



Who helps whom?

Risk Taking and Solidarity in a Virtual World Experiment

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Discussion Paper No. 310
December 2011
ISSN 1860 0921

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Abstract

Most incomes underlie some risk, i.e. ex ante they can be regarded as a lottery ticket. In every society, the lucky winners of this lottery compensate unlucky losers (unemployed workers or bankrupt entrepreneurs) privately and/or by public insurances. Do voluntary solidarity payments depend on the amount and origin of risk of winners and losers? We differentiate between people with riskless incomes (civil servants), with low risk incomes (workers), and with high risk incomes (entrepreneurs). Some of our subjects had no choice of their risk class (civil servants and some workers), some of them had the choice to be a worker or an entrepreneur. The main stylized results are: (i) Civil servants and lucky workers with and without a choice transfer similar shares of their income to unlucky workers, but (ii) discriminate against unlucky entrepreneurs. (iii) Lucky entrepreneurs give about the same share of their income to unlucky workers as lucky workers do and (iv) do not significantly discriminate. (v) The potential solidarity payments are not an incentive for taking higher risks.

Keywords: Solidarity, responsibility, risk taking

JEL Numbers: D63, D64

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1. Introduction

Most incomes underlie some risk, i.e. ex ante they can be regarded as a lottery ticket. In every society, there are voluntary private solidarity transfers from the lucky winners of the lottery to the unlucky losers and in developed countries there are public schemes which help people without income. In this paper we ask whether voluntary solidarity payments depend on the amount and the origin of risk of winners and losers. We differentiate between people with riskless incomes (civil servants), with low risk incomes (workers), and with high risk incomes (entrepreneurs). Of course, risk may have other sources than the type of job one fills. Health, for example, is another important determinant for income and welfare. Some people may have the impression that they never had a choice to influence the risk class they are in. Others know that they had the chance, and they had consciously decided one way or the other. When people make a decision about helping a needy person from their neighborhood or when they decide via elections about public unemployment compensation, welfare payments, and health insurances they may differentiate their help according to the risk class and according to the question whether the risk class was chosen voluntarily. The latter is not always possible, at least not with objective criteria (though smoking or striving for a career as an artist is an objective clue). In personal relations it is the impression of the benefactor which counts.

An environment with risky incomes and solidarity is ideally described by the Solidarity Experiment of Selten and Ockenfels (1998) which has meanwhile been replicated and varied several times (Ockenfels and Weimann, 1999; Büchner et al., 2007; Trhal and Radermacher, 2009; Bolle et al., 2012; Brosig et al., 2009; Costard and Bolle, 2011). In the original Solidarity Game there is a group of three players. Each player is independently endowed with €10 with a probability of 2/3 and with €0 with a probability of 1/3. If there are winners and losers in a group the winners can transfer money to the losers. The majority of subjects in Solidarity Experiments are willing to send positive money transfers to the victims of bad fate. In the above terms, the original Solidarity game has only workers without a choice of their lottery ticket.

A simpler environment with solidarity payments is the two-person Dictator game which has often been used to investigate the influence of social proximity,

communication, and property rights (from working for one's income). Often, however, a group of three allows the investigation of more differentiated questions. In the one-loser case of the Solidarity game, for example, it may be asked whether the (known or expected) contributions of the other winner increases or decreases a winner's transfer to the loser¹. For our investigation, it can be interesting whether a winner who is confronted with two different losers discriminates between them.

Our investigation has connections with all kinds of distribution experiments and with the norms of redistribution which are discussed in those studies. The question how income transfers should be related to ex ante behavior of income creation is related to the general discussion about fairness standards and responsibility for oneself² (Roemer, 1998). Konow (2000), Frohlich et al. (2004), Cappelen et al. (2007) and Tungodden et al. (2010) investigate behavior in Dictator experiments with a production phase preceding the distribution phase. Buitrago et al. (2009) use a variant of the Samaritan's Dilemma to find behavioral standards of helping behavior.

More important for our problem, however, is the small number of papers which is explicitly concerned with ex ante choices of individual risk and the redistribution of ex-post income³. These are Thral and Rademacher (2009) and Costard and Bolle (2011), who conduct experiments with variants of the Solidarity game, and Cappelen et al. (2010) where members of a two-person group can choose between a risky and a riskless income and where the aggregate ex-post income may be redistributed by one of the group members or by a "spectator" without own interests. The results of the three papers will be compared in Section IV with the results of this investigation.

In our experimental investigation we introduce, in addition to workers, also civil servants (riskless income) and entrepreneurs (twice the income of a worker with half of the probability). Of course, in the experiment they were not called civil servants or workers or entrepreneurs. Some of the subjects had no choice of their risk class (civil servants and some workers) and some of them had the choice to be a worker or an

¹ Different social utility functions can imply a positive or negative or no influence of the other winner's transfer. For a theoretical and empirical investigation of this question see Bolle et al. (forthcoming).

