Supplementary Online Appendix

for Kamei, Putterman and Tyran:

"Civic Engagement as a Second-Order Public Good"*

[for online publication only]

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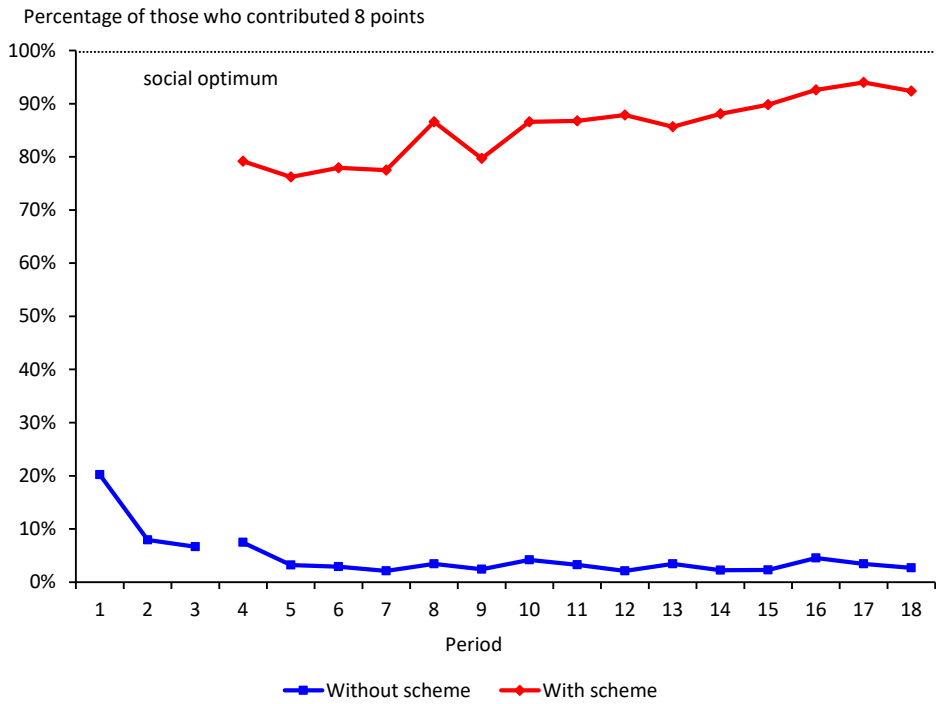
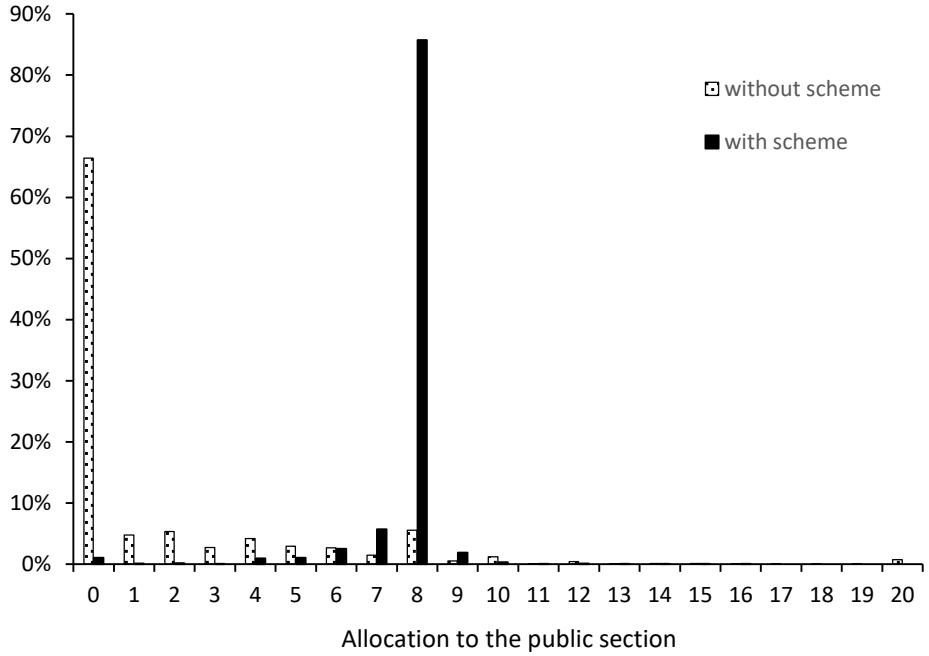
Additional tables and figures

Figure A.1: *Share of subjects contributing social optimum, and frequencies of contributions to public sector, with and without penalty scheme*



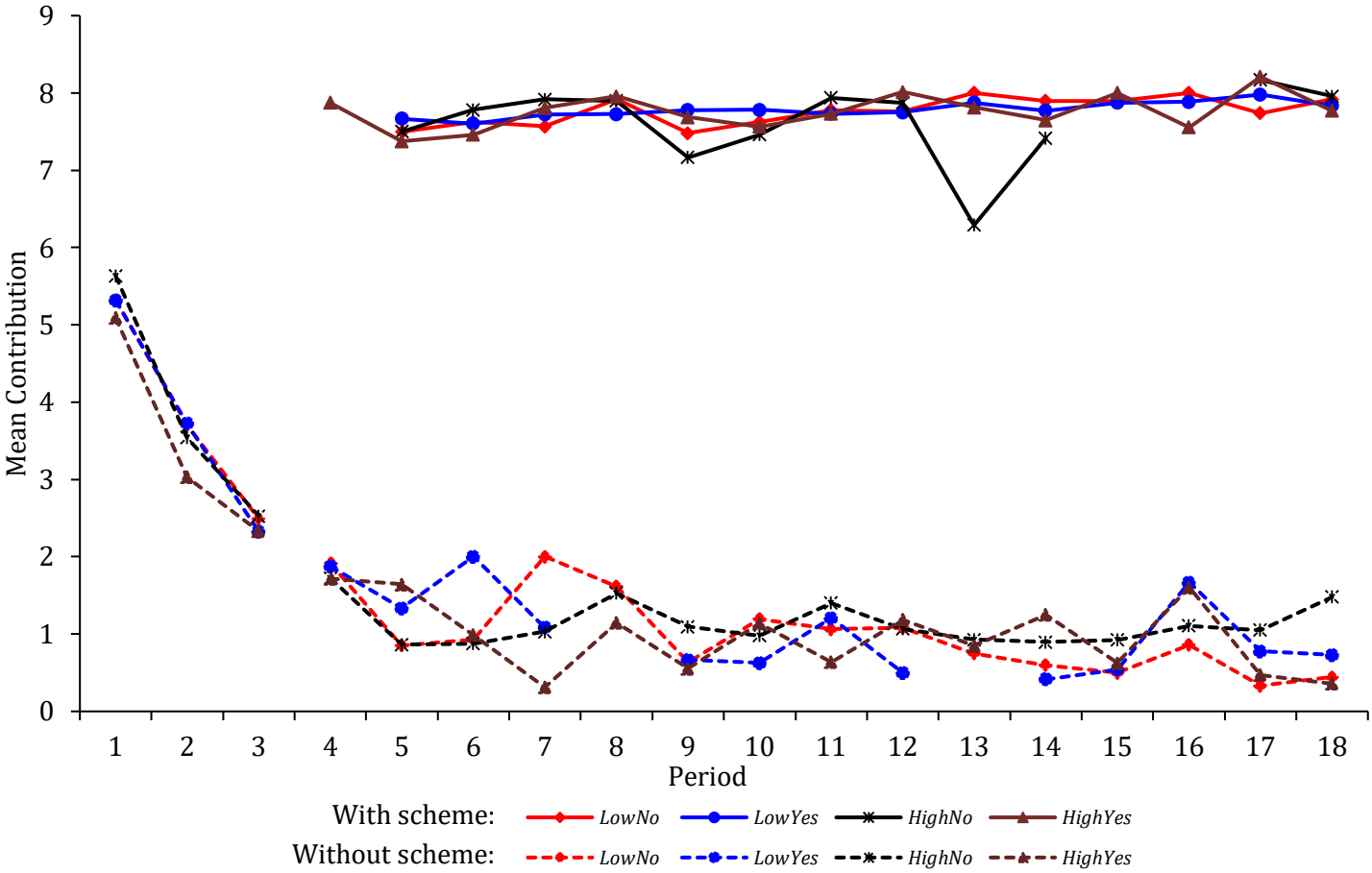
(a) The trend of percentage of subjects who contributed eight points to the public sector in presence and in absence of penalty scheme



(b) Distribution of subjects' allocations to the public sector (all periods)

Note: Both panels include data from all four treatments.

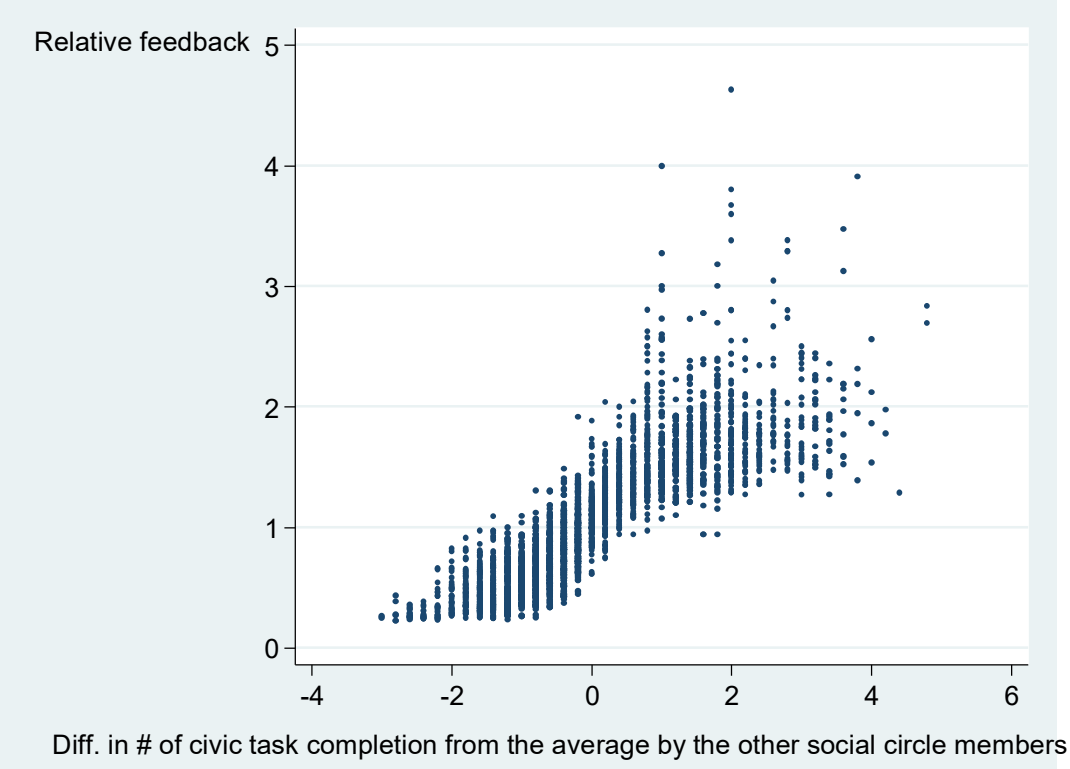
Figure A.2: *Average per subject allocation to the public sector by period and treatment (supplementing Figure 4 of the paper)*



Notes: No groups had the penalty scheme in period 4 in the *LowNo*, *LowYes* and *HighNo* treatments. No groups had the scheme in periods 15 and 16 in the *HighNo* treatment. All groups had the scheme in periods 8 and period 13 in the *LowYes* treatment. Points without scheme are left unconnected between periods 3 and 4 here and in Figure 4 to emphasize that absence of the scheme is a design feature in periods 1 – 3 whereas it results endogenously from civic task completion (and in most cases also from a random draw outcome) in periods 4 – 18.

