Ratchet up or down?
An experimental investigation of global public good provision in the United Nations Youth Associations Network

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Abstract: From a current perspective the Paris Agreement is not sufficient to limit the global mean temperature below 2°C above pre-industrial level as intended. The Agreement stipulates that parties review, compare and ratchet up efforts to combat climate change over time. Within this process, commitments heavily depend on what has been already achieved and this status-quo reflects an important reference point serving either as commitment advice or potential threat. We present an experimental study that is specifically designed to incorporate the effect of a status-quo via pre-existing contribution levels under endowment heterogeneity in a game in which participants make voluntary contributions to a public good. Our participants are sampled from the United Nations Youth Associations Network, representing participants from 51 countries. Members from developed and developing countries take decisions against the background of different initial levels of endowments and pre-existing contributions. Our analysis indicates that starting with ambitious pre-existing contribution levels can foster aggregate mitigation levels. Falling behind this status-quo contribution levels by reducing the public good appears to be a strong behavioral barrier. These observations might provide support for the basic structure of the Paris Agreement with Nationally Determined Contributions and the possibility to adjust them, even if a downward revision of national targets may not be precluded.

Keywords: Paris Agreement; Nationally Determined Contributions; Ratched-up mechanism; International public goods; Online experiment

JEL classification: H41; C91; F53; Q58

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1 Introduction

During the United Nations Climate Change Conference (COP21) in 2015 and its resulting Paris Agreement 195 countries agreed to set out a global action plan to avoid dangerous climate change by limiting global warming to well below 2°C above pre-industrial level. The agreement is based on "bottom-up" Nationally Determined Contributions (NDCs) being voluntarily imposed, not legally binding and, finally, not enforceable.[1]

Recent assessments evaluating the effects of current mitigation policies raise doubts that countries are on track to meet the globally agreed target (UNFCCC 2015b). Consequently, as formulated already in Article 3 of the Paris Agreement, "[t]he efforts of all Parties will present a progression over time [. . .]" (UNFCCC 2015a) to ratcheting-up and crank up ambition over time. As a dynamic review mechanism, the global stocktake will assess the achievements of parties under the Agreement and its long-term goals every five years, starting in 2023 (Article 14).[2]

That is, countries will review, compare and potentially adjust their efforts periodically during the stocktake. In that respect, Article 4.11 states "A Party may at any time adjust its existing [NDC] with a view to enhancing its level of ambition, [. . .]". It shows that parties are not required to stick to a particular NDC once submitted but may replace existing policies with alternative approaches. The important point is that while a downward revision of existing NDCs is very likely to provoke stark criticism of the international community, in principal it remains a legally available option under the Paris Agreement (C2ES 2017). Countries' future commitments will therefore depend on their individual assessment of what has been already achieved, both by themselves and the other countries. The status-quo of already achieved emission reductions, may serve as a typical reference point and therefore provide a strong anchor serving either as a commitment advice for strengthening ambition or may be considered as a potential threat to reverse actions being already undertaken by the respective country. In fact, again, while countries are encouraged to increase their ambitions in the stocktake, an adjustment of the NDCs to less ambitious emission reduction targets may also be possible. The decision of the current US government to withdraw from the Paris

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[1]As one core element of the Agreement, parties are encouraged to submit individual pledges for achieving substantial emission reductions at the national level to make efforts transparent and comparable. However, there is scepticism whether countries will deviate from their sovereign commitments (e.g., Barrett and Dannenberg 2016).

[2]Parties agreed on the global stocktake as central review mechanism to access collective progress towards the globally agreed target. The global stocktake should provide countries with the information for strengthening their ambitions and submitting new NDCs in the two years following the stocktake. 2018 is the first time to take stock of international efforts, and use the assessment to inform more ambitious NDCs by 2020. This will be followed with a global stocktake every five years (Article 14).

Agreement and to reverse policies being initiated by the previous government serves as an example for the latter case. The question is then: Ratchet up or down in the stocktake?

To address this question we experimentally investigate the impact of the status-quo on future climate actions with the possibility of increasing and decreasing ambition levels under wealth heterogeneity, i.e., poor and rich countries, in the negotiations. Our experimental design builds upon the canonical public good games (e.g., Ledyard 1995; Chaudhuri 2011) to capture the tension between the individual interest to free ride on contributions of other group members and the joint interest to provide the public good, i.e., the global mitigation target, at a social optimal level. We thereby focus on individuals' pre-existing climate mitigation actions being implemented exogenously. To capture the effect of the status-quo, participants in our experiment choose their actions against the backdrop of these pre-existing mitigation efforts.

Previous experimental studies devoted to the global climate tragedy account for pre-existing efforts by restricting the choice of players in a way that they can only add on top what has been already achieved (e.g., Milinski et al. 2008; Tavoni et al. 2011; Barrett and Dannenberg 2012; 2014). By contrast, our experimental design allows both for increasing and decreasing ambition levels compared to the status-quo, most importantly players can undo existing efforts by taking pre-existing contributions from the public good. In case decisions are mutually exclusive (i.e., either only give or only take from the status quo), some studies find that such status-quo framing matters (e.g., Andreoni 1995; Park 2000; Khadjavi and Lange 2015; Gächter et al. 2017), while other do not observe that it changes behavior (e.g., van Dijk and Wilke 1997; Sell and Son 1997; Cubitt et al. 2011; Dufwenberg et al. 2011; Cox et al. 2013). A recent such study by Gächter et al. (2017) reveals that differences between giving and taking frames are associated with a decrease in reciprocity in take decisions and the mixed results can be traced back to individual differences in attitudes and beliefs. In a setting where the status-quo is chosen to allows for both, ratcheting up and down pre-existing contributions, van Soest et al. (2016) find that cooperation collapses where participants can give and take compared to a pure giving frame, while Khadjavi and Lange (2015) do not observe differences. However, all these studies do not address heterogeneities between parties, a crucial feature and a major source of ongoing controversies in climate change negotiations.

In our experiment we take into account differences in wealth and we divide participants into two groups to reflect the persisting dichotomy between rich ("Annex-I") and poor ("Non-Annex-I") countries in current international climate policy.[3] Even

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[3]We are aware of one public good experiment with heterogeneous players extending the strategy set

though the Paris Agreement tries to avoid this bilateral structure, it continues to be of crucial importance to climate change negotiations (Tørstad and Sælen 2017). Building up on the reference point in a setting with an intermediate public good provision level compared to the standard giving setting with no taking option our experimental design thereby provides a more differentiated view on a potential contribution norm or burden sharing mechanism. Pre-existing provision levels thereby may either serve as a coordination advice (since they might suggest a focal point for a possible contribution norm) or as a potential threat if parties undo climate action already implemented in the past, e.g., if they fear that other group members will contribute too little.

