Online Appendix

A Omitted proofs

Proof for Proposition 1: To derive the optimal contest in maximizing the winner's effort, we can adapt the mechanism design approach in Liu et. al (2018). A direct mechanism is formally defined below. Let $\tilde{t}_i \in [a,b]$ be contestant i's reported ability. Given the profile of reports $\tilde{\mathbf{t}} = (\tilde{t}_1, \cdots, \tilde{t}_N)$, the contest designer gives a prize of $v_i(\tilde{\mathbf{t}})$ to contestant i and demands an effort of $e_i(\tilde{\mathbf{t}})$ from him.[22] Since the contests we consider have the feature that losers also need to pay for the effort, we restrict to a subset of direct mechanism where $e_i(\tilde{\mathbf{t}}) = e_i(\tilde{t}_i)$. Define the expected prize of contestant i with report $\tilde{t}_i$ as

$$V_i(\tilde{t}_i) = \int_{\mathbf{t}_{-i}} v_i(\tilde{t}_i, \mathbf{t}_{-i}) \mathbf{f}_{-i}(\mathbf{t}_{-i}) d\mathbf{t}_{-i}, \tag{5}$$

where $\mathbf{t}_{-i} = (t_1, \cdots, t_{i-1}, t_{i+1}, \cdots, t_N)$ and $\mathbf{f}_{-i}(\mathbf{t}_{-i})$ denotes the density of $\mathbf{t}_{-i}$.

Given that the other contestants truthfully report their abilities, contestant i's expected payoff when reporting $\tilde{t}_i$ is

$$\begin{aligned} u_i(\tilde{t}_i, t_i) &= \int_{\mathbf{t}_{-i}} v_i(\tilde{t}_i, t_{-i}) \mathbf{f}_{-i}(\mathbf{t}_{-i}) d\mathbf{t}_{-i} - \frac{e_i(\tilde{t}_i)}{t_i} \\ &= V_i(\tilde{t}_i) - \frac{e_i(\tilde{t}_i)}{t_i}. \end{aligned}$$

The contest designer's objective can be expressed as:

$$\max_{\{v_i(\cdot), e_i(\cdot), \forall i\}} R = \int_{\mathbf{t}} \left[\max_i \{e_i(t_i)\} + t_0 (V - \sum_i v_i(\mathbf{t})) \right] \mathbf{f}(\mathbf{t}) d\mathbf{t} \tag{6}$$

subject to the following feasibility constraints:

$$u_i(t_i, t_i) \geq u_i(\tilde{t}_i, t_i), \forall \tilde{t}_i, t_i, \forall i, \tag{7}$$

$$u_i(t_i, t_i) \geq 0, \forall t_i, \forall i, \tag{8}$$

$$\sum_i v_i(\mathbf{t}) \leq V, \forall \mathbf{t}, \tag{9}$$

$$v_i(\mathbf{t}) \geq -K, \forall \mathbf{t}, \forall i, \tag{10}$$

$$e_i(\mathbf{t}) \geq 0, \forall \mathbf{t}, \forall i. \tag{11}$$

The feasibility constraints consist of five parts: (7) is the incentive compatibility constraint, (8) is

[22] As a contestant's payoff is linear in effort and prize, it is without loss of generality to focus on a deterministic mechanism. In fact, $v_i(\tilde{\mathbf{t}})$ and $e_i(\tilde{\mathbf{t}})$ can be interpreted as the expected prize and the expected effort.

the participation constraint, (9) is the designer's budget constraint, (10) is the lower bound imposed on prizes, and (11) is the nonnegative effort constraint.

Define $\tilde{u}_i(\tilde{t}_i, t_i) = t_i \cdot u_i(\tilde{t}_i, t_i)$. Then

$$\tilde{u}_i(\tilde{t}_i, t_i) = t_i V_i(\tilde{t}_i) - e_i(\tilde{t}_i).$$

Constraints (7) and (8) can be rewritten in terms of $\tilde{u}_i(\cdot,\cdot)$. From (7) and the Envelope Theorem, we have

$$\frac{d\tilde{u}_i(t_i, t_i)}{dt_i} = \frac{\partial \tilde{u}_i(\tilde{t}_i, t_i)}{\partial t_i}\bigg|_{\tilde{t}_i = t_i} = V_i(t_i),$$

which leads to

$$\tilde{u}_i(t_i, t_i) - \tilde{u}_i(a, a) = \int_a^{t_i} V_i(s)ds.$$

Standard derivations such as those in Myerson (1981) lead to the following lemma. The proof is omitted here.

Lemma 1 *Mechanism* $(\mathbf{v}(\cdot), \mathbf{e}(\cdot))$ *is feasible if and only if the following conditions hold together with (9), (10) and (11):*

$$e_i(t_i) = t_i V_i(t_i) - \int_a^{t_i} V_i(s)ds - a \cdot u_i(a, a), \forall t_i, \forall i, \tag{12}$$

$$V_i(t_i') \geq V_i(t_i),\ \forall t_i' > t_i, \forall i, \tag{13}$$

$$u_i(a, a) \geq 0, \forall i.$$

Note that in the optimal mechanism, we must have $u_i(a, a) = 0$, i.e., the lowest ability contestant must earn zero informational rent. If $u_i(a, a) > 0$, the contest designer can simply decrease the informational rent for every ability and yield a higher level of expected total effort. Given (5) and (12), we can replace effort $\mathbf{e}(\cdot)$ by the prize function $\mathbf{v}(\cdot)$ and rewrite the contest designer's objective function as

$$\max \int_{\mathbf{t}} \sum_i \left[J^W(t_i) - t_0\right] v_i(\mathbf{t})\mathbf{f}(\mathbf{t})d\mathbf{t} + t_0 V. \tag{14}$$

Therefore, the contest designer's optimization problem can be restated as maximizing (14), subject to (9), (10), (11), (12) and (13). It is easy to see that, compared with Liu et. al (2018), the only difference is that the virtual ability function now is $J^W(t_i)$ instead of $J^T(t_i)$. It then follows that the contest proposed in the proposition is optimal.

When $K > \max\left\{\frac{VF(J^{T-1}(0))^{N-1}}{1-F(J^{T-1}(0))^{N-1}}, \frac{VF(J^{W-1}(0))^{N-1}}{1-F(J^{W-1}(0))^{N-1}}\right\} = \frac{VF(J^{W-1}(0))^{N-1}}{1-F(J^{W-1}(0))^{N-1}}$, we have $t^{*^T}(K) = t^{*^W}(K) = F^{-1}((\frac{NK}{V+NK})^{\frac{1}{N-1}})$, and thus the two optimal contests are the same. **Q.E.D.**

Proof for Proposition 3: Given the proposed equilibrium structure, we can calculate a player's

payoff for the following actions.

No entry: $u(0)$.

Enter and bid zero: $F(t_2)^{N-1}u(S-E)+\left(1-F(t_2)^{N-1}\right)u(-E)$.

Enter and bid $\hat{e}$:

$$\sum_{m=0}^{N-1} C_{N-1}^{m} F(t_1)^{N-1-m}\left(F(t_2)-F(t_1)\right)^{m} u(V+mE)+\left(1-F(t_2)^{N-1}\right)u(-E)-\frac{\hat{e}}{t}. \tag{15}$$

Note that the payoff from the first two options does not depend on a player's ability. We can pin down the two cutoffs. For a player with ability t_1, he is indifferent between no entering and entering and bidding zero. We thus have

$$u(0)=F(t_2)^{N-1}u(S-E)+\left(1-F(t_2)^{N-1}\right)u(-E)$$

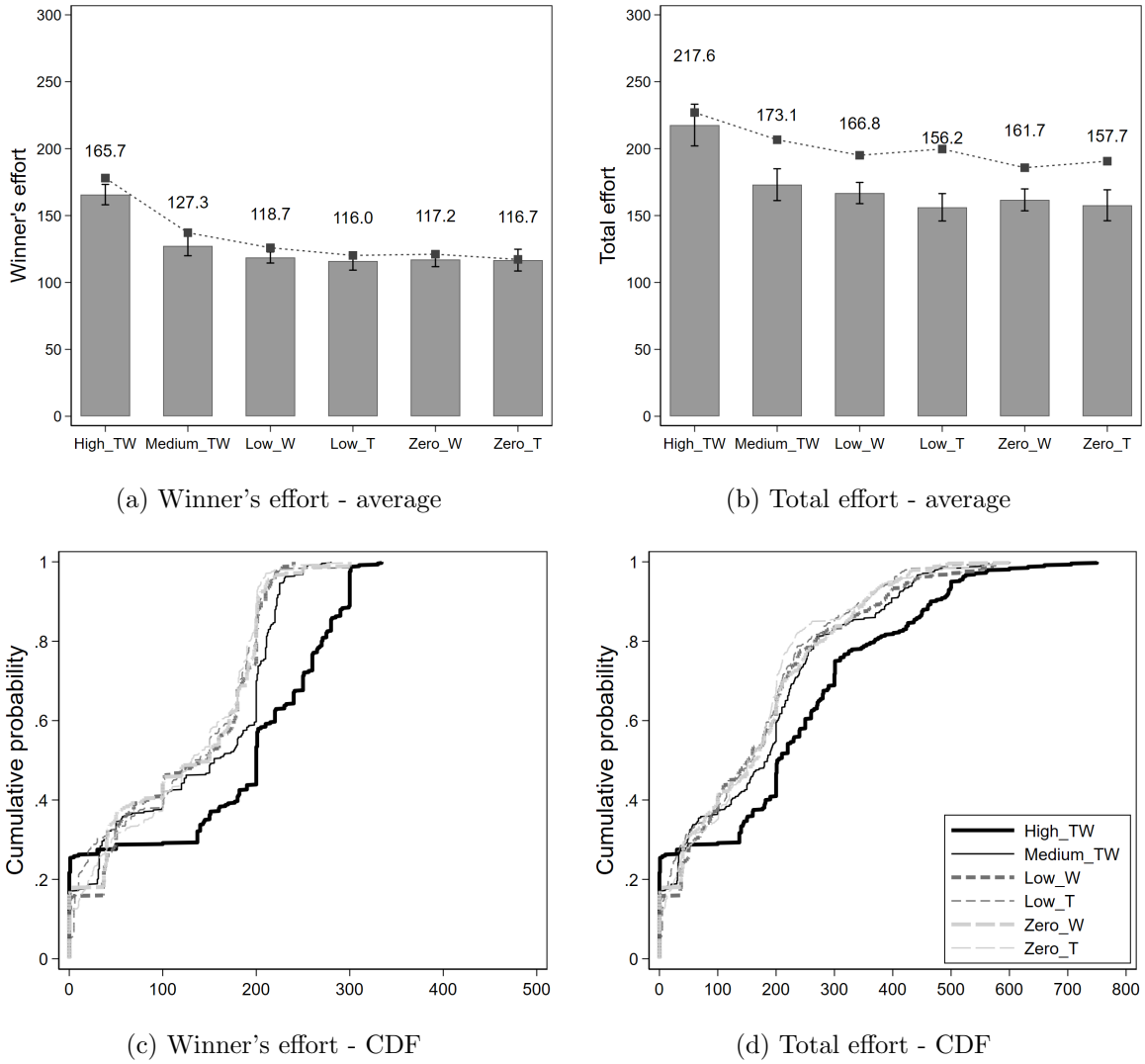
For player with ability t_2, he is indifferent between entering and bidding zero or bidding $\hat{e}$. We thus have

$$\begin{aligned} & F(t_2)^{N-1}u(S-E)+\left(1-F(t_2)^{N-1}\right)u(-E) && (16)\\ = & \sum_{m=0}^{N-1} C_{N-1}^{m} F(t_1)^{N-1-m}\left(F(t_2)-F(t_1)\right)^{m} u(V+mE)+\left(1-F(t_2)^{N-1}\right)u(-E)-\frac{\hat{e}}{t_2} \\ & F(t_2)^{N-1}u(S-E) \\ = & \sum_{m=0}^{N-1} C_{N-1}^{m} F(t_1)^{N-1-m}\left(F(t_2)-F(t_1)\right)^{m} u(V+mE)-\frac{\hat{e}}{t_2} && (17) \end{aligned}$$

