Welfare and the Act of Competing

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Abstract

Economists often view competition as a positive force that incentivizes effort and improves efficiency. Yet a full accounting of the welfare effects of competition requires consideration of the direct utility costs and benefits of competition itself. This paper investigates how competition affects utility derived purely from the act of competing, independent of realized outcomes. I conduct a series of experiments which show that competition shapes utility through two opposing channels: a belief channel, whereby competition lowers expectations of success, thus reducing utility; and an intrinsic utility channel, whereby individuals derive enjoyment directly from competing. The overall effect depends on the relative strength of these channels. I also show that these utility effects can impact future choices: attribution bias in competitive settings, as it leads individuals to misattribute the enjoyment of competition to the underlying task. This effect also reduces post-competition zero-sum thinking and fosters altruism.

Keywords: Competition, reference-dependent utility, attribution bias, experiment
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1 Introduction

One of the central principles in economics is that markets are generally an effective way to organize economic activity, and perfect competition maximizes social welfare (Mankiw, 2018). This classical perspective emphasizes the incentives that competition creates and the economic benefits it yields. Yet it overlooks a subtle dimension of welfare: the direct utility consequences of how people experience competition. Buyers may feel excitement when bidding for a desired good, while job seekers experience anxiety when competing in the labor market. Such experienced utility[1] or disutility arising directly from the act of competing can potentially have a meaningful impact on overall welfare. Ignoring these effects may lead us to overestimate welfare when competition brings distress, or underestimate it when competition generates enjoyment.

This paper investigates how competition affects individuals' utility derived purely from the act of competing, independent of realized outcomes. I ask whether this impact is context dependent–specifically, when competition generates positive utility and when it yields disutility. Beyond these direct welfare consequences, I also examine whether competition, after its removal, leaves lasting imprints on individuals' beliefs and preferences: I conjecture that it may affect beliefs about the enjoyment of specific tasks, and may even influence attitudes toward social and strategic interaction.

To address these questions, I conduct a series of pre-registered randomized controlled experiments on Prolific with two treatment dimentions: (i) competition versus no competition, and (ii) reward structures framed as gains versus losses. The typical design in the experimental literature on competition employs a gain-framing reward structure in which participants compete for a prize: the winner receives the reward, while the loser receives nothing (Niederle and Vesterlund, 2007; Croson and Gneezy, 2009; Abbink et al., 2010; Fallucchi et al., 2020; Reuben et al., 2024). Although some designs incorporate proportional-prize structures in which second- and third-place participants receive smaller payoffs, in most cases the lowest-ranked participant receives nothing (Harbring and Irlenbusch, 2011; Cason et al., 2020). I introduce a loss-framing design. In many real-world competitions, losing does not merely mean "not gaining" but instead entails outcomes worse than the status quo. For example, in the workplace, "winning" may mean keeping one's job, while losing means being laid off. Here, competition imposes losses on the unsuccessful, not simply the absence of gains. I hypothesize that the framing of reward structures helps explain when competition enhances utility and when it diminishes

[1] A measure of hedonic and affective experience, which can be derived from immediate reports of current subjective experience or from physiological indices (Kahneman et al., 1997).

it. Specifically, I expect competition to have a positive effect under gain-framing but a negative effect under loss-framing. Taken together, this design yields four experimental treatments: gain-framing competition, gain-framing control, loss-framing competition, and loss-framing control.

To implement these treatments, participants are randomly assigned to one of the four experimental conditions and complete a timed quiz. The quiz consists of 50 puzzles similar to the Raven Progressive Matrices, a widely used measure of cognitive ability (Drobner and Goerg, 2024; Willadsen et al., 2024). Participants have four minutes to complete the quiz. Each correct answer earns 1 point, each incorrect answer deducts 0.25 points, and skipped questions receive no points. This scoring rule is designed to incentivize participants to engage actively in the quiz rather than simply skip questions.

In the competition treatments, participants are randomly paired to compete for a reward. Under the gain frame, each participant receives a $2 show-up fee. The participant with the higher score on the IQ quiz earns a $4 reward, while the other receives nothing. Under loss frame, each participant receives a $6 show-up fee. The participant with the higher quiz score keeps the full $6, while the other loses $4 of it. During the competition, participants can observe their opponent's real-time raw score, which shows the accumulated number of correct answers without deductions for incorrect ones. This design feature serves two purposes. First, it heightens the sense of competition. Online experiments limit competitive engagement because participants cannot physically observe rivals; the score bar mitigates this limitation. Second, it provides information about the opponent's performance while preventing participants from inferring the competition outcome.

In the non-competition treatments, participants complete the quiz individually. Under the gain frame, as in the competition treatments, participants receive a $2 show-up fee. If their score on the quiz exceeds a predetermined threshold, they earn a $4 reward; otherwise, they receive nothing. Under the loss frame, participants receive a $6 show-up fee. If their score exceeds the threshold, they keep the full amount; otherwise, they lose $4 of it. The threshold is set at the median score from the competition treatments, ensuring that across all treatments participants faced the same ex-ante success probability of one-half and the same expected payoff, thereby holding monetary incentives constant while varying competition and framing. [2]

After the quiz, participants complete a survey assessing their enjoyment of the quiz, willingness to repeat it, and zero-sum beliefs. They then participate in decision-making

[2] I depart from the standard piece-rate design (Niederle and Vesterlund, 2007; Möbius et al., 2022) for non-competition treatments because adopting a linear payment scheme would confound the effect of competition with differences in payoff structure (linear versus binary). Utility may differ when facing a binary reward relative to a fixed piece-rate scheme.

tasks measuring altruistic preferences, including a dictator game and a public goods game.

The experiment shows that the act of competing increases utility, not only under gain framing, as expected, but also under loss framing. Although utility is generally higher in the gain frame, the difference in treatment effects across frames is not statistically significant. To understand this pattern, I decompose the effect into two channels. Through a belief channel, competition lowers individuals' winning expectations and thereby reduces utility. Through an intrinsic utility channel, individuals derive enjoyment simply from the act of competing. The intrinsic utility channel dominates the belief channel, yielding the overall positive effect of competition on utility observed in the experiment. Therefore, while the framing of reward structures does not explain when competition raises or reduces utility, the interplay of these two opposing channels does. Interestingly, the experiment indicates that competition increases utility regardless of whether individuals expect to win or lose, and those who believe their performance rank low enjoy competition more than those who believe they rank high. The effect does not differ by gender.

Beyond this channel decomposition, I also examine the emotional components of utility. Under gain framing, competition both amplifies positive emotions such as excitement and dampens negative emotions such as stress and anxiety. Under loss framing, competition likewise increases positive emotions, but its effect on negative emotions is weaker: it raises stress and anxiety, though this increase is not statistically significant.

Since competition positively impacts utility in my setting, I conjecture that the experimental treatment may affect beliefs about the costs and benefits of undertaking similar tasks in the future as a result of through attribution bias, the tendency to misattribute the influence of a temporary state to a stable property of an activity (Haggag et al., 2019). I show that individuals who enjoy competition find the quiz more appealing and are more willing to repeat it. They misattribute the enjoyment of competition to the underlying task. Moreover, I find participants exposed to competition subsequently hold weaker zero-sum mindsets and allocate more money to their partner in the dictator game, suggesting stronger altruism.

Taken together, the act of competing raises utility through intrinsic enjoyment, shapes post-competition zero-sum beliefs and altruistic preferences, generating welfare effects beyond material payoffs. Accounting for the direct effects of competition—rather than focusing only on efficiency gains—is potentially of substantial welfare consequences.

