Games and Economic Behavior 107 (2018) 123–134

Contents lists available at ScienceDirect

Games and Economic Behavior

www.elsevier.com/locate/geb

Is increasing inequality harmful? Experimental evidence ☆

Dietmar Fehr

University of Heidelberg, Department of Economics, Bergheimer Strasse 58, 69115 Heidelberg, Germany

ARTICLE INFO

Article history:
Received 20 July 2016
Available online 13 November 2017

JEL classification:
C72
C92

Keywords:
Inequality
Money burning
Fairness
Procedural concerns

ABSTRACT

Increasing inequality is commonly associated with social unrest and conflict between social classes. This paper reports the results of a laboratory experiment to study the implications of greater inequality on the tendency to burn others' income. The experiment considers an environment where higher earnings in a real-effort task are typically associated with higher effort and varies how fair and transparent this relationship is. The findings indicate that greater inequality does not lead to more money burning itself. Rather, it depends on whether the increase in inequality can be unequivocally attributed to exerted effort, i.e., the fairness of the income-generating process. Only if greater inequality can be the result of morally questionable activities, subjects engage in substantially more money burning. While most income burning aims at reducing inequality, the fairness of inequality only plays a role in the extent of money burning but not so much for the qualitative burning patterns.

1. Introduction

There has been a substantial increase in economic inequality in recent years, which has again brought inequality into the focus of public and economic debates (e.g., Piketty, 2014). A major concern is that too much inequality may trigger social unrest and conflicts between social classes.[1] While inequality is to some extent inevitable, it is not only the degree of inequality that raises concerns. Many people contest the fairness of current income and wealth distributions and express a preference for a more equal society (Norton and Ariely, 2011). Indeed, individuals' views about the fairness of the composition of inequality affects how they respond to inequality (e.g., Konow, 2000; Cappelen et al., 2007, 2013). In this paper I study the implications of greater inequality on the tendency to engage in behavior that is harmful to others and how such behavior interacts with the fairness of inequality.

Harmful (or antisocial) behavior is a frequently observed phenomenon. People become victims of random violence or sometimes people simply find pleasure in destroying or damaging the property of others (e.g., Abbink and Herrmann, 2011; Abbink and Sadrieh, 2009). There are many accounts, mostly from former socialist countries, that document property crimes,

☆ I am grateful to two anonymous referees for helpful comments. I thank the Deutsche Forschungsgemeinschaft (DFG) for financial support through the SFB 649 "Economic Risk" and individual grant FE 1452/3-1.

E-mail address: dietmar.fehr@awi.uni-heidelberg.de.

[1] In the public debate, the recent Occupy movements have, for example, addressed the economic problems of the working poor and the middle class and emphasized the link to economic inequality. The academic discourse of inequality and social class conflicts dates at least back to Durkheim (1893). Recently, empirical studies have, for instance, used data on incidences of air rage to illustrate a relationship between inequality and class conflicts by showing that the presence of first class cabins in airplanes – a form of physical inequality – is associated with more antisocial behavior in air travel (DeCelles and Norton, 2016). On a more general level, inequality is often tied to various social problems such as violence, distrust, imprisonment or drug abuse (see e.g., Wilkinson and Pickett (2009) for an overview).

https://doi.org/10.1016/j.geb.2017.11.001
0899-8256/

hostility and attacks toward more successful people. Such behavior is frequently attributed to an effort to restore equality among peers (see, e.g., Mui, 1995, for an excellent discussion) and seems closely tied to the perception that individual success is often based on illegal activities (e.g., Smith, 1990).[2] While there are many possible motives for engaging in antisocial behavior, it seems appealing to assume a relationship between increasing inequality and behavior that harms others without apparent material benefits for the transgressor. Yet causal empirical evidence is scarce, as it is difficult to isolate the different motives for antisocial behavior and to study changes in the degree and composition of inequality.[3]

To study the relationship of greater inequality and antisocial behavior, I turn to evidence from a laboratory experiment. This allows me to focus the analysis on harmful behavior that aims at reducing inequality and to investigate how such behavior depends on the composition of inequality, i.e., the fairness and transparency of the income-generating process. The experiment consists of a production phase and a "money burning" phase.[4] In the production phase participants are matched into groups of four and they each complete a real-effort task for which they receive a piece-rate wage and in some treatments a bonus, as explained below. In the money-burning phase, participants receive information on the performance and earnings of all other group members. They can then burn some of the income of each other group member, which involves no material gain for the burner. Burning decisions take place simultaneously and taking revenge for expected income reductions is not possible as only the decision of one randomly chosen group member is actually implemented.

The baseline condition considers an environment with moderate inequality where external factors, such as luck, play little role and thus higher earnings can be typically associated with higher effort. To vary inequality, in two additional treatments the best-performing participant in a group receives, in addition to the piece rate, a bonus payment. That is, the bonus payment stretches out the income distribution by increasing the income gap between the top performer and the other participants in a group. While many fairness ideals prevail in theory and society, prominent normative theories of justice assume that inequalities arising from factors under individuals control should not be eliminated (e.g., Roemer, 1998; Konow, 2003). In fact, these theories received ample support from laboratory experiments, suggesting that a majority of people do not eliminate inequalities that are due to merit or for which people can be held responsible for (Konow, 2000; Cappelen et al., 2007, 2013; Mollerstrom et al., 2015).

This fairness view, however, critically hinges on the transparency of the income-generating process. It is often hard or impossible to judge whether greater rewards are deserved or not. This is particularly the case when people can engage in morally questionable activities that have clear private benefits, i.e., unethical behavior such as corruption, doping, cheating, or tax evasion.[5] To investigate this possibility, I consider a treatment variation with a bonus payment where all subjects have the possibility to artificially inflate their performance. This performance manipulation is costly and unobservable to other group members. As such, this treatment explicitly distorts the fairness of the income distribution by allowing subjects to unobservedly tweak the income-generating process in their favor.

The main finding of this study is that the level of antisocial behavior crucially depends on the fairness of inequality. While antisocial behavior is present even in situations with moderate inequality, a mere increase in inequality has little effect on antisocial behavior. As long as higher inequality can be unambiguously attributed to exerted effort, money burning is only marginally higher than it is with low inequality. However, this is not the case when the link between earnings and exerted effort is non-transparent. If inequality is high and observed effort may result from a performance manipulation, i.e., inequality is possibly unjust, the share of money burning is substantially higher than in the two treatments where the performance is not manipulable and the resulting income distribution is likely seen as just. More specifically, the share of money burning is more than twice as high as in a situation where inequality is low and just, and 1.5 times higher than in a situation with similarly high, but unjust, inequality.

The results further suggest that subjects who received a bonus payment are more vulnerable to money burning and face harsher income reductions than any other subjects, indicating that most income reductions aim at a lowering of inequality. In fact, money burning of lower-ranked subjects results in a reduction of inequality by approximately 7 Gini points when inequality is high and unjust. Interestingly though, this harming pattern arises irrespective of whether it is easy or hard to judge the merit of the greater rewards. This indicates that the fairness of inequality only plays a role in the extent of money burning, but not so much for the qualitative burning patterns when inequality is high.

[2] Recent evidence from off-shore leaks, such as the "Panama Papers", substantiate this perception. For example, Alstadsaeter et al. (2017) document that tax evasion is increasing in wealth in Scandinavian countries (with estimates suggesting that the top 0.01% of the wealth distribution evade about 25 percent of their taxes).