These two indifference conditions are exactly the two nonlinear equations in the proposition. If the solutions are interior, then we have verified the structure of the equilibrium. It is then routine to show that no types would have incentive to deviate given the equilibrium. **Q.E.D.**

B Additional Figures and Tables

Figure B1: Averages and distributions of winner's effort and total effort during the last 10 rounds



(a) Winner's effort - average

(b) Total effort - average

(c) Winner's effort - CDF

(d) Total effort - CDF

Notes: Standard errors clustered at the matching group level are indicated by bars. For average efforts on the top panel, the connected line represents the theoretical prediction in each treatment, which is derived from each individual's optimal effort function evaluated at their actual ability parameter in each group and in each round. Note that this is different from the theoretical prediction based on the expected composition of group members with heterogeneous abilities, as shown in Table 1. The predicted winner's effort is 174.2, 136.5, 125.3, 120.8, 118.8 and 114.7 in High_TW, Medium_TW, Low_W, Low_T, Zero_W and Zero_T, respectively. The predicted total effort is 220.5, 200.9, 189.0, 196.7, 180.0 and 187.4, respectively. For both winner's effort and total effort, the average in High_TW is significantly higher than in any other treatment.

Figure B2: Winner's effort over round

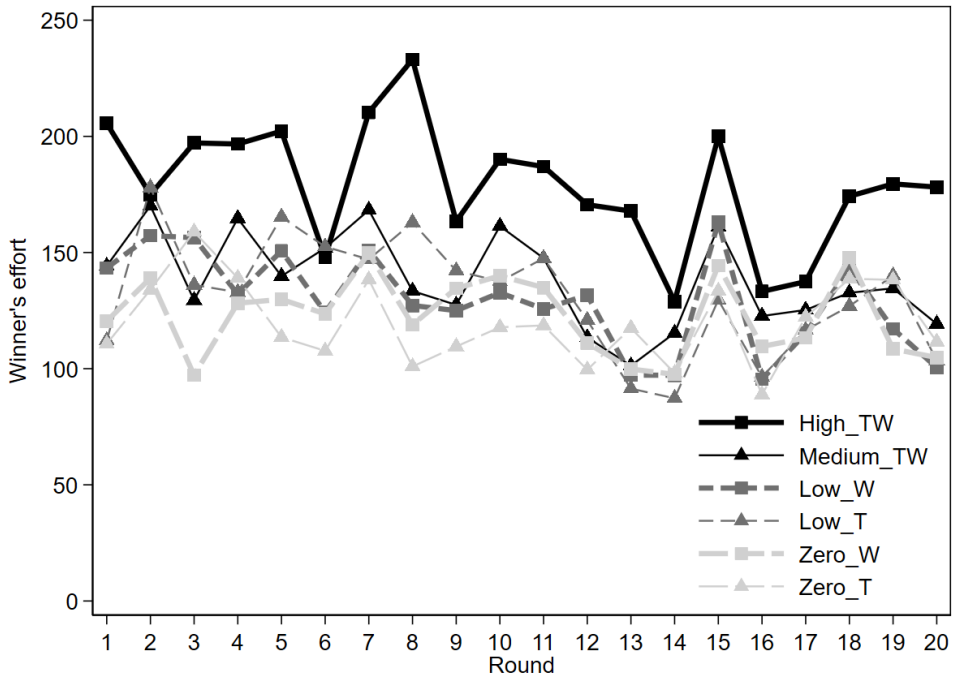


Figure B3: Total effort over round

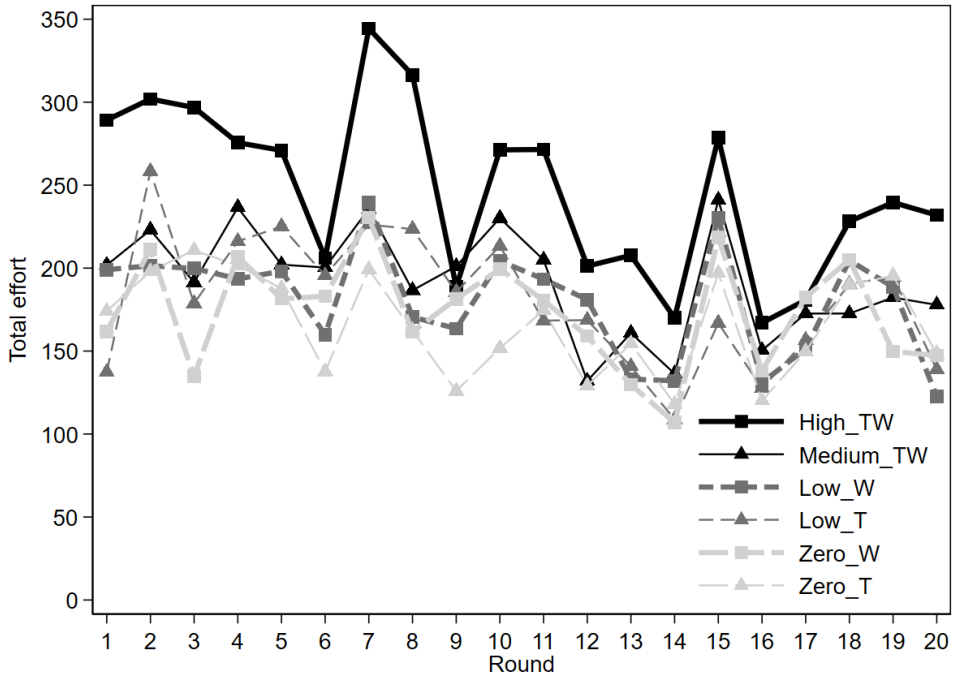


Figure B4: CDFs of observed and predicted winner's effort by treatment

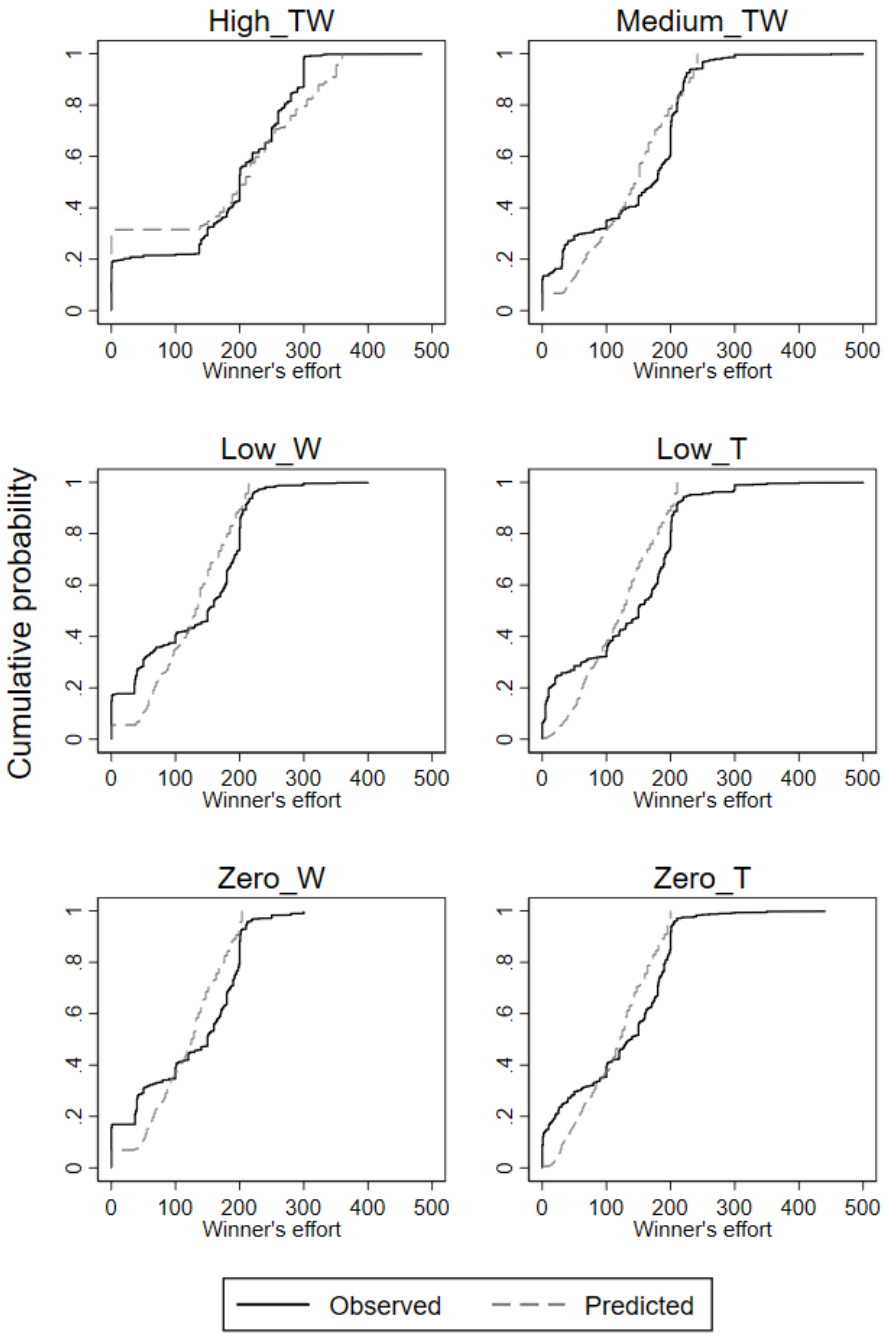


Figure B5: CDFs of observed and predicted total effort by treatment

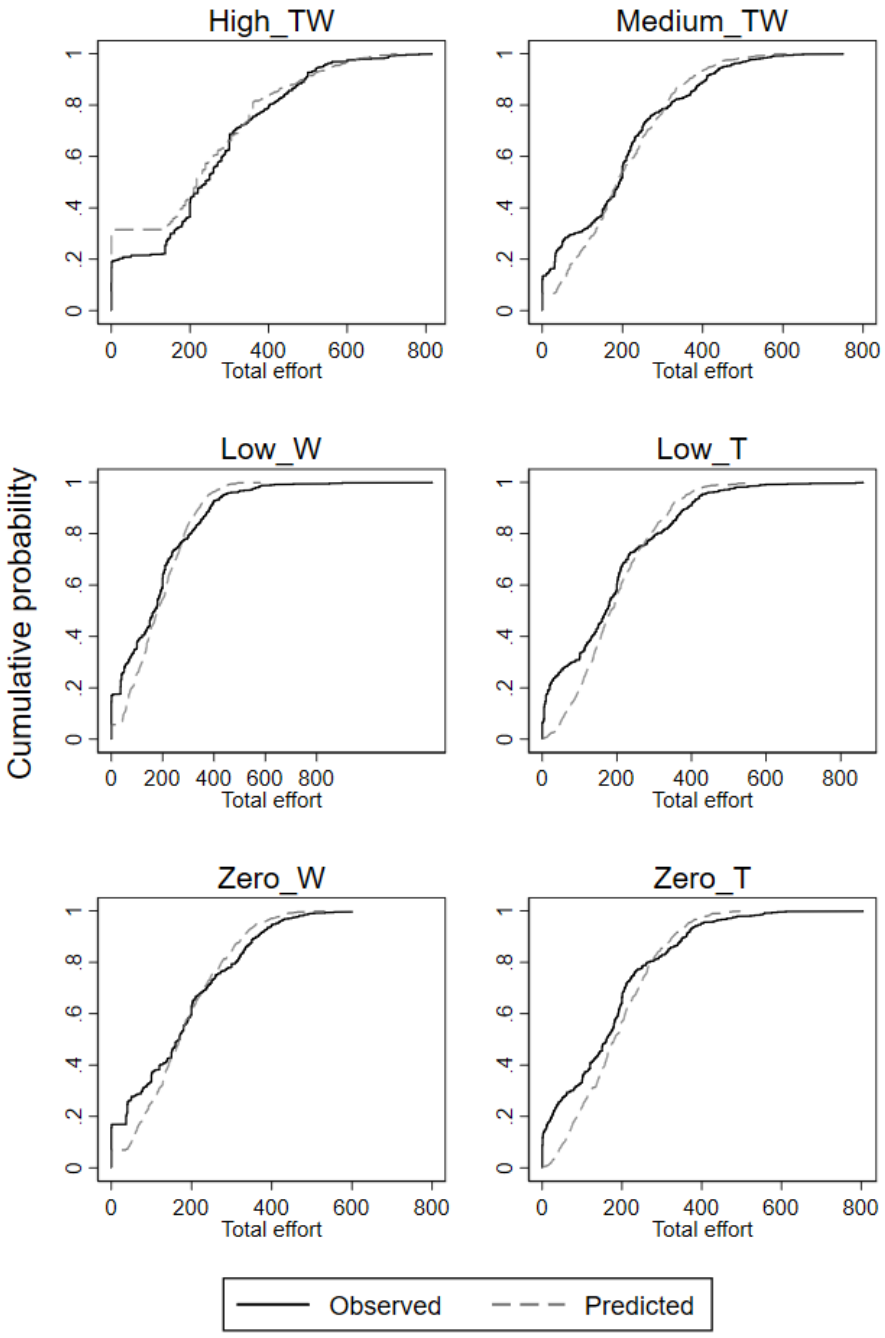


Figure B6: Frequency of entering the contest over round

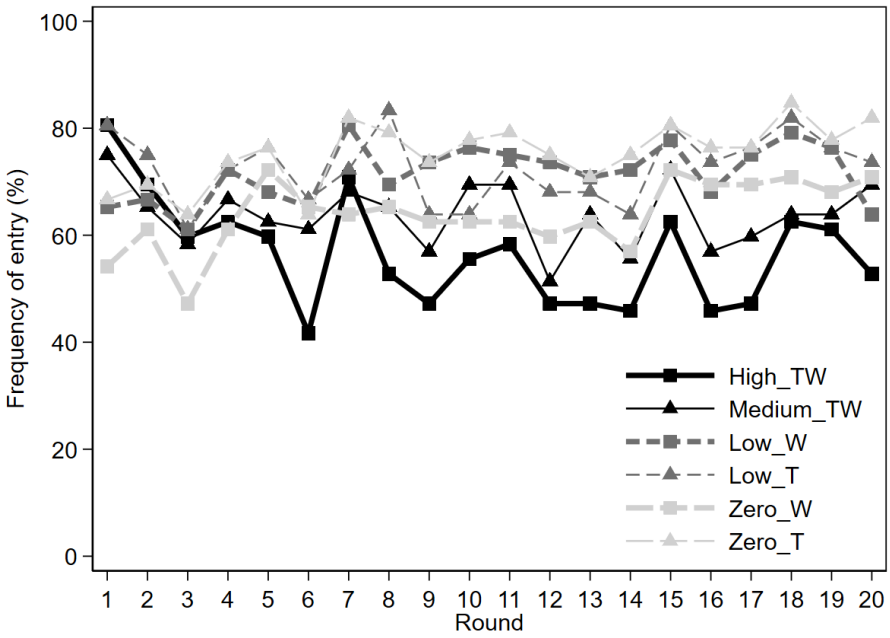
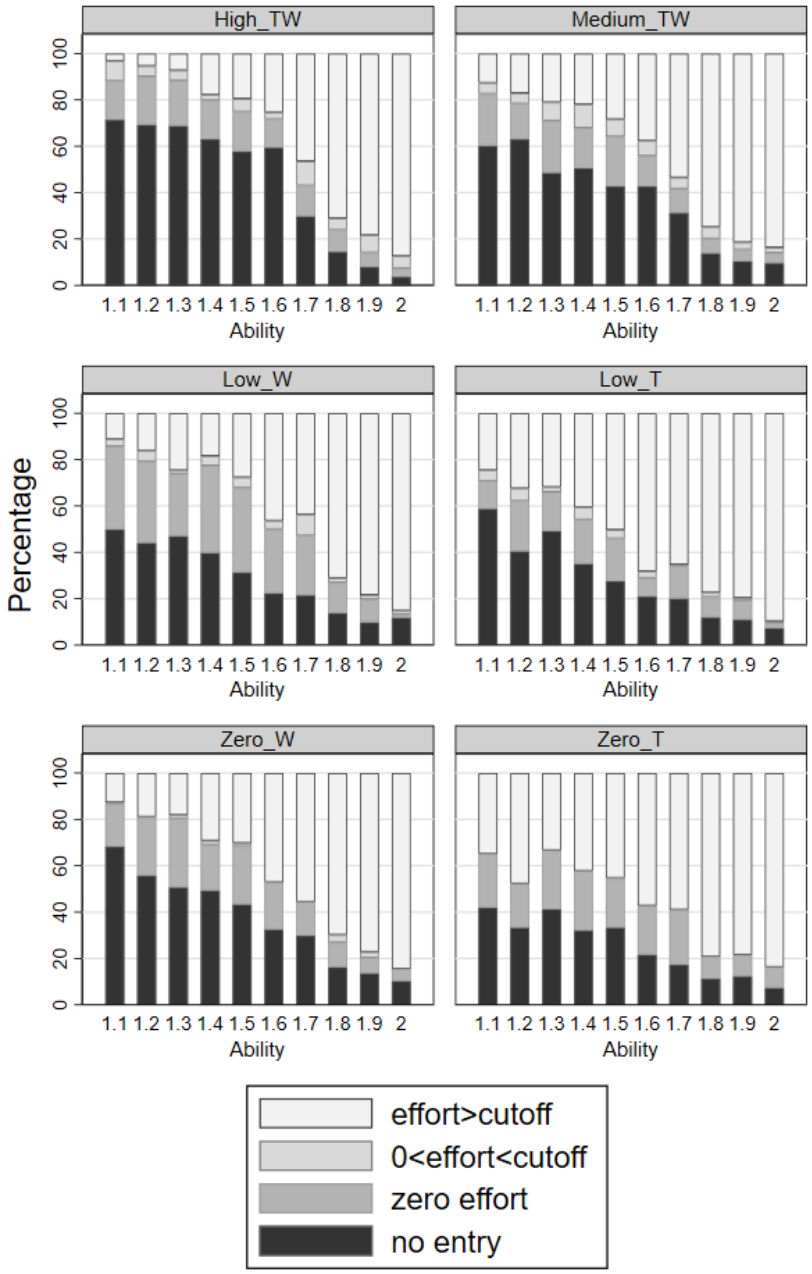


Figure B7: Categorization of behavior by ability



Notes: The ability parameter is categorized into ten groups: [1, 1.1], (1.1, 1.2], . . . , (1.9, 2]. In the figure, we use the upper bound to indicate each group.