Figure A.3: *Relative feedback received as a function of the difference of completed civic tasks from mean civic tasks in the individual's social circle*

(A) Scatterplot



Note: Observations by individual and period of Part 2. Relative feedback (y-axis) is average feedback received by a given individual *i* in period *t* (on the scale from 1 = strongly disapprove to 5 = strongly approve), divided by average feedback received by the other 5 social circle members.

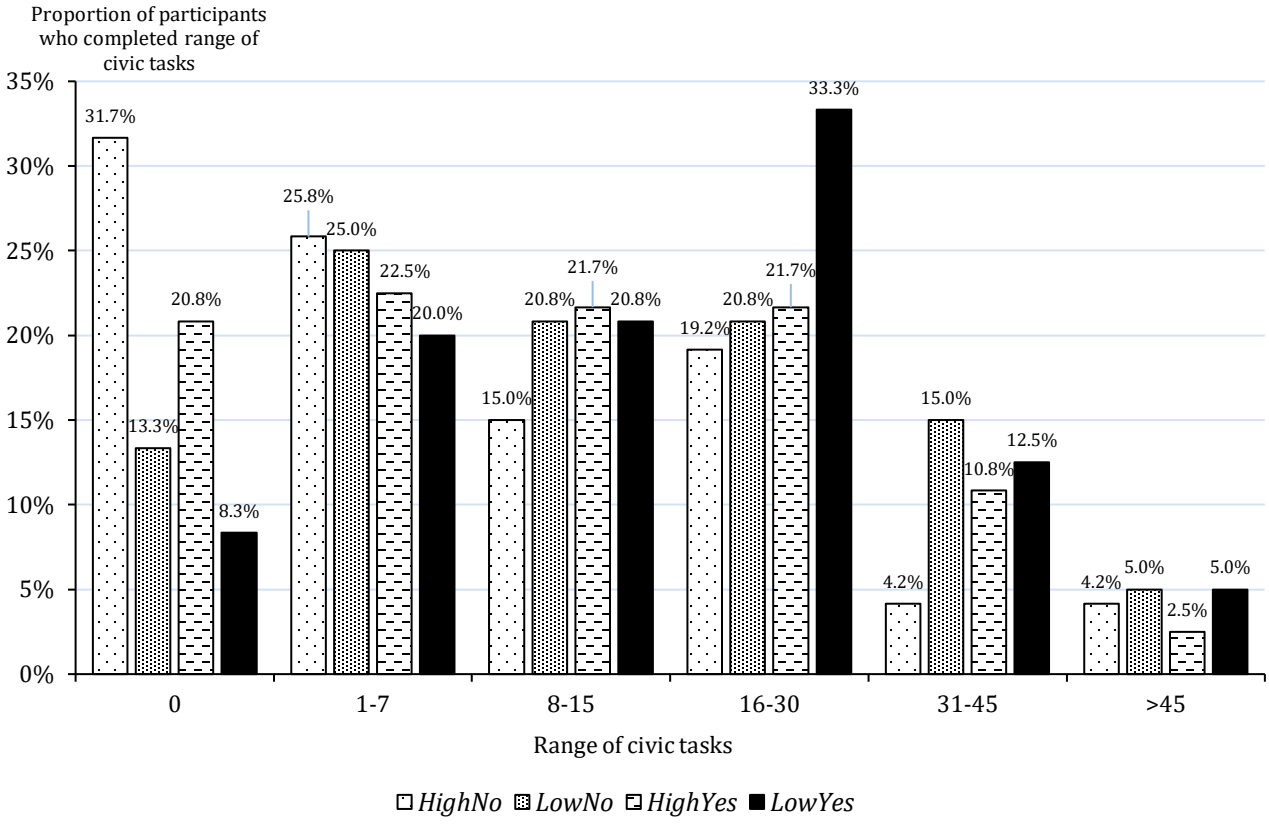
(B) Estimating partial correlation between relative feedback and relative civic task completion

Dependent Variable: Relative feedback received by subject *i* in period $t \in \{4, 5, \ldots, 17, 18\}$

Independent Variable:	(1)
Difference in the number of civic tasks completed by *i* from the average by the other social circle numbers	.365***
	(.020)
Constant	1.048***
	(.000)
# of observations	3,600
F	316.55
Prob > F	.0000***

Notes: Individual fixed effect linear regression with robust standard errors clustered by session. The numbers in parentheses are standard errors. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Figure A.4: *Distribution of subjects by completed civic tasks in total*



Notes: 15 tasks per subject represents an average of one task per period. Hence, 1–7 means a positive number of tasks, but in less than half the periods; 8–15 means a subject may have done tasks in more than half of periods but not more than one per period on average; 16–30 means the subject may have done at least one task each period, but not more than 2 per period on average; 31–45 means more than two but less than three tasks per period on average; and > 45 means more than three tasks per period on average.

Table A.1: *Public sector allocations in Part 1 (periods 1 to 3): test for treatment differences*

Dependent Variable: Allocation by subject *i* in a given period {1, 2, or 3} to the public sector

Independent Variable:	(1)	(2)	(3)	(4)	(5)
LowYes dummy {= 1 for the *LowYes* treatment; = 0 otherwise}	-.023 (.499)	-.033 (.554)	.158 (.750)	-.032 (.568)	-.017 (.522)
HighNo dummy {= 1 for the *HighNo* treatment; = 0 otherwise}	-.165 (.580)	-.170 (.562)	.412 (.768)	-.170 (.642)	.222 (.593)
HighYes dummy {= 1 for the *HighYes* treatment; = 0 otherwise}	-.586 (.650)	-.576 (.654)	-.504 (.849)	-.577 (.497)	-.330 (.598)
Period number {= 1, 2, 3}	---	-2.102*** (.117)	-1.993*** (.197)	---	---
LowYes dummy × Period number	---	---	-.099 (.298)	---	---
HighNo dummy × Period number	---	---	-.306 (.293)	---	---
HighYes dummy × Period number	---	---	-.037 (.326)	---	---
Period 2 dummy {= 1 for Period 2; = 0 otherwise}	---	---	---	-2.358*** (.172)	-2.048*** (.307)
Period 3 dummy {= 1 for Period 2; = 0 otherwise}	---	---	---	-4.182*** (.219)	-3.978*** (.524)
LowYes dummy × Period 2 dummy	---	---	---	---	.136 (.439)
HighNo dummy × Period 2 dummy	---	---	---	---	-.688 (.503)
HighYes dummy × Period 2 dummy	---	---	---	---	-.723 (.536)
LowYes dummy × Period 3 dummy	---	---	---	---	-.217 (.603)
HighNo dummy × Period 3 dummy	---	---	---	---	-.575 (.694)
HighYes dummy × Period 3 dummy	---	---	---	---	-.021 (.847)
Constant	2.749*** (.375)	6.964*** (.444)	6.755*** (.582)	4.943*** (.367)	4.781*** (.373)
# of observations	1,440	1,440	1,440	1,440	1,440
# of left(right)-censored observations	490(4)	490(4)	490(4)	490(4)	490(4)
Log likelihood	-3215.09	-3056.34	-3055.76	-3055.32	-3052.79
p-value (two-sided) for Chi-squared test H_0: Period 2 dummy = Period 3 dummy	---	---	---	< .0000***	.0002***
Maximum [mean] value of variance inflation factors[#1]	1.50 [1.50]	1.50 [1.38]	11.00[#1] [9.79]	1.50 [1.33]	5.33 [4.20]

Notes: Individual random effect Tobit regressions with bootstrapped standard errors. Numbers in parentheses are standard errors. [#1] As in Table A.3(a), we have serious collinearity when we include interaction terms between the Period number variables and the treatment dummies. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table A.2: *Possible "carry-over" of cooperative inclination from periods with to periods without sanction scheme*

Dependent Variable: Total amount allocated by the 24 subjects in a given session in period *t* (where *t* > 6) to the public sector

	LowNo		*LowYes*		*HighNo*		*HighYes*	
Independent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average allocation to the public sector in Part 1	-.333	-.135	.435	.482***	.0344	.0362	.904***	.891***
	(1.166)	(.407)	(.412)	(.147)	(.081)	(.082)	(.265)	(.255)
# of times the scheme was in place during periods *t – 1* and *t – 2* (= 0, 1 or 2)	-1.462	3.360	1.640	-.251	-4.853**	-4.800**	3.426	3.986
	(2.763)	(3.400)	(1.777)	(4.801)	(1.960)	(1.984)	(3.859)	(3.719)
proportion of Part 2 periods having scheme in period *t – 3* or earlier (back to period 4)	-44.334***	-41.696***	-13.506**	-.744	-35.206***	-34.672***	-3.507	-.051
	(14.296)	(12.596)	(5.582)	(11.666)	(6.555)	(6.753)	(12.924)	(12.547)
civic tasks completed in period *t* relative to average civic tasks in period *t*-3, *t*-2, and *t*-1[#1]	---	21.619**	---	-15.065	---	1.814	---	16.645*
		(10.674)		(16.735)		(4.530)		(8.773)
Constant	67.025	21.619	-13.567	-10.862	33.715***	31.594***	-58.920**	-76.083***
	(108.053)	(41.146)	(38.730)	(28.129)	(8.068)	(9.718)	(25.768)	(26.353)
# of observations	30	30	20	20	47	47	35	35
R-squared	.3101	.4156	.3871	.4729	.5188	.5207	.3052	.3796
Maximum [mean] value of variance inflation factors[#2]	1.07	1.30	1.30	1.40	1.09	1.14	1.33	1.34
	[1.05]	[1.17]	[1.20]	[1.32]	[1.06]	[1.07]	[1.23]	[1.19]

Notes: Session random effects linear regressions. The numbers in parentheses are standard errors. Only observations in periods of a session in which the scheme was not implemented are included. [#1] A ratio used to control for whether the number of civic tasks completed by the subjects in the session was high or low in *t* (a period the session failed to achieve a scheme) relative to the session's average civic tasks in the previous three periods. [#2] The VIFs indicate that there is no reason for concern about collinearity in any column. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Discussion of Table A.2: we check whether, in sessions that achieved the high contributions associated with the scheme during many periods, participants also attempted to achieve main stage cooperation by contributing to the public sector even without the scheme. Conceivably, successful imposition of the scheme in many periods positively affects cooperation behaviors in the main stage in future periods due to an institutional spill-over effect (e.g., Kamei, 2016) or so-called behavioral spill-over phenomenon (e.g., Bednar *et al.* 2012). In the event, the data if anything support the opposite conjecture, that participants become convinced that their successful instances of main stage cooperation

occurred only because of the presence of the scheme. Scheme presence and thus high main stage contributions in more past periods if anything reduces main stage contributions in periods lacking the scheme. Specifically, we use the data from only those periods of a session in which the scheme was not achieved, estimating separate regressions for each treatment. The dependent variable is total main stage allocation to the public sector in a given period in a session. Coefficients on share of the most recent two periods in which a penalty scheme was present are generally negative and are significant for one treatment (*HighNo*), and coefficients for percentage of still earlier periods having the scheme are all negative and reach statistical significance in all treatments except *HighYes*. There are significant indications that groups that had higher Part 1 contributions (added as a control in some specifications) have higher contributions in their Part 2 periods without scheme in the *LowYes* and *HighYes* treatments—thus, willingness to engage in main stage cooperation without a scheme is persistent, but is not positively affected by experiencing scheme presence *per se*. Session-level effort to achieve the scheme via performing pre-stage civic tasks in the period in question is included as a control in one of each pair of estimates. It obtains a positive coefficient in three of four treatments that is significant in one treatment (*LowNo*) and marginally significant in another (*HighYes*). The finding that high contributions with scheme presence if anything reduce contributions when the scheme is absent are reminiscent of the finding of Cinyabuguma *et al*. (2005) that when groups achieve nearly full cooperation in a VCM due to the threat of low contributors being expelled and suffering drastic reductions in earnings, cooperation "crashes" towards zero as soon as the threat is removed—in that case, in the known final period of play.