[3] Inequality has traditionally been associated with the occurrence of aggression and violent conflicts in academic research (e.g., Gurr, 1970; Sen, 1973) and in numerous media reports and anecdotal evidence. However, the empirical literature is not conclusive and there is, for example, an ongoing debate about the determinants of violent conflict (see e.g., Blattman and Miguel, 2010).

[4] In the game-theoretic literature the term "money burning" usually refers to burning one's own money as a signaling device (e.g., Van Damme, 1989; Ben-Porath and Dekel, 1992), whereas in the present context it refers to destroying the income of some other party. The latter use of this term originated in the seminal paper of Zizzo and Oswald (2001) and the subsequent literature on antisocial behavior (e.g., Abbink and Sadrieh, 2009; Abbink et al., 2011; Kebede and Zizzo, 2015). In the following I will use "money burning" interchangeably with income reduction and antisocial behavior.

[5] Such self-serving activities are arguably often available. For example, in professional work environments it is typically not perfectly observable how much effort others put into a project and whether someone makes use of unfair labor practices to inflate their performance in order to advance in the hierarchy. Charness et al. (2013) discuss the prevalence of illegal or unethical work practices in competitive (work) environments and show that unethical behavior, in the form of either reducing others' performance (sabotage) or inflating own performance even prevails in an experimental setting with flat wages and only symbolic rewards for performance.

That the rich are the prime target of income reductions is somewhat related to the voluminous experimental literature on social dilemmas documenting individuals' willingness to incur a cost for harming other uncooperative individuals.[6] While a major motivation for such punishment is to enforce cooperative norms in groups or communities, a recent stream of this literature emphasizes its inequality-reducing nature (e.g., Raihani and McAuliffe, 2012; Bone and Raihani, 2015). These experiments commonly involve some interaction prior to the possibility of punishment, such that it is difficult to disentangle the different motives for punishment.[7] Subjects in the present experiment are willing to harm others even in the absence of prior interaction. Clearly, the introduction of a bonus for the best-performing subject results in greater inequality and interdependent effort decisions as payments partly depend on others' exerted effort. This interdependence may trigger resentment (and income reductions), if hard work or success is seen as antisocial. Yet, greater inequality does not per se lead to more money burning in the present setup.

This paper is directly related to a strand of the literature that investigates the relationship between inequality and antisocial behavior (e.g., Zizzo and Oswald, 2001; Zizzo, 2003; Dawes et al., 2007; Abbink et al., 2011; Grossman and Komai, 2013). In these experiments, subjects can typically generate wealth by investing in risky projects and the prospects of the investment opportunities partly depend on the random assignment of advantaged or disadvantaged player roles at the beginning. They illustrate that burning others' income is a widespread phenomenon and that initially advantaged subjects (the rich) are more likely to be the target of antisocial behavior than initially disadvantaged subjects, suggesting that money burning is an effort to equalize final earnings.[8] Unlike the present study, merit or effort do not play a role in these studies as the positions in the income distribution depend on luck. Moreover, these studies do not consider the impact of increasing inequality and its fairness on antisocial behavior. Thus, the findings of this study contribute to a more complete understanding of the relationship of inequality and antisocial behavior. In particular, the findings highlight that increasing inequality does not in principle induce more antisocial behavior, but that the fairness of inequality matters.

The findings of this study also complement the recent literature on inequality acceptance (e.g., Konow, 2000; Cappelen et al., 2007, 2013; Akbaş et al., 2016; Bortolotti et al., 2017). These studies are mostly interested in which fairness ideals emerge in response to differences in how inequality is generated. As such, they focus on how stakeholders or spectators redistribute total wealth, which is typically generated through risky or risk-free investments.[9] Importantly, although redistribution can lead to a reduction of income for some subjects, it is always to the material benefit of another subject. In contrast, the present study deals with antisocial behavior where nobody benefits in material terms from reducing others' income. It thereby focuses on environments where the increase in income inequality is fair from a meritocratic point of view, i.e., inequality can be attributed to work effort, and where it is hard to judge the fairness because subjects have the possibility to artificially inflate their effort.

More generally, this study contributes to a small but emerging experimental literature showing that inequality can have negative ramifications on individual well-being, decision-making, and ethical behavior. In a rare field study, Card et al. (2012) randomly informed a subset of employees of the University of California about the existence of a database listing the salaries of state employees and thereby provided illuminating field evidence that pay inequality leads to lower job satisfaction and a higher likelihood of job search activities for low-wage workers. Most evidence comes, however, from lab experiments as the identification of relative comparisons in the field is a daunting task. These laboratory studies document, for example, that subjects at the lower end of the income distribution take unwise risks (Kuziemko et al., 2014), that subjects cheat more when they are aware that others earn more (Gill et al., 2013; John et al., 2014), that subjects with higher earnings do not give more to a charitable cause than subjects with lower earnings (Tonin and Vlassopoulos, 2017), and that higher inequality leads to a decline in trust and trustworthiness (Fehr et al., 2017). In all these studies the distribution of income is randomly assigned and there is no variation in inequality. The findings of this study extend this literature by documenting the prevalence of antisocial behavior in more complex situations where higher income is linked to higher performance or a combination of higher performance and unfair behavior.

2. Experimental setup

The experiment is divided into three parts. It starts with a real-effort task to determine subjects' initial income and after subjects get feedback on their own and relative performance in the real-effort task they can engage in antisocial behavior.

[6] Punishment is not restricted toward uncooperative individuals alone. There is a widely documented phenomenon of antisocial punishment, that is, the sanctioning of people who behave prosocially (e.g., Gächter et al., 2005; Anderson and Putterman, 2006; Herrmann et al., 2008; Gächter and Herrmann, 2009).

[7] In Bone and Raihani (2015), for example, victims of stealing could inflict punishment on the stealing interaction partner. When punishment was effective (1:3 fee to fine) a majority of subjects tailored their punishment to restore equal outcomes, but punishment also occurred frequently when it was ineffective (1:1 fee to fine), indicating that motives other than equity concerns matter as well. Punishment and egalitarian motives are also widespread in primates (e.g., Brosnan and De Waal, 2003; Leimgruber et al., 2016).

[8] A few papers demonstrate the prevalence of antisocial behavior even in situations where the motive of inequality reduction is missing, which suggests that money burning may occur out of pure pleasure (e.g., Abbink and Sadrieh, 2009; Abbink and Herrmann, 2011; Prediger et al., 2014).

[9] A related stream of literature is interested in the demand for redistribution and its link to fairness perceptions (e.g., Krawczyk, 2010; Erkal et al., 2011; Balafoutas et al., 2013; Durante et al., 2014; Rey-Biel et al., 2015). There is also evidence that the acknowledgment of earned entitlements depends on (economic) status. In a series of experiments, Barr et al. (2015) report that relatively poor subjects tend to neglect entitlements when redistributing money, and Barr et al. (2016) present evidence that unemployment has a negative effect on the recognition of entitlements.

The instructions contain all relevant details of these three parts, i.e., there is no uncertainty in the beginning about the nature of future tasks.

At the beginning, subjects are randomly matched into groups of four and then perform a real-effort task to determine their income in the first part. In the real-effort task subjects have to encode words for 20 minutes (see Erkal et al., 2011). For this purpose, subjects receive an encryption table that assigns a unique number to each letter of the alphabet in a random order. Subjects then have to encrypt words by substituting the letters with the corresponding numbers from the encryption table. The sequence of words is predetermined and is the same for all subjects. This task does not require particular skills and therefore the performance should depend to a large extent on exerted effort. All subjects earn a base wage of 5 euro and a piece rate of 7 cents for each correctly encoded word. Depending on the treatment, the best-performing subject in a group gets a bonus of 8 euro, as outlined below.