Another novelty of our study is that we investigate the impact of the status-quo on future climate actions for the case of *poor* and *rich* players, thereby capturing the international dimension of global public goods (e.g., Barrett 2007) by collaborating with the United Nations Youth Associations Network (UNYANET). We recruited 139 individuals from 51 different countries. Wealth heterogeneity was implemented such that group members from a developing country start with a lower endowment than members from developed countries.[4]

Our results reveal that starting with pre-existing public goods provision level and allowing both for giving and taking decreases contributions (i.e., additional efforts beyond the status-quo) compared to the standard giving frame. We find that both *poor* and *rich* agents contribute around 30% of their disposable endowment to the public good in both settings. However, reducing pre-existing contributions by taking out of the group account appears to be a strong behavioral barrier for the vast majority of participants. Consequently, in our setting, public goods provision is higher when starting with a pre-determined contribution level compared to a pure giving frame. While our experimental results cannot be generalized and inform directly on international climate negotiations, we provide the important insight that the mere existence of status-quo plays an important role for cooperation: The majority of individuals tend to abstain from exploiting or reversing existing public goods provision if they have the oppor-

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to taking (see McCarter et al. 2011). In case participants differ with respect to wealth, it is shown that high endowed subjects are more likely to give to the public good, while low endowed subjects are more likely to take from the public good. While this study provides valuable first insights, the experiment does not include pure giving frame and, therefore, does not allow comparing potential differences in efficiency levels between these two different institutions.

[4]One might argue that rather the personal wealth status rather than the wealth status of the respective home country matters for the individual contribution decision in the public goods game. Since delegates in real negotiations typically are expected to represent their countries' views rather than their personal interests, we are confident that assigning players into the different roles based on the economic circumstances of their home country instead of considering personal wealth or income status provides a proper way given to address our research question. Moreover, we control for the personal wealth status in our regression analysis without finding any significant impact of the personal income on the outcome variables.

tunity to do so. These observations might provide support for the basic structure of the Paris Agreement with Nationally Determined Contributions and the possibility to adjust them, even if a downward revision of national targets might not be precluded. The remainder of this paper is organized as follows. Section 2 presents the experimental design and procedure of the study. Results are presented in Section 3. A concluding discussion is provided in Section 4.

2 Experimental design and procedure

Our experiment is built upon a standard 4-player public good game. For implementing the status-quo with pre-existing contributions we adopt the design developed by Khadjavi and Lange (2015) for the case of *poor* and *rich* parties. We distinguish between two treatment conditions: A pure giving condition (GIVE) without any pre-existing contributions and a condition allowing both for giving and taking of pre-existing efforts (GITA). In both conditions, each group consists of two *poor* and *rich* agents. *Rich* agents receive an initial endowment of 30 tokens tokens, while *poor* agents receive an initial endowment of 10 tokens. In the public goods game every player has to decide how many tokens to keep for herself and how many tokens to contribute to the group account, reflecting the group climate change mitigation efforts. Each player earns 0.4 token for each token invested in the group account, regardless of whether she contributed to the group account. Under these parameters, it is in individuals' material self-interest to keep the entire endowment in their private account, however, from the group's perspective, it is socially optimal if the entire endowment of all group members is invested into the public account.

The only difference between GIVE and GITA is that in the first case the entire endowment is initially assigned to the individuals, and hence the status-quo public good provision is zero. By contrast, in GITA, 40% of the endowment (i.e., 12 tokens and 4 tokens for the *rich* and *poor* players, respectively) is initially allocated to the public good. Hence, in this treatment the status-quo of contributions is 40% of the individual initial endowment and players have the opportunity to increase contributions to the public good beyond the status-quo, to maintain the current levels, or even to undo efforts by taking existing contributions (i.e., up to 40% of their individual initial endowment) out of the public account.

Given our parameters and assuming standard preferences, the unique Nash equilibrium in dominant strategies is identical in both treatments: Zero public good provision.In GIVE players should give nothing to the public good and, accordingly, in GITA agents are expected to undo existing efforts by taking all contributions out of the group

account.[5]

To capture the international dimension of the global climate tragedy we conducted the experiment in collaboration with the United Nations Youth Associations Network (UNYANET).[6] The aim of UNYANET is to strengthen the collaboration between its members, the UN and further international organizations, e.g., by organizing Model United Nation (MUNs) sessions. Individual members of the UNYANET network were contacted by the national organizations via email, inviting them to take part in a scientific study on individual decision making conducted in collaboration with UNYANET. The email was distributed via UNYANET's official communication network. Participants were informed that they could earn an additional individual earning depending on their decisions and the decisions of their peers. In addition, participants knew that UNYANET receives a show-up fee of 2 US-Dollars for each participant. Subjects were informed that 10 percent of all participants were randomly selected after the experiment to receive their payment. We did not disclose any further information of the context or the aim of the experiment at this stage of the study.

As a first step, UNYANET members who followed the link in the invitation email had to complete an online registration in order to being able to participate in the experiment. During the registration phase, participants had to provide socio-demographic information (age, sex, income, education, religion, nationality, and residence). This information was required to assign high and low endowments to participants from developed and developing countries, respectively.[7] After the registration, participants received an individual email with a unique access code and could take part in the online experiment.[8] Conducting the experiment via the internet offers obvious advantages for our study (e.g., Eckel and Wilson 2006; Horton et al. 2011). Most importantly, using the internet enables us conducting the experiment synchronously at different sites what provides the opportunity of comparing individual decisions across regions and countries.[9]

In total, 139 UNYANET members from 51 countries followed our invitation and took part in our online experiment. Figure 1 shows the distribution of participants accord-