This paper contributes to several strands of literature. First, it connects to studies on experienced and procedural utility, which emphasize that well-being depends not only on final outcomes but also on the process that generates them. (Kahneman et al., 1997, 1999; Frey et al., 2004; Frey and Stutzer, 2005; Kahneman and Krueger, 2006; Kahneman and

Deaton, 2010; Benjamin et al., 2014; Benz and Frey, 2008). I add to this literature by showing that a central feature of economic interactions, the act of competing, carries its own experienced utility, beyond material payoffs and realized success or failure. This finding parallels insights from behavioral welfare economics on the intrinsic value of decisions: individuals attach emotions to the decisions they have made, and decisions can have value beyond their instrumental effects (Bartling et al., 2014; Bernheim et al., 2024).

Second, the study contributes to the literature on attribution bias. Prior work shows that individuals misattribute temporary states such as thirst, weather, fatigue to persistent features of goods or activities (Haggag et al., 2019, 2021; Bushong and Gagnon-Bartsch, 2023). I provide complementary evidence that attribution also arises in a strategic setting: enjoyment induced by competition is partly misattributed to the underlying task.

Lastly, this paper speaks to the experimental literature on competition. A large body of work compares piece-rate and tournament schemes to examine how competition affects effort, performance, tournament entry, and beliefs such as self-confidence (Gneezy et al., 2003; Niederle and Vesterlund, 2007, 2011; Möbius et al., 2022; Hauge et al., 2023; Englmaier et al., 2024). I introduce a noncompetitive benchmark that preserves the tournament's payoff structure: a threshold-based, binary-payoff counterfactual in the noncompetitive arm. By holding the payoff architecture constant, this design reduces confounding and yields a cleaner estimate of the effect of competition per se. Moreover, most laboratory tournaments are gain-framed: participants compete for a prize and losers receive nothing (Carpenter et al., 2010; Cason et al., 2010; Dohmen and Falk, 2011; Buser et al., 2014; Krishna et al., 2025). Relatively few studies examine loss-framed contests (e.g., Hong et al., 2015; Dato et al., 2018). I add to this literature by providing experimental evidence on the direct welfare consequences of competition in a loss-framed context.

The remainder of the paper proceeds as follows. Section 2 outlines a theoretical framework that captures experienced utility from the act of competing. Section 3 describes the experimental design and data. Section 4 analyzes the dynamics of the competition treatment. Section 5 discusses results on the effects of competition on utility, and Section 6 presents treatment effects on altruism and zero-sum thinking. Section 7 concludes.

2 Theoretical Framework

This section develops a simple theoretical framework that compares individual utility in competitive settings with a non-competitive benchmark in which individuals face a fixed performance threshold rather than opponents. The framework builds on the classical winner-take-all structure introduced by Lazear and Rosen (1981) and incorporates

reference-dependent preferences from Kőszegi and Rabin (2006) to allow utility to vary across contexts. Its primary goal is to isolate the distinct sources of utility associated with competition, disentangling utility from expected monetary payoffs, belief utility, and intrinsic utility. The framework also clarifies how the impact of competition on utility may depend on contextual framing. Section 2.1 presents the model setup, and Section 2.2 derives testable predictions for the experiment.

2.1 Setup

Consider a competition with $N \geq 2$ risk-neutral competitors, indexed by $i \in \{1, \ldots, N\}$. Each competitor i possesses an ability parameter $a_i > 0$ that is drawn independently from a common distribution F and then simultaneously chooses an effort level $e_i \geq 0$; let $\mathbf{e}_{-i}$ denote the effort profile of the opponents. Exerting effort entails a cost $c : \mathbb{R}_+ \to \mathbb{R}_+$ that is differentiable, strictly increasing, and convex, with $c(0) = 0$, $c'(\cdot) > 0$ and $c''(\cdot) \geq 0$. The competition follows a winner-take-all structure: a single competitor is the winner and all others are losers. Monetary payoffs are given by $(w^{win}, w^{lose}) \in \mathbb{R}^2$.

Competitor i has reference-dependent utility with an exogenously fixed reference point $r \in \mathbb{R}$, which is a monetary endowment. Two reference frames are considered. In the *gain frame*, each competitor i receives an initial endowment b (so $r = b$). The winner receives a reward w^{win}, leading to a final payment of $b + w^{win}$, while the losers receive no monetary reward and end with b. In contrast, under the *loss frame*, each competitor is initially endowed with $b + w^{win}$ (so $r = b + w^{win}$). The winner retains the full endowment $b + w^{win}$, while the losers forfeit w^{win} from their endowment, ending with b.[3] In theory, with everything else equal, the final expected payoffs are identical under the two frames.

Prior to the realization of outcomes, the utility of competitor i comprises the expected utility of monetary payoff and two behavioral components. The first is the utility from beliefs about winning. A large body of literature has documented that individuals may derive utility directly from their beliefs (Caplin and Leahy, 2001; Kőszegi, 2006; Bénabou and Tirole, 2011). In the context of competition, the intuition is straightforward: the higher the probability that competitor i believes they are going to win, the greater the utility they derive. Formally, I denote this by a belief–utility function $u : [0, 1] \to \mathbb{R}$ of the perceived probability of winning p, which is twice continuously differentiable, nondecreasing $\big(u'(p) \geq 0\big)$, and convex $\big(u''(p) \geq 0$ for all $p \in [0, 1]\big)$. Convexity implies that the marginal affective gain rises with perceived success: the nearer one is to winning, the larger the

[3] In the gain frame, $(w^{win}, w^{lose}) = (w^{win}, 0)$, so with initial endowment b, the final payoffs are $(b + w^{win},\ b)$. In the loss frame, $(w^{win}, w^{lose}) = (0, -w^{win})$, and with endowment $b + w^{win}$, the final payoffs are again $(b + w^{win},\ b)$.

utility gain from from an incremental increase in p. The second component is the intrinsic utility from the act of competing itself, denoted by ψ_i, which is independent of any material incentives or beliefs about winning. The term ψ_i reflects the net intrinsic value of competition: it is positive when intrinsic enjoyment exceeds costs (e.g., stress or discomfort), and negative when costs dominate. Taken together, the utility can be expressed as

$$P_i(e_i) \cdot v\big(w_i^{win}\big) + \big(1 - P_i(e_i)\big) \cdot v\big(w_i^{lose}\big) - c(e_i) + u(P_i(e_i)) + \psi_i$$

The first three terms account for the expected utility of monetary payoff, the fourth term $u(P_i(e_i))$ captures belief utility, and the final term ψ_i represents the intrinsic utility of competition. In the gain frame, $(w^{win}, w^{lose}) = (w^{win}, 0)$, while in the loss frame, $(w^{win}, w^{lose}) = (0, -w^{win})$. The perceived probability of winning is given by

$$P_i(e_i) = \Pr\left(\theta(a_i, e_i) > \max_{j \neq i} \theta(a_j, e_j)\right)$$

where $\theta(a, e)$ is a performance function that is continuous and strictly increasing in both ability a and effort e. Competitor i is perceived to win if their performance exceeds that of all others; in the event of a tie, the winner is selected uniformly at random, with probability $\frac{1}{N}$. The function $v(x)$ is a reference-dependent value function (Kőszegi and Rabin, 2006)

$$v(x) = \begin{cases} x & \text{if } x \geq 0, \\ \lambda x & \text{if } x < 0, \end{cases}$$

with a loss aversion parameter $\lambda > 1$.

In the non-competitive scenario, the comparison benchmark $\max_{j \neq i} \theta(a_j, e_j)$ is replaced by a fixed threshold θ^*, with all other components of the model remaining unchanged. An individual succeeds if performance exceeds θ^*, so payoffs depend solely on their own actions. The threshold θ^* is set to match the objective probability of success in the corresponding competitive condition. For example, when $N = 2$, the threshold is set at the median of the performance distribution, ensuring a 50 percent success probability. When $N = 10$, it is set at the 90th percentile of the performance distribution, so that the probability of surpassing the threshold coincides with the 10 percent winning probability in a winner-take-all tournament.