Table A.3: *Trends in the number of civic tasks completed per person*

(a) Session random effects regressions pooling all treatments, with observations at level of session and period

Dep. V	Civic tasks completed			Contribution to first-order PG		
	(1)	(2)	(3)	(4)	(5)	(6)
(i) *LowYes* dummy	0.492***	0.492***	0.330**	2.466***	2.466***	1.437
	(0.122)	(0.122)	(0.132)	(0.507)	(0.508)	(0.981)
(ii) *LowNo* dummy	0.374***	0.374***	0.077	1.207**	1.207**	-1.815
	(0.130)	(0.130)	(0.126)	(0.550)	(0.551)	(1.125)
(iii) *HighYes* dummy	0.145	0.145	-0.083	0.963	0.963	-0.258
	(0.129)	(0.129)	(0.143)	(0.645)	(0.646)	(1.141)
(iv) Period	---	0.007*	-0.009	---	0.020	-0.100
		(0.004)	(0.004)		(0.038)	(0.042)
(v) Period × *LowYes*	---	---	0.015**	---	---	0.094
			(0.006)			(0.060)
(vi) Period × *LowNo*	---	---	0.027***	---	---	0.275**
			(0.007)			(0.095)
(vii) Period × *HighYes*	---	---	0.021**	---	---	0.111
			(0.008)			(0.072)
Constant	0.707***	0.633***	0.805***	2.712***	2.496***	3.814***
	(0.110)	(0.112)	(0.098)	(0.428)	(0.636)	(0.828)
# of Observations	300	300	300	300	300	300
Wald χ^2	20.59	33.57	49.53	26.87	26.79	76.94
Prob > Wald χ^2	0.000	0.000	0.000	0.000	0.000	0.000
P-value for Wald χ^2 tests of signif. coeff. diff.						
H_0: (i) ≤ (ii)	0.090*	0.090*	0.017**	0.002***	0.002***	0.001***
H_0: (i) ≤ (iii)	0.001***	0.001***	0.001***	0.003***	0.003***	0.036**
H_0: (ii) = (iii)	0.018***	0.019***	0.223	0.681	0.681	0.155
H_0: (iv) + (v) ≥ 0	--	--	0.097*	--	--	0.439
H_0: (iv) + (vi) ≥ 0	--	--	0.000***	--	--	0.020**
H_0: (iv) + (vii) ≥ 0	--	--	0.053*	--	--	0.428
Maximum [mean] value of variance inflation factors (VIF)	1.50	1.50	11.72#	1.50	1.50	11.72#
	[1.50]	[1.38]	[10.41#]	[1.50]	[1.38]	[10.41#]

Notes: Session random effects linear regressions. Numbers in parentheses are robust standard errors. Session average data are used. The reference group is observations in *HighNo*. *LowYes*, *LowNo* and *HighYes* are dummy variables set to 1 for observations of the corresponding treatment. "Civic tasks completed" is the per-person number of civic tasks, "contribution to first-order PG" is the average contribution in the main stage. Interactions v to vii are with treatment dummies. *** Significant at 1%, ** at the 5%, * at 10% (2-sided). # VIF > 10 is sign of serious multicollinearity. Wald χ^2 tests are 1-sided when predicted inequality is shown, otherwise 2-sided.

(b) Coefficient estimates from session random effects regressions by treatment, with observations at level of session and period

Treatment: Data:	*LowYes*	*LowNo*	*HighYes*	*HighNo*
Periods 6 – 18	-0.016*	0.002	0.002	-0.017***
	(0.009)	(0.006)	(0.010)	(0.0063)
Periods 7 – 18	-0.017**	-0.001	0.003	-.014
	(0.007)	(0.008)	(0.012)	(.0086)
Periods 8 – 18	-0.017***	0.001	-0.001	-0.008
	(.006)	(.010)	(0.013)	(0.009)
Periods 9 – 18	-0.010	0.004	-0.007	-0.004
	(0.009)	(.017)	(0.012)	(.011)
Periods 10 – 18	-0.010	0.000	-0.016	-0.001
	(0.009)	(0.016)	(0.016)	(0.009)
Periods 11 – 18	-0.014	-0.001	-0.021	0.007
	(0.010)	(0.013)	(0.019)	(.0112)
Periods 12 – 18	-0.003	0.007	-0.023	0.022
	(0.012)	(0.021)	(0.023)	(0.022)
Periods 13 – 18	0.010	0.043	-0.029	0.034
	(0.014)	(0.028)	(0.018)	(0.027)
Periods 14 – 18	0.016	0.043	-0.024	0.037
	(0.023)	(0.052)	(0.019)	(0.034)
Periods 15 – 18	-0.014	0.080	-0.021	0.031
	(0.014)	(0.088)	(0.029)	(0.042)
Periods 16 – 18	0.017	0.058	-0.025	0.013
	(0.027)	(0.113)	(0.028)	(0.061)

Notes: Each entry is the estimated coefficient (and in parentheses, standard deviation) of the period variable in linear regression with session random effects with robust standard errors, for the periods indicated by the row heading and the session observations of the treatment indicated by the column heading. Session average data are used as in panel (a). *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Discussion: As explained in the paper, we estimated regressions to study the trends in the number of civic tasks completed per person, changing the included periods (periods 6 – 18, 7 – 18, 8 – 18, 9 – 18, 10 – 18, 11 – 18, …, 16 – 18). As in panel (a), the dependent variable is the average per person number of civic tasks completed in a given period and the Period variable is included to identify a linear trend if present. Session average observations were used because correlations within sessions are expected. The following table indicates the coefficient estimates and *p*-values for the Period variable in each treatment. As explained in the paper, no treatment shows a statistically significant trend if we focus on the final ten periods (periods 9 – 18) or on any shorter final set of three or more periods.

(c) Coefficient estimates from regressions by session, with observations at level of session and period

	Data used for regressions:										
	Pds. 6-18	Pds. 7-18	Pds. 8-18	Pds. 9-18	Pds. 10-18	Pds. 11-18	Pds. 12-18	Pds. 13-18	Pds. 14-18	Pds. 15-18	Pds. 16-18
LowYes-s1	-.046***	-0.041**	-0.033*	-0.027	-0.015	0.010	0.012	0.013	0.025	0.013	0.063
	(0.013)	(0.015)	(0.016)	(0.020)	(0.022)	(0.028)	(0.029)	(0.037)	(0.049)	(0.072)	(0.179)
LowYes-s2	0.004	-0.011	-0.027**	-.031**	-0.040**	-0.039*	-0.031	-0.015	-0.054	-0.058	0.021
	(0.016)	(0.016)	(0.011)	(0.013)	(0.014)	(0.019)	(0.027)	(0.035)	(0.041)	(0.069)	(1.594)
LowYes-s3	-.020**	-.015**	-0.010	-0.010	-0.011	0.0005	0.007	0.031	0.05	-.033**	-0.042
	(0.007)	(0.007)	(0.006)	(0.007)	(0.01)	(0.01)	(0.019)	(0.027)	(0.052)	(0.007)	(0.017)
LowYes-s4	0.002	0.003	0.001	0.011	0.016	-.035*	-0.031	-0.025	-0.013	-0.004	-0.042
	(0.01)	(0.014)	(0.021)	(0.027)	(0.042)	(0.015)	(0.018)	(0.023)	(0.028)	(0.041)	(0.102)
LowYes-s5	-0.019	-0.022	-0.015	0.007	-0.001	0.013	0.030	0.048	0.071	0.013	0.083
	(0.013)	(0.017)	(0.021)	(0.013)	(0.014)	(0.014)	(0.016)	(0.024)	(0.039)	(0.037)	(0.017)
LowNo-s1	-0.003	-0.012	-0.003	0.008	0.012	0.013	-0.016	0.017	-0.008	-0.092	-0.042
	(0.015)	(0.015)	(0.017)	(0.018)	(0.024)	(0.035)	(0.038)	(0.036)	(0.065)	(0.08)	(0.153)
LowNo-s2	0.023	0.022	0.032	0.058	0.049	0.043	0.083	0.148	0.246	.404**	0.417
	(0.028)	(0.034)	(0.041)	(0.038)	(0.048)	(0.063)	(0.076)	(0.091)	(0.113)	(0.041)	(0.102)
LowNo-s3	0.008	0.010	0.004	-0.003	-0.020	-0.033	-0.033	-0.008	0.000	0.05	0.125
	(0.009)	(0.01)	(0.013)	(0.018)	(0.019)	(0.022)	(0.031)	(0.031)	(0.047)	(0.053)	(0.051)
LowNo-s4	-0.011	-0.022	-0.027	-.047*	-0.043	-0.017	-0.012	0.019	0.000	0.058	-0.25
	(0.017)	(0.019)	(0.025)	(0.021)	(0.027)	(0.023)	(0.031)	(0.036)	(0.067)	(0.16)	(0.068)
LowNo-s5	-0.005	-0.004	-0.004	0.005	0.003	-0.010	0.010	0.042	-0.021	-0.021	0.042
	(0.006)	(0.008)	(0.011)	(0.012)	(0.019)	(0.024)	(0.035)	(0.043)	(0.027)	(0.047)	(0.051)
HighYes-s1	.037***	.043***	.047***	.039***	.031**	.040**	.052**	0.030	-0.004	0.004	.042***
	(0.008)	(0.007)	(0.009)	(0.01)	(0.01)	(0.015)	(0.018)	(0.023)	(0.01)	(0.02)	(0.000)
HighYes-s2	-0.003	-0.007	-0.009	-0.014	-0.012	-0.015	-0.043	-0.036	0.033	0.071	-0.021
	(0.009)	(0.01)	(0.012)	(0.014)	(0.019)	(0.03)	(0.031)	(0.053)	(0.039)	(0.055)	(0.111)
HighYes-s3	-.027***	-.026***	-.026*	-0.015	-0.021	-0.013	0.006	-0.008	-0.033	-0.021	0.021
	(0.006)	(0.008)	(0.012)	(0.01)	(0.013)	(0.018)	(0.014)	(0.021)	(0.023)	(0.034)	(0.043)
HighYes-s4	0.005	0.003	-0.013	-0.036	-.067***	-.077***	-.070***	-.063*	-0.038	-0.075	-0.104
	(0.015)	(0.02)	(0.024)	(0.026)	(0.011)	(0.01)	(0.014)	(0.025)	(0.033)	(0.028)	(0.043)
HighYes-s5	0.000	0.003	-0.002	-0.008	-0.010	-.041**	-.060***	-.067***	-.079***	-.083**	-.063*
	(0.009)	(0.01)	(0.012)	(0.016)	(0.025)	(0.014)	(0.006)	(0.008)	(0.007)	(0.013)	(0.009)
HighNo-s1	0.003	0.006	0.0042	0.004	0.002	0.017	0.016	0.045	0.038	0.013	-0.083
	(0.007)	(0.007)	(0.008)	(0.011)	(0.015)	(0.016)	(0.026)	(0.025)	(0.035)	(0.059)	(0.034)
HighNo-s2	-0.01	0.002	0.012	0.017	0.016	0.034	.073**	0.077	.079**	0.025	-0.063
	(0.014)	(0.013)	(0.013)	(0.016)	(0.023)	(0.033)	(0.026)	(0.037)	(0.057)	(0.067)	(0.077)
HighNo-s3	-.026**	-.023*	-0.014	-0.014	-0.017	-0.002	0.018	.045**	.058**	.033**	0.042
	(0.009)	(0.01)	(0.008)	(0.011)	(0.015)	(0.017)	(0.02)	(0.013)	(0.018)	(0.0071)	(0.017)
HighNo-s4	-.033***	-.041***	-.039***	-.040**	-.024*	-0.031	-.052***	-.068**	-.092***	-.088*	-0.063
	(0.009)	(0.007)	(0.011)	(0.016)	(0.012)	(0.017)	(0.013)	(0.017)	(0.013)	(0.02)	(0.026)
HighNo-s5	-0.017	-0.013	-0.002	0.012	0.019	0.017	.054*	.071*	0.100	.171**	0.229
	(0.016)	(0.019)	(0.02)	(0.02)	(0.024)	(0.0344)	(0.024)	(0.029)	(0.043)	(0.03)	(0.043)

