

Climate change control in cross-country perspectives: experimental study in Germany and Russia

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Overview

Setup

Experiment

Results

- Main trends

- Treatment effects

- Punishment strategies

Conclusions

Problem statement

- ▶ International cooperation follows the pattern of individual cooperations.
- ▶ It entails sacrificing individual interests for group interests, which goes against both individual rationality and, from an evolutionary perspective, natural selection.
- ▶ Ingroup-outgroup favouritism reflects national attributions and prejudices, and could especially hamper cooperation in an international context.
- ▶ Regime of sanctions is meant to affect choices of nations — or does it?

Public Goods Game with punishment

Canonical game to analyse cooperation and prosociality: Marwell and Ames, 1979 have shown the game fails to result in either full cooperation or equilibrium (zero) prediction.

$$u(c_i) = w - c_i + k \sum_j^n c_j / n - \sum_j p_{ij} - a \sum_j p_{ji}$$

threshold public goods makes the good available iff participants contribution matches or exceeds the target T , i.e. $\sum_j^n \geq T$, but offers no good otherwise.

Yamagishi, 1988; Fehr and Gächter, 2002 and many others have shown that sanctions, even costly to the punisher, work as a mechanism to enforce cooperation.

Effect of punishment, however, depends on the society: in particular, Russians have shown to exhibit large share of antisocial (spiteful) punishments — Herrmann e.a. 2008.

Relevant literature

- ▶ In general, people are known to be reasonably good at reaching disequilibrium cooperative decision (Ostrom et al., 1993); however, in case of global disagreements, coordination in social dilemmas may be difficult (Kass e.a., 2015).
- ▶ Barrett and Dunneberg (2012), Milinski e.a. (2009) and others discuss the role of coordination in climate-change issues, and show experimentally that cooperation is feasible, even under conditions of payoff uncertainty and free-riding.
- ▶ A large literature (Chen and Li (2010), Grimalda e.a. (2016)) also shows that social image may be more important than sanctions to promote cooperation.

We find evidence in support to these claims in our experiment.

Contributions

1. First large-scale cross-country experiment on PG with punishment in real time (participants convene at different locations and connect on ztree via IPs).
2. First cross-country experiment on climate control and with punishment and country effects.
3. Control for socio-economic characteristics (in particular, combination of behaviour with Schwartz values).

Design

- ▶ Groups of 6 players, playing over local network and internet.
- ▶ 10 periods threshold public goods game.
- ▶ Each player has endowment of 60 tokens per period, of which up to 50 can be invested to threshold to avoid common catastrophe, and up to 10 to punish other group members according to nonlinear quadratic scheme (in NP, just cashed).
- ▶ Probability of No loss event is proportional to the sum of contributions to threshold public good of 2100 tokens (if target reached, then no loss).
- ▶ Loss reduces all earnings by 75%, leaving Ss with just 25%. Outcomes drawn at the end of experiment in both locations using the same random device and via skype.

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Experimental setup

- ▶ 768 subjects in 4 cities: Kiel, Bonn (Germany), Moscow, Tomsk (Russia), equal in each place, balanced by gender and occupations (economists about 50%).
- ▶ Motivated experiment: Mean earnings in Russia 750 ₺, in Germany 25 €, comparable by PPP for about 2 hours of work.
- ▶ $2 \times 2 \times 2$ design: countries (indistinguishable by city for the subjects) \times known/unknown identity of other side \times punishment/non-punishment.
- ▶ 32 sessions with 24 participants and 4 groups each: 3 in one, 3 in another locations (identity known or not, depending on treatment).
- ▶ Careful explanation of the design to Ss, including written instructions with recap, quiz questions, trial period to familiarize with the screen layout, connection via skype with the other lab to prove its reality, etc.

Theoretical predictions: individual rationality

Individually rational solution for a generic player i follows from

$$u(c_i) = (w - c_i) \left(\frac{\sum_j c_j + c_i}{T} \right) + s(w - c_i) \left(1 - \frac{\sum_j c_j + c_i}{T} \right) \rightarrow \max_{c_i},$$

where w is endowment (= 600), c_i and c_j are contributions of this and other players, s is share of returns remaining in case of loss (= 0.25) and T is full insurance threshold PG value (= 2100).