More generally, let $s \in \{T, C\}$ denote the incentive structure, with T representing the competitive setting and C the non-competitive setting. Let $f \in \{G, L\}$ denote the framing of monetary outcomes, where G corresponds to the gain frame and L to the loss frame. Then, prior to the realization of outcomes, the utility of competitor i in setting (s, f),

denoted $U_i^{s,f}(e_i)$, can be written as

$$P_i^s(e_i) \cdot v\left(w_i^{win,f}\right) + \left(1 - P_i^s(e_i)\right) \cdot v\left(w_i^{lose,f}\right) - c(e_i) \;+\; u(P_i^s(e_i)) \;+\; \psi_i^f \, \mathbf{1}_{\{s=T\}}$$

The first three terms describe the expected utility of monetary payoff, denoted $U_{i,\text{money}}^{s,f}(e_i)$. The fourth term $u(P_i^s(e_i))$ captures belief utility, and the final term $\psi_i \mathbf{1}_{\{s=T\}}$ represents the intrinsic utility of competition, denoted $U_{i,\text{intrinsic}}^{s,f}$. Specifically, $P_i^s(e_i)$ is competitor i's perceived winning probability in setting s, $w_i^{win,f}$ and $w_i^{lose,f}$ are the monetary outcomes under frame f, and r^f is the corresponding reference point. ψ_i^f represents the intrinsic value under frame f, and the indicator $\mathbf{1}_{\{s=T\}}$ ensures that this intrinsic utility of competition enters only in the competitive setting. To obtain directional predictions from the model, I introduce two assumptions that are empirically testable.

Assumption 1 . *Fix a frame $f \in \{G, L\}$. For every effort level $e \geq 0$, the perceived probability of success is (weakly) lower in the competitive setting than in the non-competitive setting:*

$$P_i^T(e) \;\leq\; P_i^C(e) \quad \textit{for all } e \geq 0.$$

In the competitive setting, success requires exceeding $\max_{j \neq i} \theta(a_j, e_j)$, an endogenous and uncertain benchmark determined by opponents' abilities and effort choices. In the non-competitive setting, success is measured against a fixed and transparent threshold θ^* calibrated to match the corresponding objective success probability. Although the objective probability of success is identical across the two settings by design, the strategic uncertainty (Bruttel et al., 2023; Balafoutas and Sutter, 2019) in tournaments may depress individuals' beliefs about their prospects,[4] lowering perceived chances of success relative to fixed standards. Formally, for optimal effort $e_i^{f,*}$, $P_i^T\left(e_i^{f,*}\right) \leq P_i^C\left(e_i^{f,*}\right)$.

Assumption 2 *The intrinsic utility of competition is positive in the gain frame ($\psi^G > 0$) and negative in the loss frame ($\psi^L < 0$).*

In the gain frame, losing a competition simply means not obtaining the reward, but at least remaining at the status quo. In other words, one does not incur any deterioration relative to the initial position. In this case, the intrinsic enjoyment of the act of competing, such as excitement and satisfaction, is likely to dominate feelings like stress and

[4] Bruttel et al. (2023) show that when the source of uncertainty is strategic rather than exogenous, beliefs are systematically reshaped; Balafoutas and Sutter (2019) show that uncertainty and ambiguity in tournament rules shifts competitive behavior.

competitive pressure. This means $\psi^G > 0$. In contrast, in the loss frame, losing in competition entails a reduction from the initial endowment. According to loss aversion, whereby losses evoke stronger negative affect than equivalent gains (Tversky and Kahneman, 1979; Kahneman et al., 1991; Brown et al., 2024), such losses in competition may heighten psychological costs, such as stress and anxiety, to the point that they surpass enjoyment of competing. This implies $\psi^L < 0$.

2.2 Predictions

The simple theoretical framework provides two main predictions that guide the empirical analysis. The first one concerns the belief about winning $P_i^s(e_i)$. Competition affects utility through affecting the perceived success probability. The second concerns the intrinsic utility of competition ψ_i^f. Individuals derive direct utility from the act of competing. I experimentally test the predictions in Section 5. Proofs and auxiliary assumptions are in Appendix A.

PREDICTION 1. *(Belief channel.) Fix a frame $f \in \{G, L\}$ and hold the intrinsic utility channel ψ_i^f fixed. Under Assumptions 1, the competitive setting, relative to the non-competitive benchmark, yields:*

i. *Lower expected utility from monetary payoffs:*

$$U_{i,\text{money}}^{T,f}\big(e_T^{f,*}\big) \;\leq\; U_{i,\text{money}}^{C,f}\big(e_C^{f,*}\big).$$

ii. *(Weakly) lower belief utility:*

$$u\big(P_i^T(e_T^{f,*})\big) \;\leq\; u\big(P_i^C(e_C^{f,*})\big).$$

Intuitively, in the non-competitive (threshold) task, the target is fixed and transparent: an extra unit of effort moves performance toward a known cutoff, so the perceived chance of success rises clearly. In the competitive setting, the target is the opponents' maximum, which is uncertain and may shift with others' abilities and efforts. This moving target makes success feel less likely and less responsive to one's own effort: both the level of the perceived success probability falls and the slope with respect to effort becomes smaller. As a result, each unit of effort is believed to buy less success probability. Evaluated at the respective optima, the expected utility from monetary payoffs is lower because payoffs are probability-weighted, and belief utility, which rises with the perceived chance of

winning and is independent of money, also declines. Holding the intrinsic utility channel ψ_i^f fixed, both mechanisms reduce experienced utility in the competitive setting relative to the threshold benchmark.

PREDICTION 2. *(intrinsic utility channel) Fix $f \in \{G, L\}$ and hold the belief channel fixed. Under Assumption 2, the competitive setting, relative to the non-competitive benchmark, yields:*

i *Gain frame: higher intrinsic utility from the act of competing, i.e.,*

$$U^{T,G}_{i,\text{intrinsic}} \geq U^{C,G}_{i,\text{intrinsic}}$$

ii *Loss frame: lower intrinsic utility from the act of competing, i.e.,*

$$U^{T,L}_{i,\text{intrinsic}} \leq U^{C,L}_{i,\text{intrinsic}}$$

Intuitively, intrinsic utility is the utility of competing itself, separate from money and separate from whether one ultimately wins or loses. The act of competing can bring joy, excitement, pride, or stress and dread. The frame may determine which force dominates. In the gain frame the worst case is to stay at the status quo, so the extra randomness from facing others is not tied to material losses. The arousal of competition is coded as opportunity and tends to feel exciting and rewarding, yielding a positive intrinsic evaluation of competing. In the loss frame participants start from an endowment they may forfeit. Loss aversion makes the potential shortfall salient, and the added uncertainty of competing heightens anticipation of that shortfall. The same arousal now feels threatening rather than thrilling, so the intrinsic evaluation becomes negative. Holding beliefs about success and monetary payoffs fixed, the act of competing is therefore valued more in the gain frame and less in the loss frame.

3 Experiment

The experiment is designed primarily to investigate whether competition itself carries utility or disutility, independent of realized outcomes, and whether this utility varies across different contexts. Beyond this central question, it also considers whether competition impacts individuals' beliefs and preferences. To provide clean and credible causal evidence, I conduct an online experiment that explores the effects of competition on utility, zero-sum

thinking, and altruistic behavior. Section 3.1 introduces the experimental design, while Section 3.2 and Section 3.3 describe its implementation and the experimental data.

3.1 Experimental Design

A. Treatments

Participants were randomly assigned to one of four experimental conditions: Gain Framing with Competition, Gain Framing without Competition, Loss Framing with Competition, and Loss Framing without Competition. All participants completed a timed IQ quiz under their assigned condition, followed by a post-task survey (see Figure 1).