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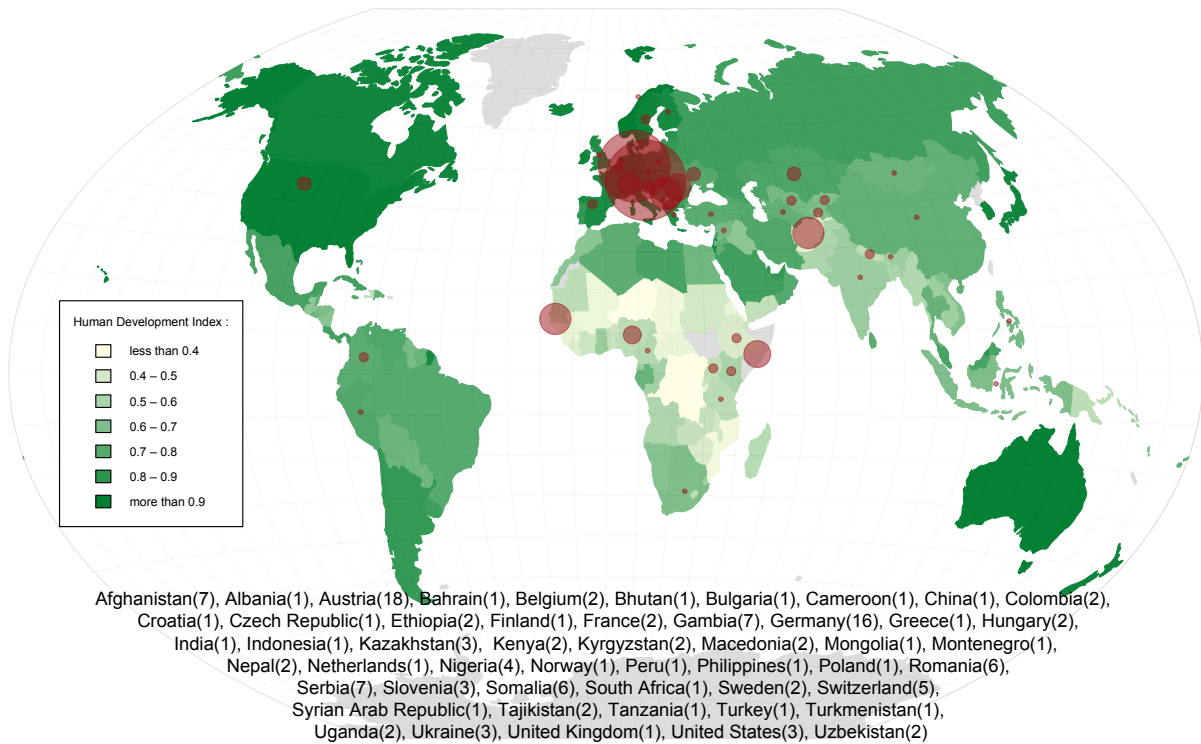[5]Experimental details are provided in the Appendix.

[6]UNYANET is the international umbrella organization of the United Nations (UN) Youth and Students associations with members from Europe, Asia, Africa and America. It was founded in 2011 and is seated in Geneva, Switzerland. For further information, see http://unyanet.org/.

[7]In particular, the classification into developed and developing countries is done using the Human Development Index (HDI). The HDI combines life expectancy, education, and per capita income indicators to rank countries according to their human development. Countries with a HDI of 0.7 and above are considered as countries with a high or very human development. Countries a HDI below 0.7 are considered to have a medium or low development.

[8]This procedure ensured that each participants could take part only once in the study.

[9]We provide the instructions in the Appendix.

Figure 1: Subject pool by country and Human Development Index

Afghanistan(7), Albania(1), Austria(18), Bahrain(1), Belgium(2), Bhutan(1), Bulgaria(1), Cameroon(1), China(1), Colombia(2), Croatia(1), Czech Republic(1), Ethiopia(2), Finland(1), France(2), Gambia(7), Germany(16), Greece(1), Hungary(2), India(1), Indonesia(1), Kazakhstan(3), Kenya(2), Kyrgyzstan(2), Macedonia(2), Mongolia(1), Montenegro(1), Nepal(2), Netherlands(1), Nigeria(4), Norway(1), Peru(1), Philippines(1), Poland(1), Romania(6), Serbia(7), Slovenia(3), Somalia(6), South Africa(1), Sweden(2), Switzerland(5), Syrian Arab Republic(1), Tajikistan(2), Tanzania(1), Turkey(1), Turkmenistan(1), Uganda(2), Ukraine(3), United Kingdom(1), United States(3), Uzbekistan(2)

ing to countries and the respective economic development. Before entering their allocation decision, individuals were guided through detailed instructions on the procedure, and a set of numerical examples. We use an ex-post protocol to match participants into groups of four players and to calculate group contribution levels and payoffs.[10] The average payment for the selected participants was a purchasing power equivalent to $25 in the respective countries. After the allocation decision, we asked participants to answer questions thereby eliciting their attitudes, e.g., towards trust and climate change.

The characteristics of participants from developed and developing countries are displayed in Table 1. In both samples the average age is 25, and around 50% are students (no significant differences between the samples). However, the share of female participants is lower in developing countries than in developed countries (36% vs. 53%, *p*-value: 0.057, Chi-squared test). In addition, participants from developed countries are more likely to define themselves as belonging to a lower income group within their home countries than participants from developed countries (2.86 vs. 3.48, *p*-

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[10]Groups always consist of two *poor* participants from developing countries and two *rich* participants from developed countries. Since our sample does not consist of participants from developing (50) and developed (89) countries in equal parts, we have re-matched participants from developed countries to determine payoffs for all participants. Participants, also those who have been re-matched, have been paid once. For re-matched participants it was randomly determined which group levels have been considered to calculate payoffs.

Table 1: Summary statistics

	Developed countries	Developing countries
Participants (in #)	89	50
Age (in years)	25.6	25.9
Female (in %)	52.8	36.0
Student (in %)	57.3	48.0
Income (category)	2.86	3.48
City (category)	3.1	2.82
Trust (in %)	47.1	20.0
Importance of climate protection (category)	4.53	4.88

Note: "Age" (in years); "Female" (female dummy) "Student" (student dummy); "Income": 1 indicates the lowest and 5 the highest income group in the participant's country, based on self-assessment; "City": grew up in big city (1) to rural village (4); "Trust": % of indicating "Most people can be trusted"; "Importance of climate change protection": importance of fighting climate change: not important (1) to very important (5).