Figure B8: Winner's effort over round in High_TW and High_Forced

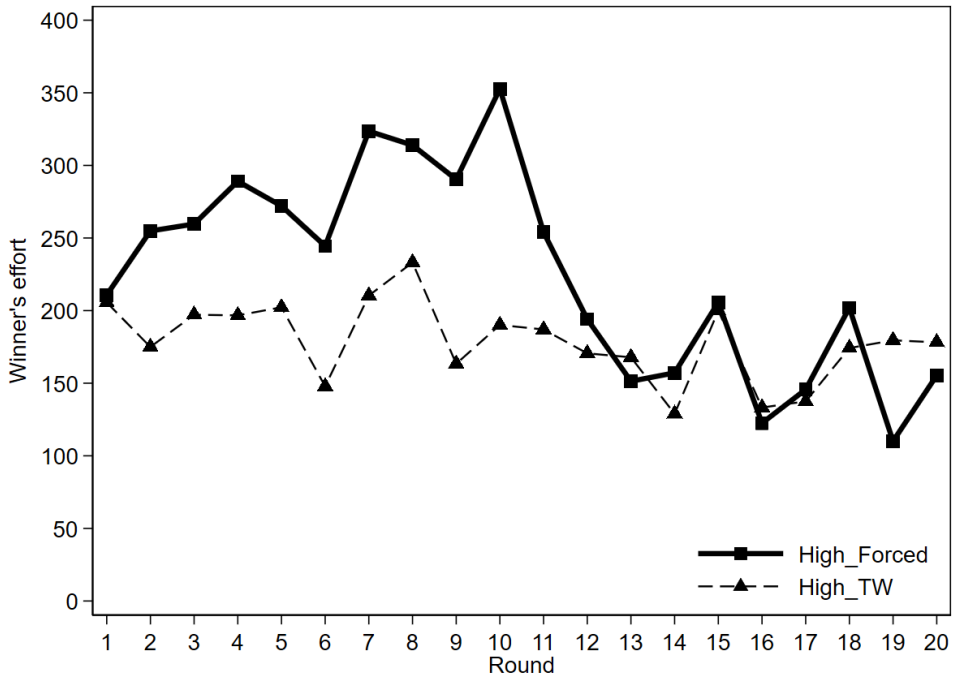


Figure B9: Total effort over round in High_TW and High_Forced

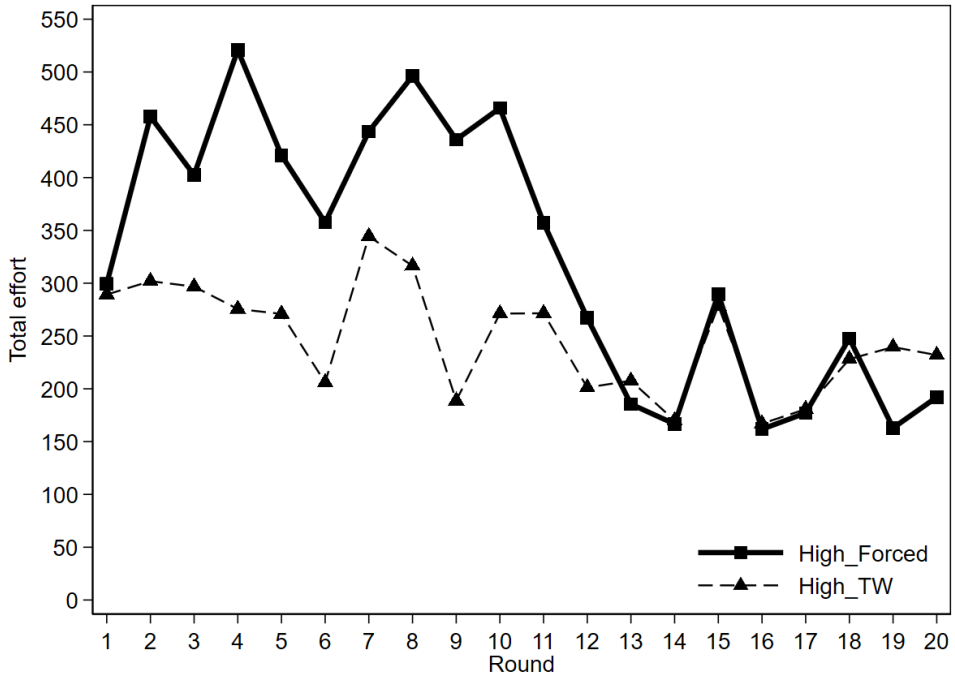
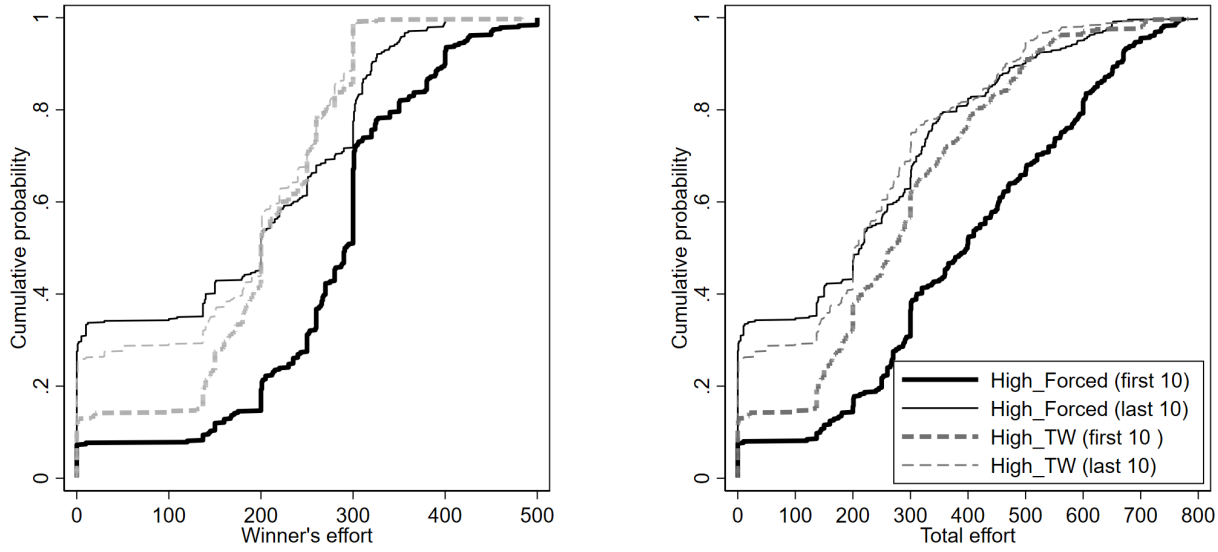


Figure B10: CDFs of winner's effort and total effort in High_TW and High_Forced



(a) Winner's effort

(b) Total effort

Figure B11: CDFs of observed and predicted winner's effort by treatment in High_TW and High_Forced

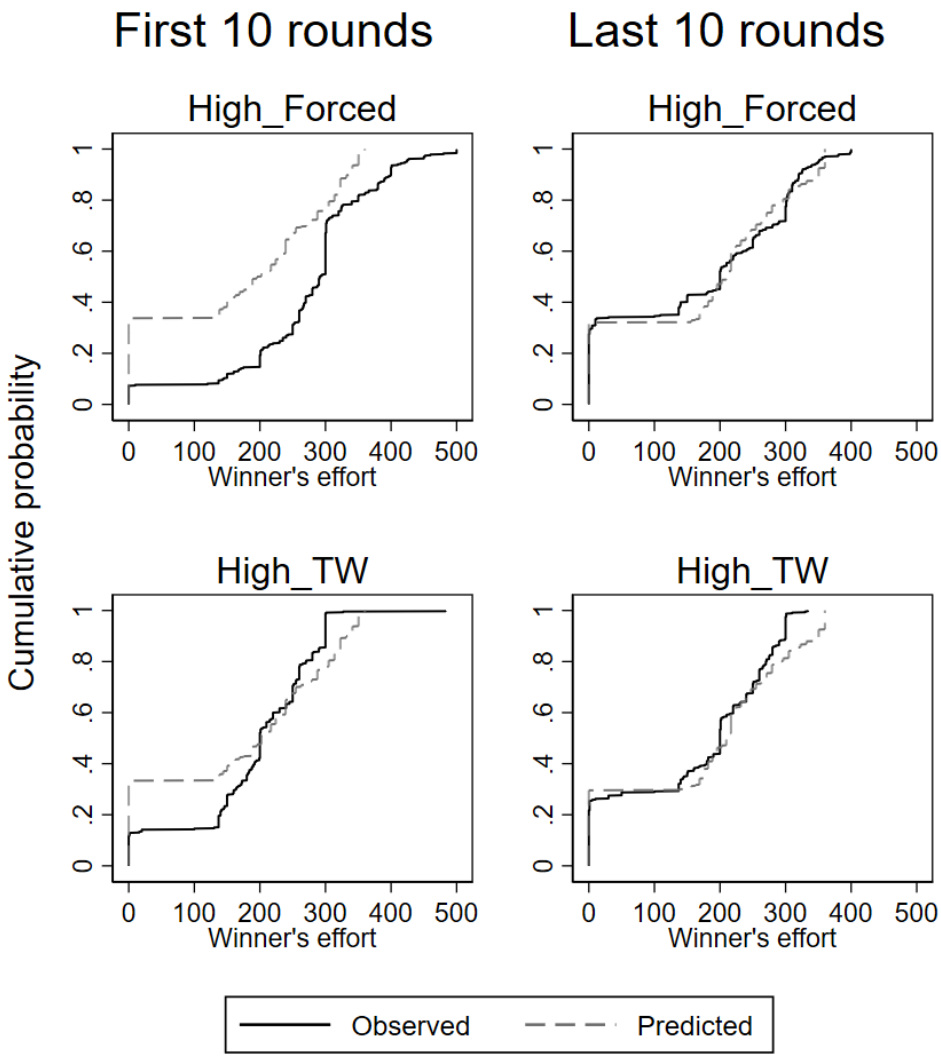


Figure B12: CDFs of observed and predicted total effort by treatment in High_TW and High_Forced

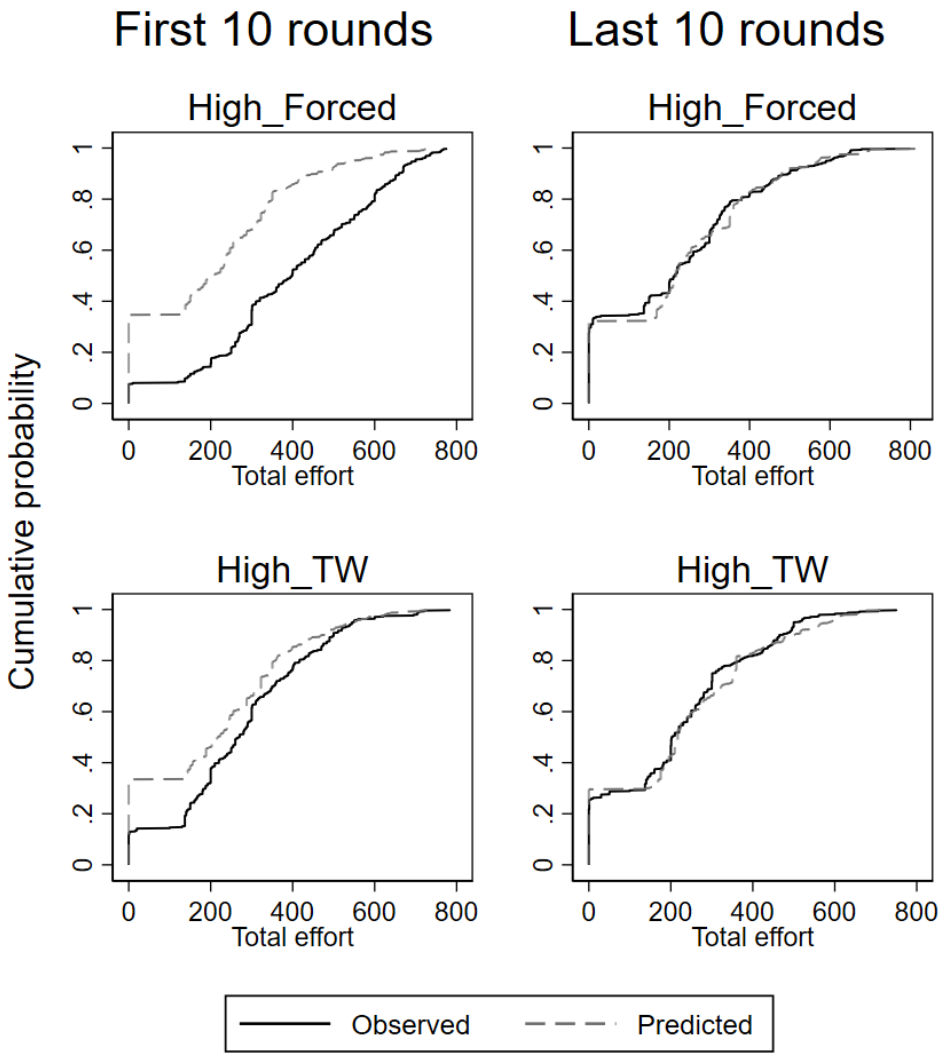


Figure B13: Frequency of entering the contest over round in High_TW and High_Forced