Notes: Each session is identified by its treatment name and a session number s1, s2, … s5, based on the chronological order in which it took place. Numbers in parenthesis are robust standard errors. The dependent variable is the average per person number of civic tasks completed in a given period, and the independent variable includes only the period number variable. Each treatment has five rows because there were five sessions. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Note on private task completions: Partly due to learning to accomplish private and civic tasks more quickly and accurately, the total number of tasks successfully completed rises from an average of about 1.7 in period 4 to about 3.9 in period 18. Most of the increase takes the form of private tasks, thus translating into somewhat higher total earnings in later than in earlier periods. Our focus is on the trend in completion of civic tasks since their aggregate number (plus random draw when required) determines whether there is a penalty scheme for the first-order dilemma and the opportunity cost of completing a civic task does not change over time. The average number of private tasks completed is 2.1, 2.8, 2.3 and 2.9 in the LowYes, LowNo, HighYes and HighNo treatments, respectively.

Table A.4.A: *Summary Statistics and Session-level Mann-Whitney Test Results*

	LowYes	*LowNo*	*HighYes*	*HighNo*	All
Avg. pub. sector alloc. in Part 1	3.79 (0.83)	3.84 (0.29)	3.49 (0.53)	3.9 (0.80)	3.75 (0.62)
Avg. total civic tasks per pre-stage	28.8 (3.1)	25.9 (4.0)	20.4 (4.0)	17.0 (6.4)	23.0 (6.3)
Avg. no. of periods with scheme	9.2 (61.3%) (1.3)	6.4 (42.7%) (1.5)	6.0 (40.0%) (2.4)	3.6 (24.0%) (2.9)	6.3 (42.0%) (2.8)
Cases $T_C < 11$, $11 \leq T_c \leq 39$, $T_c > 39$	0, 74, 1	0, 72, 3	3, 72, 0	18, 57, 0	21, 275, 4
Avg. pub. sector alloc. in Part 2	5.18 (0.66)	3.92 (0.84)	3.67 (1.17)	2.71 (1.04)	3.87 (1.25)
Avg. Part 2 pub. alloc. w/o scheme	1.04 (0.57)	1.09 (0.39)	0.94 (0.44)	1.08 (0.32)	1.04 (0.41)
Avg. Part 2 pub. alloc. w/scheme	7.76 (0.17)	7.77 (0.06)	7.73 (0.19)	7.73 (0.36)	7.75 (0.19)

Note: Standard errors in parentheses below values. Allocations to public sector are listed in per subject terms. Total civ. tasks is avg. no. of civic tasks correctly completed by 24 subjects in a given pre-stage.

B. Summary statistics and session-level Mann-Whitney tests for pooled treatment pairs

	10 (*LowYes* + *LowNo*)	22 (*HighYes* + *HighNo*)	Mann-Whitney test: 10 vs. 22	H (*LowYes* + *HighYes*)	L (*LowNo* + *HighNo*)	Mann-Whitney test: H vs. L
Avg. pub. alloc. in Part 1	3.82 (0.59)	3.69 (0.68)	0.545	3.64 (0.68)	3.87 (0.57)	0.364
Avg. civic tasks	27.4 (3.7)	18.7 (5.3)	0.001***	24.6 (5.5)	21.5 (6.9)	0.128
Avg. periods with scheme	7.8 (43.3%) (2.0)	4.8 (26.7%) (2.8)	0.010***	7.6 (42.2%) (2.5)	5 (27.8%) (2.6)	0.028**
Cases $T_C < 11$, $11 \leq T_c \leq 39$, $T_c > 39$	0, 146, 4	21, 129, 0	0.006***, 0.214, 0.034**	3, 146, 1	18, 129, 3	0.228, 0.214, 0.252
Avg. pub. sector alloc. in Part 2	4.55 (0.97)	3.19 (1.16)	0.012**	4.43 (1.20)	3.32 (1.09)	0.029**
Avg. Part 2 pub. alloc. w/o scheme	1.06 (0.46)	1.01 (0.37)	0.821	0.99 (0.48)	1.08 (0.34)	0.450
Avg. Part 2 pub. alloc. w/scheme	7.77 (0.12)	7.73 (0.26)	1.000	7.74 (0.17)	7.75 (0.23)	0.683

Notes: Standard errors in parentheses below values; Mann-Whitney test results are one-sided *p*-values except those for Part 1 decisions, for cases of $11 \leq T_c \leq 39$ and for the two final rows, which are two-sided. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

C. Session-level Mann-Whitney tests for individual treatments

Avg. pub. sector alloc. in Part 1	*LowYes*	*LowNo*	*HighYes*
LowNo	0.917	---	---
HighYes	0.465	0.251	---
HighNo	0.602	0.754	0.465

Avg. civic tasks	*LowYes*	*LowNo*	*HighYes*
LowNo	0.087*	---	---
HighYes	0.005***	0.117	---
HighNo	0.005***	0.014**	0.232

Avg. periods with scheme	*LowYes*	*LowNo*	*HighYes*
LowNo	0.012**	---	---
HighYes	0.029**	0.594	---
HighNo	0.004***	0.081*	0.165

Cases $T_c < 11$	*LowYes*	*LowNo*	*HighYes*
LowNo	.	---	---
HighYes	0.068*	0.136	---
HighNo	0.026*	0.026**	0.131

Cases $11 \leq T_c \leq 39$	*LowYes*	*LowNo*	*HighYes*
LowNo	0.219	---	---
HighYes	0.219	1.000	---
HighNo	0.062*	0.131	0.131

Cases $T_c > 39$	*LowYes*	*LowNo*	*HighYes*
LowNo	0.219	---	---
HighYes	0.159	0.136	---
HighNo	0.159	0.068*	.

Avg. pub. alloc. in Part 2	*LowYes*	*LowNo*	*HighYes*
LowNo	0.014**	---	---
HighYes	0.038**	0.602	---
HighNo	0.005***	0.087*	0.174

Avg. Part 2 pub. alloc. w/o scheme	*LowYes*	*LowNo*	*HighYes*
LowNo	0.754	---	---
HighYes	0.917	0.465	---
HighNo	0.917	0.917	0.347

Avg. Part 2 pub. alloc. w/scheme	*LowYes*	*LowNo*	*HighYes*
LowNo	0.754	---	---
HighYes	0.754	0.465	---
HighNo	0.624	0.462	0.807

Note: *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level. All tests are one-tailed (see paper, fn. 18) except those for Part 1 decisions, those for the two final panels, and tests of *LowNo* vs. *HighYes* (2-tailed).

Table A.5: *Dynamics of subject-level civic engagement incorporating the impact of evaluative feedback*

Independent Variable:	(1)	(2)	(3)	(4)
(i) *LowYes* dummy	.469**	.481***	.480**	.495***
	(.204)	(.183)	(.219)	(.183)
(ii) $p_{i,1}$ {contribution in pd. 1}	.099***	.100***	.100***	.099***
	(.028)	(.024)	(.021)	(.026)
(iii) $p_{i,3}/(p_{-i,3} + p_{i,3})$ {own pd. 3 contribution divided by	.261***	.260***	.260***	.258***
session average}	(.095)	(.088)	(.073)	(.066)
(iv) $t_{c,i,t-1}$ {# of own civic task completion in pd. *t*-1}	.344***	.353***	.336***	.294**
	(.080)	(.095)	(.115)	(.128)
(v) $t_{c,sc\text{-}i\ t-1}$ {lagged avg. # of civic tasks of others within own	.191***	.128	.169	.146
social circle }	(.067)	(.135)	(.128)	(.109)
(vi) $t_{c,oth18,\ t-1}$ {lagged avg. # of civic tasks by others outside	-.024	-.030	-.037	.123
own social circle}	(.169)	(.138)	(.135)	(.152)
(xi) positive deviation of feedback in pd. *t*-1 {=	-.096	-.107	-.097	-.057
max{average feedback received by subject *i* – 3, 0}}	(.086)	(.100)	(.104)	(.098)
(xii) negative deviation of feedback in pd. *t*-1 {= max{3 –	-.164**	-.157*	-.098	.234**
average feedback received by subject *i*, 0}}	(.075)	(.081)	(.118)	(.095)
(xiii) average others' feedback {∈ [1,5]: average feedback	---	.084	.089	.095
the others in subject *i*'s social circle received		(.147)	(.120)	(.120)
(xiv) positive deviation of feedback	---	---	.008	---
in pd. *t*-1 × $relciv_{sc}$+ in pd. *t*-1			(.078)	
(xv) positive deviation of feedback	---	---	-.154	---
in pd. *t*-1 × $relciv_{sc}$- in pd. *t*-1			(.506)	
(xvi) negative deviation of feedback	---	---	.046	---
in pd. *t*-1 × $relciv_{sc}$+ in pd. *t*-1			(.515)	
(xvii) negative deviation of feedback	---	---	-.064	---
in pd. *t*-1 × $relciv_{sc}$- in pd. *t*-1			(.093)	
(xviii) positive deviation of feedback	---	---	---	.020
in pd. *t*-1 × $relciv_{S}$+ in pd. *t*-1				(.085)
(xix) positive deviation of feedback	---	---	---	-.299
in pd. *t*-1 × $relciv_{S}$- in pd. *t*-1				(.505)
(xx) negative deviation of feedback	---	---	---	-.366
in pd. *t*-1 × $relciv_{S}$+ in pd. *t*-1				(.601)
(xxi) negative deviation of feedback	---	---	---	-.419***
in pd. *t*-1 × $relciv_{S}$- in pd. *t*-1				(.100)
Constant	-1.111***	-1.253***	-1.281***	-1.414***
	(.260)	(.378)	(.334)	(.309)
# of Observations	3,024	3,024	3,024	3,024
# of left-censored observations	1,393	1,393	1,393	1,393
Wald χ^2	245.26	195.01	333.49	403.78
Prob > Wald χ^2	.0000***	.0000***	.0000***	.0000***
Maximum [mean] value of	3.91	4.64	9.45[#]	11.21[#]
variance inflation factors[#1]	[1.91]	[2.15]	[3.12]	[3.68]