Symmetric equilibrium strategy prediction is

$$c_i^* = \frac{w(1-s) - sT}{(n+1)(1-s)}$$

where n is group size.

With our parameter values, this is positive for $T < 1800$, and 0 for our settings.

Theoretical predictions: collective rationality

Collectively rational solution for risk-neutral players imply motivation of joint welfare by joint contribution C

$$U(C) = (w - C) \left(\frac{C}{T}\right) + s(w - C) \left(1 - \frac{C}{T}\right) \rightarrow \max_C,$$

divided equally among all players.

It implies the solution

$$C^* = \frac{nw(1-s) - sT}{2(1-s)}$$

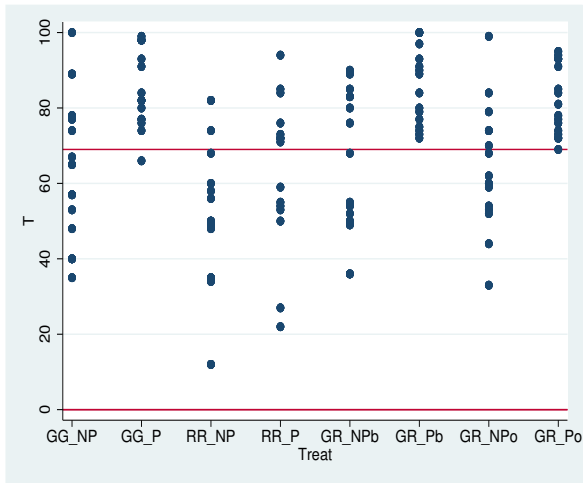
which yields insurance of $0.69T$ and positive symmetric contribution of 241 (out of 600) under our parameter values.

Optimal punishment is 0 in all treatments.

Punishment scheme

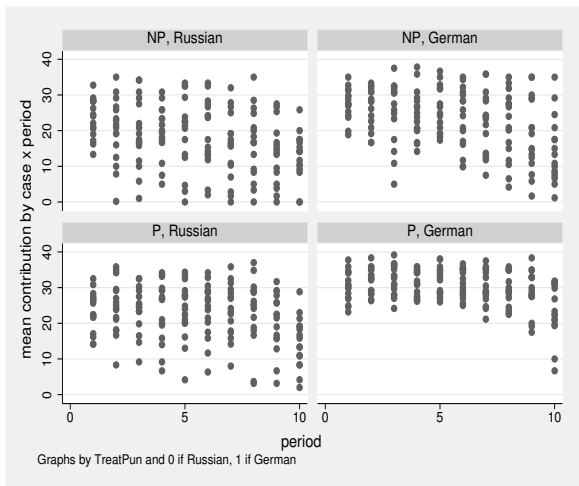
Total punishment tokens	Punishment size
0	0
1	1
2	3
3	6
4	10
5	15
6	21
7	26
8	36
9	45
10	55

Final insurance by groups and treatments



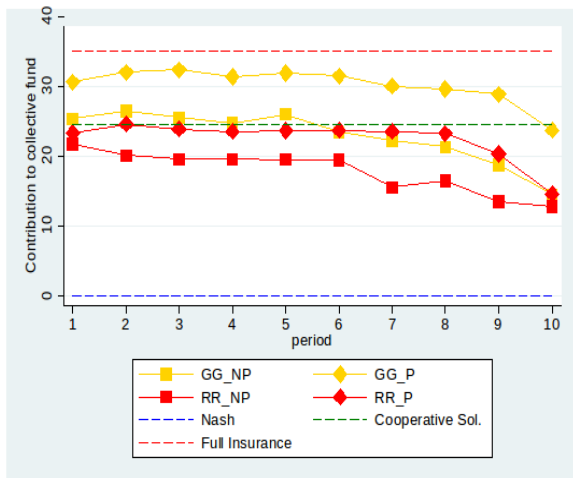
Lines correspond to Nash equilibrium and collective solution.
Result 1: Cooperation levels quite high ($mean = 70, sd = 19$), in line with collective solution.