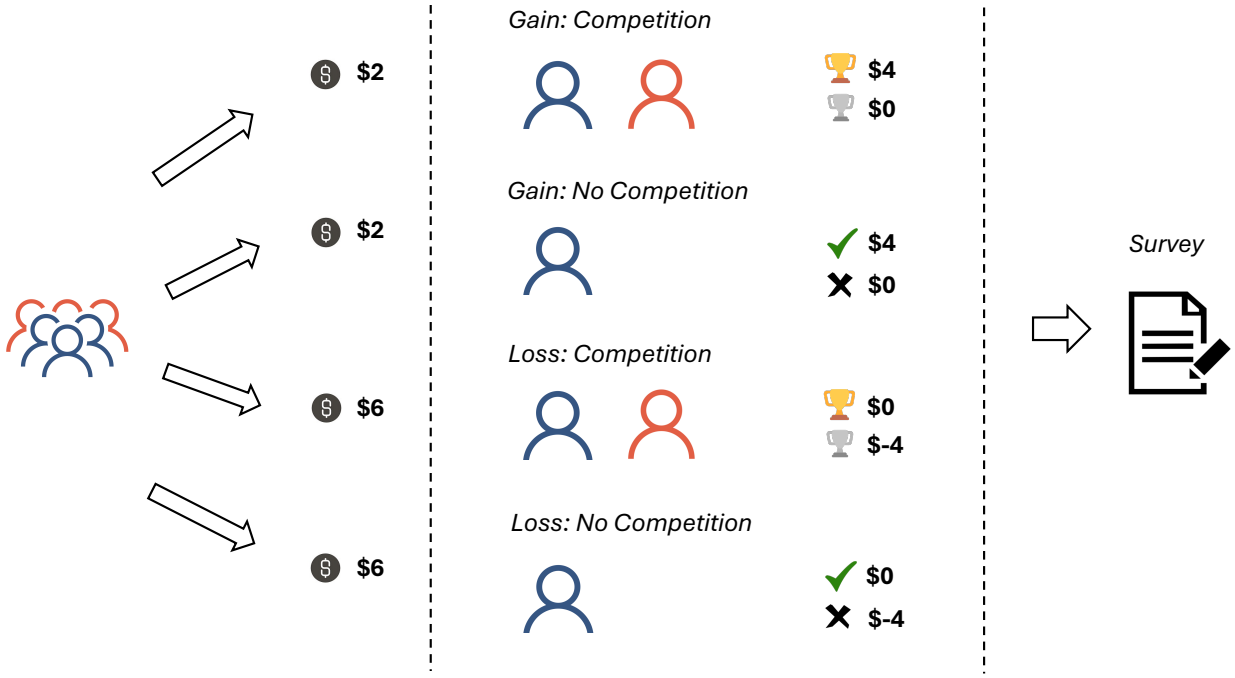


Figure 1: Visual Representation of Experimental Design

Incentives. In the gain-framing competition group, participants are randomly paired to compete in an IQ quiz. Each participant receives an initial endowment of $2. Within each pair, the higher-scoring participant is designated the "top performer" and earns an additional $4, while the lower-scoring participant receives no extra payment. In the gain-framing control group, participants complete the quiz individually. Those scoring above a predetermined threshold receive a $4 bonus, while those falling below the threshold keep only their initial endowment. The threshold is set at the median score observed in the gain-framing competition group, and participants are informed that, in a previous session, approximately half of individuals have surpassed this benchmark.

This design ensures equivalence in both the reward structure and expected payoffs across the competitive and non-competitive treatments. While piece-rate schemes are often used as non-competitive benchmarks (Niederle and Vesterlund, 2007; Möbius et al., 2022), they are less suitable here because their linear payoff structure differs from the binary outcomes of competition, potentially confounding competition effects with factors such as risk preferences or inequality aversion. By contrast, the threshold design preserves a binary reward structure in both conditions. Setting the threshold at the median score equalizes expected monetary returns: in the competitive treatment, participants receive a $2 endowment and face a 50 percent chance of winning an additional $4 (and a 50 percent chance of earning nothing), yielding expected earnings of $4. The same holds in the non-competitive treatment, where participants have a 50 percent probability of surpassing the threshold and earning the $4 bonus. By construction, expected monetary payoffs are held constant across treatments, isolating the competition effects from monetary incentives.

The loss-framing competition condition parallels the gain frame but shifts the reference point from $2 to $6. Each participant receives an initial endowment of $6 and is paired with a competitor. The higher-scoring individual retains the full $6, while the lower-scoring participant loses $4 of it. In the loss-framing control condition, participants again completes the quiz individually. Those scoring above the predetermined threshold keeps the full endowment, whereas those falling short forfeit $4. As in the gain frame, the threshold is set at the median score observed in the corresponding competition condition and is disclosed to participants. Expected payoffs are again identical across treatments: in both loss-framed conditions, participants face a 50 percent chance of keeping $6 and a 50 percent chance of ending with $2, yielding an expected payoff of $4. Across all four treatments, therefore, expected monetary payoffs are all held constant at $4.

The four groups face identical monetary incentives while differing only in the presence of competition and the framing of outcomes as gains or losses. This design enables a clean identification of the treatment effects of competition across distinct framing contexts.

IQ Quiz. The IQ quiz is identical across all experimental conditions. It consists of 50 puzzles from Civelli and Deck (2017), similar to the Raven Progressive Matrices, which is commonly used an IQ test (Drobner and Goerg, 2024); Willadsen et al. (2024). An example puzzle is shown in Figure 2. Each puzzle has four answer choices, and participants are required to select the correct one to earn points. They have four minutes to solve as many puzzles as possible. The scoring rule awards 1 point for each correct answer, deducts 0.25 points for each incorrect answer, and give zero points for skipped questions. Participants can not return to a question once they have submitted an answer or chosen

to skip it. This scoring structure is designed to encourage thoughtful participation: the expected payoff of answering a question exceeds that of skipping, and the penalty for incorrect responses discourages random guessing. Additionally, the quiz is deliberately set as time-constrained so that participants across all experimental conditions spend the same amount of time on the treatment task, thereby eliminating potential confounds related to variation in task duration.