Notes: Individual random effect Tobit regressions. Observations from *LowYes* and *HighYes* treatments, only. Number in parentheses are bootstrapped standard errors. The dependent variable is the number of civic tasks completed by subject *i* in period *t*. $relciv_{sc}$+ = max{own civic tasks – avg. civic tasks by other social circle members, 0}, $relciv_{sc}$- = max{avg. civic tasks by other social circle members – own civic tasks,0}, $relciv_{S}$+ = max{own civic tasks – avg. civic tasks by the 23 others, 0} and $relciv_{S}$- = max{avg. civic tasks by the 23 others – own civic tasks,0}. All observations in the *LowYes* and *HighYes* treatments when variable (vii) and (viii) are defined are used. All specifications control for randomness of scheme, see the following *Note on randomness controls* for details. [#] Concern for collinearity. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Note on randomness controls. In specifications (3) and (6) of the text's **Table 1** and in all specifications of **Table A.5**, we include controls for patterns of random draw outcomes to which subjects may have responded as noted by other studies of what is sometimes labeled a "hot hand phenomenon." In

periods 4 – 18 of our experiment, whether a session's subjects confronted the main stage PG problem with or without the aid of a penalty scheme was determined by the aggregate number of civic tasks they performed (T_c), but since that number lay in the 11 to 39 range in most periods, a random draw with probability (T_c – 10)/30 of a scheme resulting also helped to determine presence or absence of the scheme. Given that most subjects performed some civic tasks and that earnings of virtually all subjects were higher with than without the scheme, random draw outcomes yielding the scheme despite a probability < 1 may have been viewed as "lucky." At the same time, subjects would rationally prefer to achieve the scheme by doing as few civic tasks as possible because of the opportunity cost in the form of foregone private task earnings. The "hot hand" idea suggests in our context that a series of favorable random draw outcomes might encourage subjects to take a greater risk of scheme achievement failure by performing fewer civic tasks, and that a break in such a "streak" might conversely jolt them into increasing the number of civic tasks completed. (Psychologically, luck and civic tasks may have been perceived as substitutes in the production of the penalty scheme, thus when luck is perceived to be high, fewer civic tasks would be believed to be needed, and conversely when luck is perceived to have declined.) We checked for such effects by adding two sets of controls in the relevant columns of Table 1 and to all columns of Table A.5. First, we controlled for the level of "luckiness" in each period, defined as 1 – ((T_c – 10)/30) if there was a positive scheme outcome in the period and – ((T_c – 10)/30) if there was a negative outcome. We included two controls thus calculated: one with the "luckiness" value of the most recent past period (t – 1) only, the other with the average of the "luckiness" values of all periods prior to (t – 1) in which a random draw had been required in the session. Including these two variables required that there be at least two prior periods, hence observations of the dependent variable begin with period 6 (leaving periods 4 and 5 as required lags). Second, we controlled for whether a series of either "lucky" or "unlucky" random draw outcomes had been "snapped" or "broken" in period t – 1, treating that as having occurred so long as the random draw outcomes of period t – 2 and t – 1 differed. We defined two control variables: *break+* if a no scheme outcome in t – 2 had been succeeded by a scheme outcome in t – 1, and *break-* if the converse occurred. Both controls were assigned the value 0 if the scheme state of t – 2 was the same as that of t – 1. If a break had occurred, the relevant break variable (either *break+* or *break-*) was assigned the integer value equaling the number of successive prior periods for which the scheme state had been the same as in period t – 2. For example, if a session experienced 0 < ((T_c – 10)/30) < 1 (hence, need for a random draw) in multiple periods before period 11, if a scheme had been achieved in periods 7, 8, 9 and 10 but not in periods 6 and 11 of that session, then *break-* had value 4 and *break+* had value 0 in the regression for period 12 civic task completion. Defining the two 'break' variables also requires omitting observations from periods 4 and 5. In those few cases in which a random draw was not required in a particular session and period, we omit the session's observations for the following period because we cannot define the "luckiness" measure of t – 1 for it, and in later periods, we calculate the "luckiness" measure for periods leading up to and including t – 2 by simply leaving out the periods without draws when calculating the average. The number of periods prior to a "break" are calculated by counting from the last consecutive period having a random draw, only. We found significant or marginally significant coefficients on the "luckiness" controls and likewise on the "break" controls, especially break-. However, as Table 1 shows, adding these controls does not qualitatively change our other results. The full regression results are available on request.

Table A.6: *Average coefficient of variation (C.V.) of civic tasks completed, within and across social circles, plus ratios and trends*

	LowYes			*HighYes*			Pooled *Yes*		
	Avg. Coefficient of Variation			Avg. Coefficient of Variation			Avg. Coefficient of Variation		
period	within groups	across groups	ratio	within groups	across groups	ratio	within groups	across groups	ratio
4	1.03	0.37	2.78	1.34	0.25	5.28	1.19	0.31	3.79
5	0.89	0.25	3.59	1.03	0.42	2.45	0.96	0.33	2.87
6	0.87	0.27	3.18	1.09	0.47	2.35	0.98	0.37	2.66
7	0.76	0.31	2.50	1.21	0.40	3.04	0.99	0.35	2.80
8	0.77	0.32	2.40	1.16	0.44	2.65	0.96	0.38	2.54
9	0.86	0.40	2.15	1.18	0.49	2.41	1.02	0.44	2.29
10	0.81	0.30	2.74	1.03	0.41	2.49	0.92	0.35	2.60
11	0.81	0.42	1.93	1.08	0.45	2.42	0.95	0.43	2.18
12	0.84	0.38	2.23	1.05	0.54	1.93	0.95	0.46	2.05
13	0.87	0.44	2.00	1.13	0.40	2.80	1.00	0.42	2.38
14	0.92	0.46	2.00	1.07	0.50	2.16	1.00	0.48	2.08
15	0.85	0.43	1.96	1.14	0.45	2.52	1.00	0.44	2.25
16	0.90	0.48	1.87	1.17	0.50	2.32	1.04	0.49	2.10
17	0.87	0.48	1.82	1.22	0.50	2.45	1.05	0.49	2.14
18	0.92	0.52	1.78	1.24	0.54	2.29	1.08	0.53	2.04
reg. coef.†	0.000	0.016***	-0.101***	0.001	0.011**	-0.872	0.001	0.014***	-0.835***
	(.005)	(.003)	(.019)	(.007)	(.004)	(.060)	(.006)	(.001)	(.022)

† Regression coefficient for period on column variable in an OLS linear regression with robust standard errors. Standard error of coefficient in parenthesis. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Note: For each social circle and period, we calculated the C.V. of civic tasks completed by each subject, then calculated the average of these C.V.s, displayed in the left column for each treatment. For each session and period, we calculated the C.V. of the average of civic tasks in each of its four social circles, then calculated the average of these between-group C.V.'s for each treatment, displayed in the middle column. We also calculated the ratio of the latter two averaged C.V.s, displayed in the third column. Finally, we estimate an OLS regression of the averaged C.V.s and C.V. ratio of each period on the semi-continuous *Period* number and a constant, and we display the estimated coefficient on *Period* and its significance level at the bottom of the relevant column. Our conclusion, described in footnote 20 of the paper, is that there was no trend towards convergence of numbers of civic tasks completed by the members of given social circles, but that the numbers of civic tasks completed within different social circles of a session tended to become more different over time. This implies that although social circle members did not perfectly align on number of civic tasks performed, they exerted some influence on one another's behaviors because the choices within groups diverged over time relative to the choices within other groups. This kind of result would obtain if, for example, members of some groups exhibited rising, those of other groups constant, and those of still other groups declining numbers of completed civic tasks, with the passage of time, with each individual adjusting in the corresponding direction but retaining the same within group dispersion. Other patterns such as ones entailing "exchanging of place" between pairs within groups, and still more complicated variations, could also be consistent with the pattern of C.V.'s and with our conclusion.

Table A.7: *Tests of differences in percentages of subjects falling in different civic task completion bins of Figure A.4*

A. Testing the difference in the percentage of complete free riders (left-most bars in Figure 7)

	LowYes	*LowNo*	*HighYes*
LowNo	.082*	---	---
HighYes	.008***	.034**	---
HighNo	.008***	.008***	.056*

Notes: Two-sided *p*-values. We first counted the number of complete free riders for each session. We then performed session-level Mann-Whitney tests to study the treatment differences.

*** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

B. Testing the difference in the percentage of 'super-cooperators' (those who completed more than two [including more than three] civic tasks per period)

	LowYes	*LowNo*	*HighYes*
LowNo	.671	---	---
HighYes	.393	.239	---
HighNo	.071*	.056*	.133

Notes: Two-sided *p*-values. We first counted the number of super-cooperators for each session. We then performed session-level Mann-Whitney tests to study the treatment differences.

*** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

C. Testing the difference in the percentage of those who completed an average of more than one civic tasks per period (i.e., the number of completed civic tasks is more than 15)

	LowYes	*LowNo*	*HighYes*
LowNo	.130	---	---
HighYes	.018**	.595	---
HighNo	.008***	.140	.338

Notes: Two-sided *p*-values. We first counted the number of subjects who completed an average of more than one civic task per period for each session. We then performed session-level Mann-Whitney tests to study the treatment differences.

*** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Table A.8: *Correlations between Survey Responses and Behaviors*

Survey question: / Behaviors:	Number of observations	Average number of civic tasks completed in Part 2 by a given subject[#1]	Contribution to the public sector in period 1 by a given subject
Female dummy {= 1 for female subjects; = 0 for male subjects}	469	.029 [.484]	.188*** [.000]
Econ major dummy {= 1 for economics students; 0 otherwise}	448	-.074* [.076]	-.198*** [.000]
Number of economics courses taken	472	-.073 [.132]	-.165*** [.000]
SAT math scores	369	-.006 [.919]	-.272*** [.000]
Level of interest in politics[#2]	480	.203*** [.000]	.033 [.466]
Political view (higher = more liberal)[#3]	480	.208*** [.000]	.110** [.016]
Keeps up with events[#4]	480	.172*** [.000]	.050 [.279]
Voted[#5]	415	.135*** [.010]	.007 [.893]
Civic norm strength[#6]	480	.081* [.073]	.054 [.236]
Sign or rally[#7]	480	.124** [.012]	.071 [.119]
Political engagement[#8]	480	.143*** [.002]	.088* [.054]
Trust in others' fairness[#9]	477	.066 [.247]	.090** [.048]

Notes: The partial correlation coefficients of specified behavior variables with survey responses. The numbers in square brackets are *p*-values. The number of observations is not equal to 480 in some questions because some subjects did not answer those questions. [#1] *p*-values in this column were calculated based on linear regressions (including constants) with robust standard errors clustered by session because subjects' civic engagement activities could have been correlated with each other. [#2] This variable scored from 1 = not at all interested to 4 = very interested. [#3] Political self-description from 1 = very conservative to 7 = very liberal. [#4] How much person follows political events via media, from 1 = almost never to 6 = multiple times per day. [#5] Conditional on being a citizen, voted (=1) or didn't vote (= 0) in the 2016 U.S. election. A substantial number of missing values is associated with the considerable numbers of international students at the university. [#6] How justified is cheating in one's favor in dealings with public sector? This has 3 components: claiming government benefits, avoiding paying fare on public transit, cheating on taxes. Each part is coded from 1 = always justifiable to 10 = never justifiable. The Civic norm strength variable averages the three scores. If any one of the three is missing, we average the other two scores. If two or three are missing, we treated the variable as missing. [#7] Average of two activities a person can "have done" (= 3), "might do" (= 2) or "would never do" (= 1). The activities are: signing a petition, and attending a rally. [#8] Average of the four activities: signing a petition, attending a rally, joining a peaceful demonstration, and joining a strike. 3 = "have done" and 1 = "would never do". [#9] Trust in others on a ten-point scale. *** Significant at 1%, ** 5%, * 10%.