² To be distinguished from responsibility for others. For an experimental investigation of the latter see Bolle and Vogel (2011).

³ A complementary problem is discussed by Brock et al. (2010), namely redistribution by transferring lottery tickets instead of riskless money.

entrepreneur. In contrast to all the other experiments ours is conducted in a virtual world (EVE online). The main stylized results are: (0) The basic Solidarity Game shows the same results in the virtual world as in the classroom/ laboratory. (i) Civil servants and workers with and without a choice act similarly towards unlucky workers, but (ii) discriminate against unlucky entrepreneurs. (iii) Lucky entrepreneurs give about the same share of their income to unlucky workers as lucky workers do and (iv) do not significantly discriminate. (v) The potential solidarity payments are not an incentive for taking higher risks (moral hazard). (vi) Living in a country with a communist history does not influence the amount of solidarity. (vii) Risk preferences and personality have some influence on the choice of the high risk income.

As far as we know (i) is a new result. (ii) has been observed, though only for workers who had a choice by Costard and Bolle (2011)⁴ and, with other risk classes than we use, by Trhal and Radermacher (2009) and Cappelen (2010). (iii) and (iv) contradict Trhal and Radermacher (2009) and are only in weak accordance with Cappelen et al. (2010). (iv) does not *significantly* replicate Costard and Bolle (2011) who found that entrepreneurs discriminate in favor of unlucky entrepreneurs. (v) is a bit surprising because there is much evidence of moral hazard in the lab (e.g. Cox et al., 1996, for cost sharing contracts) as well as in the field (e.g. Edelberg, 2003, for consumer loans). (vi) contradicts studies of Ockenfels and Weimann (1999) and Brosig et al. (2010). (vii) is not very surprising but, together with (0) it may serve to strengthen the trust in our virtual world experiment.

Virtual worlds such as World of Warcraft, Second Life, and EVE online constitute an interesting new environment for experiments. With small costs it is possible to reach alternative samples of subjects and though these virtual worlds are inhabited mostly by young male individuals they may offer more variation⁵ than the narrow student subject pool of most other economic experiments. Transaction costs are small, for the participant as well as for the experimenter, because all interaction takes place

⁴ The present paper is a follow-up investigation which, first, tries to replicate (mainly successfully) the results of Costard and Bolle (2010) for another subject pool, and which, second, introduces more player types, investigates moral hazard, relates the choice of high risk income with other traits, and looks for evidence of a “myth” about an effect on solidarity from being raised in an ex-communist region.

⁵ At least the virtual world sample provided us with a sample of mainly non-students and with participants from all regions of Germany (necessary for result (vii)), while our university subjects are mostly regional students.

from one's home or office PC. The disadvantage of experiments in a virtual world is a certain loss of control. For example, one has to avoid participation of the same individual with multiple virtual selves. Another issue is the trust of the participants in the experimenter's honesty and willingness to pay the promised rewards. Contrary to classroom/laboratory experiments the experimenter does not have a reputation (as a member of her university) and there is no authority for claims. Otherwise, questions of internal and external validity are similar to those in conventional experiments.

An important example of virtual world experiments is Chesney et al. (2009) who conducted Ultimatum, Dictator, Public Good, Minimum Effort and Guessing Game experiments in Second Life. By and large, they reproduce the results of traditional experiments. Further experiments have been conducted by Spann et al. (2008, Dictator Game in World of Warcraft), Atlas and Putterman (2009), Fiedler and Haruvy (2009), Füllborn et al. (2009), all investigating the Trust Game/Investment Game in Second Life. Nicklisch and Salz (2008) investigated a Gift Exchange (wages and effort) experiment in World of Warcraft. Fiore et al. (2008) investigate a Public Goods game in an environmental framework. Again there were no major differences between student subjects in laboratories and virtual world subjects. Our topic, the Solidarity Game, has not been investigated in the virtual world.

In Section 2 we describe our experiments, in Section 3 we report the results, and in Section 4 we discuss our results and relate them in particular to the results of Trhal and Radermacher (2009), Cappelen et al. (2010), and Costard and Bolle (2011).

2. The Experiments

We differentiate between the following lottery tickets and types of players (situations):

Lottery tickets:

- A yields mISK⁶ 100 with prob = 2/3, 0 with prob = 1/3
- B yields mISK 200 with prob = 1/3, 0 with prob = 2/3

Players (situations):

⁶ ISK is the EVE online currency. While the experiment was conducted one could buy the currency with an exchange rate of about 21 mISK/€.