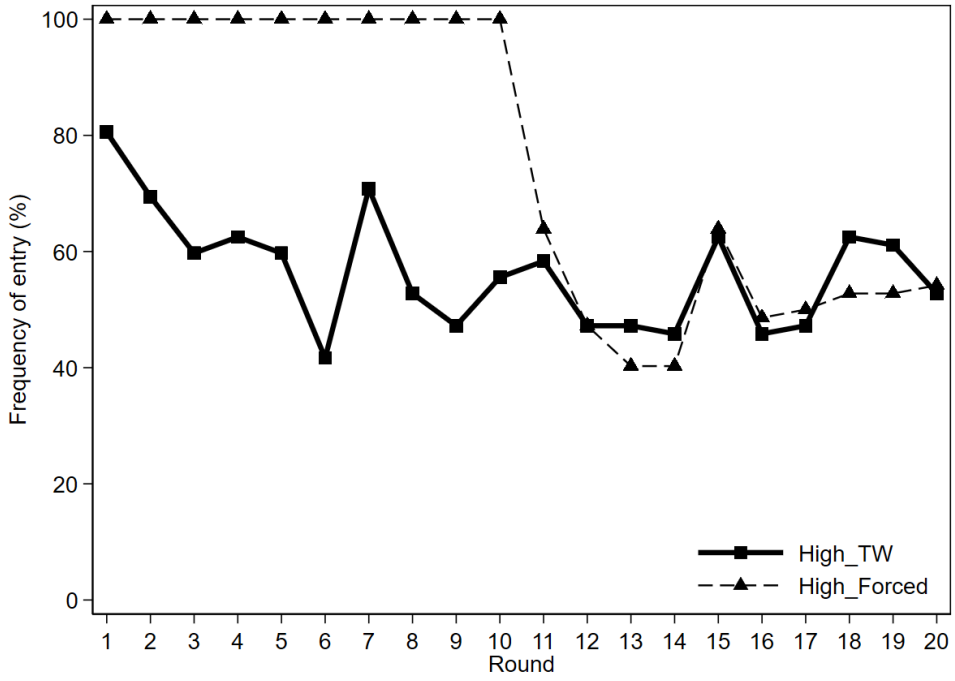
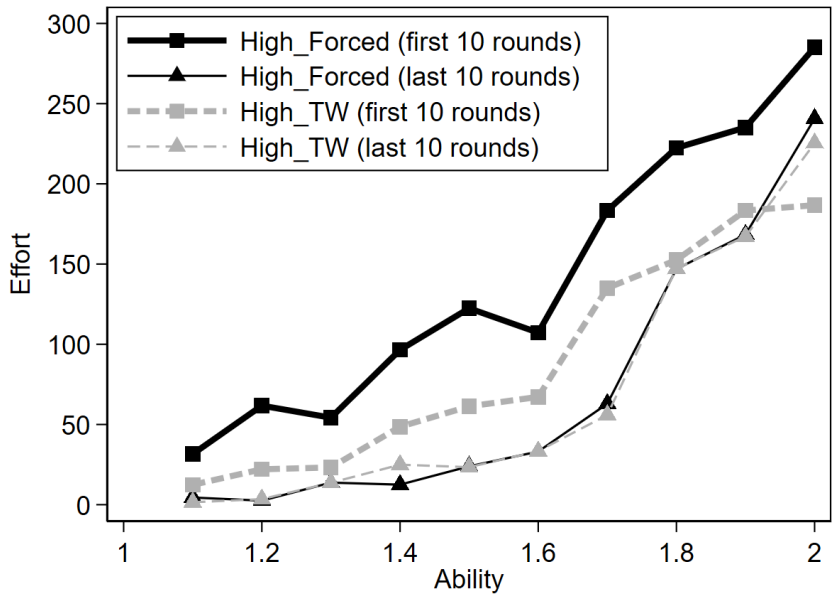
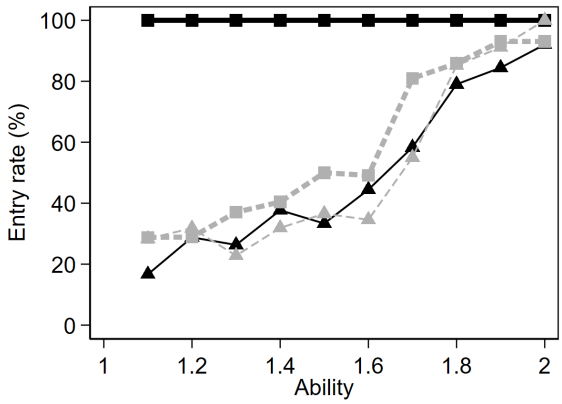


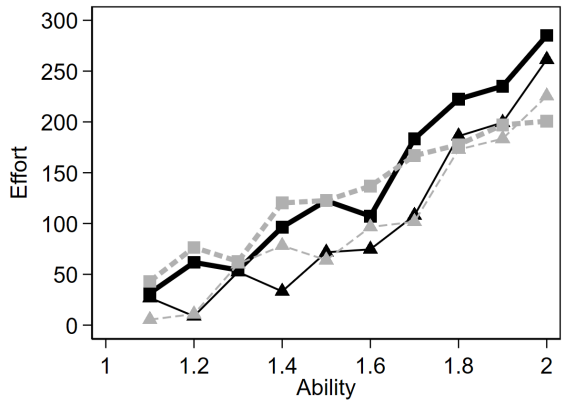
Figure B14: Average effort by ability in High_TW and High_Forced



(a) Average effort



(b) Entry rate



(c) Effort conditional on entry

Notes: The ability parameter is categorized into ten groups: [1, 1.1], (1.1, 1.2], . . . , (1.9, 2]. In the figure, we use the upper bound to indicate each group.

Table B1: Numerical calculations of percentage improvement of winner's effort and total effort

Panel A: Winner's effort improvement using the winner effort maximizing contest as opposed to the total effort maximizing contest

Weibull $F(t) = 1 - exp(-t^\theta)$					Power $F(t) = (t-1)^\theta$				
	N=2	4	6	8		N=2	3	4	5
θ=1	1.42%	4.37%	4.75%	4.22%	θ=1	2.30%	1.46%	0.95%	0.67%
1.25	1.47%	3.94%	3.71%	3.01%	1.5	1.74%	1.13%	0.68%	0.44%
1.5	2.19%	3.83%	3.02%	2.23%	2	1.48%	0.88%	0.50%	0.31%
1.75	2.65%	3.49%	2.41%	1.70%	2.5	1.21%	0.70%	0.38%	0.23%
2	2.22%	2.86%	1.90%	1.33%	3	1.07%	0.58%	0.30%	0.18%
Quadratic $F(t) = \theta t^2 + (1-3\theta)t + (2\theta - 1)$					Exponential $F(t) = 1 - exp(-\theta t)$				
	N=2	3	4	5		N=2	5	8	11
θ=-0.4	1.42%	1.12%	0.84%	0.64%	θ=1	1.55%	4.87%	4.26%	3.32%
-0.2	1.84%	1.31%	0.92%	0.67%	3	1.48%	4.81%	4.24%	3.32%
0	2.30%	1.46%	0.95%	0.67%	5	1.55%	4.87%	4.25%	3.32%
0.2	2.34%	1.49%	0.93%	0.62%	7	1.33%	4.70%	4.21%	3.31%
0.4	2.09%	1.40%	0.84%	0.55%	9	1.71%	4.97%	4.29%	3.32%

Panel B: Total effort improvement using the total effort maximizing contest as opposed to the winner effort maximizing contest

Weibull $F(t) = 1 - exp(-t^\theta)$					Power $F(t) = (t-1)^\theta$				
	N=2	4	6	8		N=2	3	4	5
θ=1	1.46%	4.90%	6.44%	7.97%	θ=1	3.70%	4.27%	4.40%	4.04%
1.25	1.62%	5.30%	6.35%	7.57%	1.5	2.78%	3.33%	3.46%	3.43%
1.5	1.59%	6.19%	6.03%	6.24%	2	2.60%	3.06%	3.05%	2.81%
1.75	1.58%	5.04%	7.14%	5.74%	2.5	2.27%	2.92%	2.68%	2.18%
2	2.48%	4.60%	4.93%	5.90%	3	2.09%	2.50%	2.41%	2.05%
Quadratic $F(t) = \theta t^2 + (1-3\theta)t + (2\theta - 1)$					Exponential $F(t) = 1 - exp(-\theta t)$				
	N=2	3	4	5		N=2	5	8	11
θ=-0.4	3.84%	4.36%	4.42%	4.41%	θ=1	1.45%	5.89%	7.51%	8.00%
-0.2	3.94%	4.36%	4.40%	4.38%	3	1.52%	5.79%	7.41%	8.10%
0	3.70%	4.27%	4.40%	4.04%	5	1.32%	5.89%	7.61%	8.10%
0.2	3.34%	3.86%	4.14%	3.90%	7	1.65%	5.60%	7.41%	8.09%
0.4	2.83%	3.63%	3.68%	3.56%	9	1.52%	5.79%	7.41%	**8.40%**

Notes: We examined four different one-parameter functional forms of the ability distribution and also varied the group size N. The percentage in each cell is the numerical calculation of the ratio improvement in terms of winner's effort (Panel A) and total effort (Panel B) when comparing the two optimal mechanisms, conditional on a specific ability distribution and group size. The liability K is always set to 0 which maximizes the ratio improvement for any given set of parameters. Since the optimal effort is linear in the prize budget V, the percentage improvement does not depend on the prize budget.