value 0.000, Mann–Whitney U test). As to personal attitudes, we find a a considerable higher trust level (47% vs. 20%, *p*-value: 0.002, Chi-squared test) for participants from developed countries than for participants from developed countries (47% of the participants from developed countries agree with the statement that "most people can be trusted", but only 20% of all participants from developing countries). Moreover, it appears that participants from developing countries assign a higher weight for the need to fight climate change than participants from developed countries (4.53 vs. 4.88, *p*-value: 0.004, Mann–Whitney U test). We take these individual characteristics and differences between the two subsamples, which might affect decision behavior, into account by adding them as explanatory variables within our regression analysis provided in the following section.
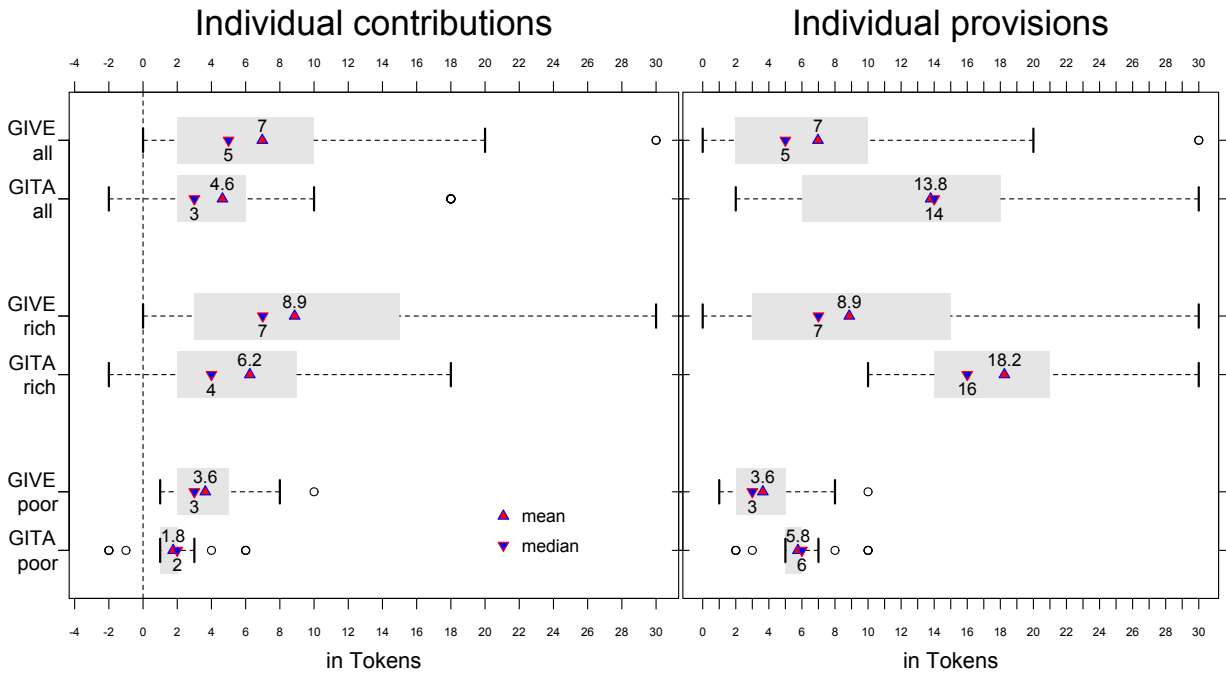
3 Results

Figure 2 shows our results for individual contributions (i.e., efforts beyond the status-quo) and individual provision levels (i.e., including both the status-quo and individual contributions) across treatment conditions.[11] We find that average individual contributions in GITA (4.6 tokens) fall below those in GIVE (7.0 tokens). Regression analyses of

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[11]Detailed summary statistics are provided in Table 3 in the Appendix.

Figure 2: Individual contributions and provision level across treatments and types of players

Note: Individual contributions (i.e., efforts beyond the status-quo) to the public good (left) and provision levels (i.e., including both the status-quo and individual contributions) (right) in absolute terms across treatments (GIVE vs. GITA) aggregated for both types of players (all) as well as separately for *rich* and *poor* players. The horizontal lines show the range of individual contributions (provision) from the minimum to the maximum. Outliers are presented separately. The ends of the "box" indicate the lower and upper values of the interquartile range, i.e., the middle 50 percent of the variable.

the data show that these differences are significant (Table 2 – column 1, *p*-value: 0.024). While participants contribute less in GITA, the vast majority abstains from undoing pre-existing contribution levels. Only 10% takes out of the public good which suggests that falling behind the status-quo appears to provoke a strong behavioral barrier in our experiment. Further evidence for this argument can be found by focusing on full free-riding behavior. In GITA not a single individual fully free-rides. In GIVE, 4.4% of all participants act purely selfishly (i.e., zero contributions) (4.35% vs. 0.00%, *p*-value: 0.120, Fisher's exact). By looking at the relative contributions (i.e., % of disposable endowment) we find that participants contribute, on average, around one third of their disposable endowment to the climate account in both treatments GIVE and GITA (32% in GITA vs. 33% in GIVE, *p*-value: 0.985, Mann-Whitney U test).

We now analyse the behavior of *rich* and *poor* players separately. Average contributions from rich players in GITA (6.2 tokens) fall below that in GIVE (8.9 tokens) (*p*-value: 0.071, Table 2 – column 2). Only 6.7% of the rich participants reduce existing climate mitigation efforts. In this line, neither the share of contributors (91.1% vs. 93.2%, *p*-value: 0.513, Fisher's exact) nor the share of participants choosing the most selfish

option (0% vs. 6.8%, *p*-value: 0.117, Fisher's exact) differs significantly between GITA and GIVE. *Poor* participants decide to transfer only about half of the amount in GITA than in GIVE (1.8 vs. 3.6, *p*-value: 0.003, Table 2 – column 2). But also for them, the possibility to fall behind the pre-existing contribution level appears to be a strong behavioral barrier. 16% of the *poor* participants decide to undo pre-existing contribution levels. Neither the share of givers (100% vs. 84.0%, *p*-value: 0.110, Fisher's exact) nor the share of strong free riders (0% vs. 0%) differ significantly across treatments for poor agents. Comparing the absolute reductions in individual contributions for both types between GITA and GIVE (*rich*: -1.9 vs. *poor*: -2.6) does not reveal any significant differences in our sample (captured by interaction term GITA x Poor, *p*-value 0.739, Table 2 – column 2). There is statistical evidence that higher trust levels increases giving, but this holds only for rich players (*p*-value: 0.001, Table 2 – column 3). The remaining control variables (age, female, student, income and city) do not significantly affect our results.

Even though GITA reduces individual contributions compared to GIVE (4.6 vs. 7.0, Table 2 – column 1, *p*-value: 0.024), average individual provision levels (i.e., including both the status-quo and individual contributions) in GITA are about as twice as high as in GIVE (13.8 vs.7.0, *p*-value: 0.000, Table 2 – column 4; Figure 2 – right-hand side). As discussed, participants in GITA hardly reduce the status-quo contributions. More precisely, in GIVE and in GITA *rich* (30% vs. 35%, *p*-value 0.406, Mann-Whitney U test) and *poor* (29% vs. 36%, *p*-value 0.411, Mann-Whitney U test) players contribute on average around 30% of the disposable income to the public good. That is, *rich* and *poor* players benefit from pre-existing contribution levels: Individual provision levels both for *rich* players (18.2 vs. 8.9, *p*-value 0.000, Table 2 –column 5) and *poor* players (5.8 vs. 3.6, *p*-value 0.000, Table 2 – column 5) are higher in GITA than in GIVE.