II. Instructions used in the Experiment

[Instructions for Part 1:]

INSTRUCTIONS FOR PART 1

This experiment involves a set of decisions by 24 participants, yourself included, in which others' decisions can affect your earnings, and your decisions can affect their earnings. Whenever you are shown feedback on the decisions of others, their real identities will be kept anonymous, but please be assured that reported decisions are indeed those of the actual participants and never fictitious participants simulated by a computer program or members of the experimenter team.

No communication between participants will be permitted during the remainder of the experiment. You are also not permitted to use your phone, tablet computer, or programs other than the designated experiment software, to communicate with others or to look up information. Members of the experiment team will check that this rule is adhered to. You will have an opportunity to ask questions before actual decision-making begins. We ask that you devote your full attention to the experiment while it is in progress.

In the instructions and the experiment itself, we'll be using two different currencies or units of account. The first kind of currency, called **tokens**, is something you are given each period to allocate as you wish in order to earn the second kind, called **points**. Throughout the experiment, you can try to accumulate points. The more points you accumulate, the more money you will be paid (privately) at the end. The rate at which points convert to money (dollars) at the end of the experiment is 195 points = $1 (each point translates into about 0.5 cents). Your overall earnings will be calculated at the end of the session and paid to you in cash, to the nearest 5 cents. As you'll see below, while the value of a point is small, your total earnings can still be substantial. Please listen carefully to the instructions and ask questions if something is unclear.

<u>Decisions and earnings</u>

The main decision to be made and the main way in which you can earn points involves the allocation of resources between a private income-generating activity and a public sector. Allocating to your private activity is always beneficial to you, but private activity earns you more when the public sector is well funded. Not only does having a well-funded public sector raise the profitability of your private activity; a well-funded public sector also brings you direct benefits (in the experiment, points), similar to the benefits in everyday life from having safe roads, law and order, and clean air.

You and your fellow participants face the problem of how to fund your public sector. In the first part of the experiment, the only way to fund the public sector is through voluntary allocations. In the second part, in contrast, you can establish a government apparatus to enforce adequate funding of the public sector, paralleling the existence of taxes in real life. The specifics of how you and fellow participants can create this apparatus—which we'll be calling a "penalty scheme," during Part 2—will be explained after the first part of the experiment is over. We now provide further details about the allocation decision between the private activity and the public sector.

<u>More about the main allocation problem</u>

In each period, you and each other participant will be endowed with 20 tokens that you must decide how to allocate between two options. As mentioned above, one option is a private activity, the other the public sector that serves all 24 participants. You can assign any integer number of tokens (including zero) to the public sector, assigning the rest of that period's 20 tokens to your private activity. Examples include: 0 to the public sector, 20 to the private activity; 7 to the public sector, 13 to the private activity; 14 to the public sector, 6 to the private activity. These are among the twenty-one possible ways you can allocate your twenty tokens. Each of you makes an allocation decision with your own 20 tokens separately and simultaneously, learning of the others' decisions only afterwards.

The number of points you earn from tokens that you allocate to your private activity depends on the number of tokens put in the public sector in that period by you and the other participants. Suppose the number of tokens you use for private activity is b (for "business"), and the number you allocate to the public sector is p (for "public"). Since you always start with 20 tokens, it's required that $b + p = 20$. We'll call the sum of the p's chosen by all 24 participants P. The points of earnings you get out of your private business investment b are b*V, where V is the value that a token generates in your private activity. A key dimension of the decision problem is that V depends on P. The minimum value V can take is 5, its value when $P = 0$. As Figure 1 below shows, V rises as P goes up, reaching a maximum value of 17 when $P = 192$ (i.e. when the average p among the 24 participants is 8). Finally, V remains at the same value—17—for any $P > 192$. Table 1, on the page that follows, shows the values that V has at various levels of P (intermediate levels of P are omitted in order to conserve space).

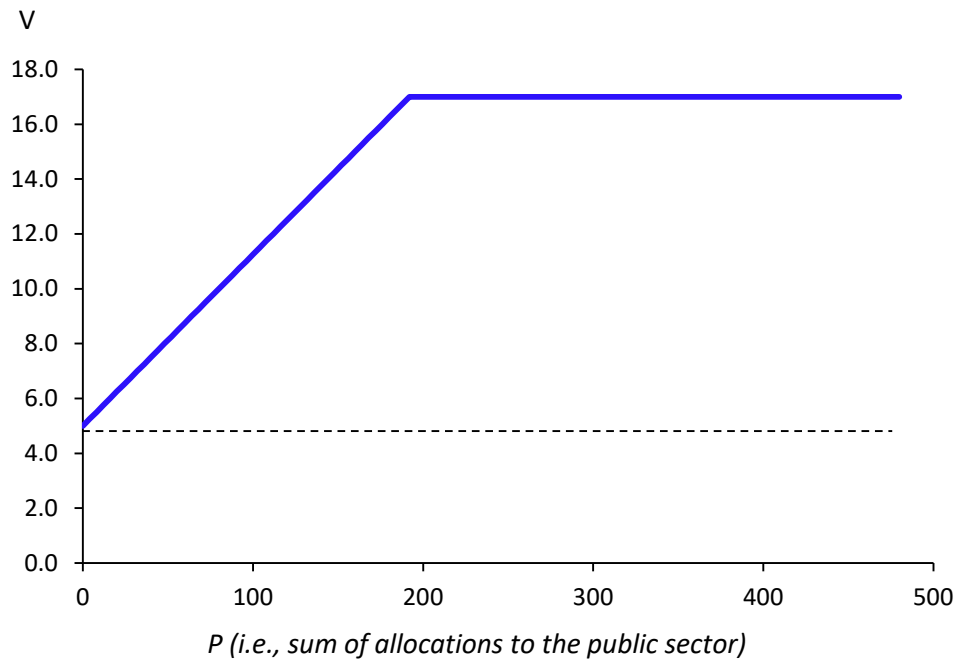


Figure 1. V as a function of *P*

P	0	20	40	60	80	100	120	140	160	180	200	220
V	5	6.3	7.5	8.8	10	11.3	12.5	13.8	15	16.3	17	17

P	240	260	280	300	320	340	360	380	400	420	440	460	480
V	17	17	17	17	17	17	17	17	17	17	17	17	17

Table 1: Value of V as a function of *P*

In addition to *P*'s effect on your earnings by influencing the value, V, of the tokens you assign to your private activity, *P* also affects your earnings in a second, more direct way. Each participant in the experiment receives a number of earnings points that rises as *P* does and that goes equally to participants without regard to differences in their individual choices of *p*. We'll call *D* (for "direct") the number of points that each participant gets directly given *P*. Using this terminology, we can say that an individual's total earnings in a period are (*b**V) + *D*, that is each participant gets his or her earnings from private activity (*b**V), influenced by *P* through its effect on V, plus *D*, his or her direct earnings from *P*.

The way in which *D* rises as *P* goes up is indicated by the curve in Figure 2, below. It shows that *D* rises slowly at first as *P* goes up from zero, then *D* rises more rapidly, then finally *D* rises slowly again as *P* approaches its maximum value of 100 points. Table 2, on the next page, indicates *D*'s numerical value at various levels of *P*.

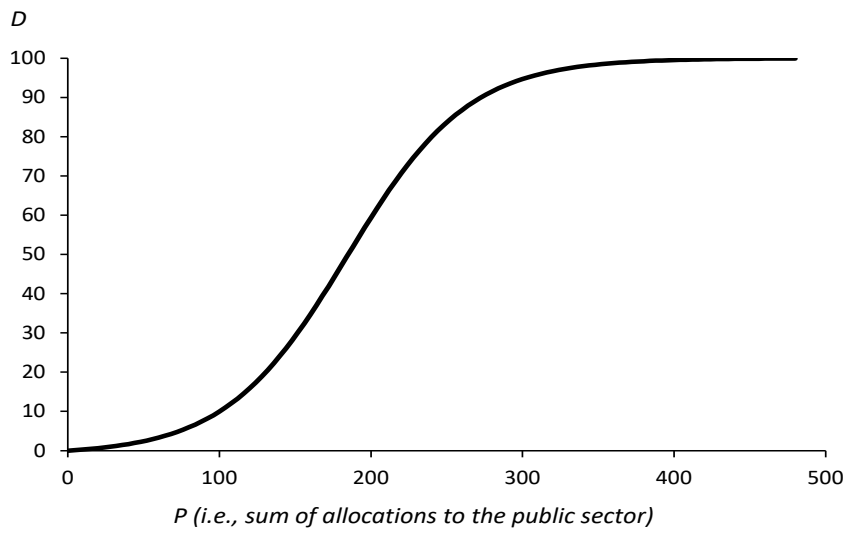


Figure 2. Direct earnings *D* as a function of *P*

P	0	20	40	60	80	100	120	140	160	180	200	220
D	0.0	0.6	1.7	3.3	5.9	10.0	15.9	24.1	34.7	46.8	59.3	70.7

P	240	260	280	300	320	340	360	380	400	420	440	460	480
D	79.9	86.8	91.6	94.7	96.7	98.0	98.8	99.2	99.5	99.7	99.8	99.9	99.9

Table 2. Direct earnings *D* as a function of *P*

The ways in which V (the return from each token used for private activity) and *D* (the direct benefit from the public sector) depend on *P*, plus the way you and others allocate the 20 tokens you are given each period, determine your overall earnings in a period. These relationships as a whole can be represented by a table in which the columns correspond to different allocations of tokens to the public sector by you and the rows correspond to different average allocations of tokens by the other 23 participants. To make the presentation more compact, the table shows only own and others' average allocations that are divisible by four.

	Own allocation to public sector					
Average allocation of 23 others	0	4	8	12	16	20
0	100	84	66	46	24	1
4	223	185	145	103	59	13
8	379	320	258	193	127	62
12	431	364	296	229	162	94
16	439	371	303	235	167	99
20	440	372	304	236	168	100

Table 3: Earnings as a function of your allocation (*p*) versus the average allocation *p* of the other 23 participants

We've shaded the diagonal entries of the table, which represent situations in which you and the others in your group happen to allocate the same amounts (or for the others, the same amount on average) to the public sector. For example, the entry *185* (second row from top, second column from left) is the total amount that you would earn if you allocated 4 of your 20 tokens to the public sector and 16 of your tokens to your private activity and if the other 23 participants also allocated an average of 4 tokens each to the public sector. Notice that among these shaded diagonal cells, the one in which your earnings would be highest is that in which you and the others on average allocate 8 tokens to the sector, giving you 258 points of earnings. That's more than two-and-a-half times your earnings if all participants put 0 in the sector, and the fact that it occurs when all allocate 8 tokens to the sector is consistent with the fact that V reaches its maximum value when P = 192 (= 24x8) (see Figure 1). It is also consistent with the fact that the rate of increase of D has begun to slow at P = 192 in Figure 2.