Mean contributions by periods, countries and treatments



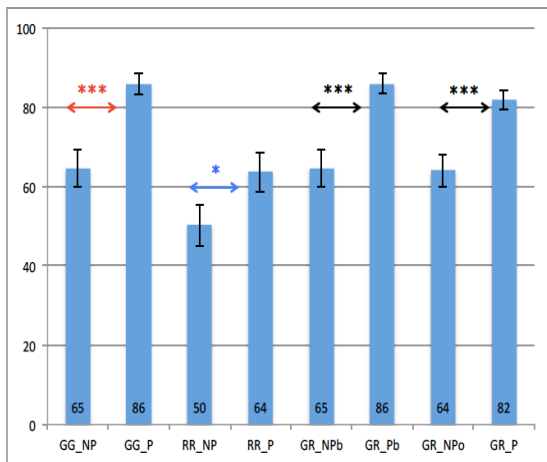
	Non-Punishment	Punishment
Germans	23.28	29.78
Russians	20.83	25.96

Mean contributions by periods, countries and treatments



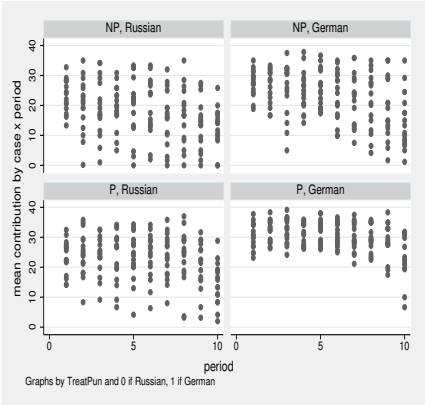
Result 2: Germans contribute more than Russians, especially under punishment (all differences significant)

Effects of punishment on contributions by countries

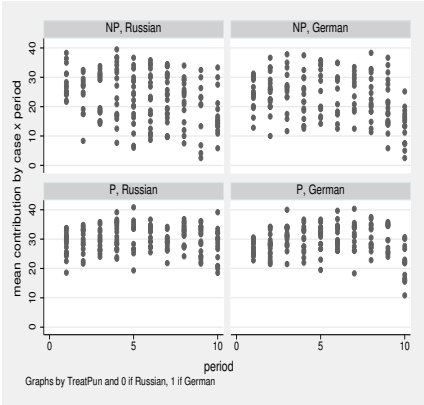


Result 3: Significant effect of punishment on German and international groups, less significant in Russian only

Mean contributions by periods, across treatments



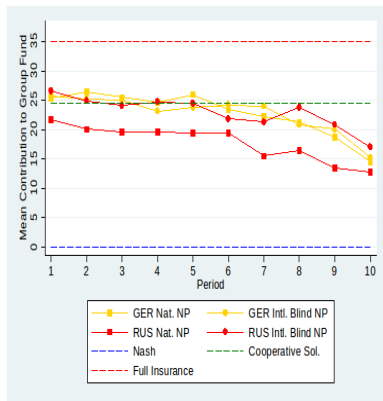
Within-countries



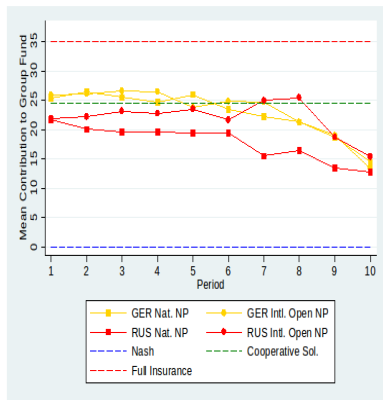
Mixed

Result 4: convergence of results under punishment in mixed groups (Germans lead Russians to cooperate)