After finishing the real-effort task subjects receive feedback (second part). First, subjects get feedback on their own performance (i.e., their number of encrypted words) and their earned income. After that, they learn their relative performance in their group. That is, subjects receive an overview of the number of encrypted words, and the income and bonus payment (if any) of all group members (including themselves) ranked from top to bottom. Before and after they get feedback on their relative performance and income within their group, subjects have to indicate their satisfaction with their own performance on a seven-point scale. Notice that subjects receive relative feedback in all treatments.

The third part is the burning phase. Subjects can burn up to half of the income of each of the other three group members (i.e., it is not possible to reduce the income of others to zero). Burning money is wasteful and involves no material benefits for the burner. The cost for reducing the income of others is 50 cents, regardless of the burned amount, i.e., harming others has zero marginal cost.[10] This mirrors cases where the cost for harming others is independent of the value of the damage. For example, it is arguably as costly for an aggressor to burn down an expensive car as it is to burn down a cheaper car (see e.g., Mui (1995) or Smith (1990) for anecdotal evidence of farmers destroying other farmers' machines, tools, barns, property, etc., in order to restore equality).

While each group member makes three money-burning decisions, I only implemented the decisions of one randomly selected group member. This minimizes the possibility of subjects basing their decision on the expected behavior of others, i.e., it is, for example, not possible to retaliate against expected income reductions of others (see e.g., Zizzo and Oswald, 2001). After the decision to burn others' incomes, subjects indicate how much they believe the other group members will reduce their own income and the income of the other three group members on average. For each correct assessment they receive 50 cents. Finally, subjects state their emotions on a seven-point scale using the same types of emotions as Bosman and Van Winden (2002).[11] Although, I am mainly interested in anger, happiness, and surprise as negative, positive and neutral emotions (see also Bolle et al., 2014), I include all types of emotions as filler questions so as to avoid leading subjects in a specific emotional direction.

The experiment consists of three treatments that differ only with respect to the determination of earnings in the real-effort task. In treatment *No Bonus* a subject's income consists of the base wage and the piece rate for each correctly encrypted word and there is no bonus payment. While I expect considerable performance differences, the modest piece rate of seven cents for each correctly encoded word ensures that the resulting income inequality is not too large. Moreover, since income is earned and greater rewards can be associated with greater effort, I expect no money burning in this treatment.

In treatment *Bonus* the best-performing subject in each group receives a bonus of 8 euro in addition to the base wage and piece rate. The bonus leads to a substantial increase in inequality in groups because it increases the earnings gap between a first-ranked subject and the other three group members. While the increase in inequality may induce some money burning, I expect no significant increase in money burning behavior in *Bonus* because inequalities arise due to exerted effort and external factors do not play a role.[12]

Finally, in treatment *Bonus & Cheating* the best-performing subject in a group gets a bonus of 8 euro as in *Bonus*. The only difference is that subjects can, in addition, manipulate their own performance before they learn about the relative performance in their group. Specifically, subjects have the option to pay 1.5 euro for a 75 percent chance of increasing their performance by $x = \{11, 12, 13, 14, 15\}$ words (all equally likely) after finishing their encryption task and before learning their *relative* performance. Thereby, the lottery adds some noise to a subject's performance and ensures that the income-generating process is non-transparent. Note that this manipulation option has a negligible impact on the magnitude of income inequality such that inequality will be about the same as in *Bonus*. Subjects then indicate their belief about how many others in their group have chosen to inflate their performance and subsequently learn their relative performance (but not whether others in their group manipulated their performance).

[10] Previous evidence suggests that antisocial behavior is insensitive to cost. For example, Zizzo and Oswald (2001) use a linear-cost scheme with (marginal) cost $c = \{0.02, 0.05, 0.1, 0.25\}$ for each burned monetary unit and find that burning rates and amounts hardly react to the different parameterizations of c.

[11] The types of emotions include irritation, anger, contempt, envy, jealousy, sadness, joy, happiness, shame, fear, and surprise.

[12] Note that prominent outcome-based models of other-regarding preferences (e.g., Fehr and Schmidt, 1999; Charness and Rabin, 2002) predict that money burning increases with disadvantageous inequality. Therefore, if subjects care not only about their own payoff but also about their relative standing, there will be money burning in *No Bonus* (if burning costs are sufficiently low) but to a lower extent than in *Bonus*. These models, however, do not take the fairness of the income-generating process into account.

Table 1
Treatments.

Treatment	#Sessions	#Groups	#Subjects	Payoff	Bonus	Score
No Bonus	4	22	88	piece rate	no	not manipulable
Bonus	4	22	88	piece rate	yes	not manipulable
Bonus & Cheating	4	22	88	piece rate	yes	manipulable

Table 2
Summary statistics: Real-effort task.

Treatment	# words encoded	min	max	# words encoded per rank			
				first	second	third	fourth
No Bonus	90.6 (14.2)	65	120	104.3 (10.1)	95.1 (12.1)	86.6 (8.7)	76.5 (7.9)
Bonus	92.4 (17.6)	52	142	111.7 (12.3)	98.0 (9.5)	85.9 (10.6)	73.8 (10.2)
Bonus & Cheating	92.2 (18.4)	53	155	110.0 (15.5)	98.1 (10.1)	87.1 (12.9)	73.5 (11.2)

Notes: Average # of encoded words and ranking within treatments are based on pure effort, i.e., before the decision to inflate the score in *Bonus & Cheating*. Standard deviation in parentheses.

A crucial feature of the cheating option is that the expected gain of 0.68 cents from inflating own performance is strictly smaller than the cheating cost (1.5 euro), but that it may increase the likelihood of getting the bonus.[13] Therefore, while the lottery itself is unattractive, the mere possibility to get the bonus should make subjects suspicious about whether greater income is based on exerted effort and thus whether the income-generating process is fair. Because of this unjust element, I expect a significant increase in money burning in *Bonus & Cheating*. To check the robustness of this hypothesis to burning costs, I ran an additional treatment using the same setup as in *Bonus & Cheating* but with a cost scheme with positive marginal cost (see the online appendix for more details).

I ran the experiment at the WZB-TU Berlin laboratory at the TU Berlin using z-Tree (Fischbacher, 2007). In total, I recruited 264 students from a database where students from all universities in Berlin can register for participation in economic experiments at the TU Berlin (ORSEE, Greiner, 2015). Table 1 shows the details of the three treatments. A session typically lasted less than an hour and students earned on average 13 euro (a minimum of 4 euro and a maximum of 23.5 euro).

