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International experiment on sanctions and cooperation to avert collective risk

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ABSTRACT

We report the protocol relative to the experimental project "Sanctions and international interaction improve cooperation to avert climate change", which connected through the internet pairs of laboratories from Kiel and Bonn (Germany) and Moscow and Tomsk (Russia). The connection was realized through Z-Tree. Each research session comprised 24 participants, who were randomly allocated to four groups, whose members were three from one laboratory and three from the other. After receiving instructions and passing a comprehension test, participants interacted over ten rounds. Each participant had a fixed allocation of money in each round, which could have been kept for oneself or contributed to a group account. Contributions decreased the probability that every group member would suffer a 75% loss in their personal account at the end of the interaction. A random draw determined whether the loss event occurred, and individual payoffs were paid privately in cash at the end of the session. Each session was run under one of eight treatments, where (a) the group partners were either from the same country or from different countries, (b) information on the other group's nationality was either revealed or not, (c) sanctioning others in the group was either possible or not.

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KEYWORDS

Experimental economics, International experiments, Internet experiment, Cooperation, Risk, Collective Risk

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MATERIALS TEXT

[Instructions.docx](#)

[Questionnaire.docx](#)

[Experimenter script.docx](#)

[RECAP Instructions Sanctions ENG.pptx](#)

[Trial Decision Demonstration Sanctions ENG.pptx](#)

[Link to Ztree Programmes](#)

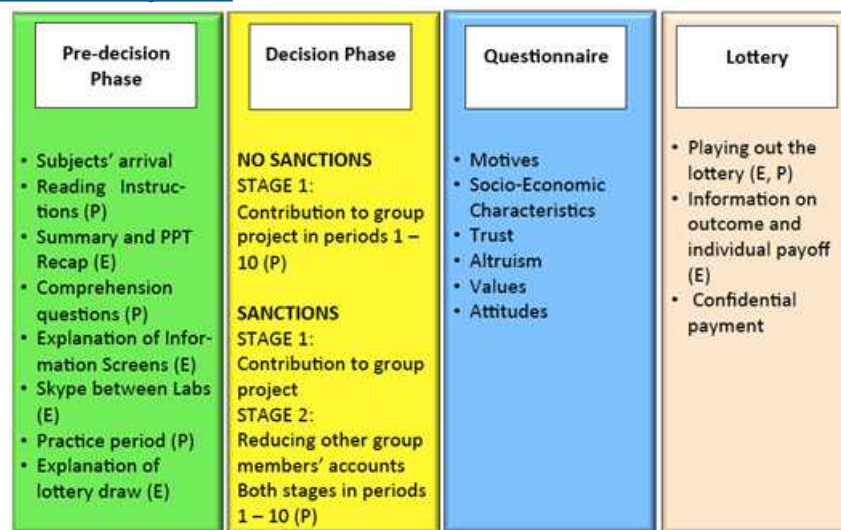


Fig. 1: Timeline of the experiment



Fig. 2 The four experimental laboratories

Period 1 out of 10 Remaining time 41

You are group member 1

You are group member	Number of Tokens in your personal account at the end of the previous period	Total number of Tokens you have allocated to the group project
1	0	0

Group member	Number of Tokens in their personal account at the end of the previous period	Total number of Tokens allocated to the group project
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0

Total number of Tokens all group members have allocated to the group project until now: 0

The probability that the loss event does NOT occur is currently (in %): 0

Number of Tokens I want to allocate to the project:

OK

Fig. 3. Participants' decision screen and information in Stage 1

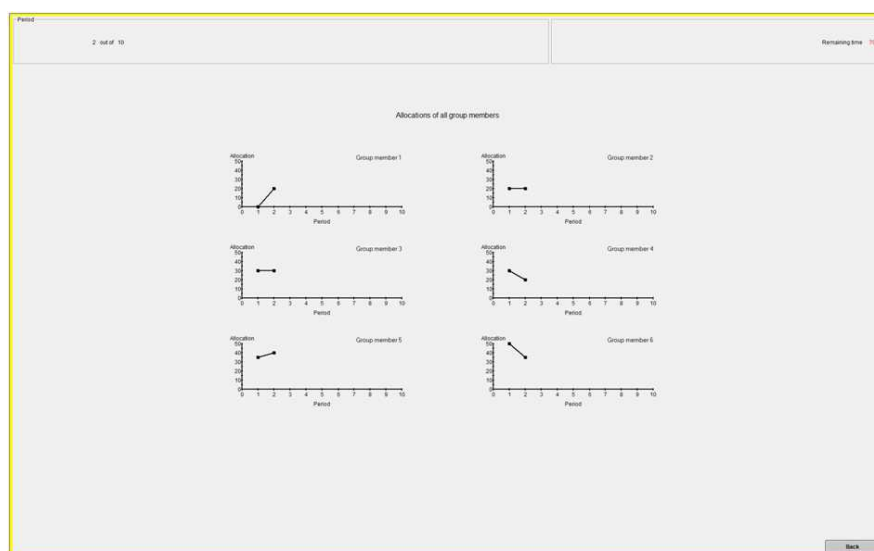


Fig. 4: Graphical information on each group member's contributions in each of the previous periods.