Mean contributions in non-punishment treatments

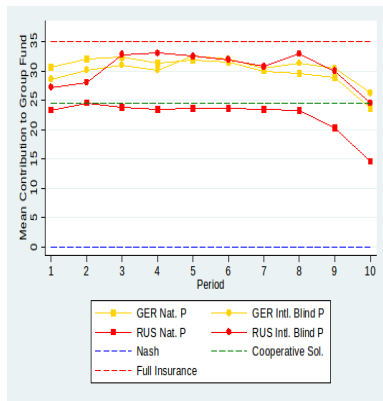


Blind

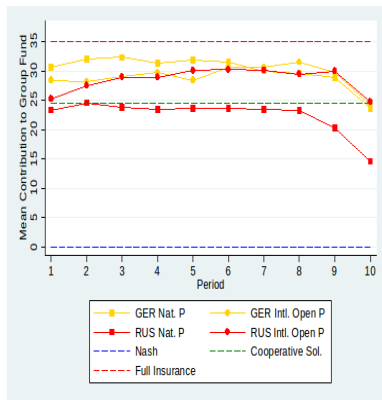


Open

Mean contributions in punishment treatments

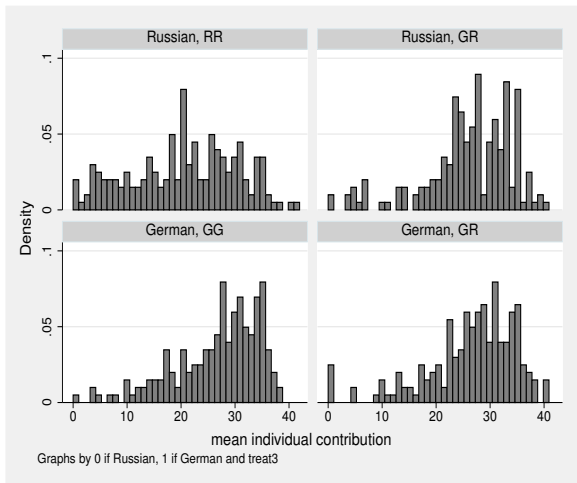


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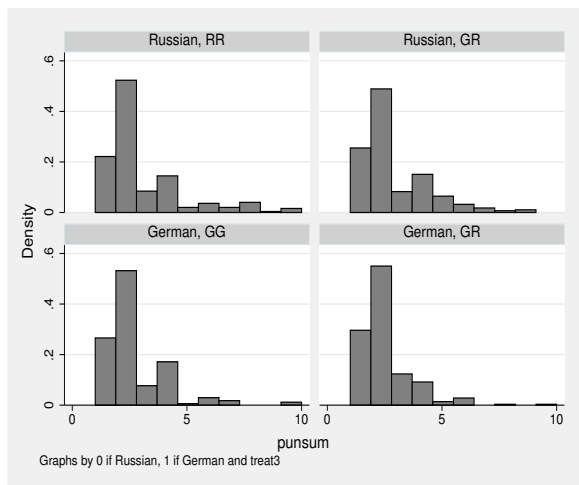
Open

Distributions of mean individual contributions by treatments



Non-significant differences in between-countries sessions (ES $W= 1.09, p < 0.89$, but Russians (20.52) contribute much less than Germans (26.79) ES $W= 50.79, p < 0.000$)

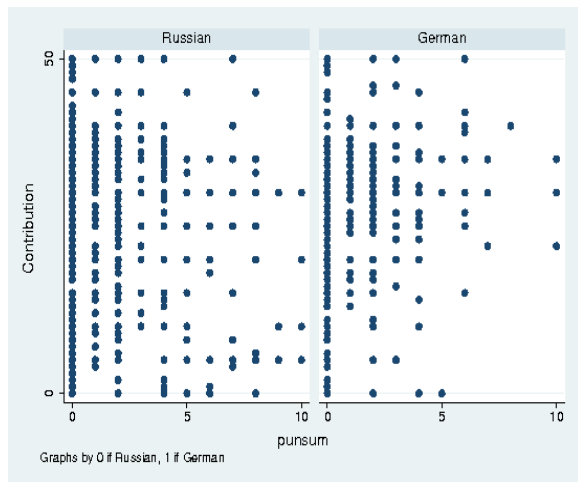
Punishment statistics by treatments



	German only	Russian only	mixed
Germans	0.43 (1.13)		0.65 (1.21)
Russians		0.72 (1.57)	0.76 (1.47)

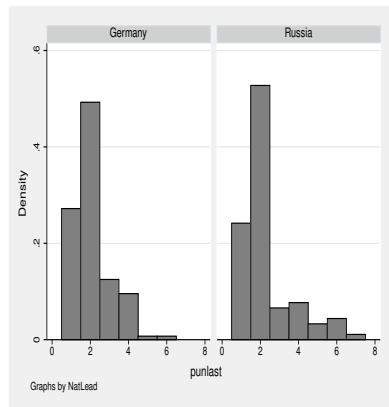
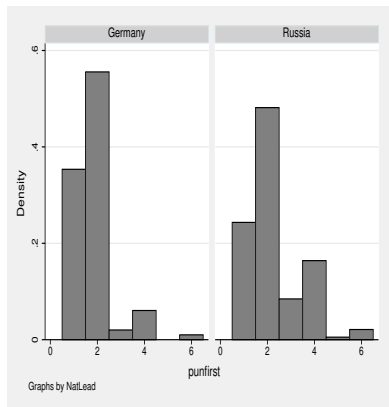
Russians punish more than Germans, no difference in mixed session.