3. Results

3.1. Aggregate results

Table 2 provides an overview of the performance of subjects, i.e., the average number of encrypted words in the three treatments. The introduction of a top-performer bonus leads to a moderate increase in the number of encrypted words in the two bonus treatments (*Bonus* and *Bonus & Cheating*). In *No Bonus* subjects encode 90.6 words, on average, whereas the bonus slightly increases the average number of encoded words to 92.4 in *Bonus* and 92.2 in *Bonus & Cheating*. The performance increase in the two bonus treatments is mainly due to the higher effort of the top-two performers in a group, leading to more dispersed performance within groups. For example, the average difference in encoded words between the top-ranked subject and bottom-ranked subject is about 28 in *No Bonus*, whereas it is about 38 in *Bonus* and about 37 *Bonus & Cheating*. Though the differences in performance between the two bonus treatments and *No Bonus* are not statistically significant.[14]

Recall that in *Bonus & Cheating* subjects can inflate their final performance by buying a lottery that provides a 75 percent chance of adding 11 to 15 encrypted words to their performance. In total, 67 percent of subjects (59 out of 88) decided to increase their performance by buying the lottery. A more detailed look at cheating rates conditional on the performance ranking (prior to the cheating decision) reveals that top-ranked and third-ranked subjects cheat slightly less (in 59 percent of cases) than second-ranked (73 percent) or fourth-ranked subjects (77 percent). Albeit, the differences are not statistically significant. Not surprisingly, the decision to buy the lottery is strongly correlated with subjects' beliefs about others' willingness to take the gamble ($\rho = 0.56$). A large majority of these subjects (66 percent) believe that *everyone else* inflates the performance, whereas among honest subjects only a minor fraction (7 percent) believe that *all others* inflate their performance. Indeed, such a belief should induce lower-ranked subjects to decline the lottery because it is only profitable for

[13] Note that the more subjects in a group choose to inflate their performance the less likely it is that the initial performance ranking will change.

[14] Regressing the number of encoded words on dummies for the two bonus treatments yields insignificant coefficients for *Bonus* (1.73, *s.e.* 2.41) and *Bonus & Cheating* (1.55, *s.e.* 2.47).

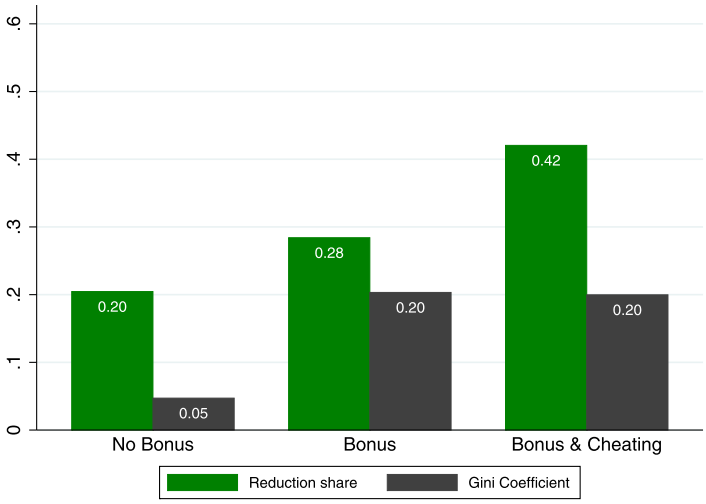

Fig. 1. Share of money burning and income inequality before money burning.

subjects receiving the bonus and it is unlikely the ranking will change if all subjects manipulate their performance.[15] On average, subjects believe that 71 percent of the group members would buy the lottery. The widespread cheating across ranks suggests that status concerns may play a role.

Fig. 1 shows the main result. It displays the share of subjects who reduce the income of at least one other group member in each of the three treatments along with the average Gini coefficient of the income distribution after the real-effort task. Evidently, subjects reduce others' income in all three treatments. In *No Bonus* 18 out of 88 subjects (20 percent) reduce the income of at least one other group member. Although inequality is naturally higher in *Bonus* and *Bonus & Cheating* than in *No Bonus* as evidenced by the larger Gini coefficient of earned income, this does not translate into an equally increased share of money burning. In *Bonus* 25 out of 88 subjects (28 percent) choose to burn money at least once. This higher share of money burning is not statistically different from the share of money burning in *No Bonus* (test of proportions, $p = 0.22$, two-sided). In contrast, the share of subjects reducing others' income is more than twice as high in *Bonus & Cheating* than in *No Bonus*. More precisely, 37 out of 72 subjects (42 percent) reduce others' income in *Bonus & Cheating*.[16] That is, if the performance ranking in groups can be manipulated by subjects and is not solely merit-based, as in *Bonus & Cheating*, the share of money burning is not only significantly higher than in *No Bonus* (test of proportions, $p = 0.01$, two-sided) but is also higher than in *Bonus* (test of proportions, $p = 0.06$, two-sided). Thus, if the income-generating process is possibly unfair, subjects display considerably more antisocial behavior.[17]

The bonus payments also find expression in how much subjects reduce others' income. While subjects in *No Bonus* reduce the income of the other three group members by an average of 5.3 euro, this total amount is almost twice as high in *Bonus* (9.7) and in *Bonus & Cheating* (9.8). The differences in the burned amounts are statistically significant using a Kruskal–Wallis test ($\chi^2_{(2)} = 11.1$, $p < 0.01$). A pairwise comparison reveals that the amount of money burning is significantly higher in both *Bonus* (t-test, $t = 2.6$, $p = 0.01$) and *Bonus & Cheating* (t-test, $t = 2.7$, $p < 0.01$) than in *No Bonus*. This suggests that money burning in the two bonus treatments aims at reducing income inequality, which I will explore in more detail below.

3.2. Who burns money and who are the victims?

In this section, I turn to a more detailed analysis of money burning. In particular, I will look at who burns money and who is the target of income reductions and focus on a comparison of these burning patterns across treatments.

[15] Subjects may cheat for several reasons. They may misjudge their performance and mistakenly believe they can get the bonus, they may want to increase their rank in the relative standing in the group (although the performance overview is anonymous) or they may think lower-ranked subjects will cheat and will thus overtake them in the ranking.

[16] Antisocial behavior is not related to cheating decisions. That is, honest and dishonest subjects do not differ with respect to their money-burning decisions ($\chi^2_1 = 2.15$, $p = 0.14$). A concern here is that some subjects may feel that their cheating decision was forced by others (particularly those subjects who believe all others will cheat) and thus may not view their cheating decision as "unethical". If this perception has implications on antisocial behavior (e.g., if these subjects are in general less or not antisocial), the observed money-burning decisions may represent a lower bound for dishonest subjects. However, differentiating between subjects who believe that *all* others cheat and those who believe that *not all* others cheat reveals no difference in money-burning behavior. Moreover, the behavior of both of these subject types is not different from the antisocial behavior of honest subjects.

[17] This is related to evidence from a recent study showing that fairness views critically depend on subjects' beliefs about possible self-serving immoral behavior. Bortolotti et al. (2017) show that spectators redistribute substantially more money from the rich to the poor if the income distribution is potentially the result of subjects' cheating behavior.

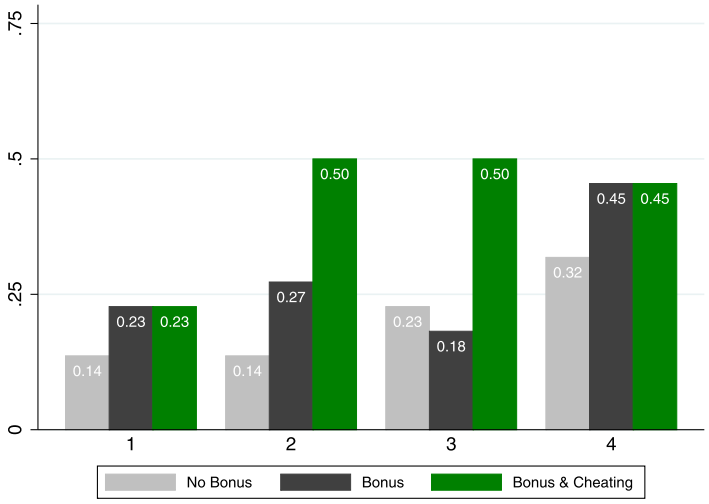

Fig. 2. Share of subjects burning money by rank.