Two further things to note are the following. First, your earnings are not sensitive to *how* others allocations add up to a given average; any combination of choices by others that generates a given average has the same impact on your earnings. Second, what you earn <u>does</u> change if your own allocation varies, taking the average allocation of the others as given. For example, suppose that the others allocate an average of 8. You earn more by allocating less than 8 yourself, as shown by the cells to the left of the one with shaded value 258. The largest number in the table, 440, is what you would earn if others assigned all of their tokens to the public sector, while you used all of yours for your private activity.

The task of allocating a 20 token endowment between the two activities, and the figures and tables above describing the consequences of your own and others' decisions, apply not only to Part 1, which the current instructions focus on, but also to Part 2. As mentioned earlier, Part 2 will differ from Part 1 in that there will be a possibility of creating a penalty scheme to encourage allocations to the public sector. We leave details to be explained after Part 1 ends. Part 1 includes 3 periods, Part 2 has 15 periods, and in both parts each period has this kind of interaction at its core.

Operationally, each period of Part 1 will unfold as follows. You'll initially see a screen telling you the period number and indicating that you have 20 tokens to allocate. When you click continue, you'll be asked to decide how many (if any) of the 20 tokens you wish to allocate to the public sector (the rest automatically goes to your private activity). When you're satisfied with your decision, you click submit. When everyone has submitted their decisions, you'll see a screen showing your overall results for the period, and when you click continue you'll see a final screen showing the amount that each of the other 23 participants assigned to the public sector

this period, plus the amount that each of them earned. You can take a moment to absorb this information, then click continue to begin the next period.

Please take some time now to study the instructions so far, including the earnings table. Then try to answer the following four comprehension questions, which will also appear on your computer screen. Raise your hand if you have any questions, and an experimenter will come to you.

Comprehension questions:

1. What is it that is measured by the vertical dimension (axis) of Figure 1, above?
   a. The number of points you earn for each token you assign to your private activity (which varies with the total amount you and others put in the public sector, i.e. *P*).
   b. The number of points you earn for each token you assign to the public sector.
   c. Your total earnings during a period, which depends only on *P*.
2. Please test your understanding of Table 3. Suppose that you were to put 12 of your 20 tokens into the public sector and that the other participants put an average of 8 of their 20 tokens into the public sector. What would you earn in the period?
   a. 127 points. b. 193 points. c. 258 points. d. 296 points.
3. Suppose that you allocate 8 tokens to the public sector and that the other 23 participants allocate 312 tokens in total to the public sector. Answer the following questions:
   a. What is *b* (the number of tokens you allocate to your private activity)? _____
   b. What is V (the per-unit productivity of your private activity)? _____
   c. What are your earnings from your private activity (i.e., *b**V)? _____
   d. Each member receives the same direct benefit (i.e., *D*) from the public sector. What is *D* in this example? _____
   e. What are your total earnings (i.e., *b**V + *D*)? _____
4. Consider another situation. Suppose that you allocate 4 tokens and that the other 23 participants allocate 256 tokens in total to the public sector. Answer the following questions:
   a. What is *b* (the number of tokens used for your private activity)? _____
   b. What is V (per-unit productivity of your private activity)? _____
   c. What are your earnings from your private activity (i.e., *b**V)? _____
   d. Each member receives the same direct benefit (i.e., *D*) from your group's public sector. What is *D* in this example? _____
   e. What are your total earnings (i.e., *b**V + *D*) in this period? _____

As a reminder, you will have three interactions in this part. After these three periods, we will pause for instructions about the second part, which has fifteen periods. The experiment will begin when everyone is ready. Does anyone have any questions?

Please begin.

INSTRUCTIONS FOR PART 2

The remaining fifteen periods of the experiment have a core structure identical to those of the first three periods. That is, in what we'll henceforth call the "main stage" of each period, you and other 23 participants each decide how to allocate 20 tokens between your private activity and the public sector. However, whereas the allocation decision was strictly voluntary in Part 1, there is the possibility that, through some initial civic activity, you can **establish a government** that can alter the main stage problem by making contributing to the public sector a requirement that is subject to penalty if not fulfilled. The allocation to the public sector that would be required to avoid a penalty will be 8 of your 20 tokens, which, as you will recall, is the allocation at which total earnings of participants are maximized (see again Table 1 of the Part 1 instructions). Under the penalty scheme, if you assign no tokens to the public sector, your earnings will be determined as in Part 1 except that a penalty of 144 points will be assessed against your earnings. If you assign 4 tokens to the public sector, your penalty will be 72 points. More generally, you pay a penalty of 18 points for each token by which you fall short of allocating 8 tokens to the public sector. If you assign 8 or more tokens to the public sector, you will incur no penalty, so your earnings will be determined exactly as in Part 1. Points lost to penalties are simply lost from your earnings; they are not transferred to other participants.

Earnings when a penalty scheme is in place are illustrated by Table 3' (like Table 3, examples of allocations divisible by 4 only are shown, for brevity). The numbers with strikethrough are earnings in the absence of the penalty scheme and the numbers immediately below them are the earnings after subtraction of the penalty.

Average *p* of 23 others	Own allocation to the public sector					
	0	4	8	12	16	20
0	~~100~~ -44	~~84~~ 12	66	46	24	1
4	~~223~~ 79	~~185~~ 105	145	103	59	13
8	~~379~~ 235	~~320~~ 248	258	193	127	62
12	~~431~~ 287	~~364~~ 292	296	229	162	94
16	~~439~~ 295	~~371~~ 299	303	235	167	99
20	~~440~~ 296	~~372~~ 300	304	236	168	100

Table 3'. Earnings as a function of your allocation (p) and the average allocation of the other 23 participants. Numbers below "struck through" numbers are your earnings net of penalties.

When is the scheme present?

As stated above, having a penalty scheme to enforce tax obligations implies establishing a government. In the experiment, as perhaps in the real world, it takes some **civic engagement** to establish a well-functioning government responsive to citizens' interests. Examples of civic engagement in the real world include reading or listening to information about public affairs, signing petitions, voting in elections, etc. Each of the fifteen periods of Part 2 will include an extra stage before the main stage—we'll call it the "pre-stage"—during which you'll have the opportunity to engage in an activity—completing "**civic tasks**"—that is a way of representing civic engagement for purposes of the experiment. You and your fellow participants can assure that you'll have a penalty scheme in place in a period's main stage by carrying out enough of these tasks. During the pre-stage, "**private tasks**" that add to your personal earnings without helping to build governing capacity will also be available as another way of using your time. Each task, whether civic or private, takes about 10 - 15 seconds to complete, and a total of 90 seconds will be available each period for the task portion of the pre-stage. Each correctly completed private task yields ten [twenty-two] points of earnings. Such earnings points are added to your overall accumulation and convert to real money at the same rate as other points at the end of the experiment. They do **not** affect how many tokens you have available to allocate in the period's main stage; that number remains 20, regardless of how many tasks you complete. Completing a **civic** task adds ten points to a "**civic engagement fund,**" and the number of points in that fund (or, to put it differently, the total number of civic tasks completed by all 24 participants) determines whether there will be a penalty scheme operating in the period's main stage. If you and other participants complete 40 or more civic tasks in total (a little less than 2 per person, on average, putting 40x6 = 240 points in the civic engagement fund), the penalty scheme will be in place during the main stage. If none of you completes any civic tasks, or if only a small number (10 or less) of civic tasks are completed, there will definitely not be a penalty scheme in that period. In that case, the main stage of that period will proceed exactly as in Part 1. In between the no penalty situation (10 or less completed civic tasks) and the penalty-with-certainty situation (40 or more completed civic tasks), presence of a penalty scheme is determined by the exact number of tasks completed and by a random draw procedure. Specifically, if the total number of civic tasks completed, call it n, is between 11 and 39, then the computer will implement a random draw with probability $(n - 10)/30$ that there will be a penalty scheme in place in the period's main stage. For instance, if a total of 20 civic tasks are completed, there will be a random draw with a $(20 - 10)/30 = 1/3$ chance that a penalty scheme will be in place, leaving a 2/3 chance that there will be no penalty scheme. If 25 civic tasks are completed, the chance of having the penalty scheme will be $(25 - 10)/30 = ½$ (= 50%), with equal chance of having no penalty scheme. With 35 civic tasks completed, the probability of having the scheme in that period is $(35 - 10)/30 \approx 83\%$. And so on. When a random draw is required, it will be carried out at the end of the pre-stage part of the period,

with a spinning roulette-wheel-like image appearing on your screen and the outcome (i.e., whether there will or will not be a penalty scheme in that period) then being displayed before the main stage begins. The period's main stage always takes place with full knowledge, shared identically by all 24 participants, as to whether a penalty scheme is in place or not.

Information sharing and feedback. [this section appears only in high social interaction treatments]

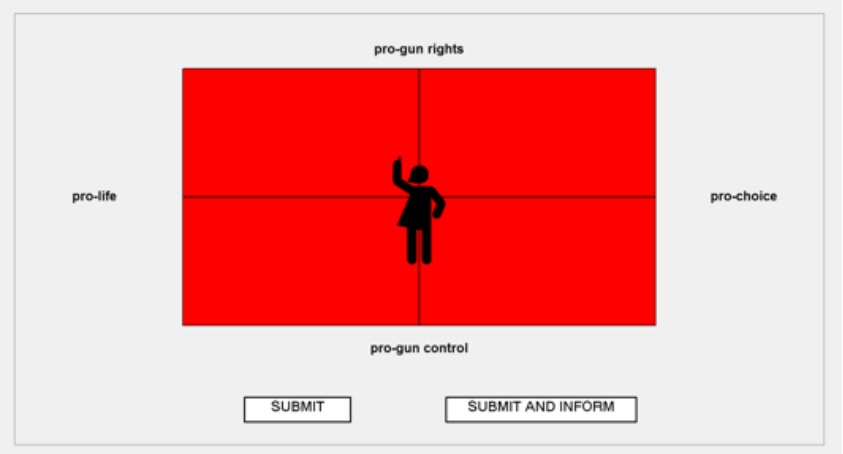
In the real world, you might wish to share with others the fact that you registered to vote, went to the polls, read up on candidates' positions, or took part in some other civic activity. Sharing with others information about your completion of civic tasks is also possible in the experiment. In particular, each of you will be a member of a social circle or group which consists of yourself and 5 other randomly chosen participants. Its membership will remain fixed for the remaining periods. Each time you complete a civic task and are ready to submit your work (generating points for the civic engagement fund), you can click a button that says "Submit," or you can instead click (at no extra cost) a button labeled "Submit and Inform." If you chose the latter button, an announcement that you've completed a civic task will be shown to your fellow group members the next time they visit the task choice screen. Each group member is identified by a letter (A, B, C, D, E or F) that is assigned randomly and remains fixed for the rest of the experiment. (Which participants belonged to each group, and who was associated with which letter, will not be revealed either during or after the experiment.) Just before the end of the pre-stage, the total number of civic tasks completed by each member of your group will be displayed next to their identification letter—this time, regardless of whether the individual used the "inform my group" option. The pre-stage will end with an opportunity to provide feedback to the others in your group (social circle), and for them to do the same to you. Specifically, you will be asked to select one of five possible comments: strongly disapprove, disapprove, neutral (neither approve nor disapprove), approve, or strongly approve. On the final pre-stage screen, you'll then be shown what feedback other group members submitted about you.

