The Impact of Audience Size on Image Concerns

Evidence from a Charity Dictator Game

Sem Manna Alessandro Stringhi[1]

[1]Università Degli Studi di Siena

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Motivation

We care deeply about others' opinion of us (our *image*)

- People have *strategic* reasons to care about their image
- Most also have an *intrinsic* preference for being regarded as "good"

The number of people with a given opinion of us could also matter

- Social media made our life "more observable"
- Audiences have grown larger but more anonymous

This work

- We address the following research questions:
  1. Can observation from of an anonymous, external, and noninteractive audience motivate prosocial behavior?
  2. Are audience effects monotonic in the number of onlookers?

- Conflicting answers to 1 are influenced by:
  - "Theoretical and Methodological moderators" (Bradley et al. 2018)
  - Active or communicative audiences with stake in the game, repeated games with roles rotation (Regner 2021), ambiguous setting (Attanasi et al. 2023)
  - As a result, these often study different social phenomena

We want to isolate the *psychological, intrinsic* valence of image concerns from the *strategic one* in an unambiguous context

Psychological Utility

Image Concerns: Preferences over others' ex-post beliefs over own private and heterogeneously distributed traits which are imperfectly observed by others (c.f. Battigalli and Dufwenberg 2022)

- Two-players case (Battigalli and Dufwenberg 2022)

$$u_i(z, \alpha_j; \theta_i^{\mathbf{I}}, \theta_i^{\mathbf{R}}) = \pi_i(z) + \theta_i^{\mathbf{I}} \left[1_i^G(z) - 1_i^B(z)\right] + \theta_i^{\mathbf{R}} \mathbb{E}\left[\tilde{\theta_i^I} | z; \alpha_j\right] \quad (1)$$

  - $\theta_i^{\mathbf{I}} \in \mathbb{R}_+$ represents i's "Good" trait
  - $\left[1_i^G(z) - 1_i^B(z)\right]$ qualifies the net "Goodness" of i's behaviour
  - $\mathbb{E}\left[\tilde{\theta_i^I} | z; \alpha_j\right]$ is loosely referred to as j's *opinion* about i's trait
  - $\theta_i^{\mathbf{R}} \in \mathbb{R}_+$ measures how much i cares about j's ex-post estimate of $\theta_i^{\mathbf{I}}$

Charity Dictator mini-Game with External Audience

- Two Actions:
  1. **Donate** $\longrightarrow$ Unambiguously and universally perceived as **"Good"**
  2. **Don't donate** $\longrightarrow$ Unambiguously and universally **"Bad"**
- Perfect but **incomplete** information
  - When observed, the choice becomes a signal for the "good" trait
- Additive utility in the opinion of others:

$$u_i(z, \alpha_{-i}; \theta_i^{\mathbf{I}}, \bar{\theta}_i^{\mathbf{R}}) = \pi_i(z) + \theta_i^{\mathbf{I}} \left[1_i^G(z) - 1_i^B(z)\right] + \sum_{\{j \neq i\} \in N} \theta_{ij}^{\mathbf{R}} \mathbb{E}\left[\tilde{\theta_i^I} | z; \alpha_j\right] \quad (2)$$

- Auxiliary assumption: according to i, for all $j \in N \backslash \{i\}$,

$$\mathbb{E}[\tilde{\theta_i^I} | z = G; \alpha_j] > \mathbb{E}[\tilde{\theta_i^I} | z = B; \alpha_j]$$

Predictions

- When observed, even *selfish types may choose to donate* if they are sufficiently worried about others' opinion of them
- The incentive to donate is *increasing* in the size of the audience

$$\Longrightarrow \textbf{Testable predictions}$$

H1: The share of individuals choosing the "Good" action is larger when an Audience is present.

H2: The share of individuals choosing the "Good" action is monotonically increasing in the number of Audience members

Hypothesis, experimental design, and analysis plan had been pre-registered on OSF: https://osf.io/yfhdp

Experimental Design

Charity Dictator mini-Game with External Audience

- Active players ("Dictators") can make a **binary choice**
  - donate half of a 10 EUR endowment to a charity (the recipient)
  - or donate only 1 EUR
- **An anonymous passive audience observes** the choice outcome, alongside a random ID for each Dictator
- The monetary payoff of the Audience is fixed at 7 EUR and is the same in all feasible terminal histories.