Table 3
Average income reduction by rank.

Treatment	Ranking			
	first	second	third	fourth
No Bonus	1.8	9.1	5.0	5.4
	(1.3)	(8.1)	(5.5)	(5.4)
	[3]	[3]	[5]	[7]
Bonus	10.2	7.8	3.6	13.0
	(5.3)	(3.5)	(2.7)	(5.3)
	[5]	[6]	[4]	[10]
Bonus & Cheating	8.7	8.5	9.9	11.8
	(6.0)	(5.8)	(4.4)	(7.7)
	[5]	[11]	[11]	[10]

Notes: Standard deviations in parentheses and number of observations in brackets.

Fig. 2 displays the share of subjects who reduce the income of at least one other group member by rank. First, it is apparent from Fig. 2 that subjects in all ranks burn the income of others. Second, in all three treatments subjects ranked second or lower seem to reduce income more often than top-ranked subjects. This pattern is most discernable in *Bonus & Cheating* where, for example, subjects who ranked second burn the income of others twice as often (50 percent) as subjects who ranked first (23 percent) and do not appear to be less likely to reduce income than subjects that ranked third or fourth. In fact, top-ranked subjects burn others' income significantly less often than the other three subjects in *Bonus & Cheating* (t-test, $t = 2.33$, $p = 0.025$, two-sided). This pattern is less pronounced and not statistically significant in *No Bonus* (t-test, $t = 1.0$, $p = 0.32$, two-sided) and *Bonus* (t-test, $t = 0.7$, $p = 0.49$, two-sided). Together this suggests, that the sharp increase in money burning in *Bonus & Cheating* is mainly driven by lower-ranked subjects who engage in substantially more antisocial behavior relative to the top-ranked subjects.

Table 3 shows how much money subjects burn in total, detailed for each rank. Apparently, the amount of money burning is higher in *Bonus* and in *Bonus & Cheating* than in *No Bonus* for most ranks. Moreover, the two bonus treatments reveal three noteworthy observations. First, last-ranked subjects typically burn the most income on average. Second, if top-ranked subjects reduce others' income, the chosen amount of money burning is fairly high. Third, it appears that the burned amounts are more evenly spread across ranks in *Bonus & Cheating* than in *Bonus*.[18]

Who are the targets of money burning? Fig. 3 shows the share of income reductions aimed at subjects ranked first, second, third, and fourth. While all subjects face income reductions irrespective of their rank, it is not surprising that subjects ranked fourth are the least likely target of income reductions in all treatments. On the other hand, it is apparent that first-ranked subjects are most often the target of income reductions. Thus, it seems that the share of income reductions

[18] Interestingly, the consequences of money burning for the income ranking within groups differ between *No Bonus* and the two bonus treatments. In *No Bonus* the overwhelming majority of money burners would find themselves in the first rank after their money-burning decision (83 percent), whereas only a small fraction of harming parties in *Bonus* (24 percent) and *Bonus & Cheating* (38 percent) would heft themselves into the leading position.

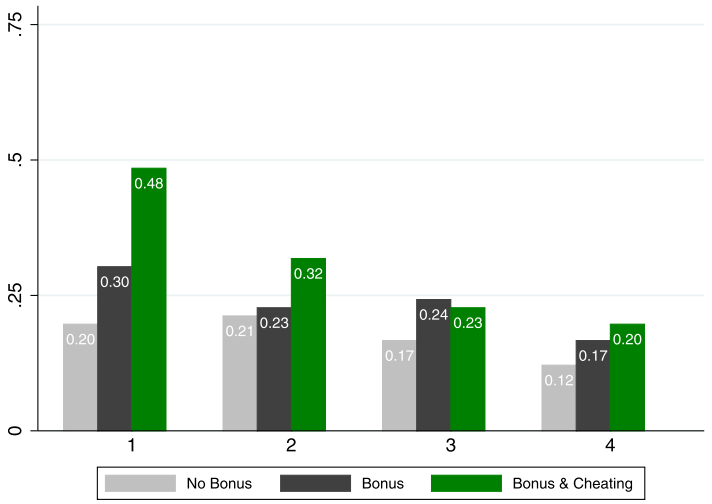

Fig. 3. Share of subjects facing income reductions by rank.

increases in income (ranks) in all treatments. This pattern is again most pronounced in *Bonus & Cheating*, where the likelihood of being targeted increases monotonically with the income ranking in the group. In particular, subjects ranked first are more than twice as likely to be the target of money burning than subjects ranked third or fourth (48 vs 23 and 20 percent). Remarkably, they are also more than twice as often the target of reductions compared to their counterparts in *No Bonus* (20 vs 48 percent).

Looking at the Gini coefficient after the income-reductions in *Bonus* and *Bonus & Cheating* reveals two notable patterns. First, income reductions of first-ranked subjects naturally increase inequality, on average, by 14 (*Bonus*) and 10 Gini points (*Bonus & Cheating*).[19] Second, the burning decisions of second and lower-ranked subjects decrease inequality, on average, by 5 Gini points in *Bonus* and by 7 Gini points in *Bonus & Cheating*. This provides further evidence that the vast majority of money burning aims at reducing inequality in the two bonus treatments and that this motive is more pronounced when inequality is unfair.

For more rigorous statistical evidence, I now turn to the results of a regression analysis. Remember that each subject made three decisions, i.e., one decision to reduce the income for each of the other three group members. While the previous analysis has only considered whether a subject burns the income of at least one other group member, the regression analysis instead looks at the three individual money-burning decision separately. As subjects first decide whether to burn money at all and then choose how much, I estimate a hurdle model (Cragg, 1971).[20] Table 4 presents the results for each treatment separately.

First, Table 4 shows that an expected reduction of own income through other group members increases the likelihood of burning others' income in all three treatments (columns 1, 3, and 5). Moreover, the expected reduction amount is positively associated with the extent of inflicted harm in all three treatments, albeit the coefficient is only significant in *No Bonus*. That expectations are related to the likelihood of the burning decision may reflect subjects' desire to retaliate to the expected money burning of others ("preemptive retaliation").[21] This would, for example, explain why top-ranked subjects engage in reducing the income of lower-ranked subjects since they are, in particular, in the two bonus treatments the prime target of money burning. In fact, top-ranked subjects expect that their income is more drastically reduced in the two bonus treatments than in *No Bonus* (7.5 euro vs 4.5 euro).

In *No Bonus*, subjects ranked third and fourth are more likely to reduce others' income than subjects ranked first, and first-ranked subjects are equally likely to be the target of money burning attempts than lower-ranked subjects (column 1). The picture is different for the amount of money burning. Subjects ranked second, third, and fourth burn more money than top-ranked subjects, but simultaneously they face less income reductions themselves, which decrease monotonically with ranks (column 2). The decision to burn as well as the amount of burning money is related to elicited emotions. Interestingly, elicited happiness is positively associated with both outcomes. While elicited surprise is not associated with

[19] There is some previous evidence that points to such inequality-increasing behavior (see e.g., Houser and Xiao (2010) for inequality-seeking punishment in a dictator game). However, the following analysis suggests that other factors may motivate first-ranked subjects' behavior as well.