- C-players have a completely certain income of mISK 100.
- CA-players hold a lottery ticket A; they had no choice of lotteries.
- A-players had the choice between lottery tickets A and B and have chosen A.
- B-players had the choice between lottery tickets A and B and have chosen B.

AC-losers, A-losers, and B-losers were unlucky and received 0 from their lottery ticket. AC-winners, A-winners, and B-winners were lucky and received their respective prize.

The first phase of our experiment consisted of recruiting experimental subjects. The experiment was announced in official EVE online forums. Applicants were informed that the experiment would be in German and they were required to fill a register form with (virtual world) name, age, gender, and home country (in the case of Germany also Bundesland). In order to make double play costly, new applicants with the same IP address as a former applicant were not accepted. Another 14 applicants were eliminated because we had the suspicion that their knowledge of German was not satisfactory. We carried out our experiments with 332 applicants who were randomly distributed on the following four experiments. In addition to further payments every participant received a “show up” fee of mISK 10.

In Experiment 1 (72 subjects) the original Solidarity Game was replicated with lottery A. The three AC-players decided about their transfers as winners before the lottery ticket A had materialized in an income of mISK 0 or mISK 100 (as in Selten and Ockenfels, 1998). This *strategy method* is used also in all other experiments. A comparison with former classroom and laboratory experiments served to detect (or not) differences in the results which should be appropriated to differences between the subject pools and/or the environment.

In Experiment 2 (110 subjects) one of the three members of a group received a certain income of mISK 100, while the other two members had a lottery ticket A. All players decided about their transfers, the C-player unconditionally, the two AC players conditional on being winners. This experiment should tell us whether receivers of riskless incomes show more or less solidarity than receivers of risky incomes.

In Experiment 3 (114 subjects) again one of the three subjects got a certain income of mISK 100. The other two subjects had the choice of lottery tickets A or B. This experiment should tell us whether risky choices B are “punished” with less solidarity. Note that players knew when they chose A or B that there would be a “solidarity phase” after the realization of lottery tickets income.

In Experiment 4 (36 subjects) the participants had the choice between A and B but without any solidarity payments. The comparison of the frequency of B choices in Experiments 3 and 4 indicates whether there is a moral hazard problem in Experiment 3, namely that many subjects chose the risky choice B because they felt “insured” by the expected solidarity of their group.

It is important that the participants trust in the ability and willingness of the experimenter to pay them and in the unbiasedness of the random mechanism which determined their income (for those who received a lottery ticket). The first issue is solved by the transfer of bn ISK 30 to the custodian Chribba who is known in the EVE online world. The Chribba institution also manages a dice tool (used for professional lotteries in EVE). The dice tool carried out a random draw for every participant. The participants could see the date and the result of this random draw after visiting Chribba.

In addition to the decisions in Experiments 1 to 4, every participant reported expectations with respect to the decisions of others and filled a questionnaire asking for personal data as age, gender and description of their virtual world character (all this is not analyzed here), the “paired lotteries” questionnaire for the measurement of risk aversion (Holt and Laury, 2002), and a personality questionnaire 16 PA (Brandstätter, 1988). In the Appendix, we provide as an example the English translation of the instructions for Experiment 3. The personality questionnaire we used is to be found in Brandstätter (1988) and the risk questionnaire in Holt and Laury (2002). The German version of all instructions and questionnaires is provided in Lübke (2010), where also some results about behavioral differences according to gender, etc. can be found.

3. Results

First of all, let us describe our subjects according to the restricted number of personal data we collected. 274 (83%) of the selected 332 applicants filled out all experimental questionnaires (with small variations over the experiments). 41 of these live in East Germany and 191 in West Germany. 98% of our participants are male which indicates that the sample is by no means representative for the general population⁷. Ages reached from 15 to 52 years (mean value 28.0). From our question concerning education we can estimate that the student share was less than 10% and the share of subjects with a university degree was about 12%. Therefore our subject pool is certainly different from the usual (economics) student population.

III.1 Do students and inhabitants of EVE online behave similarly?

Experiment 1 was a replication of the original Solidarity Game and served to confirm the comparability of our subjects from the virtual world and the student subjects from “normal” economic experiments. Transfers in the one-loser case were on average 22% of endowment and, in the two-loser case, 16% of endowment (to both losers). Selten and Ockenfels (1998) observed rather similar averages, namely 25% and 16%.

Result (0): In the original solidarity game, there are no significant differences between the behavior of EVE online subjects and those of Selten and Ockenfels (1998).

III.2 Does solidarity depend on own and other's risk and choice of risk?