▸ See User Interface

Treatments and Procedures

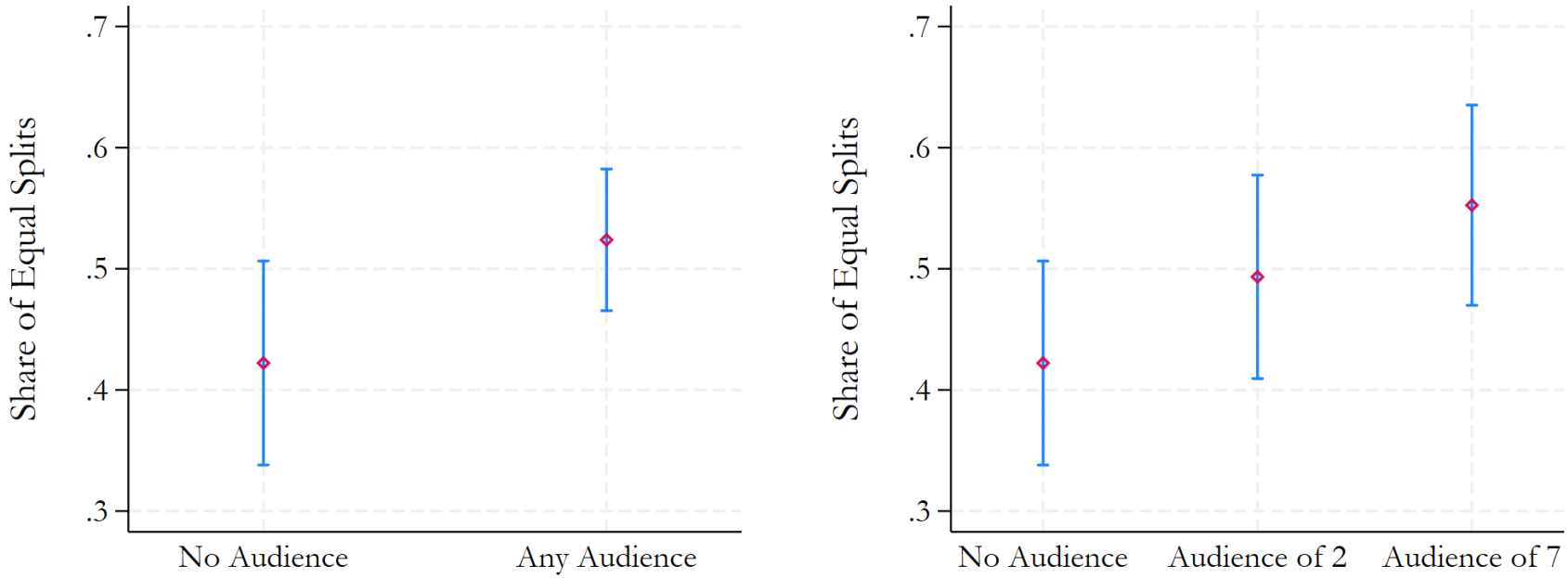
- **Treatments** (Between-subjects design):
  - **Baseline**: No Audience
  - **T1**: Audience of 2
  - **T2**: Audience of 7

- **Procedures**
  - **5 rounds** under a **random stranger** matching protocol with **charitable organizations**.
  - Audience observed all choice outcomes **after every round**
  - One round randomly selected for payments
  - The number of observers choices was common knowledge

▸ More on Procedures

Preliminary Results

Figure 1: Average Share of Equal Splits



Note: 95% CIs computed using individual averages across all rounds (one data point per participant).