[20] This model is a more flexible alternative to the Tobit model as it assumes that the decision to burn money and the amount burned are governed by different stochastic processes. The selection equation determines whether a subject clears the hurdle, and the outcome equation determines the value of the outcome conditional on having cleared the hurdle.

[21] Alternatively, the observed positive relationship between expected income reductions and burning decisions may simply reflect an ex-post rationalization of behavior as expectations were elicited after the burning decision.

Table 4
Regression: Decision to burn money and burned amount.

	No Bonus		Bonus		Bonus & Cheating	
	Selection	Outcome	Selection	Outcome	Selection	Outcome
Expectation	0.520***	0.593***	0.381***	0.137	0.462***	0.177
	(0.133)	(0.194)	(0.096)	(0.212)	(0.107)	(0.324)
Burner's rank: 2nd	0.943	1.483**	1.256**	−4.130**	1.818**	−1.041
	(0.692)	(0.714)	(0.621)	(1.999)	(0.821)	(3.549)
Burner's rank: 3rd	1.760**	2.052**	1.030	−6.554***	1.432	−0.930
	(0.783)	(0.886)	(0.674)	(2.314)	(0.893)	(3.025)
Burner's rank: 4th	2.625***	1.929**	1.937***	−1.307	1.568	1.470
	(0.985)	(0.815)	(0.727)	(1.629)	(0.975)	(3.393)
Target's rank: 2nd	0.152	−0.706**	−0.417***	−3.995***	−0.578***	−5.669***
	(0.141)	(0.312)	(0.152)	(0.567)	(0.177)	(0.911)
Target's rank: 3rd	−0.012	−1.069***	−0.492***	−4.423***	−1.078***	−5.518***
	(0.129)	(0.256)	(0.157)	(0.487)	(0.244)	(0.858)
Target's rank: 4th	−0.033	−1.586***	−0.466***	−4.185***	−1.305***	−7.098***
	(0.240)	(0.367)	(0.159)	(0.788)	(0.248)	(1.338)
Emotion: anger	0.016	0.431**	0.043	0.695***	0.341***	−0.035
	(0.174)	(0.184)	(0.102)	(0.221)	(0.105)	(0.428)
Emotion: surprise	−0.074	0.116	0.073	−0.191	−0.243**	−0.328
	(0.080)	(0.160)	(0.075)	(0.175)	(0.101)	(0.343)
Emotion: happiness	0.275**	0.472**	0.054	−0.903***	−0.039	−0.338
	(0.112)	(0.227)	(0.093)	(0.263)	(0.092)	(0.391)
Increased Performance					0.280	
					(0.313)	
Individual controls	yes		yes		yes	
N	264		264		264	
Pseudo R^2	0.39		0.28		0.27	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Cragg hurdle regression. "Selection" reports the parameter estimates for the selection model and "Outcome" reports the estimates for the outcome model. Each income-reduction decision constitutes an observation, i.e., three observations per subject, and standard errors (in parentheses) are clustered at the individual level. "Expectation" is the expected average reduction from others. Individual controls include sex, age, and a dummy variable indicating whether a subject is enrolled in science, technology, engineering, or mathematics (STEM field).

the burning decision or the amount of burning, the coefficient on elicited anger is positive in both models. However, it is only significantly related to the amount of money burning.

The introduction of the bonus in *Bonus* and *Bonus & Cheating* induces more inequality and as a consequence top-ranked subjects face significantly more income reductions in both treatments (column 3 and 5). At the same time top-ranked subjects engage in less money burning themselves. In particular, they destroy less often others' income than second-ranked subjects in both bonus treatments.

Looking at the amount of money burning, it is apparent that lower-ranked subjects typically face lower reductions of earnings than the top-ranked subjects. For example, in *Bonus & Cheating* the amount of money burning decreases monotonically with subjects' rank. Although top-ranked subjects are less likely to reduce others' income, they typically burn large amounts. In *Bonus* top-ranked subjects burn more income than second and third-ranked subjects, whereas in *Bonus & Cheating* there are no difference across all ranks. Elicited emotions seem to play little role for burning decisions in *Bonus*, but anger is positively and happiness negatively associated with the amount of money burning. The picture is reversed for *Bonus & Cheating*. While elicited anger is positively associated with the decision to burn, it plays no role in the amount of burning. Thus, it seems that elicited emotions do not systematically influence the decision or the amount of money burning in this setup.

The analysis shows that independent of the magnitude of inequality subjects in all ranks engage in money burning, suggesting that it is a broader phenomenon. Although it is typically the case that top-ranked subjects are less likely to become a transgressor than lower-ranked subjects. In situations with low inequality (*No Bonus*) all subjects are the targets of antisocial behavior, whereas higher inequality makes top-performers more vulnerable to the antisocial behavior of others. This is the case in both *Bonus* and *Bonus & Cheating* and is thus irrespective of whether the deservingness of greater rewards can be attributed to merit or whether the deservingness is unclear because subjects can artificially tweak performance. If top-ranked subjects are the target of money burning, they face harsher income reductions than other lower-ranked subjects in all three treatments. However, the level of the income reductions toward top-ranked subjects is highest in *Bonus & Cheating* and lowest in *No Bonus*. To summarize, while the level of money burning critically depends on whether inequality is fair or not, the qualitative patterns of money burning seem to be insensitive to such considerations.

4. Conclusion

This paper uses a controlled laboratory experiment to investigate how increasing inequality affects harmful behavior toward others. The experiment considers an environment where higher earnings are typically associated with higher effort and varies how fair and transparent this relationship is. More specifically, an increase in inequality can either be fully attributed to exerted effort or to a combination of exerted effort and unfair behavior.

The results reveal that the extent of antisocial behavior crucially depends on how transparent the increase in inequality is. Complementing previous findings (e.g., Zizzo and Oswald, 2001; Zizzo, 2003; Abbink and Sadrieh, 2009; Abbink and Herrmann, 2011), I find that antisocial behavior is prevalent even in a situation where subjects earn their income and where inequality is low. About 20 percent of subjects reduce the income of at least one other group member in the treatment with no performance bonus (*No Bonus*). Bonus payments naturally increase inequality within groups, and they also lead to more antisocial behavior. However, as long as increasing inequality clearly originates from exerted effort (*Bonus*) antisocial behavior is not statistically different from a situation without a bonus and low inequality as in *No Bonus*. This indicates that greater inequality does not by itself lead to more antisocial behavior. Rather, it depends on whether the increase in inequality can be unequivocally ascribed to effort, i.e., whether the increase is fair. When it is possible to inflate performance, as in *Bonus & Cheating*, 67 percent of subjects do so and believe that, on average, 71 percent of others will artificially enhance their performance as well. As a result, almost every second subject (42 percent) in *Bonus & Cheating* engages in antisocial behavior. Although the fairness of inequality plays a role in the degree of antisocial behavior, it is less relevant for the qualitative burning patterns as most income reductions aimed at reducing inequality in the two bonus treatments. That is, top-performers, i.e., those who received a bonus payment, are more often the target and face harsher reductions of income than other subjects in both *Bonus* and in *Bonus & Cheating*.