In Experiment 2 one of the members (type C) of a group got a riskless income⁸ while the other two members (type CA) got a lottery ticket A. The CA-players had to indicate their transfers only for the one-loser case; C-players indicated transfers for the one- and the two-loser cases. The average transfers were rather similar, namely

⁷ On the other hand, with 98% men we can be rather confident that we were provided with the real gender of our subjects and not with that of avatars where gender swapping (mainly men pretending to be women, see Hussain and Griffiths, 2008; Huh and Williams, 2009) is relatively frequent.

⁸ C-players are in the same situation as the dictators in Dictator experiments. If they are aware that they got their position randomly then the only difference to CA-players is that they decide unconditionally because they know already that they are winners.

21.5% by C-players and 22.5% by CA-players (22.0% by the CA-players in Experiment 1).

In Experiment 3, again one of the members received a riskless income C. The other two members had the choice of a lottery ticket A or B. Types A and B determined transfers only in the one-loser case, type C in the one- and two-loser cases. 42 of 63 (66.7%) who had the choice chose lottery A. This percentage seems to be surprisingly small compared with a similar choice in Cappelen et al. (2010) where more than 90% decided for the less risky alternative. There is, however, a crucial difference between the choice situations. A and B are both risky lotteries with the same expectation value, while Cappelen et al. (2010) let their subjects decide between a riskless and a risky lottery ticket (in the above comparison also with the same expectation value). The different results illustrate the well known certainty bias (e.g. Cohen and Jaffray, 1988). Another reason for the many risk seekers in this experiment could have been the “insurance” by expected solidarity payments. As announced already, this will be excluded by result (v).

C-players, A-winners, and AC-winners behave similarly. On average, in the one-winner case (Table 1), they give A-losers between 17.2% and 20.6% of their income and they all discriminate significantly against B-losers who get only 11.9% and 14.7%. In the two-loser case (Table 2), CA-winners from Experiment 1 gave about the same amount to both CA-losers (16.0%) as C-players in Experiment 2 did (15.4%). The discrimination of the C-players against B-losers is particularly visible in the two-loser case of Experiment 3 (Table 2) where A-losers receive on average 18.8% of the C-player’s endowment while B-losers receive only 13.5%.

B-winners’ solidarity towards A-losers (17% of their income), is nearly as strong (not significantly different) as that of A-winners, AC-winners, and C-players. In absolute terms B-winners transfer double as much as the others. They are different insofar as they show nearly as much solidarity with B-losers (giving 19% of their income) as with A-losers (17%, Table 1). This implies that they give significantly more to B-losers than the other players do. The “asymmetric” solidarity which is expressed by these results will be discussed in the last section of this paper.

Table 1: Transfers (percentage of income) x_1 in the one-loser case.

*(**) significantly different from transfers to A-losers according to Wilcoxon matched-pairs signed-rank tests, 5% level (1% level). + significantly different from transfers by C-types and A-winners to B-losers according to a Mann-Whitney U-test, 5 % level.

| Transfers | by C-players | | by CA-winners | | by A-winners | by B-winners |
|--------------|--------------|--------------------|---------------|--------|-------------------|-------------------|
| | Exp.2 | Exp. 3 | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 3 |
| to CA-losers | 21.5 | - | 22.0 | 22.5 | - | - |
| to A-losers | - | 17.2 | - | - | 20.6 | 17.0 |
| to B-losers | - | 11.9 ^{**} | - | - | 14.7 [*] | 19.0 ⁺ |

Table 2: Transfers (percentage of income) x_2 in the two-loser case.

In Experiment 3 averages of the cases two A(B) losers and one A-/one B-loser.

§ = significantly less than to A-losers (Wilcoxon matched-pairs signed-rank tests, $p < 0.001$)

| Transfers | by C-players | | by CA-winners |
|--------------|--------------|-------------------|---------------|
| | Exp. 2 | Exp. 3 | Exp. 1 |
| to CA-losers | 15.4 | - | 16.0 |
| to A-losers | - | 18.8 | - |
| to B-losers | - | 13.5 [§] | - |

Results: Players in the Solidarity Game seem to separate into two groups: the low risk group (low income without risk or with mandatory low risk or with chosen low risk) and the high risk group (high income with high risk). (i) Players of the low risk group transfer similar amounts to low risk losers (about 17.2% to 22.5% of income in the one loser case), but (ii) discriminate against high risk losers who get significantly less. (iii) High risk winners give nearly the same share of their income as low risk winners to low risk losers but (iv) do not significantly discriminate. Their transfers to high risk losers are significantly larger than those from low risk winners.

III.3 Do East Germans show less solidarity than West Germans?