▸ More preliminary results

But: TE attenuated by a relevant gender unbalance

Balance

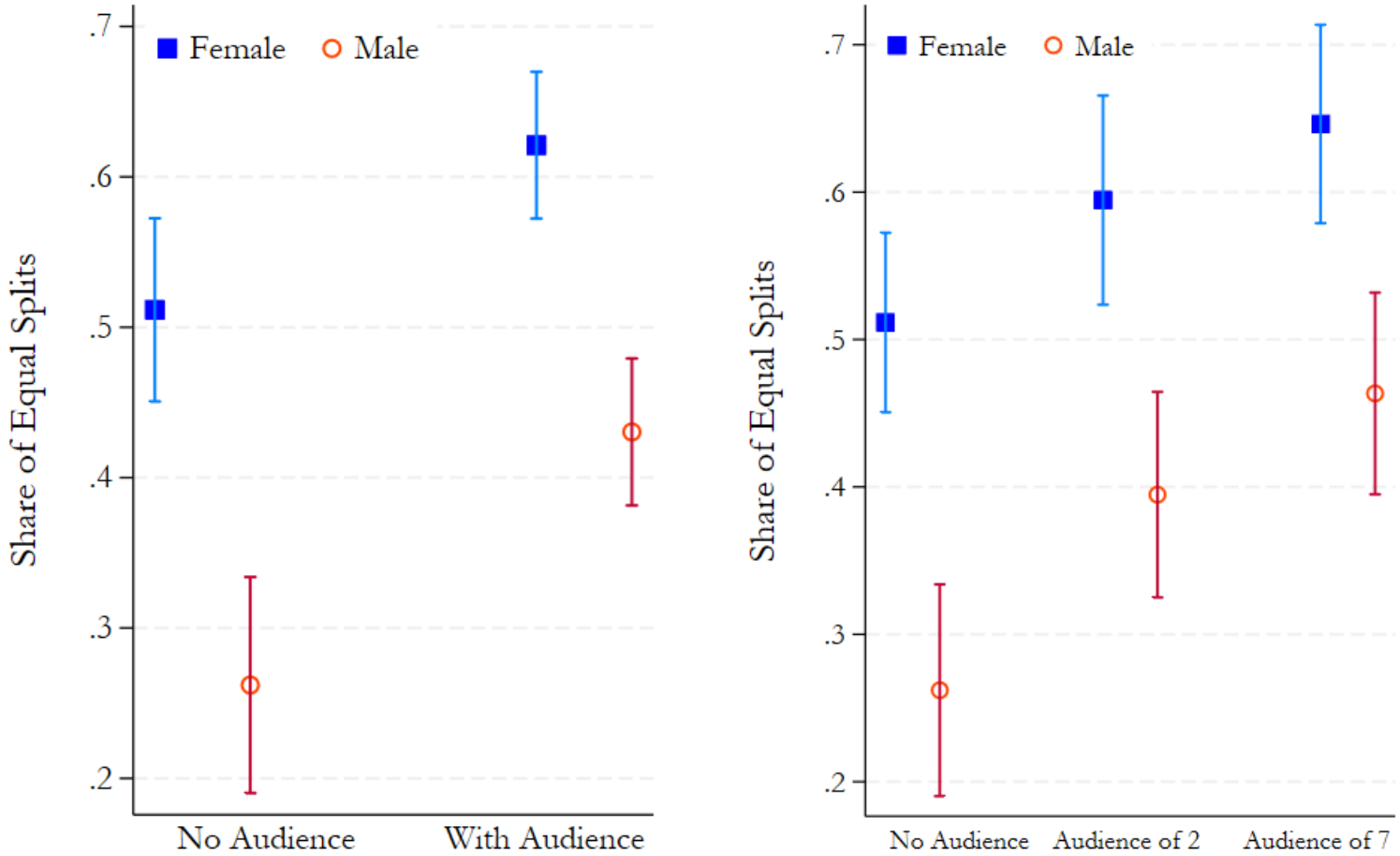
Table 1: Descriptive statistics and Balance by Treatment. Active Players Only.

Variable	(1) No Audience	(2) Audience of 2	(3) Audience of 7	(4) Difference (2-0)	(5) Difference (7-0)	(6) Difference (7-2)
Age	20.741	20.720	20.663	-0.021	-0.078	-0.058
	(1.571)	(1.849)	(1.534)	(0.274)	(0.245)	(0.272)
Male	0.358	0.507	0.512	0.149*	0.154**	0.006
	(0.482)	(0.503)	(0.503)	(0.079)	(0.078)	(0.081)
# of Experiments	2.136	2.813	2.987	0.678	0.852**	0.174
	(2.042)	(3.502)	(3.087)	(0.455)	(0.412)	(0.529)
Econ or Finance	0.481	0.507	0.312	0.025	-0.169**	-0.194**
	(0.503)	(0.503)	(0.466)	(0.081)	(0.076)	(0.078)
Politics	0.062	0.040	0.075	-0.022	0.013	0.035
	(0.242)	(0.197)	(0.265)	(0.036)	(0.040)	(0.038)
Law	0.074	0.067	0.100	-0.007	0.026	0.033
	(0.264)	(0.251)	(0.302)	(0.041)	(0.045)	(0.045)
Managment	0.358	0.320	0.387	-0.038	0.029	0.068
	(0.482)	(0.470)	(0.490)	(0.076)	(0.077)	(0.077)
Stats or CompSci	0.012	0.027	0.075	0.014	0.063*	0.048
	(0.111)	(0.162)	(0.265)	(0.022)	(0.032)	(0.036)
Other	0.012	0.040	0.050	0.028	0.038	0.010
	(0.111)	(0.197)	(0.219)	(0.025)	(0.027)	(0.034)
Year of Study	2.593	2.573	2.513	-0.019	-0.080	-0.061
	(1.367)	(1.397)	(1.414)	(0.221)	(0.219)	(0.226)
Observations	81	75	80	156	161	155

Note: Standard deviations/errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Gender Heterogeneity

Figure 2: Average Share of Equal Splits by Gender



Note: 95% CIs computed using individual averages across all rounds (one data point per participant).