The results of this experiment provide evidence that inequality can indeed increase antisocial behavior. Gurr (1970), for example, argues that with rising inequality the opportunity costs of the disadvantaged decrease, while the inclination to engage in violent redistributive demands rise. This may relate to the observation that the share of labor devoted to the exercise of power (i.e., "guard labor") is positively associated to inequality (Jayadev and Bowles, 2006). Despite that, the empirical support for Gurr's thesis remains scarce. While the lack of support may simply reflect that inequality has no bearing on antisocial behavior, it is equally likely that other reasons account for the missing evidence, such as poor availability and quality of data or inadequate inequality measures that do not sufficiently capture the motives for antisocial behavior. The findings of this study clearly refute that there is no relationship between greater inequality and antisocial behavior, though in a stylized setting. Moreover, the results highlight the importance of the fairness of greater inequality, something that is neglected by commonly used indicators of inequality, such as the Gini coefficient.[22]

There are numerous anthropological and sociological accounts particularly about successful people in former socialist countries or China, who became victims of hostility and attacks by their less successful peers (see e.g., Mui, 1995). Some observers of the transition process in these countries note that people frequently engaged in some form of illegal activities and this may have increased their suspicion that individual success or an increase of inequality is closely tied to these activities (e.g., Smith, 1990). If success triggers antisocial behavior it is possible that people avoid getting ahead in the first place with detrimental effects on economic well-being and development.[23] Indeed, Cason and Mui (2002), for example, report on a lab experiment that provides a glimpse into how distributional conflicts prevent innovations from occurring. The study of Kebede and Zizzo (2015) corroborates this finding by relating real-life innovation behavior of farmers to their antisocial behavior in a lab-in-the-field experiment in Ethiopia. More precisely, they find that farmers adopt less agricultural innovations if they live in a community with high money-burning rates in the experiment. The findings of this study are consistent with these accounts. First, there is substantially more antisocial behavior when the income-generating process is unjust as a result of subjects having the possibility to inflate their performance. Second, the data reveal that money burning in *Bonus* and *Bonus & Cheating* is positively related to the income of other group members. This suggests that an important motive for this kind of destructive behavior is indeed the reduction of inequality, which can as a consequence hamper economic development.

The results may also have implications for organizational settings. Organizations often implement tournament-style compensation schemes where earnings and promotions depend on relative performance comparisons (Bognanno, 2001; Bothner et al., 2007; Casas-Arce and Martínez-Jerez, 2009). Yet such schemes are prone to unethical behavior, such as sabotage or performance-enhancing activities, and subjects frequently make use of such opportunities as evidenced by the results of *Bonus & Cheating*. More importantly, the results suggest that too large rewards may severely damage cooperation and interaction among co-workers.[24] This may explain why firms sometimes prefer smaller prize spreads or rely on substantial wage compression (Lazear, 1989).

[22] For a generalization of the standard Gini coefficient that captures different interpretations of what is considered to be a fair income distribution see e.g., Almas et al. (2011).

[23] It is often argued that strong norms of equality is one reason that holds developing countries back (Platteau, 2000). For example, the research by Jakiela and Ozier (2016) illustrate that individuals forgo profitable investments and opportunities in order to avoid the social pressure of sharing their fortune with their family or kin.

[24] In a similar fashion, a few studies demonstrate that competitive or discriminatory payment schemes can subsequently lead to less cooperation (Buser and Dreber, 2015) or more antisocial behavior (Grosch and Rau, 2017).

Appendix A. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.geb.2017.11.001.