Ockenfels and Weimann (1999) and Brosig et al. (2010) find East German students to show significantly less solidarity than West German students. We do not replicate such differences in EVE online. On the contrary, our East German subjects (defined by current residence) seem to be a bit (though not significantly) more generous than their West German co-citizens (see Table 3). The experiments are not completely comparable (different subjects, different environment, different definition of being “East” or “West”), which may explain the large differences between the East contributions and between the West contributions of the studies. Nonetheless our results show that we have to be cautious when comparing East/West German patterns of behavior. In particular, general conclusions on the perpetual influence of socialistic culture need a broader empirical basis.

Table 3: Comparison of east and west German subjects’ solidarity measured by percentage of endowment sent to losers. $X_k(N)$ = transfer to k loser(s), $k=1, 2$. N =number of subjects.

| | Ockenfels and Weimann (1999) | | Brosing et al. (2010) | | EVE online | | EVE online | |
|------|------------------------------|---------------|-----------------------|--------------|--------------|-------------|----------------|---------------|
| | Treatment 1 | | Treatment 1 | | Treatment 1 | | all treatments | |
| | $x_1(N)$ | $x_2(N)$ | $x_1(N)$ | $x_2(N)$ | $x_1(N)$ | $x_2(N)$ | $x_1(N)$ | $x_2(N)$ |
| East | 18.2 (60) | 11.5 (60) | 9.5 (54) | 6.6 (54) | 20.2 (6) | 16.0 (6) | 25.6 (43) | 17.0 (24) |
| West | 25.8 (120) | 16.1 (120) | 22.6 (90) | 14.1 (90) | 26.0 (50) | 9.6 (50) | 18.7 (198) | 15.6 (127) |

Result (v): East and West German inhabitants of EVE online do not differ significantly with respect to their solidarity transfers.

III.4 Are risky choices due to moral hazard?

Did B-players dare to choose the risky lottery only on the background of the expected solidarity of other group member? The lower transfers of the low income players to B-losers may be partly caused by such a suspicion. The question whether B-types

reveal moral hazard behavior is investigated by comparing Experiment 3 with Experiment 4 where subjects could choose between lotteries A and B without a subsequent phase of solidarity transfers. The plain result is that lottery A is chosen with the same frequency in both experiments, namely 66.7% in Exp. 3 and 69.7% in Exp. 4.

Result (vi): High risk choices are independent of the “insurance” by the solidarity group.

III.5 Are risky choices due to general risk preferences? Are risky choices supported by certain personality traits?

General risk preferences were measured with a proposal of Holt and Laury (2002). Subjects had to decide for 10 probabilities p between a low risk option $L=(mISK 16$ with p , $mISK 20$ with $1-p$) and a high risk option $H=(mISK 1$ with p , $mISK 38.5$ with $1-p$), $p=0, .1, \dots, .9$. A risk neutral subject should choose L four times (for $p=.6, .7, .8, .9$). Thus subjects who choose L less than four times are called risk loving, those who choose exactly four times L are called risk neutral, and those who choose L more than 4 times are called risk averse. The number of choices of L is a measure of risk aversion. As in Holt and Laury (2002) one of the choices is selected randomly and paid according to the outcome of the lottery.

Those who chose B in Experiment 3 (4) chose L on average 5.29 (5.30) times, those who chose A showed more risk aversion also according to the Holt & Laury measure, namely 6.57 (6.17) times. Both differences are significant in a Mann-Whitney U-test with $p<.01$. Note that even those who chose B are on average risk averse according to the Holt & Laury measure.

Brandstätter (1988) develops a simplified personality test which relies on a subject's self-evaluation with respect to 32 pairs (right and left) of attributes. On a scale between -4 and $+4$ the subjects have to indicate to which extent the left or the right attribute applied. According to factor loadings derived by Brandstätter (1988), values of five factors (self-control, emotional stability, independence, tough-mindedness, extroversion) are determined.

We find that, in Experiment 3, B-types show more *emotional stability* and more *independence* than A-types (Mann-Whitney U-test, $p < .05$). Perhaps due to the lower number of subjects, we find no significant differences in Experiment 4. Beyond these plausible differences we find similar personality traits for A- and B-types.

Result (vii): The choice of the high risk/ high income lottery B is negatively correlated with a measure of *risk aversion*. B-types show more *independence* and more *emotional stability* than A-types.