Table B2: Random effects regressions on the winner's effort and total effort

	Winner's effort		Total effort	
	(1) All rounds	(2) Last 10 rounds	(3) All rounds	(4) Last 10 rounds
High_TW	59.058***	49.008***	80.581***	59.946***
	(7.388)	(10.328)	(13.479)	(18.016)
Medium_TW	18.338*	10.638	25.685	15.404
	(10.832)	(10.166)	(19.137)	(15.379)
Low_W	9.465	1.988	13.604	9.146
	(8.046)	(8.464)	(14.409)	(13.001)
Low_T	11.475	-0.666	14.785	-1.492
	(8.719)	(9.827)	(15.216)	(14.320)
Zero_W	2.798	0.496	7.192	4.054
	(8.016)	(9.029)	(14.969)	(13.139)
Round	-1.518***	0.184	-2.726***	0.716
	(0.359)	(0.799)	(0.525)	(1.269)
Constant	135.796***	113.831***	194.924***	146.587***
	(6.495)	(14.123)	(12.894)	(22.270)
Clusters	36	36	36	36
N	2880	1440	2880	1440
H0: High_TW = Medium_TW	$p < 0.001$	$p < 0.001$	$p = 0.001$	$p = 0.014$
H0: High_TW = Low_W	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.002$
H0: High_TW = Low_T	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.001$
H0: High_TW = Zero_W	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.001$
H0: Medium_TW = Low_W	$p = 0.388$	$p = 0.270$	$p = 0.479$	$p = 0.637$
H0: Medium_TW = Low_T	$p = 0.526$	$p = 0.224$	$p = 0.540$	$p = 0.245$
H0: Medium_TW = Zero_W	$p = 0.130$	$p = 0.230$	$p = 0.292$	$p = 0.396$
H0: Low_W = Low_T	$p = 0.802$	$p = 0.720$	$p = 0.925$	$p = 0.375$
H0: Low_W = Zero_W	$p = 0.358$	$p = 0.813$	$p = 0.600$	$p = 0.630$

Notes: Standard errors clustered at the matching group level are in parentheses. Zero_T serves as the benchmark.
*** $p < 0.01$.

Table B3: Summary statistics for entry and effort choices - last 10 rounds

	High_TW	Medium_TW	Low_W	Low_T	Zero_W	Zero_T
Entry rate						
All	53.1%	62.6%	73.2%	73.6%	66.3%	77.8%
High ability	91.2%	73.5%	83.3%	79.8%	79.0%	/
Low ability	35.4%	45.7%	57.4%	49.7%	46.5%	/
Above-cutoff rate if enter						
All	61.8%	67.0%	62.0%	80.2%	66.9%	100%
High ability	83.7%	78.6%	74.2%	83.2%	78.3%	/
Low ability	35.6%	38.0%	34.6%	61.6%	36.6%	/
Positive effort but below-cutoff rate if enter						
All	11.0%	10.0%	5.1%	3.6%	2.5%	0%
High ability	7.7%	7.8%	3.8%	2.8%	2.9%	/
Low ability	14.9%	15.5%	8.0%	8.2%	1.5%	/
Zero effort rate if enter						
All	27.2%	23.1%	32.8%	16.2%	30.6%	23.6%
High ability	8.7%	13.7%	21.9%	14.0%	18.8%	/
Low ability	49.4%	46.5%	57.4%	30.1%	61.8%	/
Average effort if enter						
All	136.7	92.1	76.0	70.7	81.4	67.6
High ability	192.3	117.7	99.2	79.2	102.2	/
Low ability	70.3	28.3	23.7	17.5	26.3	/

Notes: High (low) ability is determined by whether a contestant's ability parameter is above (below) the cutoff value in a round. This cutoff value is 1.218 in Low_T, 1.455 in Medium_TW, Low_W and Zero_W, and 1.707 in High_TW. "Above-cutoff rate if enter" refers to the frequency of contestants' efforts above the cutoff effort, which is 36.5 in Zero_W, 35.5 in Low_W, 4.5 in Low_T, 30.5 in Medium_TW and 136.5 in High_TW.

Table B4: Random effects regressions for entry and effort choices: Robustness check

	All rounds		Last 10 rounds	
	Pr(Entry)	Effort if enter	Pr(Entry)	Effort if enter
High_TW	-0.273***	65.871***	-0.392***	65.890***
	(0.035)	(7.909)	(0.042)	(10.190)
Medium_TW	-0.170***	25.199***	-0.225***	23.982***
	(0.039)	(8.337)	(0.042)	(8.900)
Low_W	-0.071	9.903	-0.081	9.283
	(0.071)	(6.748)	(0.074)	(8.093)
Low_T	-0.075*	9.852	-0.097*	2.323
	(0.042)	(6.557)	(0.050)	(8.966)
Zero_W	-0.173***	14.589*	-0.190***	12.921
	(0.041)	(8.195)	(0.057)	(9.612)
Ability	0.639***	160.097***	0.645***	160.033***
	(0.029)	(7.560)	(0.034)	(7.519)
Believe 1 enters	-0.090***	33.533***	-0.090***	31.461***
	(0.019)	(5.510)	(0.019)	(7.729)
Believe 2 enter	-0.334***	40.056***	-0.337***	41.021***
	(0.025)	(5.832)	(0.030)	(7.983)
Own entry	0.087***	-3.129	0.055***	-1.596
in previous round	(0.013)	(2.219)	(0.014)	(2.767)
No. of other entrants	0.013*	5.271***	-0.010	3.288
in previous round	(0.007)	(1.928)	(0.010)	(2.123)
Female	-0.013	6.990	-0.041	4.212
	(0.031)	(4.904)	(0.038)	(5.148)
Risk	0.028**	0.181	0.034***	0.551
	(0.011)	(2.461)	(0.013)	(2.732)
Competitive	0.018**	-0.568	0.021**	-0.704
	(0.009)	(2.107)	(0.010)	(2.099)
CRT	0.034***	-2.647	0.032***	-0.563
	(0.011)	(2.574)	(0.012)	(2.642)
Round	-0.001	-1.924***	0.000	-1.382***
	(0.002)	(0.246)	(0.002)	(0.468)
Clusters	24	36	36	36
N	8208	5506	4320	2927

Notes: Columns (1) and (3) report the average marginal effects from random effects probit regressions on the entry decision. Columns (2) and (4) report estimates from random effects linear regression on the effort choice for contestants who have entered the contest. Standard errors clustered at the matching group level are in parentheses. Zero_T serves as the benchmark. "Risk" is self-reported general attitudes toward risk-taking in daily life on the scale from 1 (not risk-taking at all) to 7 (extremely risk-taking). "Competitive" is self-reported general attitudes toward being competitive in daily life on the scale from 1 (not competitive at all) to 7 (extremely competitive). "CRT" refers to the Cognitive Reflection Test using the standard three questions developed by Frederick (2005) to assess cognitive ability. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B5: Random effects regressions for entry and effort choices by treatment

	Pr(Entry)						Effort if enter					
	High_TW	Medium_TW	Low_W	Low_T	Zero_W	Zero_T	High_TW	Medium_TW	Low_W	Low_T	Zero_W	Zero_T
Ability	0.801***	0.661***	0.557***	0.572***	0.694***	0.391***	189.051***	169.782***	162.078***	155.148***	139.458***	137.820***
	(0.017)	(0.029)	(0.155)	(0.077)	(0.045)	(0.049)	(22.632)	(14.831)	(13.701)	(20.642)	(8.329)	(21.256)
Believe 1 enters	-0.171***	-0.162***	0.032	-0.001	-0.063**	0.048	55.382***	31.050***	24.235***	36.189***	24.360**	21.678**
	(0.035)	(0.036)	(0.115)	(0.073)	(0.031)	(0.067)	(16.386)	(2.446)	(5.396)	(5.294)	(9.708)	(10.001)
Believe 2 enter	-0.448***	-0.379***	-0.144	-0.243***	-0.325***	-0.116	77.727***	43.199***	28.809***	50.294***	22.470***	20.435*
	(0.031)	(0.061)	(0.158)	(0.069)	(0.047)	(0.080)	(17.010)	(4.086)	(8.098)	(3.087)	(6.503)	(11.881)
Female	0.016	-0.009	0.031	-0.016	-0.216	0.009	-3.806	16.788**	-7.141	11.766	25.484**	2.476
	(0.045)	(0.077)	(0.092)	(0.070)	(0.145)	(0.094)	(10.532)	(8.330)	(10.835)	(15.168)	(11.458)	(12.800)
Risk	0.052**	0.048***	0.071**	-0.007	0.001	0.042	-2.469	-4.138	-10.779	1.854	1.943	8.076**
	(0.020)	(0.013)	(0.033)	(0.028)	(0.040)	(0.041)	(10.631)	(2.967)	(8.710)	(4.072)	(6.532)	(3.815)
Competitive	0.029**	0.019	-0.021	0.018*	0.027	-0.009	-3.749	1.288	14.692	4.512	-1.533	-9.581**
	(0.014)	(0.015)	(0.051)	(0.011)	(0.027)	(0.029)	(4.212)	(7.419)	(9.264)	(4.194)	(4.000)	(3.763)
CRT	-0.009	0.028*	0.036	0.035	0.067***	0.061**	-5.455*	8.314**	-6.302	-2.132	-2.903	-4.583
	(0.017)	(0.017)	(0.027)	(0.046)	(0.024)	(0.025)	(3.094)	(4.236)	(6.717)	(7.906)	(9.114)	(3.393)
Round	-0.017***	-0.006***	0.003	-0.001	0.006	0.008***	-0.750	-1.365*	-1.811***	-1.729***	-1.609***	-1.614***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.002)	(0.742)	(0.730)	(0.558)	(0.460)	(0.411)	(0.303)
Clusters	6	6	6	6	6	6	6	6	6	6	6	6
N	1440	1440	1440	1440	1440	1440	814	918	1030	1045	920	1083

Notes: Columns (1) to (6) report the average marginal effects from random effects probit regressions on the entry decision. Columns (7) to (12) report estimates from random effects linear regression on the effort choice for contestants who have entered the contest. Standard errors clustered at the matching group level are in parentheses. "Risk" is self-reported general attitudes toward risk-taking in daily life on the scale from 1 (not risk-taking at all) to 7 (extremely risk-taking). "Competitive" is self-reported general attitudes toward being competitive in daily life on the scale from 1 (not competitive at all) to 7 (extremely competitive). 'CRT" refers to the Cognitive Reflection Test using the standard three questions developed by Frederick (2005) to assess cognitive ability. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B6: Random effects regressions for entry and effort choices of high-ability individuals by treatment