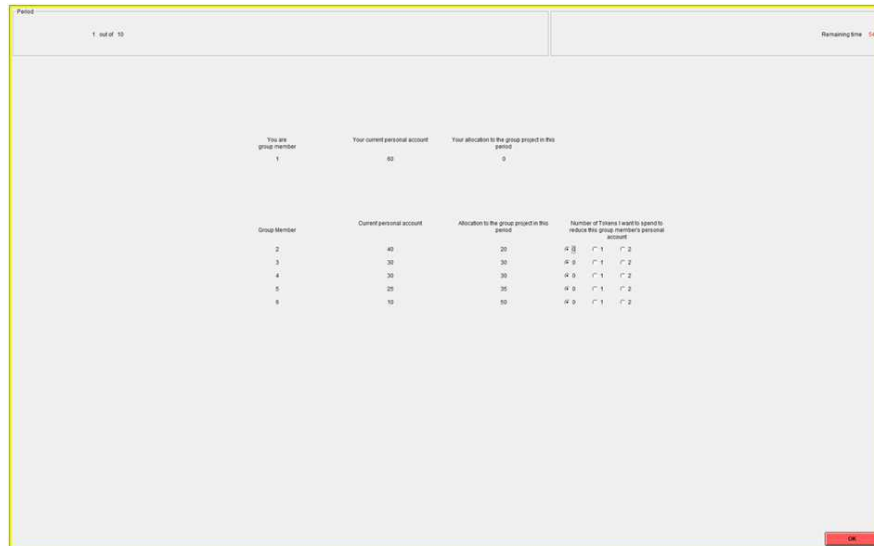


Fig. 5: Participants' decision screen and information in Stage 2

Methods to ensure between-country comparability of data

- 1 International experimental research is subject to three problems that may compromise data comparability (Roth et al. 1991). We follow relevant literature in responding to such issues (Roth et al. 1991; Hermann et al., 2008; Buchan et al., 2009; Georg et al., 2016)).

■ *Experimenter effects*

It is well-known that personal differences between experimenters conducting research sessions may induce some differences in participants' behavior. Personal differences include personality or gestural differences, or other physiological differences in, for instance, voice pitch, intonation, and, of course, gender and age, which may ultimately elicit different responses by participants. These effects could not be eliminated, but we strived to minimize them. Firstly, we produced an experimental script that provided a detailed description of the various stages of the experimental session and the instructions to be administered to participants (see the timeline of the experiment in Materials: Fig. 1). Each lead researcher (the authors of this paper) read the same instructions from this script in the session (see Experimenter script), thus ensuring that identical information was given in identical order and in identical format in all the research sessions. Some of these instructions involved PowerPoint® presentations (see Materials: "Powerpoint presentations" for instruction summary and presentation of decisions stages), which were prepared using the same format for all locations. Since the sessions were run simultaneously, the duration of the various stages of the session had to be approximately the same. Research materials, such as the materials to run the final lottery draw, and the video cameras used for the video links (see next steps) were also the same in all locations. Secondly, the lead researchers participated in two collective meetings before data collection, in which session procedures were discussed and agreed upon. In one meeting in Moscow, a mock experimental session was conducted by one lead researcher under the observation of all others, in order to make the conduction of the session as uniform as possible.

- 2 ■ *Language effects*

Since a word may have a different nuance, or additional meanings, when translated into another language, language effects may also pre-empt full comparability of international experimental data. Differences in syntactic rules across languages, and the fact that language expressions ultimately reflect different cultural norms in the way people address each other in different countries, may also introduce some subtle differences in the way people react to the same set of instructions in different languages. In fact, a significant foreign language effect in decision-making has been found (Costa et al., 2014). We followed what we believe is the best practice in cross-country and inter-country experimental research, as set out by Herrmann et al. (2008) and used the back-translation method to make instructions in Russian and German as comparable as possible.

As none of the five authors is bilingual in German and Russian, we elaborated the master version of the instructions in English. Researchers from our team translated this version into their native language. We then asked a professional German-Russian translator to back-translate the Russian version of the instructions into German. This back-translated version was compared with the original German version. Every difference in the two versions was discussed among members of our team and the translator, and the original translations were then adapted to minimize differences in connotation.