3. Solidarity theory

The structure of solidarity transfers can be explained by a social utility function suggested by Cappelen et al. (2010) and generalized by Costard and Bolle (2011). In the one winner/two losers case i 's utility V_i is

$$(1) \quad V_i = \gamma_i - \beta_i (y_j - F^{k(j)})^2 / 2X - \beta_i (y_h - F^{k(h)})^2 / 2X .$$

y_i is the income which winner i reserves for himself and y_j and y_h are the losers' incomes, i.e. i 's transfers to them. $X = y_i + y_j + y_h$ is i 's prize (mISK100 or mISK200). γ is a general and β_i is an individual positive parameter. $F^{k(j)}$ is an individual fairness standard for j 's income which can take one of three forms. For a share λ^{EP} of the population the ex post standard "equality of income", i.e. $F^{k(j)} = F^{EP} = X/3$ is assumed to be fair; for a share λ^{EA} it is the ex ante standard "equality of opportunity" (everybody has the same options) with $F^{k(j)} = F^{EA} = f^{EA} * X < F^{EP}$. For a share $\lambda^{CE} = 1 - \lambda^{EP} - \lambda^{EA}$ a conditional fairness standard applies: F^{EP} is fair if i and j both "have chosen the same lottery ticket" and $F^{k(j)} = F^{CE} = f^{CE} * X < F^{EP}$ is fair otherwise. For this investigation we define "choice of the same lottery ticket" as a="having no choice or choosing A" and b="having a choice and choosing B". a-players and b-players with a conditional fairness norm show in-group favouritism. The social utility function yields the forecast

$$(2) \quad \frac{y_j}{X} = \max\left\{0, \frac{F^{k(j)}}{X} - \frac{\gamma}{\beta_i}\right\}$$

and correspondingly for loser h. $F^{k(j)} / X = f^{EA}$ or f^{CE} or $1/3$ implies that the in-group transfers of a-players and b-players (as shares of their prize) should be the same. Also the out-group transfers should be the same. In-group transfers should be larger than out-group transfers. In the last section, all these relations have been shown to apply with the only exception that b-players (B-winners) do not give significantly more to b-players than to a-players (A-losers).

If there is one loser j and a second winner h then, from i's point of view,

$$(3) \quad V_i = \gamma y_i - \beta_i (E_i y_j - F^{k(j)})^2 / 2X - \beta_i (E_i y_h - F^{k(h)})^2 / 2X$$

$E_i y_j = t_i + E_i t_h$ is the loser's expected income after i's transfer t_i and h's expected transfer $E t_h$. When only C and CA players are present, i.e. in Experiments 1 and 2, X is mISK 200, in Experiment 3 (where one player is a C-player) every A- or B-winner knows that the C-player must be the second winner, i.e. X is i's lottery prize plus mISK 100. Only for the C-player in Experiment 3 X has to be estimated. If C-player i guesses the share of A-players to be α_i then the conditional probability that the only other winner is an A-player is $\delta_i = 4\alpha_i / (1 + \alpha_i)$. The C-player expects $X = mISK (100 + \delta_i * 100 + (1 - \delta_i) * 200)$.

i's maximization of (3) yields

$$(4) \quad t_i = X \max \left\{ 0, \frac{F^{k(j)}}{X} - \frac{E_i t_h}{X} - \gamma / \beta_i \right\}.$$

(4) should be regarded as i's best reply in the game he plays with h. For $t_i > 0$ expected contributions of h completely crowd out i's own contributions. Therefore, under utility functions (3), the game between i and h has a Nash (under complete information) or Bayesian equilibrium with fixed total but indeterminate individual contributions. This poses the question where the expectations $E_i t_h$ should come from and whether the elicited expectations are those we need to know in (4). For a

discussion of the question whether i 's transfer is determined by or determines i 's expectations $E_i t_h$, see Selten and Ockenfels (1998).

If the relative expectations $E_i t_h / X$ are the same over player classes and experiments then, after substituting the prize in Table 1 by the aggregate income X , the same relations should hold as indicated in Table 1 for the one winner/two losers case, but with X equal to the (expected) sum of both winners' income. Table 3, however, shows that there are (significant) differences of expectations. B-winners significantly expect C-players to decide in favor of their group. A-winners expect the contrary and also C-players expect the other players to decide in favor of A. This supports the conclusions from Table 1 because, according to (4), higher expected transfers for a group should crowd out the contributions to this group. In spite of this, also relative to X , B-winners give more to B-losers (12.7%) than to A-losers (11.1%) and A-winners and C-players give significantly ($p < 0.05$) more to A-losers (10.3% and 7.4%) than to B-losers (7.4% and 5.2%). Thus we observe in-group favoritism also if transfers are measured relative to X .

Table 3: Expectations of the other winner's transfers as percentage of aggregate income X in the one-loser case.