Regression Analysis

We estimate the following linear random effects model:

$$\text{Choice}_{i,t} = \beta(\text{Audience Size})_{i,t} + \alpha_i + \gamma X_{i,t} + \varepsilon_{i,t}$$

Table 2: GLS Random-Effects Estimator

Dependent Variable	(1)	(2)	(3)	(4)	(5)
	Share of Equal Splits				
Audience Size	0.0174**	0.0211***	0.0199**	0.0200**	0.0200**
	(0.00818)	(0.00785)	(0.00788)	(0.00795)	(0.00796)
Male		-0.205***	-0.205***	-0.203***	-0.203***
		(0.0465)	(0.0463)	(0.0479)	(0.0480)
# of Experiments Control	✗	✗	✓	✓	✓
Year of Study Controls	✗	✗	✗	✓	✓
Field of Study Controls	✗	✗	✗	✓	✓
Round FE	✗	✗	✗	✗	✓
Observations	1,180	1,180	1,180	1,180	1,180
# of individuals	236	236	236	236	236
Avg. Share in Control	0.4222	0.4222	0.4222	0.4222	0.4222

Note: Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

▸ Categorical Audience

Conclusions

By employing a simple design we found:

- Robust evidence that anonymous, external, and noninteractive observers can motivate prosocial behavior
  - 31% increase in "fair" donations when an audience is present
- Suggestive evidence that this effect may be monotonic in the number of observers
  - 5% average increase for each observer $\Rightarrow$ main novelty!
- Showed promising research topics in the application of Psychological Game Theory in applied work

Thank You!

Questions?

sem.manna@studbocconi.it

Bibliography

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Bradley, Alex, Claire Lawrence, and Eamonn Ferguson, "Does observability affect prosociality?," *Proceedings of the Royal Society B: Biological Sciences*, 2018, *285* (1875), 20180116.

Regner, Tobias, "What's Behind Image? Toward a Better Understanding of Image-Driven Behavior," *Frontiers in psychology*, 2021, *12*, 614575.

Procedures - Extra

Procedures

- The experiment took place in April and October 2023 at BELSS
- Participants were recruited through BELSS's SONA
- 6 (September) + 4 (October) sessions of 27 participants
- Total of **270 participants**, 236 Active and 34 Audience
- Five, minor and less-known Italian **charitable organizations**
- Random allocation to computer cubicles (and roles)
- Instructions and charities descriptions read aloud and displayed
- Decision-making phase followed by a short survey on basic demographics

