Climate Policy Commitment Devices

Sebastian Dengler, Reyer Gerlagh,

Stefan Trautmann , Gijs van der Kuilen

Annual EAERE conference
24 June 2016, Zurich

Climate change problem = international public good game

- EAERE: McEvoy, Barrett, Dannenberg,…

and happy family planning

Or? (EAERE: Ahlvik, Liski, Harstad,…)

Happy family falling apart

- Future planners may backtrack on past agreements:

- Trump (26 May 2016):
  - “President Obama entered the United States into the Paris Climate Accords – unilaterally, and without the permission of Congress.”
  - “We’re going to rescind all the job-destroying Obama executive actions including the Climate Action Plan”
  - “We’re going to save the coal industry and other industries threatened by Hillary Clinton’s extremist agenda.”
  - “We’re going to cancel the Paris Climate Agreement and stop all payments of U.S. tax dollars to U.N. global warming programs.”

- Rubio, Cruz, Christie, Bush, Kasich voiced similar ideas

The **Problem**: Fossil Fuel Conservation and Climate Change

- Need to keep some fossil fuels in deposits to prevent climate catastrophe (threshold)
- But how much? (uncertainty)
- If we=2016 save FFs, they still may be exhausted by 2100 (FF conservation is strategic substitutes).

Possible institutional solutions

- Cheap clean energy could make FF redundant
- Certain (worst-case) climate damages

Possible ethical solutions

- Eco-dictator
- ‘Rawls’

Sequential Public Good Threshold Game with Uncertainty

4 periods: t={1,2,3,4}

3 players, one for each period t=1,2,3

t=1:

- Start with 2 resource units: $S_1=2$
- Exploit, or not: $R_1=0$ or $R_1=1$

$t=2,3$

- Start with S_t resource units: $S_t=S_{t-1}-R_{t-1}$
- Exploit (possible if resource left), or not: $R_t=0$ or $R_t=1$

t=4:

- stable climate if 2 resource units conserved: $C=1$ if $S_4=2$
- catastrophe if 0 resources left (full extraction): $C=0$ if $S_4=0$
- $p=0.5$ catastrophe if 1 resource left: $E[C]=1/2$ if $S_4=1$

Private – Public optimum

Preferences:

- Exploitation is individually rational (backwards induction)
- Conservation is Socially Optimal

$\boldsymbol{V_t=2R_t+8/3C}$

- Resource extraction pays 2 units
  - and increases catastrophe by 50% chance
- Stable climate pays 8/3 units (eg altruism)
  - In expectations: resource conservation pays 4/3 units

Study the intertemporal social dilemma under different conditions

- Liberal (benchmark sequential DM)
- Certainty (any resource use causes catastrophe)
  - alternative interpretation: scare them into climate policies
- Solar (costly investments prohibits FF extraction)
- Dictator (first player decides full game)
- Rawls (random player decides full game)

Two measures of success:
(i) conservation
(ii) payoff/efficiency

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Research questions:

1. Can we mimic intertemporal climate change dilemma?
2. Do policy interventions help (Certainty; Solar)?
3. Do subjects choose effective interventions?

Study the intertemporal social dilemma under different conditions

Benchmark: **privately optimal play** (backward induction)

- Liberal: exhaustion
- Certainty: conservation to prevent catastrophe
- Solar: first player invests & extracts: still risk
- Dictator: first player extracts & restricts others
- Rawls: full conservation (social opt)

Experimental Implementation

Payment as before: $\boldsymbol{V_t=2R_t+8/3C}$ times 3 Euros

3 stages

1. Play, no learning about other players' strategies (strategy method)
2. Vote and play
   - What game do players prefer/ do they pick the highest-payoff game?
3. Repeated play with learning
   - Does learning matter?