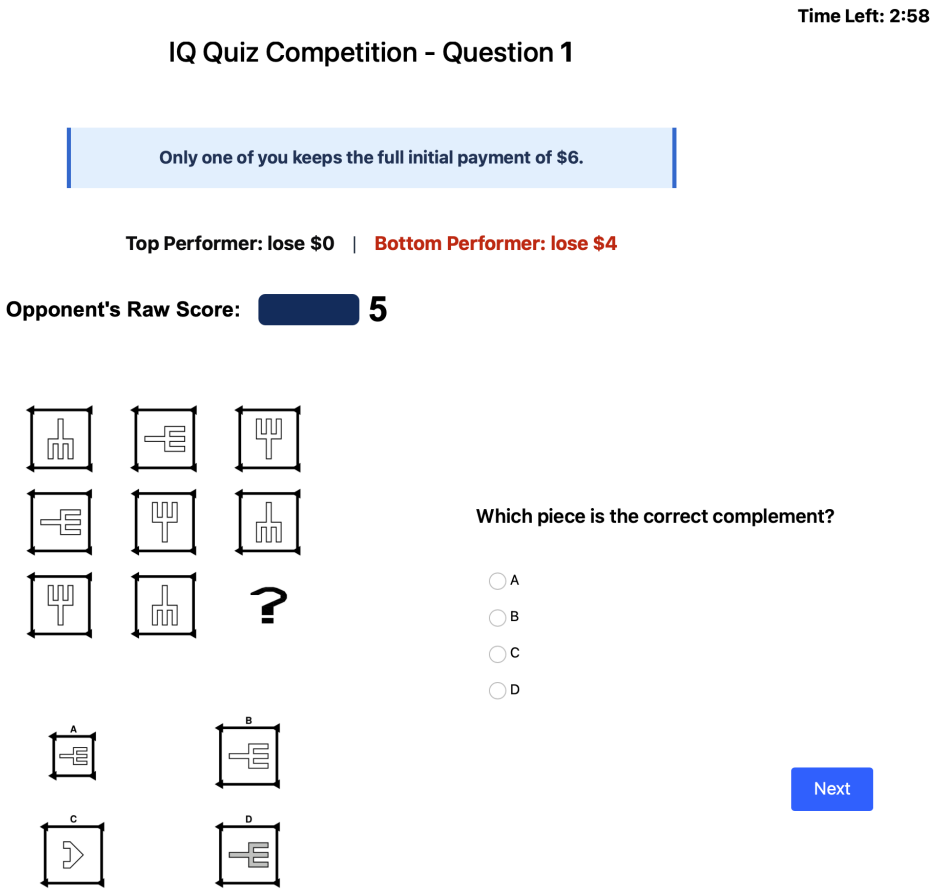


Figure 2: IQ Quiz Interface

The choice of the IQ quiz as the treatment task is also deliberate. The study's primary objective is to isolate the effect of competition itself. An appropriately chosen task can facilitate this goal. The IQ quiz is well-suited in this respect: it is ego-relevant and naturally induces utility responses, since performance conveys information about intelligence, shapes self-evaluations, and potentially affect perceived utility. Moreover, the quiz resembles tasks commonly encountered in real-life contexts such as academic and workplace settings, in terms of both seriousness and cognitive demands. This resemblance enhances

the external validity of a laboratory-style experiment. While the use of an IQ quiz carries potential drawbacks—such as the possibility that participants avoid IQ competition, leading to differential attrition across groups—this concern did not materialize in practice.

Online Matching. In the competition treatments, participants in both gain-framing and loss-framing conditions are randomly matched in real time with another participant as their opponent. The maximum waiting time is set to five minutes. In practice the average waiting time was 19 seconds. Figure 3 displays the matching screen shown to participants during this stage. Once matched, participants begin the IQ quiz simultaneously. In the non-competitive treatments, participants proceed directly to the IQ quiz after the instruction phase without matching.[5]

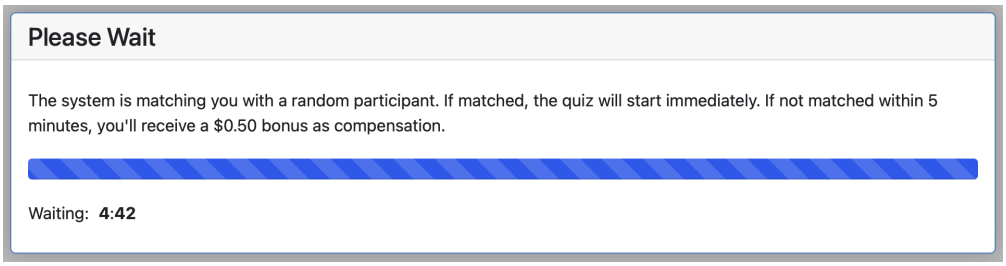


Figure 3: Participant Matching Screen

Interface. Figure 2 shows the IQ quiz interface for the loss-framing competition group. The interfaces for the loss-framing control, gain-framing competition, and gain-framing control groups are presented in Section C. Two design features of the task screen are worth noting. The first is the *real-time opponent score bar* . In both gain-framing and loss-framing competitive treatments, participants observe their opponent's *raw* score in real time. The raw score represents the cumulative number of correct answers up to that point, without deductions for incorrect answers. This score bar design serves two purposes. On one hand, its dynamic nature heightens the salience of competition and may evoke emotions such as excitement, nervousness, or stress, thereby enabling us to detect whether participants derive utility from the act of competing. Online experiments often limit engagement because participants cannot physically observe rivals; the score bar mitigates this limitation by making competition more tangible. On the other hand, because only raw scores are shown, participants learn about their opponents' performance only partially and cannot infer the final outcome. This feature is crucial, as the aim of the experiment is to isolate

[5] Since the actual waiting time was very short, the matching stage is highly unlikely to introduce systematic differences between treatment and control groups.

the effect of competition itself. The score bar is displayed only in the competitive treatments. Second, the interface wording is tailored to each experimental group to reinforce treatment salience. In the competitive conditions, it states: "Only one of you earns the $4 bonus" in the gain frame and "Only one of you keeps the full initial payment of $6" in the loss frame, underscoring both rivalry and the zero-sum nature of the task. In the non-competitive conditions, by contrast, the wording stresses the individual dimension: "Reach the target score to earn the $4 bonus" in the gain frame and "Reach the target score to keep the initial payment of $6" in the loss frame.

IQ Quiz Performance Feedback. Participants receive no information about their own performance during the quiz. At the end of the experiment, they are informed of their own quiz score, their opponent's score, and whether they beat their opponent (in competition treatments) or met the threshold (in non-competition treatments). This design ensures isolating the utility derived from competition itself, independent of realized outcomes. Although in competitive conditions the display of the opponent's real-time score may enable participants to form beliefs about outcomes, this concern is mitigated by showing only raw instead of final scores.

B. Outcome Measures

The outcome variables are measured through survey questions and incentivized decision-making tasks administered following the IQ quiz, as shown in Figure 1. Utility, task preferences, and zero-sum thinking are elicited in the survey, while altruistic behavior is measured using a dictator game and a public goods game.

Measuring Utility. A self-reported measure of well-being is commonly used to capture individuals' perceptions of their experience. ((Kahneman and Krueger, 2006; Kahneman et al., 1997; Frey et al., 2004; Haggag et al., 2019) Following this approach, I use a survey question with a seven-point Likert scale to measure experienced utility: "On a scale from 1 (not at all enjoyable) to 7 (extremely enjoyable), how enjoyable was the IQ Quiz (or, in treatment groups, the IQ Quiz Competition)?" To capture specific emotional components of utility, I adapt the approach of Bernheim et al. (2024), who elicit the feelings associated with individuals' choices. Participants are asked: "Thinking back to how you felt during the IQ Quiz (or IQ Quiz Competition for the treatment groups), please indicate the extent to which you experienced the following emotions (excitement, satisfaction, stress, embarrassment, and anxiety), on a scale from 1 (not at all) to 7 (extremely)." The first two emotions are classified as positive and the latter three as negative. These measures are administered uniformly across all experimental conditions.

Measuring Task Preference. Individuals are generally aware of state-dependent preferences. For example, food tastes better when one is hungry and vacations are more enjoyable when the weather is sunny. However, they may fail to account for the transient nature of such states and instead misattribute their influence to stable characteristics of the good or activity (Haggag et al., 2019; Bushong and Gagnon-Bartsch, 2023). While the literature has documented such attribution biases in non-strategic contexts such as hunger and thirst, less is known about whether similar biases arise in strategic environments. This study provides an opportunity to examine whether competitive settings shape individuals' preferences for a task through such biases.

To measure task preferences, I adapt survey questions from Haggag et al. (2019). The primary measure asks respondents whether they would accept the task under varying hypothetical payments. They are presented with the following scenario: "Imagine you have another IQ quiz in front of you right now, similar to the one you just completed but with a different set of fifty questions. You again have four minutes to answer as many as possible. If you get at least six questions[6] correct within the four minutes, you will receive a payment. For each amount ($0.20, $0.40, $0.60, $0.80, $1.00, $1.20, $1.40, $1.60, $1.80, $2.00, $2.50, $3.00, and $5.00), please indicate 'Yes' if you would be willing to take the quiz for that payment, or 'No' otherwise." As a complementary measure, respondents are also asked: "On a scale from 1 (not at all likely) to 7 (extremely likely), how likely would you be to voluntarily take another set of 10 IQ questions, similar to the ones you just completed, with no monetary rewards?"