The private provision of public goods among heterogeneous agents always raises issues on a fair burden sharing, i.e., who should bear the costs of providing the public good? We now compare provision at the group level (see Figure 3). Groups in GIVE contribute on average 25 tokens to the public good. The two *poor* players per group contribute together 7 tokens and the two *rich* players contribute 18 tokens. Consequently, nearly 28% of all contributions are provided by *poor* participants and the remaining 72% by their *rich* partners which shows that participants coordinate on an equalizing redistribution that offsets the initial differences in endowments. This trend is even more pronounced in GITA, where two *rich* players contribute 12 tokens to the public good and the two *poor* players contribute 4 tokens. Taking into account the status-quo level (8 tokens for the *poor* and 24 tokens for the *rich* players), the overall provision level increases to 48 tokens per group. Therefore, 75% of the total public

Table 2: Determinants of individual contribution and provision levels

	Individual contribution levels			Individual provision levels		
	(1)	(2)	(3)	(4)	(5)	(6)
GITA	-2.33**	2.62*	-2.742*	6.81***	9.38***	9.26***
	(1.02)	(1.44)	(1.51)	(1.22)	(1.44)	(1.51)
Poor		-5.22***	-4.02*		-5.22***	-4.02*
		(1.23)	(2.14)		(1.23)	(2.14)
GITA x Poor		0.74	1.54		-7.26***	-6.46***
		(1.57)	(1.65)		(1.57)	(1.65)
Trust			5.31***			5.31***
			(1.60)			(1.60)
Trust x Poor			-5.11***			-5.11***
			(1.73)			(1.73)
Climate			0.11			0.11
			(1.04)			(1.04)
Climate x Poor			0.08			0.08
			(1.35)			(1.35)
Age			0.04			0.04
			(0.12)			(0.12)
Female			-0.39			-0.39
			(1.02)			(1.02)
Student			-0.50			-0.50
			(1.29)			(1.29)
Income			-0.87			-0.87
			(0.63)			(0.63)
City			0.36			0.36
			(0.49)			(0.49)
Constant	6.97***	8.86***	7.71	6.97***	8.86***	7.71
	(0.801)	(1.14)	(4.76)	(0.80)	(1.14)	(4.76)
R-squared	0.037	0.184	0.334	0.184	0.520	0.603
AIC	895.234	887.155	768.232	945.941	876.155	768.234
Observations	139	139	122	139	139	122

Note: OLS regressions, with robust standard errors in parentheses. $*p < 0.1$, $**p < 0.05$ and $***p < 0.01$. Dependent variable are participants' individual contribution to the public good in Model (1) – (3) and the corresponding provision level in Model (4) – (6).

Figure 3: Public good provision at group level by treatments and types of players
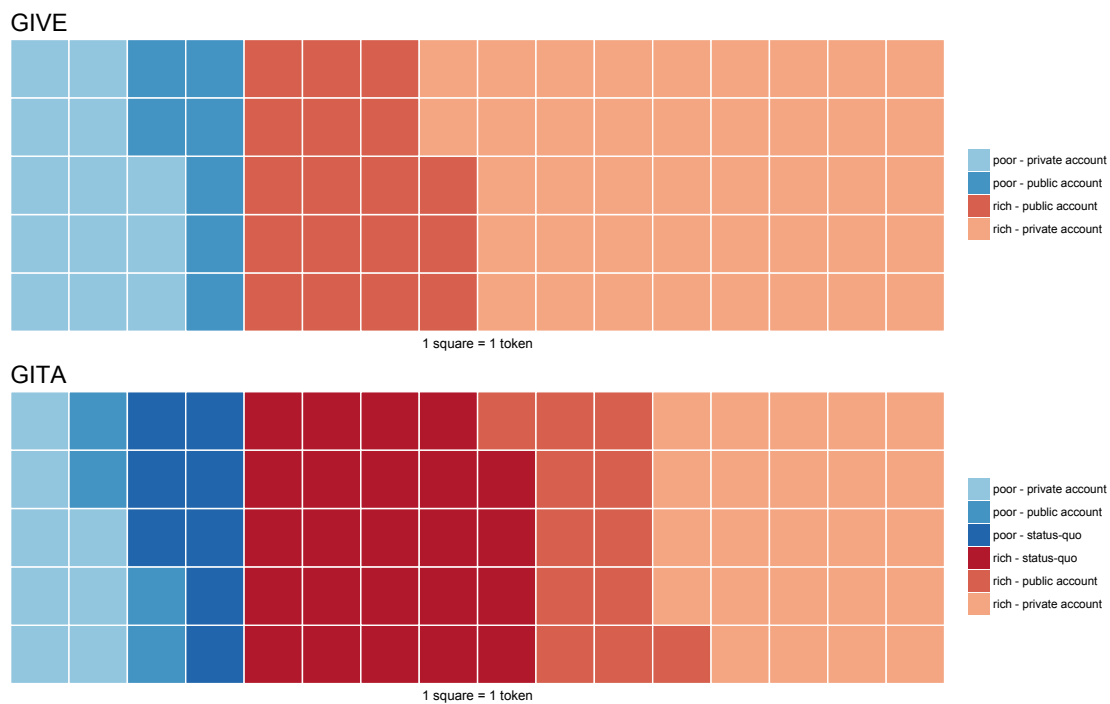
Note: Each square corresponds to one token contributed to the public good on average per group in GIVE (GITA) on top (below). Squares are highlighted in different colors for different participants (poor participants from developed countries vs. rich participants from developing countries). In GITA, also initial contribution levels are highlighted separately.

good level is provided by the *rich* agents. This is remarkable since *rich* players' status-quo contribution was already three times higher compared to the *poor* players' levels. We thus find that an institutional design which builds up on pre-existing provision levels characterizing the status quo– even though the taking option fully ensures co-operation to be voluntarily – generates higher benefits than a pure giving frame even if players differ with respect to their initial wealth.

4 Summary and concluding remarks

The Paris Agreement arguably gives new hope to climate change negotiations (e.g., Bodansky 2016) but from a current perspective, it seems insufficiently ambitious to limit the global mean temperature increase to 2°C (UNFCCC 2015b). According to Article 3 of the Agreement, the global efforts to combat climate change at a dangerous level will present a progression over time. As a dynamic mechanism to review the voluntarily implemented NDCs of the different Parties, the global stocktake will as-

sess the achievements of the international community every five years, starting in 2023 (Article 14). As countries will review, compare and potentially adjust their efforts periodically during this process, their future commitments will depend on what has been already achieved. This status-quo reflects an important reference point serving either as a commitment advice for strengthening the ambition or even revising it downwards. We experimentally investigate the impact of the status-quo on future climate actions in a stylized negotiation setting reflecting the persisting dichotomy (Tørstad and Sælen 2017) between rich ("Annex-I") and poor ("Non-Annex-I") countries. Our results stress the importance of the status-quo on cooperative behavior. The analysis suggests that starting with pre-existing mitigation levels can foster aggregate mitigation levels. As an important insight, falling behind the pre-determined status-quo builds a strong behavioral barrier. The vast majority of players tends to abstain from reversing existing mitigation efforts.