	Pr(Entry)					Effort if enter				
	High_TW	Medium_TW	Low_W	Low_T	Zero_W	High_TW	Medium_TW	Low_W	Low_T	Zero_W
Ability	0.146	0.885***	0.350	0.530***	0.804***	132.036***	211.246***	255.485***	184.806***	186.976***
	(0.127)	(0.111)	(0.260)	(0.073)	(0.132)	(17.384)	(23.121)	(4.119)	(19.570)	(13.250)
Believe 1 enters	-0.002	-0.095***	0.076	0.010	-0.021	81.827***	55.065***	32.565***	43.751***	35.481***
	(0.040)	(0.033)	(0.140)	(0.057)	(0.017)	(21.378)	(9.631)	(7.617)	(2.893)	(11.492)
Believe 2 enter	-0.066	-0.232***	0.014	-0.179***	-0.214***	98.992***	70.194***	38.594***	57.694***	34.604***
	(0.051)	(0.057)	(0.140)	(0.065)	(0.071)	(18.547)	(10.345)	(10.614)	(3.586)	(9.320)
Female	0.002	0.020	0.000	0.015	-0.056	-14.536	11.531	-13.016	12.988	21.414
	(0.009)	(0.059)	(0.057)	(0.064)	(0.119)	(10.011)	(11.287)	(15.527)	(14.477)	(16.921)
Risk	0.001	0.038**	0.020	-0.002	0.014	-3.990	-4.101	2.889	-9.635	1.622
	(0.013)	(0.019)	(0.024)	(0.032)	(0.033)	(12.255)	(3.705)	(6.020)	(10.309)	(4.444)
Competitive	0.010	0.018	0.014	0.019	0.040	0.398	3.432	-0.261	12.316	5.066
	(0.010)	(0.024)	(0.037)	(0.013)	(0.031)	(5.274)	(8.619)	(4.972)	(10.333)	(4.628)
CRT	-0.005	0.018	0.010	0.032	0.072*	0.122	8.730*	-1.371	-3.240	0.855
	(0.008)	(0.012)	(0.026)	(0.046)	(0.041)	(2.697)	(5.183)	(10.753)	(8.658)	(9.116)
Round	-0.002	-0.003*	0.001	0.000	0.008***	0.128	-1.060	-1.535***	-1.372***	-1.966***
	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)	(0.537)	(0.845)	(0.500)	(0.468)	(0.490)
Clusters	6	6	6	6	6	6	6	6	6	6
N	444	828	828	1173	828	404	632	688	914	640

Notes: Columns (1) to (5) report the average marginal effects from random effects probit regressions on the entry decision. Columns (6) to (10) report estimates from random effects linear regression on the effort choice for contestants who have entered the contest. Standard errors clustered at the matching group level are in parentheses. "Risk" is self-reported general attitudes toward risk-taking in daily life on the scale from 1 (not risk-taking at all) to 7 (extremely risk-taking). "Competitive" is self-reported general attitudes toward being competitive in daily life on the scale from 1 (not competitive at all) to 7 (extremely competitive). 'CRT" refers to the Cognitive Reflection Test using the standard three questions developed by Frederick (2005) to assess cognitive ability. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B7: Random effects regressions for entry and effort choices of low-ability individuals by treatment

	Pr(Entry)					Effort if enter				
	High_TW	Medium_TW	Low_W	Low_T	Zero_W	High_TW	Medium_TW	Low_W	Low_T	Zero_W
Ability	0.660***	0.366**	0.578***	1.352**	0.653***	164.406***	69.020***	6.324	-75.265**	40.747***
	(0.069)	(0.157)	(0.169)	(0.558)	(0.158)	(26.758)	(23.406)	(25.503)	(33.898)	(10.063)
Believe 1 enters	-0.258***	-0.200***	-0.034	0.036	-0.174**	47.611***	8.955	9.199	27.920*	3.224
	(0.045)	(0.040)	(0.097)	(0.134)	(0.078)	(17.057)	(6.324)	(6.203)	(14.852)	(9.944)
Believe 2 enter	-0.574***	-0.579***	-0.349*	-0.417**	-0.483***	68.614***	2.772	6.485	45.851***	2.014
	(0.040)	(0.082)	(0.193)	(0.184)	(0.093)	(22.644)	(8.010)	(7.548)	(16.955)	(9.122)
Female	0.010	-0.044	0.089	-0.103	-0.369*	2.433	21.861**	1.566	14.581	41.892***
	(0.057)	(0.133)	(0.155)	(0.089)	(0.191)	(15.617)	(10.216)	(11.827)	(13.716)	(4.974)
Risk	0.067***	0.073***	0.174***	-0.010	0.015	-2.646	-2.913	-16.275**	3.340	2.863
	(0.021)	(0.013)	(0.047)	(0.044)	(0.046)	(9.112)	(2.626)	(6.565)	(2.985)	(9.818)
Competitive	0.031	-0.003	-0.084	0.019	0.001	-6.008	-1.038	20.941***	1.200	-4.214
	(0.020)	(0.014)	(0.070)	(0.037)	(0.030)	(5.106)	(5.877)	(7.092)	(3.001)	(3.799)
CRT	-0.013	0.036	0.106***	0.053	0.053**	-9.956*	8.229**	-18.970***	-15.414	-2.531
	(0.021)	(0.032)	(0.030)	(0.086)	(0.020)	(5.558)	(3.411)	(3.874)	(11.068)	(7.531)
Round	-0.022***	-0.009*	0.006	-0.002	0.006	-1.676	-2.122**	-1.950***	-0.569	-1.464**
	(0.003)	(0.005)	(0.005)	(0.002)	(0.005)	(1.113)	(0.934)	(0.704)	(0.639)	(0.566)
Clusters	6	6	6	6	6	6	6	6	6	6
N	996	612	612	267	612	410	286	342	131	280

Notes: Columns (1) to (5) report the average marginal effects from random effects probit regressions on the entry decision. Columns (6) to (10) report estimates from random effects linear regression on the effort choice for contestants who have entered the contest. Standard errors clustered at the matching group level are in parentheses. "Risk" is self-reported general attitudes toward risk-taking in daily life on the scale from 1 (not risk-taking at all) to 7 (extremely risk-taking). "Competitive" is self-reported general attitudes toward being competitive in daily life on the scale from 1 (not competitive at all) to 7 (extremely competitive). 'CRT" refers to the Cognitive Reflection Test using the standard three questions developed by Frederick (2005) to assess cognitive ability. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B8: Random effects regressions on the winner's effort and total effort in High_TW and High_Forced

	Winner's effort		Total effort	
	First 10 rounds	Last 10 rounds	First 10 rounds	Last 10 rounds
High_Forced	88.996***	4.100	153.958***	4.100
	(10.129)	(8.849)	(16.310)	(8.849)
Round	5.512**	-4.141**	2.444	-4.141**
	(2.233)	(2.111)	(3.515)	(2.111)
Constant	161.831***	229.884***	262.685***	229.884***
	(14.618)	(30.388)	(26.556)	(30.388)
Clusters	12	12	12	12
N	480	480	480	480

Notes: Standard errors clustered at the matching group level are in parentheses. High_TW serves as the benchmark.
*** $p < 0.01$.

Table B9: Random effects regressions for effort conditional on entry in High_TW and High_Forced during the first 10 rounds

	Effort if enter
High_Forced	3.312
	(15.746)
Ability	246.109***
	(17.331)
Believe 1 enters	59.273***
	(20.660)
Believe 2 enter	77.299***
	(25.578)
Female	-16.105
	(10.297)
Risk	11.770*
	(6.219)
Competitive	2.436
	(5.043)
CRT	-4.710
	(4.110)
Round	2.036*
	(1.061)
Constant	-359.528***
	(54.180)
Clusters	12
N	1152

Notes: "Believe 2 enter" is always coded as 1 for the first 10 rounds in High_Forced since this is always true by design. The table reports estimates from random effects linear regression on the effort choice for contestants who have entered the contest. Standard errors clustered at the matching group level are in parentheses. High_TW serves as the benchmark. "Risk" is self-reported general attitudes toward risk-taking in daily life on the scale from 1 (not risk-taking at all) to 7 (extremely risk-taking). "Competitive" is self-reported general attitudes toward being competitive in daily life on the scale from 1 (not competitive at all) to 7 (extremely competitive). "CRT" refers to the Cognitive Reflection Test using the standard three questions developed by Frederick (2005) to assess cognitive ability. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C Experimental Instructions

C.1 Instructions for Medium_TW

[The instructions for High_TW, Low_T and Low_W are omitted here since they only differ in terms of the entry fee and minimum amount of investment.]

You are about to participate in an experiment. The instructions are the same for all participants. Please read them carefully. No communication is allowed during the experiment. If you have any question, please raise your hand and an experimenter will come to help you.

You have received 15 Yuan for showing up on time. You may earn more money by making decisions in the experiment. The points you may earn depends on your decision and on other participants' decisions. At the end of the experiment, all points you earn will be converted to RMB at the rate of 25 points for 1 RMB. Both your identity and your decisions are strictly anonymous throughout the experiment.

Overview

This experiment consists of 20 periods. At the beginning of each period, you will be randomly matched into a group of 3 participants. Thus, you will be in a different group every period.

In each round, you must first decide whether to enter into a contest to compete against other group members to win a prize. The value of the total prize depends on the number of group members who choose to enter:

- If you choose **not to enter into the contest**, then you have no further decision to make in this round.
- If you choose **to enter into the contest**, then you must pay an entry fee worth 10.5 points and also decide how much resource to invest in the contest.

At the beginning of each round, each participant will receive an endowment of 300 points to cover the entry fee and investment cost in the contest.

In the following, we will explain in detail the determination of the total prize and the contest rule.

Total prize

The total prize will consist of two components:

1. The base prize: 120 points.
2. The total amount of entry fees collected from all contestants

Therefore, **the total prize in each round = 120 + n*entry fee**, where n is the number of contestants in your group. For example, if two group members choose to enter in a round, the total prize in that round is equal to 120 + 2*entry fee.

Note: you will not be informed about how many group members choose to enter or about the exact value of the total prize until the end of each round.

Prediction of the number of contestants

Whether or not you choose to enter in a round, you will be asked to predict the number of contestants in your group (including yourself). If your prediction is correct, you will earn additional 10 points.

Investment cost

If you choose to enter, then you also need to decide how much resource to invest in the contest. Your investment cost is equal to:

Investment cost = invested resource / productivity

where **productivity** can take any value from **1.00 to 2.00 (up to 2 decimal points)**. That is, the higher your productivity, the lower your investment cost for a given amount of invested resource. The computer will randomly and independently draw the productivity value for everyone in your group. In every period everyone will have new draws.

Note: at the beginning of each period ,you will be informed of your productivity value. But you will not know other group members' productivity values.