Measuring Zero-sum Thinking. Following the approaches used in the World Values Survey (Inglehart et al., 2014) and Carvalho et al. (2023), I measure zero-sum thinking using two survey questions. The first asks respondents to position their views on a scale between two opposing statements: (1) "Wealth can grow so there's enough for everyone" and (2) "People can only become wealthy at the expense of others." Participants select a number from 1 to 10 that best represents their view, where 1 indicates complete agreement with the first statement (non-zero-sum thinking) and 10 indicates complete agreement with the second (high zero-sum thinking), and intermediate values represent intermediate views. The second question adapts the measure from Carvalho et al. (2023). Respondents are presented with a scenario in which both immigrants and locals work as day laborers (see Figure 4). On Day 1, immigrant workers find 20 jobs while local workers find 40 jobs. On Day 2, immigrant workers find 40 jobs. Respondents are asked to estimate the number of jobs found by local workers on Day 2, choosing between 20 and 80. Choosing

[6]Six correct answers correspond to the median performance in the sample.

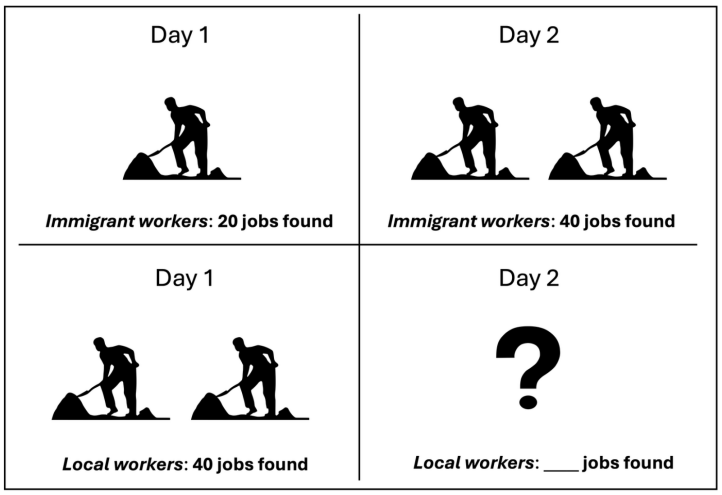


Figure 4: Measure of Zero-Sum Thinking

20 reflects zero-sum thinking: the reasoning is that the total number of jobs is fixed, so if immigrants take more, fewer remain for locals. Choosing 80 reflects non-zero-sum thinking: the reasoning is that a common demand shock doubled the number of jobs for immigrants, and thus the number of jobs for locals would also double.

Measuring Altruistic Behavior. I measure altruistic behavior using a dictator game and a public goods game. In the dictator game, I follow Enke et al. (2023): participants are asked to split $100 between themselves and a randomly selected participant (see Figure 5). This design provides a vivid and efficient measure of altruism. In the public goods game, participants are randomly paired. Each receives a $0.50 endowment and must decide whether to keep it or contribute it to a common pool. Payoffs are determined as follows: if both keep, each earns $0.50; if both contribute, each earns $0.80; if one keeps while the other contributes, the keeper earns $0.90 and the contributor $0.40. The decision interface is shown in Figure 6. All payments are real and paid as part of participants' final bonuses. After making their decision, participants are asked to estimate the share of others who chose to keep their endowment. This belief elicitation is incentivized: correct answers earn a monetary bonus.

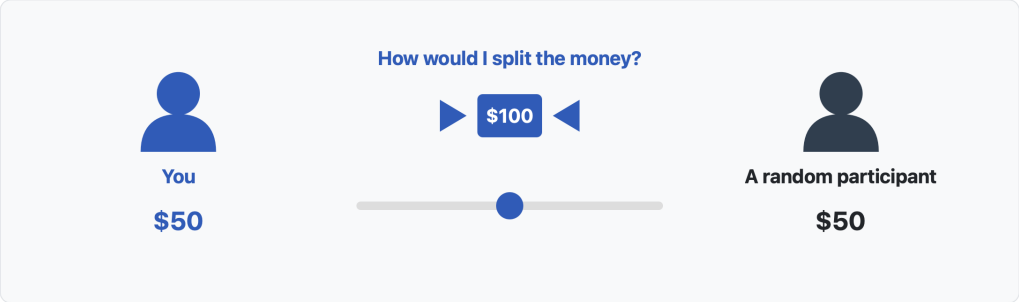


Figure 5: Dictator Game

Additional Measures. As suggested by the theoretical framework in Section 2, beliefs about the probability of winning and perceived relative ability are important components of utility. I therefore elicit both in the survey. To measure beliefs about winning, I follow Niederle and Vesterlund (2007). Participants in the competition treatment are asked whether they believe they were the top performer in the IQ Quiz Competition (yes/no). In the control treatments, they are asked whether they believe their score exceeded the threshold (yes/no). These questions are incentivized: participants receive a bonus for a correct answer. Perceived relative ability is measured by asking participants to rate their performance relative to others on a 0–10 scale, where 0 indicates believing they performed worse than almost everyone, and 10 indicates better than nearly everyone. For instance, a response of 7 corresponds to believing one performed better than about 70% of participants. In addition, I collect basic demographics (gender, race, income, education). To ensure data quality, participants are also asked how well they understood the instructions, with response options "fully understand," "almost," "partly," or "none." The full survey is provided in Section C.7.

C. Comprehension and Attention Checks

To further ensure data quality, I implement comprehension questions, bot detection, and attention checks. Before the IQ quiz, participants are required to complete a practice question; only those who answer correctly can proceed. A second comprehension question is administered prior to the public goods game to verify participants' understanding of the payment rules. Participants must answer correctly to continue. I also record the number of attempts taken on each comprehension question, which serves as a screening criterion for later data analysis. To prevent automated participation, a reCAPTCHA verification is included at the start of the experiment. Only participants who pass this verification can continue. For attention checks, I adopt the method used in Bernheim et al. (2024).

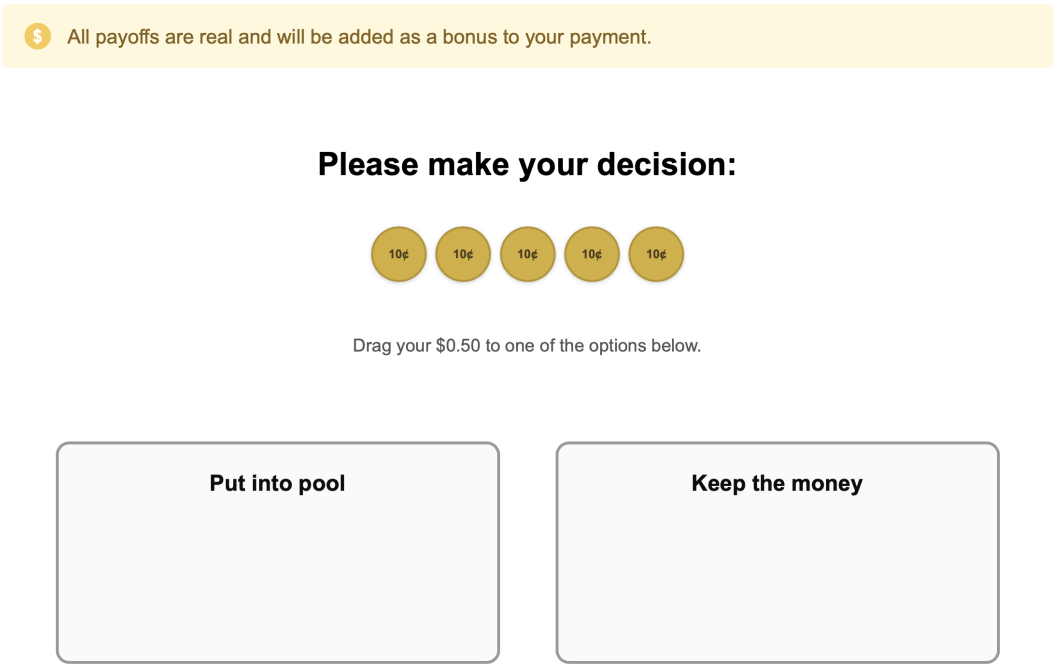


Figure 6: Public Goods Game

Specifically, in one survey item embedded among the main questions, participants are instructed not to select any option. Selecting an option indicates a failed attention check, and the participant's data is excluded from the analysis.