◂ Back to Procedures

Figure 3: Decision Interface, No Audience

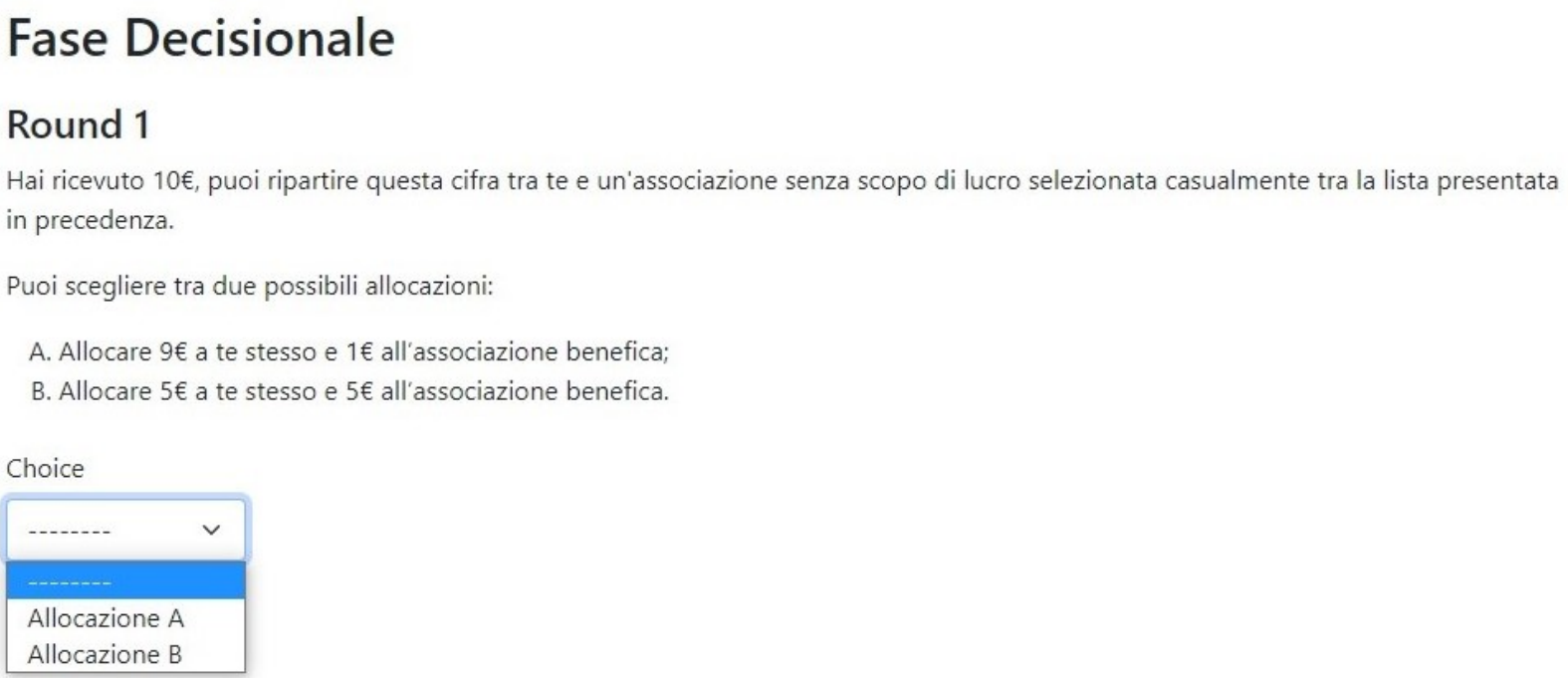
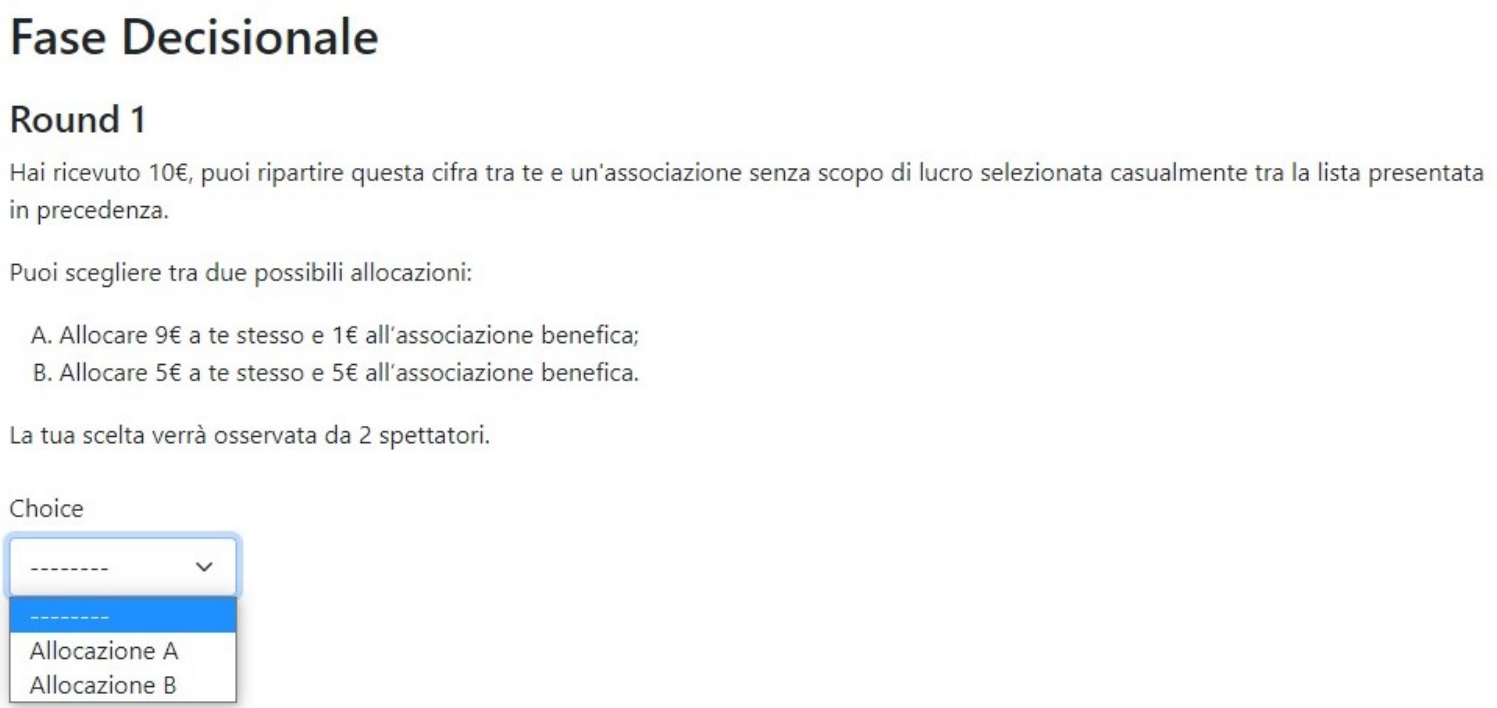