More about pre-stage tasks.

When a Part 2 period begins, always with its pre-stage, you'll see a screen on which you select whether the first task you want to do will be a private or a civic task. Once you click on your choice, you'll begin that task. The private and civic tasks are very similar. Each task begins with a description of a person differing in two dimensions or characteristics. When you click continue, you'll see a two-dimensional grid. There, you'll left click on a person-shaped icon, drag the icon to whichever of the four quadrants corresponds to the description, drop it in place (you'll see the chosen quadrant turn blue, while the remaining quadrants remain red), and submit that decision. [[Local social interaction treatments only:] For private tasks, you do that by simply clicking on the "Submit" button; for civic tasks, you can click on either the "Submit" button or on the "Submit and Inform" button, keeping in mind that the latter

generates a message to those in your group (social circle).] In the civic tasks, you'll be identifying the position of a public official or politician with regard to two issue dimensions, for example importance of environmental protection, importance of cutting taxes, importance of defense spending, etc. Note that you cannot go back from the grid screen to view the verbal description, although you are free to take notes to help you remember it. If you answer incorrectly, you will be offered the chance to try again beginning with rereading that description. You will also be offered the alternative option of moving on to a fresh task of either civic or private type.

Example. You'll see a description reading: "Senate candidate Wendy White favors unrestricted gun ownership and is committed to a woman's right to choose whether to continue or to terminate a pregnancy." You click continue and see a grid with axes labeled "pro-gun rights"/"pro-gun control", and "pro-life"/"pro-choice" (see below). To earn the available ten [twenty-two] points, you left click on the icon and drag it to the pro-gun and pro-choice quadrant, drop it in place, and submit your answer. A pop-up on the screen tells you if your answer is correct and prompts you to return to the screen at which you choose another civic or private task. When you return to that screen, it will be updated to show how many private and how many civic tasks you've completed in the period, thus far [[High social interaction treatments:], and will display messages about others' civic task completions if they've used the "Submit and Inform" option].



In the private tasks, you'll be identifying the "market position" of a consumer with regard to two features of his or her shopping or purchasing preference; for example, feature one can be preference for restaurant versus home meals, and feature two can be preference for gourmet dishes versus simple foods.

Example. "John Smith eats out frequently at a local diner." You click continue and see a grid with axes labeled "home"/"restaurant" and "gourmet"/"plain". You left click on the icon and drag it to the restaurant and plain quadrant, drop in place, and submit your answer. As with a

civic task, you'll see a pop-up indicating whether your answer is correct. If incorrect, you can choose to try again or go on to another task, exactly as with civic tasks.

Note that at both the screen showing the description of the public official or consumer and the screen showing the four quadrant grid, the experiment software requires you to spend a minimum of three seconds before you can continue or submit your answer. This time requirement is to encourage you to pay attention to the tasks, rather than engage in random clicking.

As mentioned, the tasks part of the pre-stage will last for a total of 40 seconds. When that time runs out, you'll see a screen saying "Time's up!" and you'll be informed of the number of civic tasks completed by each of the five others in your group or social circle. You'll be asked then to give feedback to each of them from among the five options mentioned above (strongly approve, approve, neutral, disapprove, and strongly disapprove). On the next screen, you'll be shown the average feedback you yourself received from them. The pre-stage then ends with a screen on which you learn how many civic engagement tasks were completed in total (from all 24 participants, combined). The spinning wheel indicating random choice will be shown if applicable, and you'll learn whether a penalty scheme will be in place in the main stage of the period. Then, once you click continue, you'll go to the main stage, which will work exactly as in the earlier periods except when there is a penalty scheme.

Before Part 2 begins, please answer the comprehension questions which will also appear on your computer screen. Raise your hand if you have any questions and we'll come to you to help provide answers. [Answers shown in brackets.]

1. There will be fifteen periods in this second and final part of the experiment. How many of these periods will begin with a pre-stage involving private and civic tasks?
   a. Each period will begin with a pre-stage. [*]
   b. Only the first period begins with a pre-stage.
   c. A few randomly chosen periods have pre-stages.

2. Suppose that the penalty scheme is in place during a period's main stage. How many points will you be losing as a penalty if you assign 5 tokens to the public sector? _____ [(8 – 5)x18 = 3x18 = 54]

   How many points will you lose as a penalty if you assign 9 tokens to the public sector? _____ [no points]

3. Suppose that in a certain period each participant completes exactly two civic tasks. Which best describes the effect on presence or not of a penalty scheme in the period's main stage?

a. There will definitely be a penalty scheme. [*]
b. There will be a random draw to determine whether there is a penalty scheme.
c. There will definitely not be a penalty scheme.

4. Suppose that in a certain period each participant completes exactly one civic task. Which of the following applies?
   a. There will definitely be a penalty scheme.
   b. There will be a random draw with probability (24/30) that there will be a penalty scheme.
   c. There will be a random draw with probability (24 – 10)/30, i.e. 14/30, that there will be a penalty scheme. [*]
   d. There will definitely not be a penalty scheme.

5. For each private task you complete during the pre-stage, how many points are added to your earnings? _____ [10 or 22, depending on treatment]

6. Suppose that, based on the number of civic tasks completed in a certain period, there is a probability of 21/30, or 70%, that there will be a penalty scheme in the main stage. When will you be informed of the outcome of the random draw regarding the penalty scheme?
   a. Whether there will or will not be a penalty scheme this period is indicated at the end of the pre-stage. [*]
   b. The result of the random draw is announced only at the end of the main stage. Main stage decisions themselves are therefor made with knowledge of the 70% chance of penalty, but not knowing whether the penalty in fact applied until the end of the period.

III. Private and Social Optimum in main-stage allocation problem without sanction

A. Optimal allocation decision of a material payoff maximizer

The payoff of subject *i* in the main stage is given by:

$$Y_i(p_i; p_{-i}) = b_i * V(P) + D(P)$$

$$= (20-p_i)*(5 + (1/16)P) + \frac{101}{1+100\text{Exp}[-0.025*P]} - 1 \text{ for } P < 192;$$

$$= (20-p_i)*17 + \frac{101}{1+100\text{Exp}[-0.025*P]} - 1 \text{ for } P > 192.$$

Here, p_i (b_i) indicates *i*'s allocation to public activities (business), $p_i + b_i = 20$, p_{-i} is the sum of the others' allocations to public activities, and $P = p_i + p_{-i}$. As $V(.)$ has a kink at $P = 192$, we need to consider two cases as below. In each of the two cases, $\frac{\partial Y}{\partial p_i}$ is negative always, regardless of the size of p_{-i}. This suggests that the situation *i* faces is a social dilemma.

Case 1: When $P < 192$:

$$\frac{\partial Y}{\partial p_i} = -5 - \frac{P}{16} + (20 - p_i)\frac{1}{16} + 101\frac{2.5\text{Exp}[-0.025*P]}{(1+100\text{Exp}[-0.025*P])^2}$$

$$= -3.75 - \frac{p_{-i}}{16} - \frac{p_i}{8} + 101\frac{2.5\text{Exp}[-0.025*P]}{(1+100\text{Exp}[-0.025*P])^2} < 0 \text{ for any } p_i.$$

This is because $101\frac{2.5\text{Exp}[-0.025*P]}{(1+100\text{Exp}[-0.025*P])^2} < 2.5.$

Notice that $101\frac{2.5\text{Exp}[-0.025*P]}{(1+100\text{Exp}[-0.025*P])^2} = \frac{101}{1+100\text{Exp}[-0.025*P]}\frac{1}{100}\frac{1+100\text{Exp}[-0.025*P]-1}{(1+100\text{Exp}[-0.025*P])} \cdot 2.5.$

Here, $\frac{101}{1+100\text{Exp}[-0.025*P]}\frac{1}{100} < 1$, and $\frac{1+100\text{Exp}[-0.025*P]-1}{(1+100\text{Exp}[-0.025*P])} = 1 - \frac{1}{(1+100\text{Exp}[-0.025*P])} < 1.$

Case 2: When $P \geq 192$:

$$\frac{\partial Y}{\partial p_i} = -17 + 101\frac{2.5\text{Exp}[-0.025*P]}{(1+100\text{Exp}[-0.025*P])^2} < 0.$$

Notice that as discussed in Case 1 above, the second term is less than 2.5.

These calculations show that it is materially beneficial for *i* to contribute zero to the public sector, regardless of the size of p_{-i}.

B. Social optimum

As is the case for Part A, we need to consider two cases.

Case 1: When $P < 192$:

$$\sum_{all\ j} Y_i\,(p_i; p_{-i}) = \sum_{all\ j}\left[(20 - p_i)\cdot(5 + P/16) + \frac{101}{1+100\mathrm{Exp}[-0.025*P]} - 1\right]$$

$$= (20N - P)\cdot(5 + P/16) + \frac{101N}{1+100\mathrm{Exp}[-0.025*P]} - N\ ,$$

where N = 24 (the number of players in a given session).

$$\frac{d}{dP}\sum_{all\ j} Y_i\,(p_i; p_{-i}) = -1\cdot(5 + P/16) + (20N - P)\cdot 1/16 + 101N\frac{2.5\mathrm{Exp}[-0.025*P]}{(1+100\mathrm{Exp}[-0.025*P])^2}$$

$$= -\frac{P}{8} + 25 + 101N\frac{2.5\mathrm{Exp}[-0.025*P]}{(1+100\mathrm{Exp}[-0.025*P])^2}.$$

Clearly, $\frac{d}{dP}\sum_{all\ j} Y_i\,(p_i; p_{-i}) > 0$ always, because $\frac{2.5\mathrm{Exp}[-0.025*P]}{(1+100\mathrm{Exp}[-0.025*P])^2} > 0$ and $-\frac{P}{8} + 25 > 0$ when $P < 192$.

Case 2: When $P \geq 192$:

$$\sum_{all\ j} Y_i\,(p_i; p_{-i}) = \sum_{all\ j}\left[(20 - p_i)\cdot 17 + \frac{101}{1+100\mathrm{Exp}[-0.025*P]} - 1\right]$$

$$= (20N - P)\cdot 17 + \frac{101N}{1+100\mathrm{Exp}[-0.025*P]} - N.$$

$$\frac{d}{dP}\sum_{all\ j} Y_i\,(p_i; p_{-i}) = -17 + 101N\frac{2.5\mathrm{Exp}[-0.025*P]}{(1+100\mathrm{Exp}[-0.025*P])^2}.$$

Here, the second term (the slope of the logistic function times N) has a maximum when P = 192 since the inflection point is less than 192. As $101N\frac{2.5\mathrm{Exp}[-0.025*P]}{(1+100\mathrm{Exp}[-0.025*P])^2} = 1.065$ when P = 192, $\frac{d}{dP}\sum_{all\ j} Y_i\,(p_i; p_{-i}) < 0$.

These calculations show that the social optimum occurs when P = 192. Panel (a) of Figure 2 in the main text shows the graph of $\sum_{all\ j} Y_i\,(p_i; p_{-i})$ as a function of P.