* Significantly different from expectations by C-players about transfers to A-losers and CA-losers (Mann-Whitney U-test, $p < 0.05$). + Significantly different from B-winners' expectations about transfers to A-losers (Wilcoxon matched-pairs signed-rank test, $p < 0.05$)

| Transfers to | Expectations by C-players | | Expectations by CA-winners | | Exp. by A-winners | Exp. by B-winners |
|--------------|---------------------------|--------|----------------------------|--------|-------------------|-------------------|
| | Exp.2 | Exp. 3 | Exp. 1 | Exp. 2 | Exp. 3 | Exp. 3 |
| CA-losers | 10.7 | - | 8.2 | 8.8 | - | - |
| A-losers | - | 8.7 | - | - | 9.3 | 6.6* |
| B-losers | - | 7.8 | - | - | 7.0 | 8.9 ⁺ |

4. Discussion and Conclusion

The members of a society vary a lot with respect to the risk they take. Some would never give up their secure job for an opportunity to double their income in a young firm with an insecure fate; some would. Both types are insured by the same social insurance, but in case of bad fortune social insurance is not everything. The well-being of the jobless depends to a great deal on how they are treated by their friends and family. Will someone who decided for greater risk and failed get less empathy and personal help than someone who did not “tempt fate”? Some people drive their cars more riskily than others; some are engaged in dangerous sports activities, some smoke and eat junk food, etc. Is there less pity for “self-inflicted harm” if those people are injured or get cancer? The question in such cases is: Who is ready to help whom?

This question is answered by the results (i), (ii), (iii), and (iv) from above. We find always the same average transfers (about 20% of a winner's income in the one-loser case), except from the no risk C-players and the low risk A-winners to the high risk B-losers (only about 13% of the winners income). Let us now compare these results with other investigations of redistribution behavior.

Trhal and Radermacher (2009) compare transfers in the original Solidarity Game ST (our experiment 1) with transfers in a game RT where all participants can choose between a completely safe option S of €10 (with prob = 1) and a risky option R (€0 with prob = 0.5, €10 with prob = 0.4, €60 with prob = 0.1)⁹. Contrary to our study, the winners did not know whether the receiver(s) of their transfers had chosen S or R, but in RT losers received fewer transfers than in ST which is interpreted by the authors as a tendency not to reward self-inflicted harm. As all subjects took part in both experiments subjects in ST could be classified according to their choice in RT. Transfers in RT are lower than those in ST even from those who decided for risk themselves. Our results significantly contradict this indirect observation. Note, however, that the order in which the experiments ST and RT are conducted is crucial: the differences between the S-players' solidarity payments are much smaller if the

⁹ The options are called A and B in Trhal and Radermacher (2009); they are relabelled here in order not to confuse them with our options A and B.

games are played in the order RT-ST than in opposite order. Possibly the self-image of the players develops only after they have decided in the RT game, and possibly only after the RT game has been played they are aware that, in the ST game, they are confronted with the same mixture of S- and R-players as in RT.

Costard and Bolle (2010) give all three members of a group the choice between lottery A (€10 with prob = 2/3, €0 with prob = 1/3) and lottery B (€20 with prob = 1/3, €0 with prob = 2/3). They find that A-winners transferred more to A-losers than to B-losers and that B-winners transferred more to B-losers than to A-losers. Perhaps due to the different subject pool, the result of Costard and Bolle (2010) is only partly confirmed by our study. Our B-winners transferred only insignificantly more to the B-losers than to the A-losers.

Cappelen et al. (2010) give their subjects first a binary choice of either a riskless income or a lottery ticket. Then the ex-post aggregate income of two randomly matched subjects can be redistributed by one of them or by a spectator without own interests. Cappelen et al. (2010) find that the redistribution behavior of their subjects can be explained by social utility functions, one of which discriminates between risk seekers and risk averters. This is in principle supported by our experiment. There are, however, indications that risk seekers are different from risk-averters beyond their risk preferences, a question which has not been investigated by Cappelen et al. (2010).

The differences between these four studies need not indicate a fundamental contradiction. It is more plausible that we still lack a consistent interpretation of the results of these experiments which vary a lot with respect to the experimental games and with respect to the subject pools. Explicit models (Cappelen et al., 2000) as well as behavioral rules as “less solidarity for self-inflicted harm” (Trhal and Radermacher, 2009) or “risk preferences create group identity feelings” (Costard and Bolle, 2010) are possibly too much focused on single experiments. Perhaps a description of subjects in terms of personality characteristics (our result (vii)) may help to understand their choice of individual risks as well as their redistribution decisions. The last remark shows that also “side results” may be rather important. The existence or, as in this investigation, the lack of moral hazard behavior (result (v)) may be an

important condition for the winners' willingness to help. Also for a political evaluation of public welfare schemes this aspect is rather important.

A (too easily generalized) finding that East Germans (who are raised in an ex-communist region) show less solidarity than West Germans (Ockenfels and Weimann, 1999; Brosig et al., 2009) contributes to the image and self-image of people even if one does not believe in a strong impact of scientific studies. Our result (vi) casts considerable doubts on this finding which may perhaps be restricted to a student population.