Of course, our experimental setup reflects only one particular aspect of the global stocktake as a review mechanism, namely its potential to affect players' cooperative behavior via the status-quo. Our results thereby stress the sensitivity of overall climate mitigation efforts for this reference point. Poor and rich agents contribute around 30% of their disposable endowment to the climate account both in a setting with and without pre-determined contribution levels. Consequently, a status-quo comprising 40% of the initial wealth resulting in an increase in overall ambition levels. The possibility to revise contributions later might have led to more ambitious contribution levels initially (C2ES 2017). Given our results, the higher pre-determined contribution levels might indeed result in more climate mitigation efforts. The robustness of this finding against the background of different pre-existing contribution levels, provides an avenue for future research. Finally, whether the global stocktake process fosters the implementation of the Paris Agreement and increases overall climate actions will also depend on a variety of different factors which we did not consider in our experiment including, e.g., strategic behavior over multiple periods, sequential decision making, and an open and non-anonymous discussion about targets and intentions. This provides an interesting and important route for further research.

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Appendix

Summary Statistics

Table 3: Summary statistics

	Developed (*rich*)		Developing (*poor*)	
	GIVE	GITA	GIVE	GITA
Mean contribution level	8.86	6.24	3.64	1.76
% of contributions < 0	-	7.00	-	16.00
% of contributions = 0	7.00	2.00	0.00	0.00
% of contributions > 0	93.00	91.00	100.00	84.00
% of endowment	29.53	20.80	36.40	17.60
% of disposable endowment	29.53	34.67	36.40	29.33
Mean provision level	8.86	18.24	3.64	5.76

Experimental design details

The material incentives for each agent i, π_i, is given by the following equation:

$$\pi_i = w_i^t - a_i^t + h(\sum_{j=1}^{n} e_j^t + \sum_{j=1}^{n} a_j^t).$$

Where w_i^t is i's endowment in treatment t, $a_i^t \in A_i^t$ represents the transfer of i in treatment t, A_i^t is the corresponding strategy set, h denotes the per capita return to the public good with $0 < h < 1 < hn$ and e_i^t is i's initial allocation to the public good in treatment t. We choose $n = 4$ and $h = 0.4$.

Agents in differ with respect to their initial endowment. Each group consists of two *rich* agents and two *poor* agents. *rich* agents receive an initial endowment of 30 tokens and *poor* agents, in contrast, receive an initial endowment of 10 tokens.

Our experiment design consists of two treatments summarized in Table 4. Treatments differ in the initial allocation to the public good, e_i^t, the initial endowment w_i^t, and the corresponding actions set available A_i^t. We use a pure giving frame (GIVE) as baseline. In this voluntary contribution mechanism, no initial allocations to the public good are

Table 4: Experimental parameters

		Endowment	Initial cont.	Action space
GIVE	poor	$w_{poor}^{GIVE} = 10$	$e_{poor}^{GIVE} = 0$	$a_{poor}^{GIVE} \in [0, 10]$
	rich	$w_{rich}^{GIVE} = 30$	$e_{rich}^{GIVE} = 0$	$a_{rich}^{GIVE} \in [0, 30]$
GITA	poor	$w_{poor}^{GITA} = 10$	$e_{poor}^{GITA} = 4$	$a_{poor}^{GITA} \in [-4, 6]$
	rich	$w_{rich}^{GITA} = 30$	$e_{rich}^{GITA} = 12$	$a_{rich}^{GITA} \in [-12, 18]$

made ($e_{poor}^{GIVE} = e_{rich}^{GIVE} = 0$). Consequently, agents are endowed with $w_{poor}^{GIVE} = 10$ and $w_{rich}^{GIVE} = 30$ and have the following actions sets: $a_{poor}^{GIVE} \in [0, 10]$ and $a_{rich}^{GIVE} \in [0, 30]$. In our second treatment, agents can either add to or subtract from the public good. In this giving and taking (GITA) frame, both rich and poor agents made an initial contribution of 40% of their endowment to the public good, i.e., $e_{poor}^{GITA} = 4$ and $e_{rich}^{GITA} = 12$. In GITA, the remaining endowments are given by $w_{poor}^{GITA} = 6$ and $w_{rich}^{GITA} = 18$ and, consequently, poor agents can decide on transfers between -4 and 6 tokens ($a_{poor}^{GITA} \in [-4, 6]$) and rich agents between -12 and 18 tokens ($a_{rich}^{GIVE} \in [-12, 18]$).

Instructions [†]

- Screen 1 -

Welcome!

Dear [Name], Thank you very much for your interest in contributing to our research. You can start the Online-Study immediately. Prior to participating, please read through the most important information briefly summarized here: - Participation will take no more than 10 minutes of your time. - The study consists of both a decision task and a questionnaire. - You will receive detailed information on the decision task during the study. - All explanations are carried out as described: By "money" we mean real amounts of money which will be paid out. By other "participants" we mean real members of the UNYANET network who participate in this study just like you. Note: Please always use the provided buttons and not your internet browser for navigation. Otherwise a successful completion of the study cannot be guaranteed. Please click "Next" to learn more about the expense allowance.

- Screen 2 -

[†]Explanatory notes are given in square brackets. Please note that we use braces to indicate the alternative wording [DEVELOPED vs. DEVELOPING] and parameters [GIVE vs. GITA] used in the different treatments.

Your expense allowance consists of two parts: For each complete participation, UNYANET receives a fixed amount of 2 US-Dollars. Additionally, an individual payment can be obtained in the decision task. Whether you will receive the individual payment and how much you will get, depends on two factors: (i) Your decision in the study as well as the decisions of other participants. (ii) After all participants have made their decisions, we randomly select 10 percent of all participants who will receive their individual payment. Please click "Next" to learn more about the decision task.

- Screen 3 -

We now start the explanation and the procedure of the decision task. Please carefully read through the following instructions.

Explanation and procedure of the decision task

In this section, you have the chance to determine your individual payment. **Who is involved in the study?** We create groups of four participants; in addition to you there are three other participants in your group. Members of your group are from a variety of countries. We categorize countries according to the Human Development Index (HDI) published by the United Nations Development Programme. The HDI is a summary of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI divides countries into four different groups. For our study, we classify countries of "very high human development" and "high human development" as developed countries and we classify countries of "medium human development" and "low human development" as developing countries. Like you one other participant is from a [DEVELOPED: developed] [DEVELOPING: developing] country. The two remaining participants are, in contrast, from [DEVELOPED: developing] [DEVELOPING: developed] countries.

The decision you will make affects both you and the other members of your group. Therefore, your individual payment will be influenced by both your decision and the decisions of the other group members. Please note, that all other members of your group possess exactly the same amount of information and face the same decision as you do.