Punishments and contributions



Punishment occurs only in 75% of instances. Mean positive punishment of Russians (2.67) is larger than that of Germans (2.28), with signs of spiteful punishments *and more*.

Punishments to whom: within nations



Own subgroup, ES

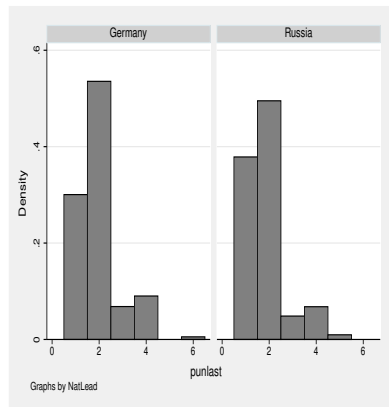
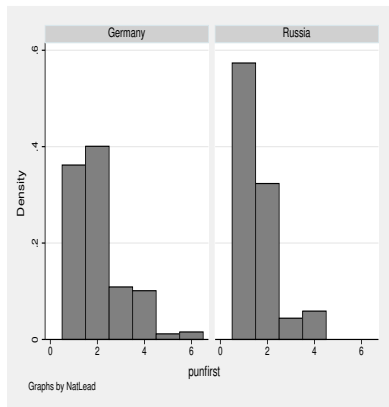
$W = 18.13, p < 0.001$

Other subgroup, ES

$W = 12.05, p < 0.016$

Russians are more nasty to other Russians than Germans to other Germans.

Punishments to whom: across nations



Own subgroup, ES
 $W = 16.75, p < 0.002$

Other subgroup, ES
 $W = 4.40, p < 0.35$

In mixed groups, Germans punish Germans more than in within-groups, whereas Russians punish Russians less

Estimations

Variable	Coefficient	(Std. Err.)
L.pun	0.143	(0.025)
Ger	4.668	(3.568)
0.pun x Rus	omitted	
0.pun x Ger	-4.969	(3.606)
1.pun x Rus	0.055	(1.195)
1.pun x Ger	-4.231	(3.463)
3.pun x Rus	-0.557	(0.956)
3.pun x Ger	-4.645	(3.760)
6.pun x Rus	2.582	(2.785)
6.pun x Ger	-6.550	(3.798)
10.pun x Rus	-0.309	(2.458)
10.pun x Ger	-8.709	(3.141)
15.pun x Rus	-7.138	(2.786)
15.pun x Ger	-0.242	(9.733)
21.pun x Rus	-7.785	(2.189)
26.pun x Rus	9.457	(0.337)
36.pun x Rus	31.851	(1.249)
sex	-8.067	(1.337)
Intercept	30.255	(0.901)

Punishment results (preliminary!)

1. Punishment is less common than normally, mostly because it is really unneeded (!)
2. Some, but apparently very moderate spiteful punishment exists among Russians.
3. Males are less generous than females (expected)
4. Russians punish more than Germans, esp. in within-country sessions.
5. In cross-country sessions, Germans tend to punish more, but mostly Germans (be good example to aliens!), whereas Russians decrease punishment of Russians (get away of my bro!).
6. Punishment works, yet moderate punishment seems (!) to have negative effect on contributions of Germans, large-scale punishment — positive, on Russians.

Discussion and further directions

1. Large and common threat is a VERY good coordination device, which works well within and across cultures.
2. Subjects are good at reaching collectively rational decision (encouraging!).
3. Punishment still serves to foster cooperation, yet often indirectly (opportunity rather than action) and in a framed way.
4. Equilibrium solution most often fails, albeit justification in terms of incomplete information game is possible.
5. Cooperation stops at a level short of the threshold, implying reference-dependence (model to be developed).

The End

Thank you for your attention. Updates of the paper to appear at
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