Contest rule

If you choose to enter, your earnings from the contest are determined by the following conditions:

- Condition 1: whether any other group members choose to enter.
  - Case 1: if no other group member chooses to enter, then no matter how much resource you invest, you will automatically win the total prize, i.e., **the base prize of 120 points plus your returned entry fee**. Your earnings in this round is: 300 - investment cost + 120.
  - If at least one other group member chooses to enter, then we consider Condition 2.
- Condition 2: whether at least one contestant's invested resource is greater than 30.5, i.e., the minimum amount of investment.
  - Case 2: if no contestant's invested resource is greater than 30.5, then all contestants (those who enter) **share the total prize, i.e., sharing the base prize of 120 points plus your returned entry fee**. Your earnings in this round is: 300 - investment cost + 120/n, where n is the number of contestants (including yourself).
  - If at least one contestant's invested resource is greater than 30.5, then we consider Condition 3.
- Condition 3: whether you invest the highest amount of resource.

– Case 3: if you invest the highest amount of resource, then you will win the total prize all by yourself, i.e., **the base prize of 120 points plus all contestants' entry fees (including yours)**. Your earnings in this round is: 300 - investment cost + 120 + n*entry fee - entry fee = 300 - investment cost + 120 + (n - 1)*entry fee, where n is the number of contestants (including yourself).

– Case 4: if you invest the highest amount of resource but there are also other group members investing the same amount, then all winners share the total prize, i.e., **the base prize of 120 points plus all contestants' entry fees (including yours)**. Your earnings in this round is: 300 - investment cost + (120 + n*entry fee)/m - entry fee, where m is the number of contestants who invest the highest amount of resource (including yourself), n $\geq$ m.

– Case 5: if your invested resource is not the highest, then you do not win the prize. Your earnings in this round is: 300 - investment cost - entry fee.

Note: the situations where your entry fee will be returned include 1) only you enter into the contest; 2) no contestant's invested resource is greater than 30.5; 3) your invested resource is the highest. In other words, only when someone else but not you invests the highest amount of resource exceeding 30.5 will your entry fee not be returned.

If you decide not to enter into in the contest, your earnings are equal to your endowment of 300 points.

Below we will demonstrate the payoff calculation through two examples.

Example 1

ID	Productivity	Enter	Resource	Investment Cost	Win?	Entry fee returned?	Payoff calculation
1	1.50	No	0	0	Yes	Yes	300-0+120/2=360
2	2.00	Yes	30	15	Yes	Yes	300-15+120/2=345
3	1.00	No	/	/	No	/	300

Example 2

ID	Productivity	Enter	Resource	Investment Cost	Win?	Entry fee returned?	Payoff calculation
1	1.50	Yes	150	100	No	No	300-100-10.5=189.5
2	2.00	Yes	200	100	Yes	Yes	300-100+120+(3-1)*10.5=341
3	1.00	Yes	20	20	No	No	300-20-10.5=269.5

Feedback and final payoff

At the end of each period, you will be informed about the number of contestants, the highest invested resource, and your period earnings. At the end of the experiment, **five out of 20 periods**

will be drawn randomly to determine your earnings. The earnings you receive in these five periods will be summed and converted into RMB.

Some common questions: What if my earnings are negative? They will be compensated with your other gains. If at the end of the session your earnings are negative, you will receive 15 Yuan, the participation payment. Are there any questions?

C.2 Instructions for Zero_W

You are about to participate in an experiment. The instructions are the same for all participants. Please read them carefully. No communication is allowed during the experiment. If you have any question, please raise your hand and an experimenter will come to help you.

You have received 15 Yuan for showing up on time. You may earn more money by making decisions in the experiment. The points you may earn depends on your decision and on other participants' decisions. At the end of the experiment, all points you earn will be converted to RMB at the rate of 25 points for 1 RMB. Both your identity and your decisions are strictly anonymous throughout the experiment.

Overview

This experiment consists of 20 periods. At the beginning of each period, you will be randomly matched into a group of 3 participants. Thus, you will be in a different group every period.

In each round, you must first decide whether to enter into a contest to compete against other group members to win a prize.

- If you choose **not to enter into the contest**, then you have no further decision to make in this round.
- If you choose **to enter into the contest**, then you must also decide how much resource to invest in the contest.

At the beginning of each round, each participant will receive an endowment of 300 points to cover the investment cost in the contest.

In the following, we will explain in detail the determination of the total prize and the contest rule.

Total prize

The total prize will be 120 points.

Note: you will not be informed about how many group members choose to enter until the end of each round.

Prediction of the number of contestants

Whether or not you choose to enter in a round, you will be asked to predict the number of

contestants in your group (including yourself). If your prediction is correct, you will earn additional 10 points.

Investment cost

If you choose to enter, then you also need to decide how much resource to invest in the contest. Your investment cost is equal to:

Investment cost = invested resource / productivity

where **productivity** can take any value from **1.00 to 2.00 (up to 2 decimal points)**. That is, the higher your productivity, the lower your investment cost for a given amount of invested resource. The computer will randomly and independently draw the productivity value for everyone in your group. In every period everyone will have new draws.

Note: at the beginning of each period, you will be informed of your productivity value. But you will not know other group members' productivity values.

Contest rule

If you choose to enter, your earnings from the contest are determined by the following conditions:

- Condition 1: whether at least one contestant's invested resource is greater than 36.5, i.e., the minimum amount of investment.
  - Case 1: if no contestant's invested resource is greater than 36.5, then no one will obtain any prize. Your earnings in this round is: 300 - investment cost.
  - If at least one contestant's invested resource is greater than 36.5, then we consider Condition 2.
- Condition 2: whether you invest the highest amount of resource.
  - Case 2: if you invest the highest amount of resource, then you will win the total prize all by yourself. Your earnings in this round is: 300 - investment cost + 120.
  - Case 3: if you invest the highest amount of resource but there are also other group members investing the same amount, then all winners share the total prize. Your earnings in this round is: 300 - investment cost + 120/m, where m is the number of contestants who invest the highest amount of resource (including yourself).
  - Case 4: if your invested resource is not the highest, then you do not win the prize. Your earnings in this round is: 300 - investment cost.

If you decide not to enter into in the contest, your earnings are equal to your endowment of 300 points.

Below we will demonstrate the payoff calculation through two examples.

Example 1

ID	Productivity	Enter	Resource	Investment Cost	Win?	Payoff calculation
1	1.50	No	0	0	No	300-0=300
2	2.00	Yes	30	15	No	300-15=285
3	1.00	No	/	/	No	300

Example 2

ID	Productivity	Enter	Resource	Investment Cost	Win?	Payoff calculation
1	1.50	Yes	150	100	No	300-100=200
2	2.00	Yes	200	100	Yes	300-100+120=320
3	1.00	Yes	20	20	No	300-20=280

Feedback and final payoff

At the end of each period, you will be informed about the number of contestants, the highest invested resource, and your period earnings. At the end of the experiment, **five out of 20 periods** will be drawn randomly to determine your earnings. The earnings you receive in these five periods will be summed and converted into RMB.

Some common questions: What if my earnings are negative? They will be compensated with your other gains. If at the end of the session your earnings are negative, you will receive 15 Yuan, the participation payment. Are there any questions?

C.3 Instructions for Zero_T

You are about to participate in an experiment. The instructions are the same for all participants. Please read them carefully. No communication is allowed during the experiment. If you have any question, please raise your hand and an experimenter will come to help you.

You have received 15 Yuan for showing up on time. You may earn more money by making decisions in the experiment. The points you may earn depends on your decision and on other participants' decisions. At the end of the experiment, all points you earn will be converted to RMB at the rate of 25 points for 1 RMB. Both your identity and your decisions are strictly anonymous throughout the experiment.

Overview

This experiment consists of 20 periods. At the beginning of each period, you will be randomly matched into a group of 3 participants. Thus, you will be in a different group every period.

In each round, you must first decide whether to enter into a contest to compete against other group members to win a prize.

- If you choose **not to enter into the contest**, then you have no further decision to make in this round.

- If you choose **to enter into the contest**, then you must also decide how much resource to invest in the contest.

At the beginning of each round, each participant will receive an endowment of 300 points to cover the investment cost in the contest.

In the following, we will explain in detail the determination of the total prize and the contest rule.

Total prize

The total prize will be 120 points.

Note: you will not be informed about how many group members choose to enter until the end of each round.

Prediction of the number of contestants

Whether or not you choose to enter in a round, you will be asked to predict the number of contestants in your group (including yourself). If your prediction is correct, you will earn additional 10 points.

Investment cost

If you choose to enter, then you also need to decide how much resource to invest in the contest. Your investment cost is equal to:

Investment cost = invested resource / productivity

where **productivity** can take any value from **1.00 to 2.00 (up to 2 decimal points)**. That is, the higher your productivity, the lower your investment cost for a given amount of invested resource. The computer will randomly and independently draw the productivity value for everyone in your group. In every period everyone will have new draws.

Note: at the beginning of each period, you will be informed of your productivity value. But you will not know other group members' productivity values.

Contest rule

If you choose to enter, your earnings from the contest are determined by the following conditions:

- Condition 1: whether any other group members choose to enter.
  - Case 1: if no other group member chooses to enter, then no matter how much resource you invest, you will automatically win the total prize. Your earnings in this round is: 300 - investment cost + 120.
  - If at least one other group member chooses to enter, then we consider Condition 2.
- Condition 2: whether you invest the highest amount of resource.

- Case 2: if you invest the highest amount of resource, then you will win the total prize all by yourself. Your earnings in this round is: 300 - investment cost + 120.
- Case 3: if you invest the highest amount of resource but there are also other group members investing the same amount, then all winners share the total prize. Your earnings in this round is: 300 - investment cost + 120/m, where m is the number of contestants who invest the highest amount of resource (including yourself).
- Case 4: if your invested resource is not the highest, then you do not win the prize. Your earnings in this round is: 300 - investment cost.

If you decide not to enter into in the contest, your earnings are equal to your endowment of 300 points.

Below we will demonstrate the payoff calculation through two examples.

Example 1

ID	Productivity	Enter	Resource	Investment Cost	Win?	Payoff calculation
1	1.50	No	0	0	No	300-0=300
2	2.00	Yes	30	15	Yes	300-15+120=405
3	1.00	No	/	/	No	300

Example 2

ID	Productivity	Enter	Resource	Investment Cost	Win?	Payoff calculation
1	1.50	Yes	150	100	No	300-100=200
2	2.00	Yes	200	100	Yes	300-100+120=320
3	1.00	Yes	20	20	No	300-20=280

Feedback and final payoff

At the end of each period, you will be informed about the number of contestants, the highest invested resource, and your period earnings. At the end of the experiment, **five out of 20 periods** will be drawn randomly to determine your earnings. The earnings you receive in these five periods will be summed and converted into RMB.

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