What is the decision task? During the study your individual payment is calculated in tokens. Subsequently to the study your payment will be converted from tokens into US-Dollars at the following exchange rate:

$$1 \text{ Token} = 1.5 \text{ US \$ [adjusted for purchasing power parity]}$$

Please note, the value of one token is the same in all countries. [GIVE: In this decision task, you and the other member of your group from a [DEVELOPED: developed] [DEVELOPING: developing] country possess an initial endowment of [DEVELOPED: 30] [DEVELOPING: 10] tokens in a private account. The two remaining participants from [DEVELOPED: developing] [DEVELOPING: developed] countries possess, in contrast, an initial endowment of [DEVELOPED: 30] [DEVELOPING: 10] tokens in their private accounts. Your task is to decide on the transfer of tokens between your private account and the group account: That is how many of the [DEVELOPED: 30] [DEVELOPING: 10] tokens in your private account you transfer to the group account. You will be asked to indicate your transfer on a slider as shown below. If you move the slider to the right, you decide to transfer tokens from your private account to the group account. Please note, your transfer can be between 0 and [DEVELOPED: 30] [DEVELOPING: 10] tokens (only integer numbers).] [GITA: In this decision task, you and the other member of your group from a [DEVELOPED: developed] [DEVELOPING: developing] country possess

an initial endowment of [DEVELOPED: 18] [DEVELOPING: 6] tokens in a private account. The two remaining participants from [DEVELOPED: developing] [DEVELOPING: developed] countries possess, in contrast, an initial endowment of [DEVELOPED: 18] [DEVELOPING: 6] tokens in their private accounts. In addition, there are 32 tokens in a joint group account shared by all members of your group. Your task is to decide on the transfer of tokens between your private account and the group account: That is how many of the [DEVELOPED: 18] [DEVELOPING: 6] in your private account you transfer to the group account and how many of the 32 tokens you leave in the group account respectively. Your transfer is related to the group account as described below: A positive transfer is a transfer of tokens from your private account to the group account. Respectively, a negative transfer is a transfer of tokens from the group account to your private account. You will be asked to indicate your transfer on a slider as shown below. If you move the slider to the left, you decide to transfer tokens from the group account to your private account (negative transfer). If you move the slider to the right, you decide to transfer tokens from your private account to the group account (positive transfer). Please note, you are from a [DEVELOPED: developed] [DEVELOPING: developing] country and your transfer can be between [DEVELOPED: -12] [DEVELOPING: -4] and [DEVELOPED: 18] [DEVELOPING: 6] tokens (only integer numbers). Participants from [DEVELOPED: developing] [DEVELOPING: developed] countries can transfer [DEVELOPED: -4] [DEVELOPING: -12] and [DEVELOPED: -12] [DEVELOPING: -4] and [DEVELOPED: 18] [DEVELOPING: 6] [DEVELOPED: 6] [DEVELOPING: 18] tokens (only integer numbers).]

How do the accounts differ from each other? Your individual payment depends on your decision as well as on the decisions of the other three group members according to the rules explained below. You receive a payment from tokens in your private account and you and the other three group members receive a payment from tokens in the group account. **Private account:** It's only you who can transfer tokens from your private account to the group account or vice versa. For every token which is in your private account, you will receive 1 token. The other three group members do not receive any payment from your private account. However, every participant equally owns a respective private account. **Group account:** Apart from you, the other three group members can also transfer tokens from their private account to the joint group account. For every token which is in the group account, you and the other three group members will receive a payment of 0.4 tokens. Your total individual payment consists, consequently, of two parts: Part one: the amount of tokens in your private account, and Part two: the payment from the group account.

- Screen 4 -

Examples

Before deciding on your transfer, this page will provide you with two examples of different transfers and how these decisions affect payments.

Example 1: [GIVE: Assume you are Participant A. You are from a [DEVELOPED: developed] [DEVELOPING: developing] country. You decide on a transfer of 2 tokens from your private account to the group account. Participants B decides to transfer 2 tokens from its private account to the group account. C decides to transfer 3 tokens and D decides to transfer 1 token. The group account now contains 8 (2+2+3+1) tokens. According to the rules, this amount of tokens is multiplied by 0.4 and all group members benefit equally from it. Consequently, everybody receives 3.2 tokens from the group account. Your total individual payment is given by your initial endowment minus your transfer plus the payment from the group account: [DEVELOPED: 30] [DEVELOPING: 10]-2+3.2= [DEVELOPED: 31.2] [DEVEL-

OPING: 11.2].] [GITA: Assume you are Participant A. You are from a [DEVELOPED: developed] [DEVELOPING: developing] country. You decide on a transfer of 2 tokens from your private account to the group account. Participants B decides to transfer 2 tokens from its private account to the group account. C decides to transfer 3 tokens and D decides to transfer 1 token. The group account now contains 40 (32+2+2+3+1) tokens. According to the rules, this amount of tokens is multiplied by 0.4 and all group members benefit equally from it. Consequently, everybody receives 16 tokens from the group account. Your total individual payment is given by your initial endowment minus your transfer plus the payment from the group account: developed [DEVELOPED: 18] [DEVELOPING: 6] - 2+16= [DEVELOPED: 32] [DEVELOPING: 20] tokens.]

Example 2: [GIVE: Assume you are Participant A. You are from a [DEVELOPED: developed] [DEVELOPING: developing] country. You decide on a transfer of 6 tokens from your private account to the group account. Participants B decides to transfer 2 tokens from its private account to the group account. C decides to transfer 3 tokens and D decides to transfer 1 token. The group account now contains 12 (6+2+3+1) tokens. According to the rules, this amount of tokens is multiplied by 0.4 and all group members benefit equally from it. Consequently, everybody receives 4.8 tokens from the group account. Your total individual payment is given by your initial endowment minus your transfer plus the payment from the group account: [DEVELOPED: 30] [DEVELOPING: 10]-6+4.8= [DEVELOPED: 28.8] [DEVELOPING: 8.8].] [GITA: Assume you are Participant A. You are from a [DEVELOPED: developed] [DEVELOPING: developing] country. You decide on a transfer of 2 tokens from the group account to your private account. Participants B decides to transfer 2 tokens from its private account to the group account. C decides to transfer 3 tokens and D decides to transfer 1 token. The group account now contains 36 (32-2+2+3+1) tokens. According to the rules, this amount of tokens is multiplied by 0.4 and all group members benefit equally from it. Consequently, everybody receives 14.4 tokens from the group account. Your total individual payment is given by your initial endowment minus your transfer plus the payment from the group account: [DEVELOPED: 18] [DEVELOPING: 6] -(-2)+14.4= [DEVELOPED: 34.4] [DEVELOPING: 22.4] tokens.]

- Screen 5 -

Contribution Decision

[GIVE: At this stage, you now have to decide upon your transfer. Please note, that the other members of your international group also indicate their decisions. You have [DEVELOPED: developed] [DEVELOPING: developing] tokens in your private account. Please indicate the amount of tokens you want to transfer: 0-[DEVELOPED: 30] [DEVELOPING: 10].] [GITA: At this stage, you now have to decide upon your transfer. Please note, that the other members of your international group also indicate their decisions. The group account contains 32 tokens and you have [DEVELOPED: 18] [DEVELOPING: 6] in your private account. Note again, any negative transfer between [DEVELOPED: -12] [DEVELOPING: -4] tokens and -1 is a transfer from the public account to your private account. Accordingly, any positive transfer between 0 and [DEVELOPED: 18] [DEVELOPING: 6] tokens is a transfer from your private account to the public account.] Confirm: Please confirm your choice by clicking "Next".