3 ■ *Currency effects*

Another issue that could hinder comparability is the possibility that the monetary incentives used in different locations were different from each other. We followed standard practice in experimental economics, and formulated instructions referring to 'tokens' rather than to national monetary units. Adjusting the monetary value of a token using the official exchange rate between two currencies is not sufficient, because differences in general price levels between the two countries will alter the purchasing power of a currency when exchanged into another currency. Given that official statistics of Purchasing Power Parity are published with a delay of some years on current prices, we used the standard hourly pay rate for student assistants at universities in each country as the conversion factor to ensure that the monetary value of a token had the same purchasing power in each location. This method is appropriate for university students. This resulted in a token [being worth 0.07 Euros in German locations and 2.0 Ruble in Russian locations](#). In addition, participants received a show-up fee of 5 Euro/150 Ruble.

Determination of sample size

- 4 We anchored the sample size in our study to the sample size of other studies with a similar design to ours (in particular Milinski et al., 2008; Barrett and Dannenberg, 2012). In these studies, the unit of observation is a group of participants, and each group comprises 6-10 participants (we chose the lower bound of 6 for our experiment). These studies had 10 groups per treatment and found a very large effect size for their treatments. In particular, the size of the effect of introducing uncertainty over the safety threshold in Barrett and Dannenberg (2012) was Cohen's $d=3.59$ ($m_1=150.9$, $m_2=79.9$, $sd_1=7.69$, $sd_2=26.90$). We were skeptical that in the context of our study, in which the main treatment concerns the variation in cooperation in an international environment vis-à-vis a national one, the effect size would have been as large. Therefore, we decided to increase sample size to $N=16$ per treatment. Ex post power analysis confirmed that our prediction was correct. The sample size requested for Type-1 error = 0.05 and for Power = 0.80 to detect a significant difference in the means observed in one of our key treatments (the difference of cooperation in the International Open treatment and the National Russian treatment under sanctions, where $\{m_1=22.4375$, $m_2=28.7875$, $sd_1=6.9067$, $sd_2=4.6133\}$) is $N=15$, which is very close to our choice of $N=16$. The size of this effect is Cohen's $d=1.16$.

Ethical approval and data protection

- 5 Since our research could not provide any harm to participants and did not involve any medical treatment, the approval by an ethics committee or institutional review board was waived by our universities. The experiments were run according to the ethical standards of the experimental economics profession that do not allow deception. We followed standard procedures when dealing with human subjects, and asked every participant to read an information sheet and sign an informed consent form. Data were fully anonymized upon starting the session, as participants were assigned ID codes as soon as they entered the experiment room, and every one of their decision and answer to the questionnaire was recorded through that number. Payments were paid in cash inserted in a sealed envelope at the end of the session. Participants were asked to sign a receipt, but this was not handled by researchers but was sent to the university administrative office. No participant refused to sign the informed consent form or decided to drop out of the study, even if it was clearly stated that this was possible at any time during the session.

Experiment procedures

6 ■ *Randomization*

Randomization occurred at the session level. Since we wanted to achieve a fully balanced sample across treatments, we did not randomize a treatment for each session, but rather we followed a pre-fixed sequence that alternated treatments. The treatment sequence had to take into account various constraints. One constraint was that our International "Blind" treatments (where participants were not informed that they were interacting with people from another country) had to be conducted before the International "Open" treatments. Had we done differently, "contagion" effects across participants from different sessions may have affected the internal validity of the Blind treatments, because some students may have inferred that other participants were from another country. Our strategy was overall

successful because most participants revealed that they expected the other laboratory to be located within their country in the Blind treatments. Other constraints had to do with the university academic calendars, as students were not present on campus out of term. We balanced the assignment of treatments to starting times, to avoid that, say, all sessions belonging to one treatment were run in the morning, while all sessions relative to another treatment were run in the afternoon. This aspect of the design should prevent that treatment effects were confounded with self-selection into particular times of the day.

7 ■ *Recruitment and admission*

[32 sessions were conducted between](#) November 2016 and February 2017. We tried to run the sessions in the shortest possible time, compatibly with the university calendars. Participants were recruited via email in Tomsk and via the recruiting systems BeLab-System in Moscow and hroot (Bock et al., 2014) in Kiel and Bonn. Upon arrival, we checked students' passport and admitted only national passport holders to the session. Participants were given an information sheet and were asked to sign an informed consent form before entering the laboratory. Upon arrival, participants were randomly allocated to individual cubicles divided by opaque separators (Fig. 2) to ensure privacy of decisions. They were randomly divided into groups of six with three group members each being from two different locations in Germany and/or Russia depending on the treatment.