Figure 4: Decision Interface, Audience of 2



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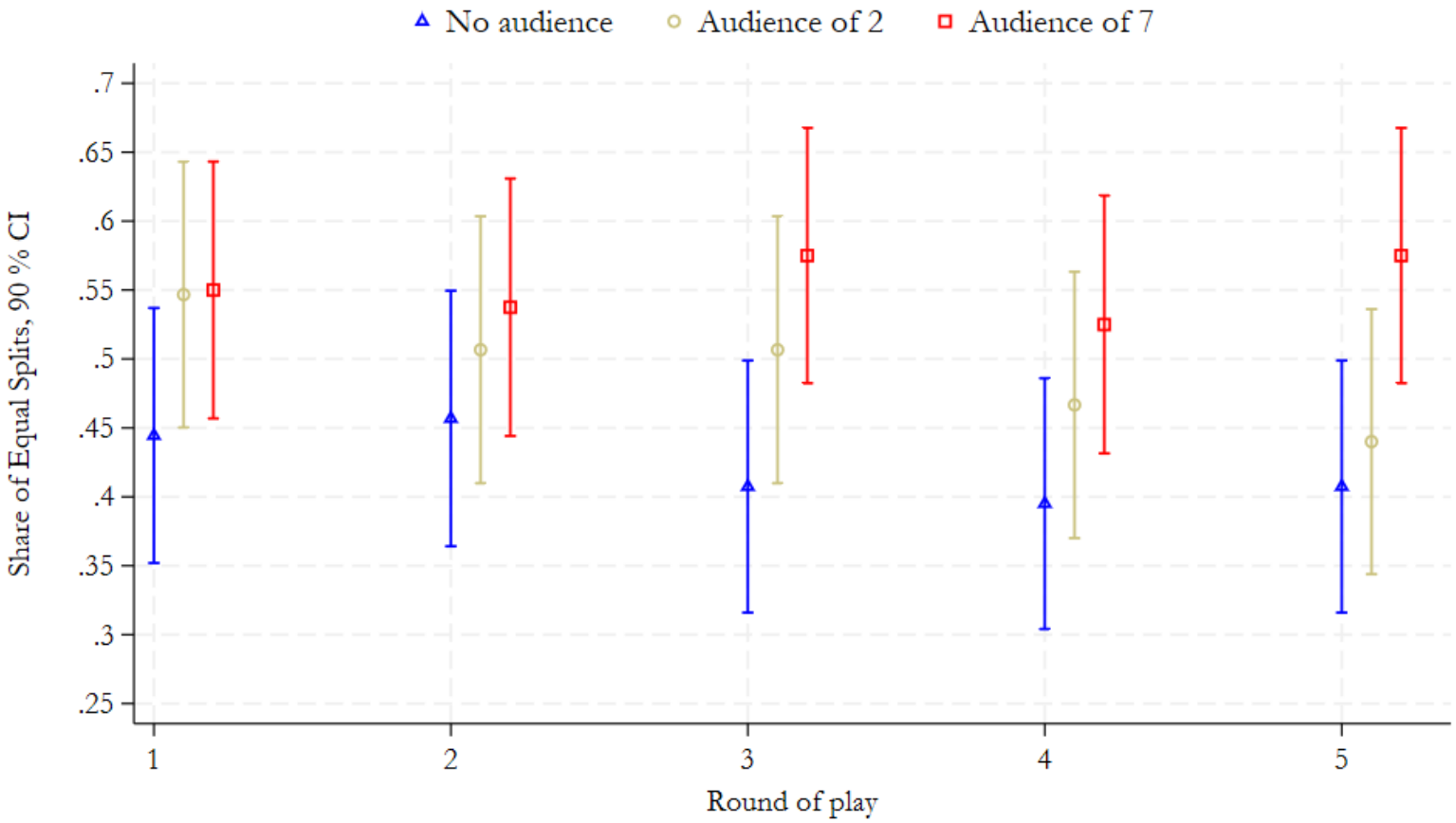
Preliminary Results (II)

- **Audience Effects**
  - +10.1 pp (+24.0%) "fair" splits when an audience wrt baseline
  - Two-sided t-test significant at 5% (p-value 0.0478)
- Comparing treatments:
  - **Audience of 2 vs Baseline**
    - +7.1 pp (+16.8%) "fair" splits
    - Two-sided t-test not significant (p-value 0.2364)
  - **Audience of 7 vs Baseline**
    - +13.0 pp (+30.9%) "fair" splits
    - Two-sided t-test significant at 5% (p-value 0.0295)

◂ Back to Preliminary results

Preliminary Results (III)

Figure 5: Average Share of Equal Splits by Round of Play



Note: 90% Confidence Intervals, average share of equal splits by treatment assignment.