3.2 Experimental Procedures

Participant Pool. Participants were recruited via Prolific, a widely used online platform for social science research (Peer et al., 2022). All participants resided in the United States and were at least 18 years old. To ensure high data quality, I applied several screening criteria. First, participants were required to have completed at least 100 prior submissions on Prolific. Second, their prior approval rate had to be at least 95%. Third, the sample was balanced by gender within each experimental condition.[7] Fourth, each participant could access only one recruitment posting and participate in a single experimental condition.[8] Finally, to ensure smooth implementation, only desktop or laptop devices were permitted; responses from mobile phones and tablets were disallowed.

[7]This step was necessary because Prolific's participant pool contains more females than males; simple random assignment would otherwise risk gender imbalance.

[8]Because the median IQ quiz score from competitive treatments was used as the benchmark for non-competitive treatments, experimental conditions were conducted sequentially. Preventing multiple participation was therefore essential. Based on the data, no participant took part in more than one condition.

Procedures. The experiment was conducted on June 4, 2025, with the four experimental groups implemented over the course of the day in the following order: Gain Framing with Competition, Gain Framing without Competition, Loss Framing with Competition, and Loss Framing without Competition. In all groups, the study title read "A short quiz and a set of survey questions (15–25 minutes)." In the study description, participants in the Gain Framing condition were told the study paid $2 with the possibility of earning a bonus, whereas participants in the Loss Framing condition were told the study paid $6 with the possibility of a deduction.[9]

Upon entering the study, participants first viewed a welcome page outlining the study purpose, and compensation. They then read the informed consent form, entered their Prolific ID, and completed a reCAPTCHA verification. Next, participants received the main instructions, which varied slightly across treatment arms. The instructions described the IQ quiz, the follow-up survey, the expected duration of the experiment, and the payment rules. In the Gain Framing conditions, participants were informed that they would begin with $2 and could earn up to a $4 bonus based on their quiz performance. In the Gain-Competition condition, the bonus required outperforming a randomly matched online opponent. In the Gain-No Competition condition, the bonus was tied to meeting a prespecified threshold, which was the median quiz score from a prior session. In the Loss Framing conditions, participants were told they would begin with $6 and could lose up to $4. In the Loss-Competition condition, avoiding the deduction required outperforming a random opponent. In the Loss-No Competition condition, avoiding the deduction required meeting a prespecified threshold.[10]

All participants were required to answer comprehension questions after reading the instructions, and they had to correctly answer all questions before proceeding. Data indicate that 94.3% of participants passed within two attempts. Participants then completed a practice question to familiarize themselves with the IQ quiz format, followed by a reminder page reiterating the payment rules. In the competition condition, participants were additionally reminded that they would be matched in real time with another participant and would observe their opponent's raw score bar updating live. On the matching page, a five-minute countdown timer was displayed. Participants who were not matched within this period received $0.50 compensation for their time. In practice, 99.7% of participants

[9] In the Gain Framing condition, the description stated: "The base payment for participating in the study is $2.00. You can earn a bonus of up to $4.00 in the first section, and additional bonuses in later sections." In the Loss Framing condition, the description stated: "The base payment for participating in the study is $6.00. You may lose up to $4.00 of this amount in the first section. Bonuses are available in later sections."

[10] In practice, the median quiz scores in the Gain–Competition and Loss–Competition groups were similar (6.25 and 6.75, respectively). For simplicity, I set the threshold at 6 in the non-competition conditions under both gain and loss framing.

were matched, with an average wait time of 19 seconds (minimum: 1.8 seconds).[11] Once matched (or directly proceed in the non-competition condition), participants completed the four-minute IQ quiz. Afterwards, they answered survey questions on utility, task preferences, zero-sum thinking, and made decisions in a dictator game and a public goods game. Questions on beliefs about winning, perceived relative ability, and demographic characteristics were asked at the end. On the final page, participants were shown their quiz performance and informed whether they had beaten their opponent (or, in the non-competition condition, whether they had passed the threshold score). [12]

Pre-registration. The experiment was preregistered on the AEA RCT Registry[13]. The preregistration specified the experimental design, interventions, planned sample sizes by treatment arm, and the primary hypotheses concerning competition and the main outcomes.

3.3 Data Description

A total of 798 participants enrolled in the study: 198 in the Gain Framing–Competition group and 200 in each of the other three groups (Gain Framing–Control, Loss Framing–Competition, and Loss Framing–Control).[14] Of these, 8 participants failed the attention check and 3 submitted incomplete responses. Excluding these 11 yields a final sample of 787.[15] Attrition was minimal. The median completion time was 18 minutes.[16]

Demographic characteristics and balance tests are presented in Table 1. The sample is well balanced across most demographics, including age, gender, and race. In the loss-framing treatments, the proportions of respondents with a high school education and with incomes between $10,000 and $34,999 differ slightly between the competition and control

[11]The experiment was programmed in oTree and hosted on Heroku. Matching was implemented within oTree. To maintain server stability during peak recruitment, participation slots were released in staged batches (e.g., 50 positions at a time) until the target sample size was reached.

[12]In the Loss Framing conditions, participants were informed they might lose part of their payment. At the end of the experiment, a debrief clarified that, consistent with Prolific policy, advertised payments could not be reduced; all participants received the full $6 regardless of performance. Participants in the competition groups also received an additional debrief because competition had not been disclosed in the consent form. While some participants may have known Prolific's policy, comments from study participants suggest this was rare. Random assignment ensures any such effect was balanced across conditions.

[13]ID: AEARCTR-0015723, https://doi.org/10.1257/rct.15723-2.3.

[14]The target sample was 800, with 200 per group. A shortfall of two resulted from minor technical issues on the Prolific platform.

[15]Exclusions: 3 from Gain Framing with Competition, 4 from Gain Framing without Competition, 1 from Loss Framing with Competition, and 3 from Loss Framing without Competition.

[16]18 in Gain Framing–Competition, 17 in Gain Framing–Control, 19 in Loss Framing–Competition, and 17 in Loss Framing–Control.

