). These results reveal a consensus among subjects in all treatments that neither purely egalitarian or purely meritocratic criteria for distributions should prevail in any context. This consensus limits the scope for treatment differences because decisions of high and low contributors are less likely to differ across the treatments.

Demands of the high contributors are exactly in the expected direction across the treatments. They are highest in the skill treatment, lowest in the luck treatment and in between in the education treatments. Further, they are higher in the short education treatment than in the long education treatment. However, not all of the differences are statistically significant. The difference between the skill treatment and the luck treatment is statistically significant (Wilcoxon rank sum test, $p = .006$), the same holds for the difference in demands of high contributors in the short education and luck treatments ($p = .046$). With respect to proposals, we find that the education treatments are within the luck and skill treatments, but also here, not all differences are significant. Proposals of high contributors differ significantly between the luck and the skill treatment ($p = 0.044$; according to the Wilcoxon rank-sum test). Proposals of high contributors with short education are insignificantly higher than in the luck treatment ($p = .116$). All other comparisons are insignificant.

Regarding the low contributors, the pattern looks somewhat different. Proposal and demand are closer to the luck condition than to the skill condition and short education treatment and for the proposals, the choices are even more egalitarian than in the luck conditions. With respect to statistical significance, we can show that the demands of low contributors in the skill treatment and in both education treatments differ significantly (Wilcoxon rank sum test, $p = .014$ and 0.023). With respect to the proposals, low contributors in the skill treatment do not make significantly more generous proposals than those in the luck and the long education treatments. The difference in low contributors' proposals between the skill and the short education treatment is significant ($p = .040$).

These results suggest that there is a larger conflict of norms in the education treatments than in the skill and the luck treatment. This is actually the case. Acceptance rates of first round proposals were similar in the skill and in the luck treatment (51.4% and 55.6%, respectively) but significantly lower in the education treatment (37.5%, in the long education treatment and 35.5% in the short education treatments, all $p < .10$, Wilcoxon rank-sum test). Even though there was a larger conflict in the first round, people did not need more bargaining rounds in the education treatments (1.85 rounds in the skill treatment, 2.03 in the

long education treatment, 2.17 in the luck treatment and 2.61 in the short education treatment. None of the treatment differences is significant).

The relationship between proposals (and own minimum demands, respectively) and the contribution to the common pool provides more specific information about differences in distribution norms between the three treatments. If the egalitarian norm is prevalent, proposals and demands should equal to 50% independent of the individuals contributions. If people follow the desert norm, the people's share should equal their contribution. Thus, the coefficient of an OLS estimations of the proposed share for the other player (and own minimum demand, respectively) with the own share of production as the single independent variable informs us about the relative importance of the two norms. This coefficient can be interpreted as the average share of the income that is not redistributed. If all subjects follow the equity norm, the coefficient equals zero; if all follow the desert norm, it equals one. As above, we only use the proposals and demands from the first round. Table 4 shows the relationship in the four 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%)	.672 (.040)***	.681 (.035)***
Constant	2.843 (.997)***	.171 (.886)
Adjusted R ²	.806	.843
Short Education Treatment		
Share of Production (-50%)	.380 (.077)***	.426 (.045)***
Constant	5.684 (1.693)***	2.382 (1.260)*
Adjusted R ²	.341	.544
Long 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: 70 in skill, 76 in short education, 72 each in long education and luck, standard errors in parentheses

Again 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. The production coefficients for proposals and demands are remarkably similar within each treatment. In order to estimate treatment differences regarding the impact of production shares on demands and proposals, we use interaction terms between the treatment variables 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	Short Education Treatment	
	Proposed Share for herself (-50%)	Minimum Demand (-50%)
Dependent Variable:		
Share of Production (-50%)	.380 (.045)***	.426 (.039)***
Luck	-2.781 (1.816)	-3.854 (1.580)**
Luck × Share of Production (-50%)	.028 (.065)	.002 (.057)
Skill	-2.841 (1.834)	-2.210 (1.596)
Skill × Share of Production (-50%)	.292 (.069)***	.254 (.060)***
Long Education	-1.629 (1.816)	-1.548 (1.580)
Long × Share of Production (-50%)	.105 (.065)	-.009 (.057)
Constant	5.684 (1.270)***	2.382 (1.105)**
Adjusted R ²	.584	.653

*** significance level $p < .01$; ** $p < .05$; * $p < .10$; $N = 290$ in both OLS estimations, standard errors in parentheses. The interaction terms (Luck × Share of Production, Skill × Share of Production, Long × 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 treatments. The impact of contributions on demands and proposals are remarkably similar in both education treatments and 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.

5 Summary and Conclusion

In this paper, we investigate how people respond to one of the most important sources of economic inequality, unequal access to education. We induce unequal opportunities with a real-effort experiment in which some people get random access to training. Depending on the treatment, luck, skill or random access to skill-enhancing education determined the size of the individual contributions. Our subjects knew 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.

We do observe that neither completely egalitarian proposals nor completely meritocratic proposals dominate. In all treatments, proposals and demands are correlated with individual contributions to the common pool, but the correlation is not perfect. Interestingly, people partly respect the individual contributions, 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 differently by those who benefit from the better education and those who get the worse education. Both groups tend towards the norm that is in their self interest. While those who get the better education apply a norm that is closer to the desert norm, subjects without access to such education make similar demands and proposals as those subjects with a randomly determined contribution. We find that the average share of redistribution is very similar in the luck treatment and in the education treatments, and significantly higher than in the skill treatment. 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. However, this is a fragile consensus. With shorter learning time, demands and proposals of educated high proposers shift away from those of their fellows in the luck treatment.