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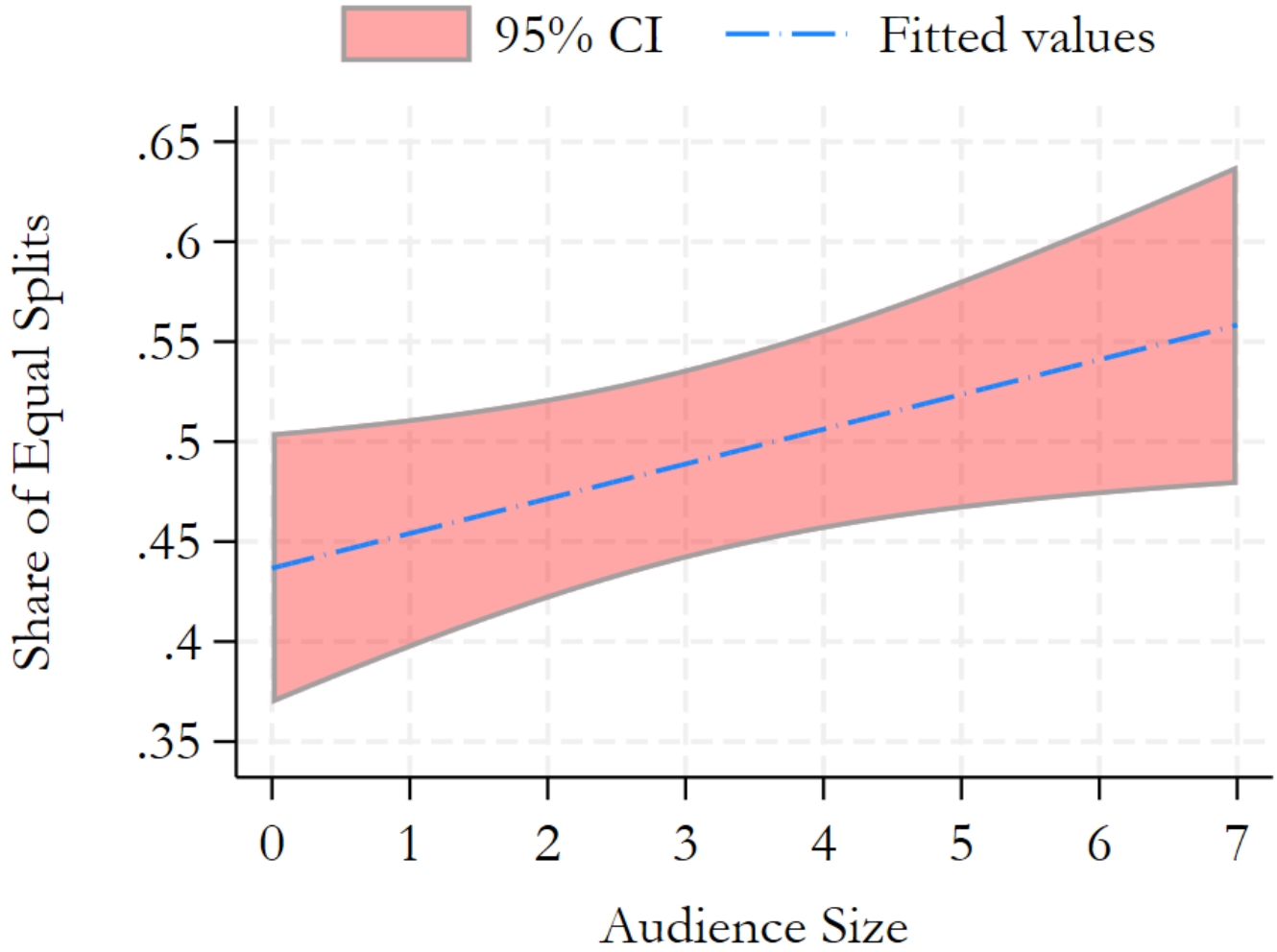
Linear Fit in the Size of the Audience