References

Abbink, Klaus, Sadrieh, Abdolkarim, 2009. The pleasure of being nasty. Econ. Letters 105 (3), 306–308.
Abbink, Klaus, Herrmann, Benedikt, 2011. The moral costs of nastiness. Econ. Inquiry 49 (2), 631–633.
Abbink, Klaus, Masclet, David, Mirza, Daniel, 2011. Inequality and Riots–Experimental Evidence. CIRANO-Scientific Publication (2011s-10).
Akbaş, Merve, Ariely, Dan, Yuksel, Sevgi, 2016. When is Inequality Fair? An Experiment on the Effect of Procedural Justice and Agency. Mimeo.
Almas, Ingvild, Cappelen, Alexander, Lind, Jo Thori, Sørensen, Erik Ø, Tungodden, Bertil, 2011. Measuring unfair (in) equality. J. Public Econ. 95 (7), 488–499.
Alstadsaeter, Annette, Johannesen, Niels, Zucman, Gabriel, 2017. Tax Evasion and Inequality. NBER working paper 23772.
Anderson, Christopher, Putterman, Louis, 2006. Do non-strategic sanctions obey the law of demand? The demand for punishment in the voluntary contribution mechanism. Games Econ. Behav. 54 (1), 1–24.
Balafoutas, Loukas, Kocher, Martin, Putterman, Louis, Sutter, Matthias, 2013. Equality, equity and incentives: an experiment. Europ. Econ. Rev. 60, 32–51.
Barr, Abigail, Burns, Justine, Miller, Luis, Shaw, Ingrid, 2015. Economic status and acknowledgement of earned entitlement. J. Econ. Behav. Organ. 118, 55–68.
Barr, Abigail, Miller, Luis, Ubeda, Paloma, 2016. Moral consequences of becoming unemployed. Proc. Natl. Acad. Sci. 113 (17), 4676–4681.
Ben-Porath, Elchanan, Dekel, Eddie, 1992. Signaling future actions and the potential for sacrifice. J. Econ. Theory 57, 36–51.
Blattman, Christopher, Miguel, Edward, 2010. Civil war. J. Econ. Lit. 48, 3–57.
Bognanno, Michael, 2001. Corporate tournaments. J. Lab. Econ. 19 (2), 290–315.
Bolle, Friedel, Tan, Jonathan, Zizzo, Daniel, 2014. Vendettas. Am. Econ. J. Microecon. 6 (2), 93–130.
Bone, Jonathan, Raihani, Nichola, 2015. Human punishment is motivated by both a desire for revenge and a desire for equality. Evol. Hum. Behav. 36 (4), 323–330.
Bortolotti, Stefania, Soraperra, Ivan, Sutter, Matthias, Zoller, Claudia, 2017. Too Lucky to be True: Fairness Views under the Shadow of Cheating. CESifo Working Paper Series.
Bosman, Ronald, Van Winden, Frans, 2002. Emotional hazard in a power-to-take experiment. Econ. J. 112 (476), 147–169.
Bothner, Matthew, Kang, Jeong-han, Stuart, Toby, 2007. Competitive crowding and risk taking in a tournament: evidence from NASCAR racing. Adm. Sci. Q. 52 (2), 208–247.
Brosnan, Sarah, De Waal, Frans, 2003. Monkeys reject unequal pay. Nature 425 (6955), 297–299.
Buser, Thomas, Dreber, Anna, 2015. The flipside of comparative payment schemes. Manag. Sci. 62, 2626–2638.
Cappelen, Alexander, Drange Hole, Astri, Sørensen, Erik, Tungodden, Bertil, 2007. The pluralism of fairness ideals: an experimental approach. Amer. Econ. Rev. 97 (3), 818–827.
Cappelen, Alexander, Konow, James, Sørensen, Erik, Tungodden, Bertil, 2013. Just luck: an experimental study of risk-taking and fairness. Amer. Econ. Rev. 103 (4), 1398–1413.
Card, David, Mas, Alexandre, Moretti, Enrico, Saez, Emmanuel, 2012. Inequality at work: the effect of peer salaries on job satisfaction. Amer. Econ. Rev. 102 (6), 2981–3003.
Casas-Arce, Pablo, Martínez-Jerez, F. Asís, 2009. Relative performance compensation, contests, and dynamic incentives. Manag. Sci. 55 (8), 1306–1320.
Cason, Timothy, Mui, Vai-Lam, 2002. Fairness and sharing in innovation games: a laboratory investigation. J. Econ. Behav. Organ. 48 (3), 243–264.
Charness, Gary, Rabin, Matthew, 2002. Understanding social preferences with simple tests. Quart. J. Econ. 117 (3), 817–869.
Charness, Gary, Masclet, David, Villeval, Marie Claire, 2013. The dark side of competition for status. Manag. Sci. 60 (1), 38–55.
Cragg, John, 1971. Some statistical models for limited dependent variables with application to the demand for durable goods. Econometrica 39, 829–844.
Dawes, Christopher, Fowler, James, Johnson, Tim, McElreath, Richard, Smirnov, Oleg, 2007. Egalitarian motives in humans. Nature 446 (7137), 794–796.
DeCelles, Katherine, Norton, Michael, 2016. Physical and situational inequality on airplanes predicts air rage. Proc. Natl. Acad. Sci. 113 (20), 5588–5591.
Durante, Ruben, Putterman, Louis, van der Weele, Joël, 2014. Preferences for redistribution and perception of fairness: an experimental study. J. Eur. Econ. Assoc. 12 (4), 1059–1086.
Durkheim, Emile, 1893. De la division du travail social: étude sur l'organisation des sociétés supérieures. Alcan.
Erkal, Nisvan, Gangadharan, Lata, Nikiforakis, Nikos, 2011. Relative earnings and giving in a real-effort experiment. Amer. Econ. Rev. 101 (7), 3330–3348.
Fehr, Dietmar, Rau, Hannes, Trautmann, Stefan, Xu, Yilong, 2017. Inequality, Fairness and Social Capital. Mimeo.
Fehr, Ernst, Schmidt, Klaus, 1999. A theory of fairness, competition, and cooperation. Quart. J. Econ. 114, 817–868.
Fischbacher, Urs, 2007. z-tree: Zurich toolbox for ready-made economic experiments. Exper. Econ. 10 (2), 171–178.
Gächter, Simon, Herrmann, Benedikt, 2009. Reciprocity, culture and human cooperation: previous insights and a new cross-cultural experiment. Philos. Trans. R. Soc. Lond. B, Biol. Sci. 364 (1518), 791–806.
Gächter, Simon, Herrmann, Benedikt, Thöni, Christian, 2005. Cross-cultural differences in norm enforcement. Behav. Brain Sci. 28 (06), 822–823.
Gill, David, Prowse, Victoria, Vlassopoulos, Michael, 2013. Cheating in the workplace: an experimental study of the impact of bonuses and productivity. J. Econ. Behav. Organ. 96, 120–134.
Greiner, Ben, 2015. Subject pool recruitment procedures: organizing experiments with ORSEE. J. Econ. Sci. Assoc. 1 (1), 114–125.
Grosch, Kerstin, Rau, Holger, 2017. Do Discriminatory Pay Regimes Unleash Antisocial Behavior? Cege Discussion Paper Series.
Grossman, Philip, Komai, Mana, 2013. Within and Across Class Envy: Anti-social Behaviour in Hierarchical Groups. Monash University, Department of Economics.
Gurr, Ted, 1970. Why Men Rebel. Princeton University Press.
Herrmann, Benedikt, Thöni, Christian, Gächter, Simon, 2008. Antisocial punishment across societies. Science 319 (5868), 1362–1367.
Houser, Daniel, Xiao, Erte, 2010. Inequality-seeking punishment. Econ. Letters 109 (1), 20–23.
Jakiela, Pamela, Ozier, Owen, 2016. Does Africa need a rotten kin theorem? experimental evidence from village economies. Rev. Econ. Stud. 83 (1), 231–268.
Jayadev, Arjun, Bowles, Samuel, 2006. Guard labor. J. Devel. Econ. 79 (2), 328–348.
John, Leslie, Loewenstein, George, Rick, Scott, 2014. Cheating more for less: upward social comparisons motivate the poorly compensated to cheat. Org. Behav. Hum. Decis. Process. 123 (2), 101–109.
Kebede, Bereket, Zizzo, Daniel John, 2015. Social preferences and agricultural innovation: an experimental case study from Ethiopia. World Devel. 67, 267–280.
Konow, James, 2000. Fair shares: accountability and cognitive dissonance in allocation decisions. Amer. Econ. Rev. 90 (4), 1072–1091.
Konow, James, 2003. Which is the fairest one of all? A positive analysis of justice theories. J. Econ. Lit. 41 (4), 1188–1239.
Krawczyk, Michał, 2010. A glimpse through the veil of ignorance: equality of opportunity and support for redistribution. J. Public Econ. 94 (1), 131–141.
Kuziemko, Ilyana, Buell, Ryan, Reich, Taly, Norton, Michael, 2014. "Last-place aversion": evidence and redistributive implications. Quart. J. Econ. 129 (1), 105–149.

Lazear, Edward, 1989. Pay equality and industrial politics. J. Polit. Economy 97, 561–580.
Leimgruber, Kristin, Rosati, Alexandra, Santos, Laurie, 2016. Capuchin monkeys punish those who have more. Evol. Hum. Behav. 37 (3), 236–244.
Mollerstrom, Johanna, Reme, Bjørn-Atle, Sørensen, Erik, 2015. Luck, choice and responsibility: an experimental study of fairness views. J. Public Econ. 131, 33–40.
Mui, Vai-Lam, 1995. The economics of envy. J. Econ. Behav. Organ. 26 (3), 311–336.
Norton, Michael, Ariely, Dan, 2011. Building a better America—One wealth quintile at a time. Perspect. Psychol. Sci. 6 (1), 9–12.
Piketty, Thomas, 2014. Capital in the Twenty-First Century. Harvard University Press.
Platteau, Jean-Philippe, 2000. Institutions, Social Norms and Economic Development. Harwood Academic Publishers.
Prediger, Sebastian, Vollan, Björn, Herrmann, Benedikt, 2014. Resource scarcity and antisocial behavior. J. Public Econ. 119, 1–9.
Raihani, Nichola, McAuliffe, Katherine, 2012. Human punishment is motivated by inequity aversion, not a desire for reciprocity. Biol. Lett. 8 (5), 802–804.
Rey-Biel, Pedro, Sheremeta, Roman, Uler, Neslihan, 2015. When Income Depends on Performance and Luck: The Effects of Culture and Information on Giving. Mimeo.
Roemer, John, 1998. Equality of Opportunity. Harvard University Press.
Sen, Amartya, 1973. On Economic Inequality. Oxford University Press.
Smith, Hedrick, 1990. The New Russians. Random House.
Tonin, Mirco, Vlassopoulos, Michael, 2017. Sharing one's fortune? An experimental study on earned income and giving. J. Behav. Exper. Econ. 66, 112–118.
Van Damme, Eric, 1989. Stable equilibria and forward induction. J. Econ. Theory 48, 476–496.
Wilkinson, Richard, Pickett, Kate, 2009. Income inequality and social dysfunction. Annu. Rev. Sociol. 35, 493–511.
Zizzo, Daniel, 2003. Money burning and rank egalitarianism with random dictators. Econ. Letters 81 (2), 263–266.
Zizzo, Daniel, Oswald, Andrew, 2001. Are people willing to pay to reduce others' incomes? Ann. Econ. Statist., 39–65.