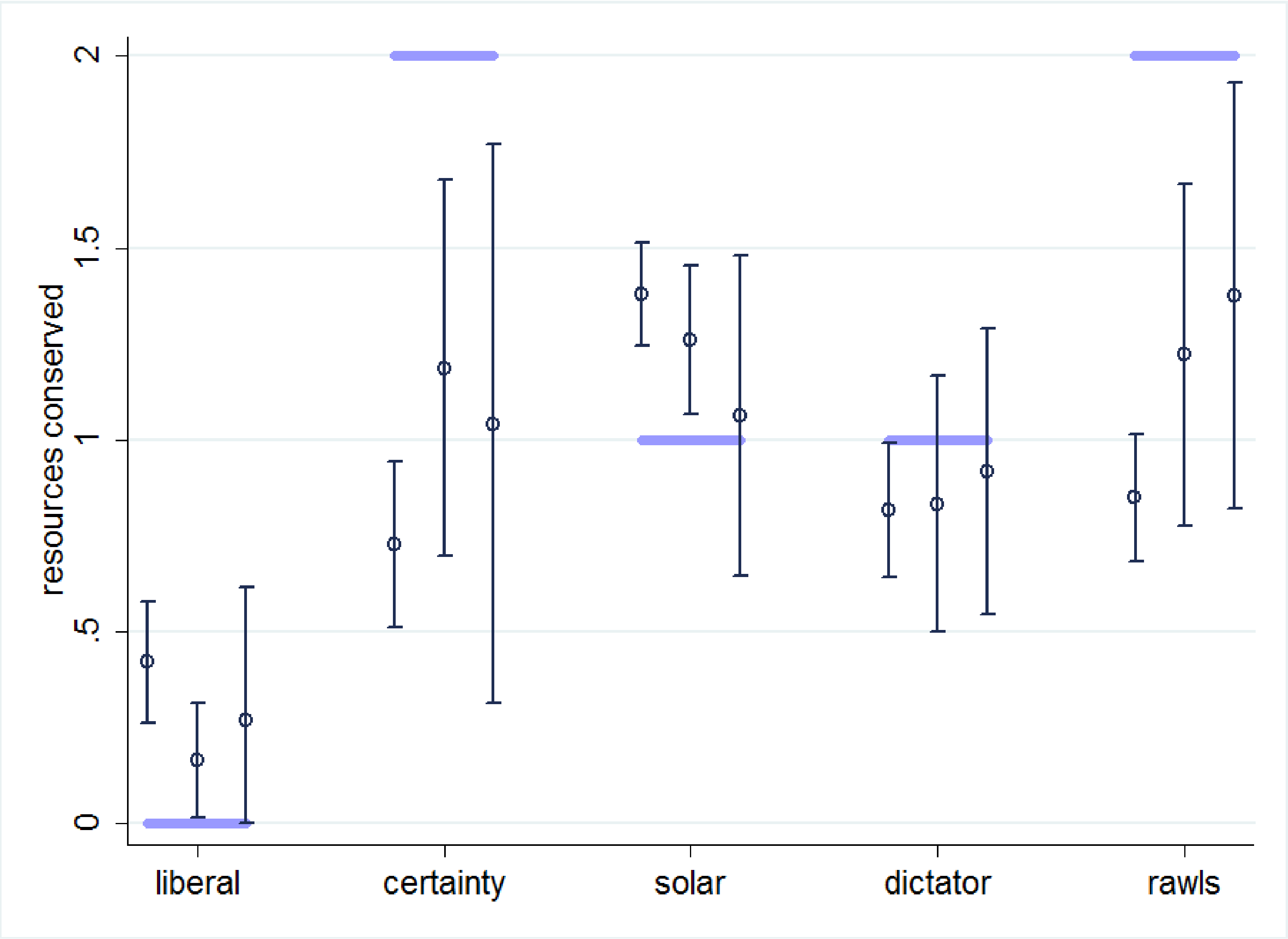
Experimental Implementation

Subjects: 120 Tilburg Uni students

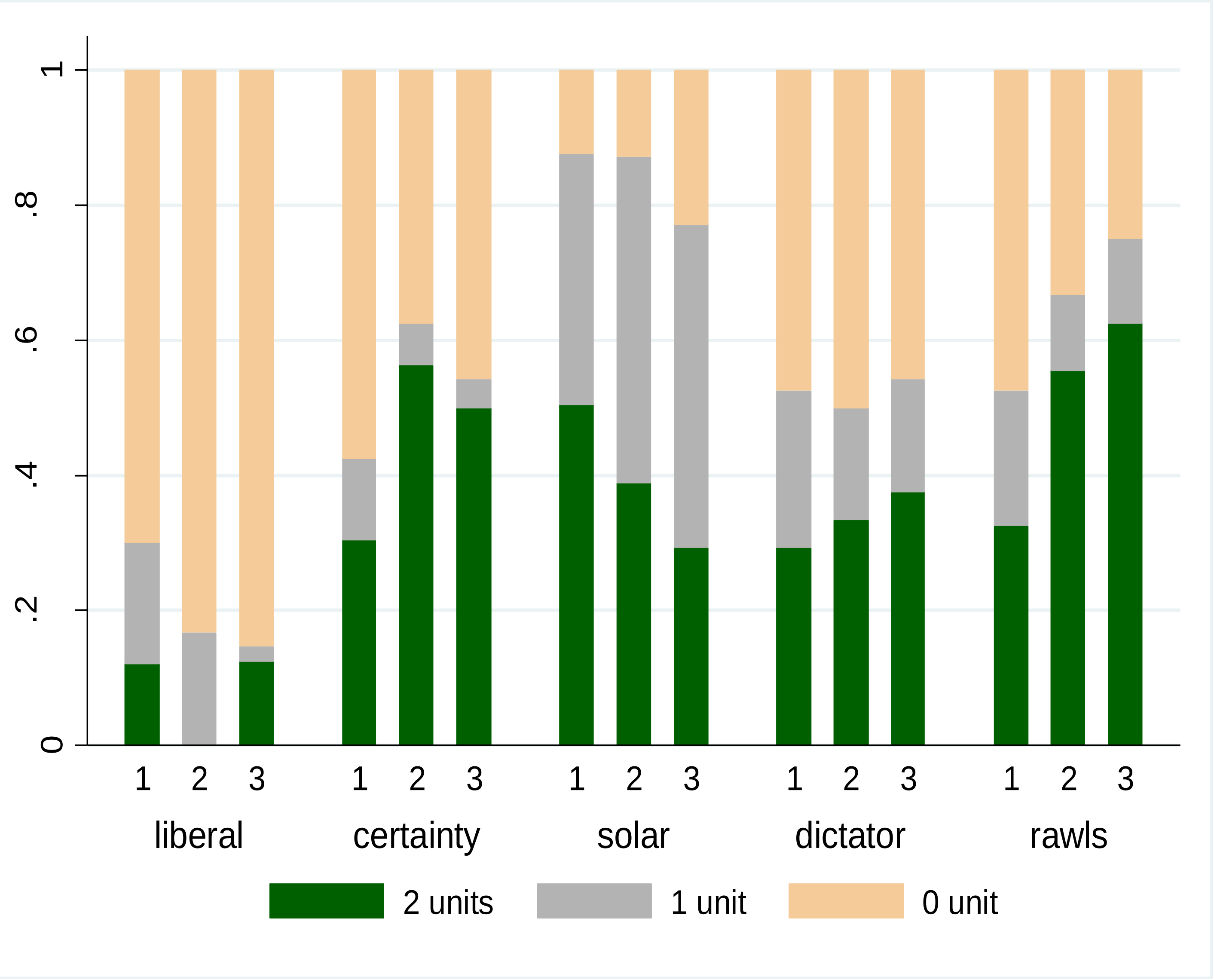
Duration: 75 mins for series of games

Payments: random selection of game, average payment €9.32

Results: average resource conservation at group level



Using 1 resource vs (0 or 2)



Results: group level, conservation & welfare

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	$\bar{S}_4^o$	E$[S_4]$	1–2	$\bar{S}_4^o$	E$[S_4]$	4–5	E$[V]$	E$[V]$
Player-interaction	No	Yes		No	Yes		Yes	Yes
Stage	1	1	1	3	3	3	1	3
Liberal	41	21	20***	17	14	3	21	14
Certainty	51**	36***	15***	63**	52##	10	24	48
Solar	75***	69***	6***	54**	53**	1	57***	41**
Dictator	41	41***		46**	46**		41***	46**
Rawls	43	43***		69**	69***		43***	69***