Empirical studies show that if more people believe that luck determines income, then the demand for redistribution is higher.⁶ Our experimental results reveal and distinguish underlying behavioral phenomena that shape this general trend. We observe that people accept moral property rights even if luck alone determines contributions. Second, subjects always have a preference for redistribution even in the most meritocratic context. These two phenomena make distributional relatively similar across different contexts and always significantly different from purely egalitarian or meritocratic ideals. Within these limits, the impact of skills on income generation is almost irrelevant if the link between luck and access to relevant skills is very salient. This result is particularly striking because subjects were fully aware that meritocratic criteria still mattered in this context. If people have to work relatively

⁶ 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.

hard in order to acquire the benefits of education, then the beneficiaries are less likely to consider the role of luck. In consequence, people disagree more often about what constitutes a fair distribution of income.

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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

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.

Education Treatment

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.

Luck Treatment

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:

The screenshot shows a trivia game interface. At the top right, it says "Verbleibende Zeit [sec]: 872". Below this, there are 10 questions, each with a number from 21 to 30. Below the questions, there are 10 red buttons labeled "Antwort zeigen". At the bottom, there are 6 navigation buttons labeled "Fragen Seite 1" through "Fragen Seite 6".

Verbleibende Zeit [sec]: 872

Frage 21. In welcher Stadt traten die Beatles in den 1960er-Jahren im berühmten Star-Club auf?

Frage 22. In welchem Dschungel-Thriller kämpft Arnold Schwarzenegger gegen ein unsichtbares Monster?

Frage 23. Welcher Kultregisseur drehte 2001 ein Remake des Sciencefiction-Klassikers 'Planet der Affen'?

Frage 24. Welcher religiöse Führer und Fanatiker stürzte den Schah von Persien?

Frage 25. Welcher NATO-Generalsekretär wurde 1999 quasi zum ersten Außenminister der Europäischen Union bestimmt?

Frage 26. Welches sagenhafte Goldland im nördlichen Südamerika versuchten im 14./15. Jahrhundert einige Abenteurer aufzustoßen?

Frage 27. Wem übergab Nelson Mandela 1999 die Nachfolge als zweiter Staatspräsident Südafrikas?

Frage 28. Welches 'Stückchen Russland' gaben die drei Raumfahrer Afanasjew, Awdejew und Haigneré 1999 auf?

Frage 29. Welcher französische König wurde in Rom von Papst Leo III. zum Kaiser gekrönt?

Frage 30. Nach welche italienischen Entbecker in Diensten Spaniens benannte der Kartograph Martin Waldsee-Müller den größten Doppelkontinent?

Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen Antwort zeigen

Fragen Seite 1 Fragen Seite 2 Fragen Seite 3 Fragen Seite 4 Fragen Seite 5 Fragen Seite 6

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.

<i>Skill Treatment</i>	<i>Education Treatment</i>	<i>Luck Treatment</i>
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.

Verbleibende Zeit [sec]: 883

Anzahl bereits bearbeiteter Fragen: 6

Frage: Welcher Architekt übergab 1999 Bundestagspräsident Thieme die Schlüssel des neuen Berliner Reichstages?
 A: Sir Norman Foster
 B: Daniel Libeskind
 C: Herzog De Meuron
 D: Peter Zumthor

Ihre Antwort: A
 B
 C
 D
 Weiss nicht

nächste Frage

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:

Ihre Punkte aus der Produktionsphase wurden jetzt durch Rangpunkte ersetzt. Der Teilnehmer im Raum mit den wenigsten Punkten aus der Produktionsphase erhält 10 Punkte, derjenige mit den zweitwenigsten 20 Punkte, derjenige mit den drittwenigsten 30 usw.

Anzahl Rangpunkte, die Sie erhalten: 20

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 eighth 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.

Anzahl Punkte, die Sie in der Produktionsphase gesammelt haben:	56.0
Punkte, die Sie auf dem privaten Konto haben:	5.6
Anzahl Punkte die durch Punkte aus einer Urne ersetzt werden:	50.4

Bitte geben Sie hier die Ihnen zugewiesenen Punkte ein:

Bitte geben Sie hier den dazugehörigen Code ein:

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.

The screenshot shows a bargaining interface with the following elements:

- Top right corner: Verbleibende Zeit [sec]: 895
- Top left section:
 - Von Ihnen anfänglich eingebrachte Punkte: 10.0
 - Von Ihrem Gruppenmitglied anfänglich eingebrachte Punkte: 20.0
- Top right section:
 - Punkte auf dem Gruppenkonto: 30.0
 - Aktuelle Verhandlungsrunde: 1
- Main area:
 - Question: Welche Aufteilung des Gruppenkontos schlagen Sie vor, falls Sie in der Rolle von A sind?
 - Input fields:
 - Prozentualer Anteil für den anderen:
 - Prozentualer Anteil für mich:
- Bottom right corner: OK button

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.

The screenshot shows a negotiation interface with a light beige background. In the top right corner, there is a red text label 'Verbleibende Zeit [sec]' followed by the number '049'. The main area is divided into two columns. The left column contains two lines of text: 'Von Ihnen anfänglich eingebrachte Punkte: 10.0' and 'Von Ihrem Gruppenmitglied anfänglich eingebrachte Punkte: 20.0'. The right column contains two lines: 'Punkte auf dem Gruppenkonto: 30.0' and 'Aktuelle Verhandlungsrunde: 1'. Below this information, a question is displayed: 'Welchen prozentualen Anteil fordern Sie mindestens ein, falls Sie in der Rolle von B sind?'. Underneath the question is a small, empty blue rectangular input field. In the bottom right corner of the interface, there is a red rectangular button with the white text 'OK'.

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? _____

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