Figure 6: Linear Fit in the Number of Observers



Audience Size as a categorical variable

Table 3: GLS Random-Effects Estimator, Categorical Treatment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	Share of Equal Splits									
Audience (any size)	0.102**	0.133***	0.124**	0.131***	0.131***					
	(0.0515)	(0.0490)	(0.0496)	(0.0492)	(0.0493)					
Audience of 2						0.0711	0.102*	0.0945*	0.106*	0.106*
						(0.0595)	(0.0568)	(0.0569)	(0.0565)	(0.0566)
Audience of 7						0.130**	0.163***	0.153***	0.156***	0.156***
						(0.0591)	(0.0565)	(0.0569)	(0.0572)	(0.0573)
Male		-0.210***	-0.209***	-0.209***	-0.209***		-0.210***	-0.209***	-0.209***	-0.209***
		(0.0464)	(0.0462)	(0.0479)	(0.0480)		(0.0463)	(0.0461)	(0.0478)	(0.0478)
# of Experiments	✗	✗	✓	✓	✓	✗	✗	✓	✓	✓
Year of Study	✗	✗	✗	✓	✓	✗	✗	✗	✓	✓
Field of Study	✗	✗	✗	✓	✓	✗	✗	✗	✓	✓
Round FE	✗	✗	✗	✗	✓	✗	✗	✗	✗	✓
Observations	1,180	1,180	1,180	1,180	1,180	1,180	1,180	1,180	1,180	1,180
# of individuals	236	236	236	236	236	236	236	236	236	236
Avg. Share in Control	0.4222	0.4222	0.4222	0.4222	0.4222	0.4222	0.4222	0.4222	0.4222	0.4222

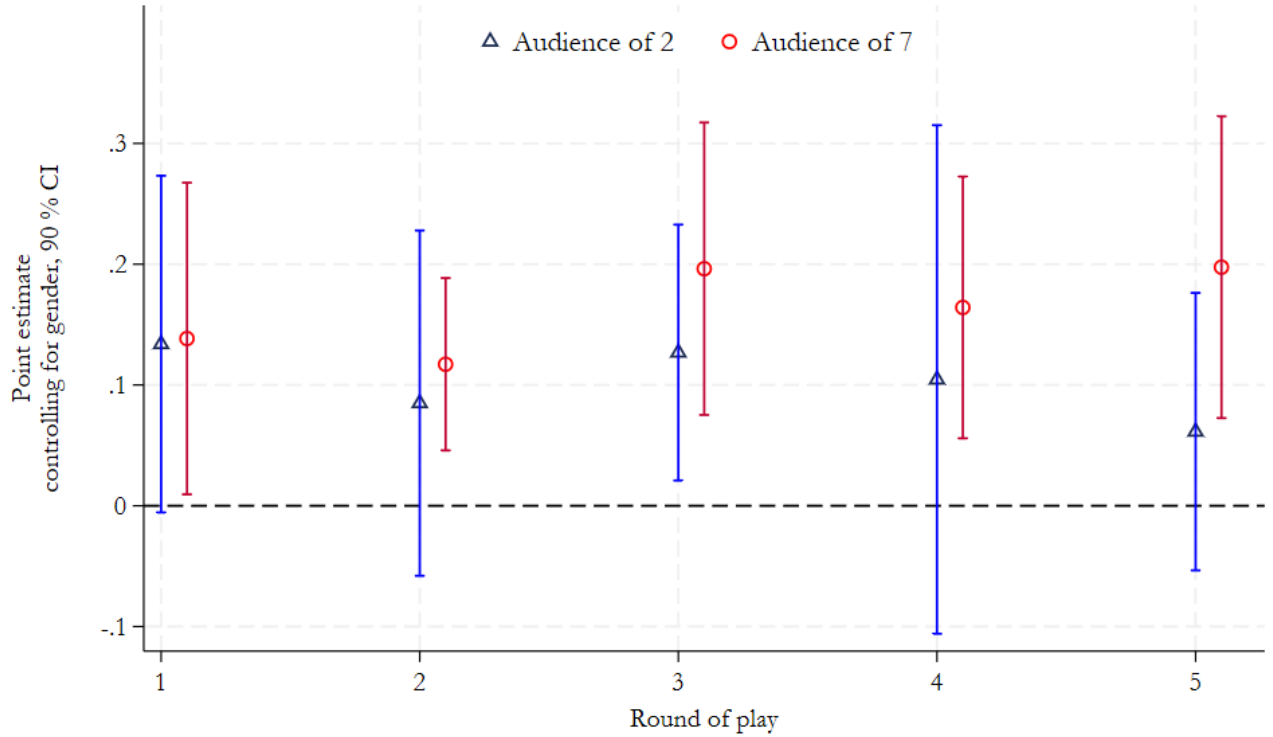
Note: Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Treatments comparison by round of play

We estimate the following model for each round of play and plot point estimates on the two audience treatments:

$$\text{Choice}_i = \beta_1(\text{Audience of 2})_i + \beta_2(\text{Audience of 7})_i + \text{Gender}_i + \varepsilon_i$$

Figure 7: Point estimates on the two treatments



Note: 90% Confidence Intervals, SE clustered of the experimental session

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