At last let us come back to the asymmetry of solidarity which is expressed in the results (i) to (iv). The high income B-winners give on average more than all other receivers of income. Expressed in terms of taxes they pay (on average) *voluntarily* progressive taxes on their ex post income. This casts a positive light on the progressive taxation of income in nearly all developed countries. Under the inclusion of later solidarity payments the high risk players therefore have ex ante a smaller expected income than the low risk players. This raises the question of whether people who dare to take higher risks are also more generous than those scaredy cats.

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Appendix

Instructions for the two players in Treatment 3 who had the choice between Lottery A and Lottery B (the third player got a certain income of 100 mISK).

Please read the following instructions carefully:

In the following experiment your initial endowment (in million ISK, abbreviated: mISK) will be determined by random process of your choice:

- Random process A: with a probability of $\frac{2}{3}$ you win mISK 100, with a probability of $\frac{1}{3}$ you lose and get mISK 0.
- Random process B: with a probability of $\frac{1}{3}$ you win mISK 200, with a probability of $\frac{2}{3}$ you lose and get mISK 0.

As a compensation for participation every participant receives additional mISK 10 (if the questionnaire is completely filled out).

Every participant of this experiment is a member of a **group of three** which will be randomly formed. The groups are anonymous, i.e. nobody is informed about the identity of the other members.

The second member of your group can choose – as can you - between random processes A or B. Correspondingly he can – as can you – win or lose.

The third member of your group is **directly** provided with mISK 100, without any random process. Therefore one of the three group members gets mISK 100 anyway.

Participant 1 (you): Random process A or B → Winner or loser
 Participant 2: Random process A or B → Winner or loser
 Participant 3: mISK 100 directly

Before you know whether you have won or not you must decide whether and, if yes, how much money you would transfer to a loser in your group. The other group members make the corresponding decisions.

If your group consists only of winners no money is transferred. If it turns out that you are a loser you get, in addition to your firm compensation of mISK 10, that amount of money which the winning group members have reserved for you. If you are a winner you get, in addition to your firm compensation of mISK 10, your initial endowment minus your transfer to the loser.

Your compensation will be transferred to your EVE online account a few days after the end of the experiment.

Which random process do you choose?

- **Random process A**: with a probability of 2/3 you win mISK 100, with a probability of 1/3 you lose and get mISK 0.

- **Random process B**: with a probability of 1/3 you win mISK 200, with a probability of 2/3 you lose and get mISK 0.

Please choose:

- Random process A**
- Random process B**

What do you think which percentage of participants will choose A? Which percentage will choose B?

The participant with the best estimate gets, in addition to his other payoffs, mISK 50. (in the case of several best estimates the mISK 50 will be equally distributed).

I think that _____ of 100 will choose random process A.

I think that _____ of 100 will choose random process B.

If you decided for A go to the page “Random process A”, if you decided for B go to the page “Random process B”.

[**Page Random process A**, we do not report Random Process B because only one letter and one number are exchanged]

Remember:

- participants who chose random process A get mISK 100 with a probability of 2/3
- participants who chose random process B get mISK 200 with a probability of 1/3
- the third group member gets mISK 100 directly

All participants are members of randomly selected groups of three.

You have chosen random process A. For the following decisions imagine that you have won 100 mISK. Please indicate for all combinations of results in your group of three your decision.

In your group there is one loser. How much do you give to the loser?

I: To a loser who had decided for random process A I give _____

II: To a loser who had decided for random process B I give _____

Expectations with respect to the second group member:

*How much do you expect will other winners give **on average** in such a case? (The best estimation for every question will be rewarded with mISK 50.)*

On average I expect a loser who chose random process A to get _____

On average I expect a loser who chose random process B to get _____

Expectations with respect to the third group member:

*How much will the group member give, who received mISK 100 **directly**, if the loser chose **random process A**? (The best estimation will be rewarded with mISK 50.)*

CaseA-1: If there is one loser who has chosen random process A I expect him to get on average: ____

Case A-2: If there are two losers who both chose random process A I expect both of them to get on average ____

*How much will the group member give, who received mISK100 **directly**, if the losers chose **random process B**? (The best estimation will be rewarded with mISK 50.)*

Case B-1: If there is one loser who has chosen random process B I expect him to get on average: ____

Case B-2: If there are two losers who both chose random process B I expect both of them to get on average ____

*How much will the group member give, who received mISK 100 **directly**, if there are two losers and one of the losers chose random process A and the other random process B? (The best estimation will be rewarded with mISK 50.)*

Case AB-A: I expect the one who chose random process A to get on average ____

Case AB-B: I expect the one who chose random process B to get on average ____