- Observation 1: All conditions improve on Liberal in terms of conservation

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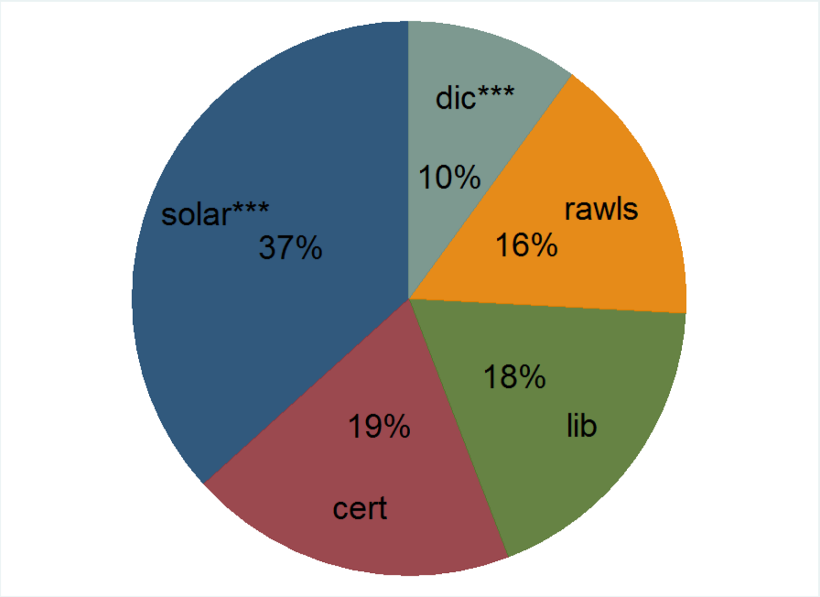
Rawls	43	43***		69**	69***		43***	69***

- Observation 2: All conditions (except Certainty) improve on Liberal in terms of Welfare

Results: Voting behavior

	(1)	(2)	(3)	(4)	(5)
Voted for	Liberal	Certainty	Solar	Dictator	Rawls
Observations / %	22 /18%	23 / 19%	44 / 37%	12 / 10%	19 / 16%

- Solar most popular; dictator least
- Rawls has highest expected payoff, but too difficult?



Conclusions

- Intertemporal social dilemma game relevant practical problem
- Reduced threshold uncertainty => improves outcomes despite worse environment
- Solar => improves outcomes despite being initially costly
- Solar popular institute (while neutral framing = no mention of solar)

- Decision Makers cannot commit to future carbon price, but through investments in Clean Energy Innovation, they can commit to future lower emissions.

Economists find renewables ‘too costly’, …

Economists find renewables ‘too costly’, but others love them

Appendix: Reciprocity does not prevent exhaustion in Liberal

	(1)	(2)	(3)	(4)	(5)
Variable	$\mathbb{E}(R_1)$	$\mathbb{E}(R_2)$	$\mathbb{E}(R_2)$	$\mathbb{E}(R_3)$	$\mathbb{E}(R_3)$
Conservation		S_1=2	S_1=1	S_2=2	S_2=1
Stage 1					
Liberal	0.63	0.54	0.63	0.38	0.64 ***
Certainty	0.49	0.35	0.73 ***	0.15	0.72 ***
Solar	0.41	0.51	0.59	0.35	0.58 ***
Stage 3					
Liberal	0.88	0.58	0.83	0.38	0.88 **
Certainty	0.38	0.38	0.79 **	0.17	0.75 **
Solar	0.67	0.63	0.88 **	0.54	0.79

Observation: conditionality in Liberal Period 3 inconsistent with Nash strategy. Period 2 consistent with Nash?

Appendix: Small 'mistakes' propagate backwards in Certainty

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Observation: strong conditionality in Certainty consistent with Nash strategy. Incomplete trust in round 1+2.

Results: Voting behavior

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Voted for	Liberal	Certainty	Solar	Dictator	Rawls
Observations / %	22 /18%	23 / 19%	44 / 37%	12 / 10%	19 / 16%
Stage 1 behavior	Resource conservation $\bar{S}_4^O$ (percentage out of 2)				
Liberal	39	41	45	21	45
Certainty	45	70**	48	33	55
Solar	75	85*	77	67	66*
Dictator	48	39	35	29	55*
Rawls	36	59*	34	33	55
Average	39	51**	41	31**	44
% Invested in Solar	68	47***	92***	75	60

Understanding and exploiting Solar => vote Solar

* indicates different from all others; here indicated only for last two rows

Appendix. Voting behavior

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Pro-social players vote certainty. Don’t want to waste resources on solar. Understand coordination-benefits from certainty.

Appendix. Those who voting Dictator are poor coordinators

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A-social players / poor coordinators choose ‘dictator’ (want to play without interaction?)