8 ■ *Instructions*

[All sessions were computerized using the experimental software z-Tree](#) (accessible at: <https://osf.io/x82j5/>) (Fischbacher, 2015). Participants from the two locations interacted via the Internet and took their decisions at the same time. They received equivalent experimental instructions in their respective native language. Participants were informed that all participants would take their decisions simultaneously and would be provided with equivalent instructions. (See Materials for the English translation of the Instructions).

Participants were given ample time to read the instructions and ask clarifying questions which were answered in private. To ensure that participants understood the decision task and the procedure of the experiment, we summarized the instructions in a PowerPoint® presentation with text in German or Russian (see Materials). We also made clear that due to our confidential payment method we were not able to trace any individual participant's decisions. Participants then had to answer a set of comprehension questions on their computer screens – showing German text in the German locations and Russian text in the Russian locations also in international treatments. The decision stage did not start unless all participants had answered all control questions correctly.

Before entering the decision part of the experiment, participants were presented an information recap in PowerPoint® to make them familiar with the information options provided throughout the experiment.

9 ■ *Videoconference link*

To attenuate possible suspicions on the existence of the other lab, we set up two Skype® connections during the session, lasting a few minutes each. Lead researchers would briefly greet each other and introduce the other participants on a large projector screen visible to all participants. Participants were not allowed to talk or communicate with each other in this phase – as well as in any other phase of the research session. To show that the interaction was occurring in real time, we followed Eckel and Wilson (2006) and asked some participants in one location to state some numbers. Such numbers were communicated via the internet to researchers at the other location, who then wrote these numbers on a slip of paper and showed them on the projector screen through the videoconference link. The same procedure was repeated at the other location. An identical protocol was repeated in all sessions, with the exception that researchers communicated in the respective national languages in the National treatments, interacted in English in the International Open treatments, while the Skype® link was muted in the International Blind treatments. We believed that this set of procedures was the best suited to fully assure participants that they were not being deceived and that all the information given in the instruction was truthful.

10 ■ *Decisions*

After the videoconference link, participants completed a practice period on their computers. In order not to bias actual experimental decisions, participants were not communicated others' decisions in the practice period but rather were only allowed to get familiar with the commands of the software. Afterward, the experimenters in both locations explained how the lottery would be implemented. Finally, participants made their decisions in periods 1 to 10 in the No-Sanction (NS)- or Sanction (S)-treatments.

To illustrate the participants' decision task, Fig. 3 in Materials provides the decision screen for the contribution decision

in Stage 1. In addition to making their decisions, each member was informed about the contributions of all six group members as well as about the tokens in each of their personal accounts, both accumulated over the previous periods. Furthermore, they saw the total number of tokens contributed to the project and the current probability that the loss event will not occur.

After participants had taken their decisions they could get visual information on each group member's contributions in each of the previous periods (Materials: Fig. 4). In NS-treatments, the period ended at this point and each participant was informed about their contribution in the current period as well as about everyone's personal account in tokens at the end of the previous and the current periods.

In S-treatments, participants entered Stage 2 and made their decision on how many tokens they wanted to spend to sanction each of the other group members. Before having done so they could retrieve information on each group member's contributions in each of the previous periods (Materials: Fig. 4) and in the current period (Materials: Fig. 5), the accumulated number of tokens in each group member's personal account, and the number of tokens each group member spent in the last period on each of the other group members to reduce that person's personal account.

At the end of Stage 2 of each period, participants received the same information as in NS-treatments and learned the number of tokens spent on others and deducted from their own account.

11 ■ Final procedures

Having finished the experimental tasks, the lottery to decide whether the loss event would occur was played out. From a bag containing lottery chips numbered 1 - 100, one chip was drawn by a participant. If the number was larger than the percentage x of the target amount the group members had contributed to the group project, the loss event occurred and 75% of the amount collected in each group member's personal account was lost. If the number drawn was smaller or equal to x , the loss event did not occur and each group member was paid out the total amount in his or her personal account. This procedure was repeated for each of the four groups participating in a session. The outcomes of the lottery draws were transmitted via Skype® to both participating labs but information on the lottery outcome relevant for a specific group was not made available to the participants until they had filled in a non-incentivized questionnaire on social characteristics, risk attitudes (Falk et al., 2018), personal values (Schwartz, 1992) and other questions taken from the World Value Survey (see Experimenter Script). The survey questions were available and externally validated in both languages.

Finally, we applied an anonymized payment procedure by distributing the payments from the experiment plus the show-up fee and receipts in an envelope marked with the cubicle number. Participants took the money, signed the receipt, confidentially put the receipt into a box, and left the laboratory. All features of the experimental design and procedure were common knowledge and did not raise any questions. Sessions lasted about 2 hours on average. [Mean earnings were 25.00€ in Germany and 750 Ruble in Russia](#) (12.5€ at the time of running the experiment) including the show-up fee.

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