- Screen 6 -

Belief Group 1: Irrespective of your own decision: What do you think is the transfer chosen by the other group member from a [DEVELOPED: developed] [DEVELOPING: developing] country? [GIVE: Please indicate the amount of tokens 0-[DEVELOPED: 30] [DEVELOPING: 10].] [GITA: Note again, any

negative transfer between [DEVELOPED: -12] [DEVELOPING: -4] and -1 is a transfer from the public account to the private account. Accordingly, any positive transfer between 0 and [DEVELOPED: 18] [DEVELOPING: 6] is a transfer from the private account to the public account.]

Belief Group 2: Irrespective of your own decision: What do you think is the transfer chosen by the other group members from [DEVELOPED: developing] [DEVELOPING: developed] countries? [GIVE: Please indicate the amount of tokens 0-[DEVELOPED: 10] [DEVELOPING: 30].] [GITA: Note again, any negative transfer between [DEVELOPED: -4] [DEVELOPING: -12] and -1 is a transfer from the public account to the private account. Accordingly, any positive transfer between 0 and [DEVELOPED: 6] [DEVELOPING: 18] is a transfer from the private account to the public account.]

- Screen 7 -

Please use the following scale to indicate how much you agree with the following statement: To me, the decision task was easy to understand. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

- Screen 8 -

Please use the following scale to indicate how you classify yourself: In general, are you rather risk seeking or do you avoid to be exposed to risk? 0 (risk-averse) to 5 (prepared to take risks) O 1 O 2 O 3 O 4 O 5 O No answer

Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? O Most people can be trusted O You need to be very careful O No answer

- Screen 9 -

Please indicate for each of the following actions whether you think it can always be justified, never be justified, or something in between, using this scale:

a) Claiming government benefits to which you are not entitled. O Never justifiable O Mostly not justifiable O Neutral O Mostly justifiable O Always justifiable O No answer

b) Avoiding a fare on public transport. O Never justifiable O Mostly not justifiable O Neutral O Mostly justifiable O Always justifiable O No answer

c) Cheating on taxes if you have a chance. O Never justifiable O Mostly not justifiable O Neutral O Mostly justifiable O Always justifiable O No answer

- Screen 10 -

Please classify the area where you grew up. O Big city O Small city O Rural village O No answer

People see themselves and how they relate to the world differently. Using this scale, can you indicate how strongly you agree or disagree with each of the following statements about how you see yourself?

a) I see myself as a world citizen. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

b) I see myself as part of the [home country] nation. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

c) I see myself as an autonomous individual. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

- Screen 11 -

If you use the following products or services, do you use them to contact people living in other parts of your country, or also people living in other countries?

a) Postal mail. O Local area O Other parts of my country O Other countries O No answer

b) Phone. O Local area O Other parts of my country O Other countries O No answer

c) Internet. O Local area O Other parts of my country O Other countries O No answer

Consider the following geographical areas. How often do you travel, either for work or for vacation, in each of them?

a) To other countries within my continent. O Every week O Every month O Every year O Less often O Never O No answer

b) To other countries outside my continent. O Every week O Every month O Every year O Less often O Never O No answer

How often do you do the following activity?

a) Watch a television program or movie from a different country. O Every day O Every week O Less often O Never O I do not have access O No answer

b) Watch or listen to an international news source (CNN International, BBC World, Euronews, etc.). O Every day O Every week O Less often O Never O I do not have access O No answer

c) Read an international news source (Time, The Economist, Le Monde, etc.). O Every day O Every week O Less often O Never O I do not have access O No answer

- Screen 12 -

Do you belong to a religion or religious denomination? O Roman Catholic O Protestant O Othodox (Russian/Greek/etc.) O JEW O Muslim O Hindu O Buddhist O Do not belong to denomination O Other:

Please use the following scale to indicate how religious you are (1: not religious at all, 5: very religious). O 1 O 2 O 3 O 4 O 5 O No answer

- Screen 13 -

Please use the following scale to indicate how important it is for you to own a piece of land (1: not important at all, 5: very important). O 1 O 2 O 3 O 4 O 5 O No answer

Please use the following scale to indicate how important it is for you to maintain small species at the Amazon forest in South America (1: not important at all, 5: very important). O 1 O 2 O 3 O 4 O 5 O No answer

Using this scale, can you indicate how strongly you agree or disagree with each of the following statements concerning principles underlying potential rules to allocate climate change mitigation costs across countries:

a) Countries with high income levels must pay a larger share of the costs than countries with low income levels. This option says that countries with greater ability to pay should pay more. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

b) Countries with currently high emissions levels must pay a larger share of the costs than countries with currently low emission levels. This option says that those countries that are currently polluting more should pay more. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

c) Countries with a history of high emissions levels must pay a larger share of the costs than countries with a history of low emissions. This option recognizes that CO_2 builds up in the atmosphere over many years. Thus, countries which polluted more in the past should pay more because they caused more of the problem. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

d) Countries with emissions per person greater than an agreed amount must pay, and they must pay more the higher their emission per person are. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

e) Each country shall reduce its emissions by an equal percentage rate. That is, a countries' overall share in global emissions remains constant. O Strongly disagree O Disagree O Neutral O Agree O Strongly agree O No answer

- Screen 14 -

Using this scale, can you indicate how important the following global challenges are in your opinion:

a) International efforts in combating climate change. O Very important O Important O Neutral O Moderately important O Not important O No answer

b) Securing world nutrition and eradicating poverty. O Very important O Important O Neutral O Moderately important O Not important O No answer

c) Combating epidemics. O Very important O Important O Neutral O Moderately important O Not important O No answer

d) Stabilizing the international financial system. O Very important O Important O Neutral O Moderately important O Not important O No answer

e) Combating terrorism. O Very important O Important O Neutral O Moderately important O Not important O No answer

- Screen 15 -

What comes next? After all participants have made their decisions, the ZEW research team will screen all decisions. To support the activities of your network, UNYANET will receive 2 US-Dollars for each participant. Furthermore, 10 percent of all participants will be randomly selected and receive their individual payment. If you have been selected, you will be informed via email subsequently to the study.

- Screen 16 -

Did you enjoy taking part in this study and do you want to participate in other scientific studies of this type? We would be pleased to add your name to our member database and would be happy to invite you to further studies. As a matter of course, your data are not used for any other purposes. If you wish to withdraw your participation offer at any point of time, your data will be directly unsubscribed from the database. Please click on "Yes", to add your name to our database.

- Screen 17 -

Thank you for your time and support! Do you have any questions left? Our research team would be glad to help you. Do not hesitate to contact: onlinestudy@zew.de. Please note details concerning the research agenda and the results of the study will be circulated among all registered persons subsequently to the study