Table 1: Descriptive Statistics and Balance Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Gain Framing		**Loss Framing**		**Diff.**	
	Full Sample	Competition	Control	Competition	Control	(2)-(3)	(4)-(5)
Gender: Female	0.50	0.51	0.52	0.50	0.50	-0.01	0.00
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	[0.84]	[0.96]
Age	40.12	39.72	40.21	38.97	41.55	-0.50	-2.58*
	(13.41)	(13.64)	(13.13)	(13.75)	(13.06)	[0.71]	[0.06]
Race: White	0.60	0.62	0.59	0.56	0.61	0.03	-0.05
	(0.49)	(0.49)	(0.49)	(0.50)	(0.49)	[0.52]	[0.34]
Race: African American	0.28	0.30	0.27	0.30	0.25	0.03	0.05
	(0.45)	(0.46)	(0.45)	(0.46)	(0.43)	[0.46]	[0.25]
Race: Hispanic	0.05	0.04	0.07	0.06	0.04	-0.03	0.02
	(0.22)	(0.20)	(0.25)	(0.23)	(0.18)	[0.27]	[0.33]
Race: Asian	0.05	0.02	0.05	0.05	0.07	-0.03	-0.02
	(0.21)	(0.14)	(0.22)	(0.21)	(0.26)	[0.11]	[0.29]
Education: High school and less	0.24	0.22	0.29	0.16	0.30	-0.07	-0.14***
	(0.43)	(0.41)	(0.45)	(0.37)	(0.46)	[0.12]	[0.00]
Education: Bachelor's degree	0.46	0.45	0.45	0.51	0.44	0.00	0.07
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	[0.99]	[0.15]
Education: Graduate or professional degree	0.29	0.33	0.26	0.33	0.26	0.07	0.07
	(0.46)	(0.47)	(0.44)	(0.47)	(0.44)	[0.13]	[0.14]
Income: Less than $10,000	0.03	0.03	0.03	0.03	0.03	0.00	0.00
	(0.16)	(0.16)	(0.17)	(0.16)	(0.16)	[0.77]	[0.99]
Income: $10,000 - $34,999	0.14	0.14	0.19	0.09	0.16	-0.05	-0.06**
	(0.35)	(0.35)	(0.39)	(0.29)	(0.36)	[0.19]	[0.05]
Income: $35,000 - $74,999	0.33	0.29	0.31	0.35	0.36	-0.02	0.00
	(0.47)	(0.45)	(0.46)	(0.48)	(0.48)	[0.63]	[0.95]
Income: $75,000 - $149,999	0.37	0.40	0.33	0.38	0.35	0.07	0.03
	(0.48)	(0.49)	(0.47)	(0.49)	(0.48)	[0.15]	[0.51]
Income: $150,000 or more	0.13	0.14	0.14	0.15	0.11	0.01	0.04
	(0.34)	(0.35)	(0.35)	(0.35)	(0.31)	[0.85]	[0.29]
Employment: Full time	0.65	0.64	0.57	0.69	0.69	0.08	0.00
	(0.48)	(0.48)	(0.50)	(0.46)	(0.46)	[0.12]	[0.97]
Policy: Extreme or leaning left	0.36	0.31	0.30	0.40	0.42	0.01	-0.02
	(0.48)	(0.47)	(0.46)	(0.49)	(0.50)	[0.77]	[0.64]
Policy: Extreme or leaning right	0.42	0.46	0.48	0.36	0.37	-0.02	0.00
	(0.49)	(0.50)	(0.50)	(0.48)	(0.48)	[0.76]	[0.95]
Policy: Center	0.22	0.22	0.22	0.24	0.21	0.00	0.03
	(0.42)	(0.42)	(0.41)	(0.43)	(0.41)	[0.96]	[0.53]
Residence: U.S.	1.00	0.99	1.00	1.00	0.99	-0.01	0.01
	(0.06)	(0.10)	(0.00)	(0.00)	(0.07)	[0.15]	[0.32]
Nationality: U.S.	0.99	0.99	0.98	0.99	0.99	0.01	-0.01
	(0.11)	(0.10)	(0.14)	(0.10)	(0.07)	[0.42]	[0.56]
Observations	787	194	196	198	199	390	397

Notes: Means are reported with standard deviations in parentheses. P-val in brackets. All variables are coded as indicators and shown as proportions. Column (1) reports statistics for the full sample. Columns (2)–(3) present treatment and control groups under gain framing, and Columns (4)–(5) present treatment and control groups under loss framing. Column (6) shows mean differences between groups under gain framing, with p-values from two-sided t-tests in brackets, while Column (7) reports the same for loss framing. "Observations" indicates the number of responses in each condition.

groups. These differences are not concerning: joint tests of balance show no evidence of systematic imbalance (*F-test* (p-val = 0.61) for Gain Framing competition vs. control; *F-test* (p-val = 0.17) for Loss Framing competition vs. control).

4 Interpreting the Competition Treatment

In the experiment, "competition" is introduced through two primary features.[17] The first is the presence of another participant. In the competition treatments, individuals are paired with another person working on the IQ quiz and are made explicitly aware of this pairing through the matching stage, whereas control participants work independently with no interaction with others. This distinction is subtle. A more central feature is the *opponent's raw score bar*, which appears only in the competition treatments. This feature introduces two elements that jointly characterize the competitive environment: (i) it provides real-time information about the opponent's performance through their raw score. This score is a noisy signal of actual performance but nevertheless affects beliefs about the probability of winning monetary rewards (for example, a rapidly rising opponent score may lead a participant to revise downward their perceived winning probability); and (ii) it evokes a heightened sense of competition, eliciting positive emotions such as excitement or negative emotions such as stress. The latter captures the intrinsic utility of competition independent of expected monetary payoffs.

Figure 7 shows the IQ quiz score distributions for the four experimental groups, namely the competition treatments and the control treatments, under both gain and loss framing. The score distributions do not differ significantly in the gain frame (Kolmogorov–Smirnov test, $p = 0.128$) or in the loss frame (Kolmogorov–Smirnov test, $p = 0.924$). Using performance as a proxy for effort, these results suggest that effort levels were similar across groups. Differences in outcome variables are therefore unlikely to be driven by differences in effort. As noted above, the core treatment in the experiment is participants' exposure to their opponent's raw score bar. Participants were randomly matched. Figure 8 shows the realized matching patterns, with each participant's performance on the horizontal axis and their opponent's performance on the vertical axis. Panel A shows the matching pattern under gain framing, and Panel B under loss framing; the patterns are broadly similar. The dotted 45-degree line represents equal scores between a participant and their opponent. Purple and blue dots, representing participants with relatively low performance (scores below zero and between zero and five, respectively), generally lie above the line, indicating

[17] A third, minor feature is the wording of the instructions.. Competition treatments use terms such as *competition* and *opponent*, whereas control treatments use terms such as *work independently* and *target score*.

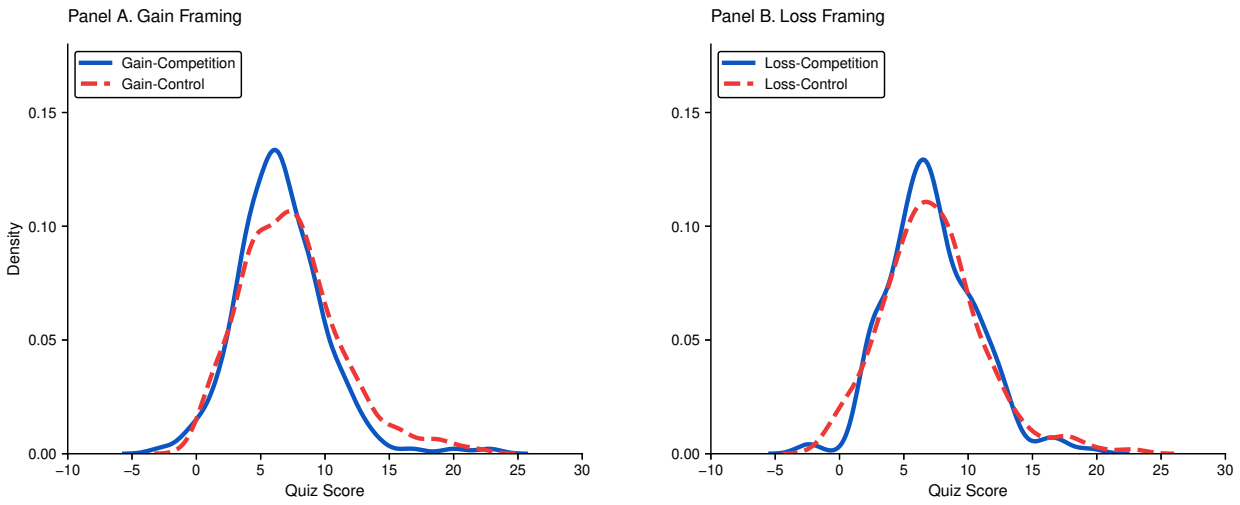


Figure 7: Distribution of IQ Quiz Scores

Notes: This figure plots the distribution of quiz scores by framing and treatment. Panel A (Gain) contrasts Competition (solid blue) with Control (dashed red); Panel B (Loss) contrasts Competition (solid blue) with Control (dashed red). Scores are on the -10 to 30 scale; densities integrate to one within each panel.

that these participants tended to face stronger opponents. Those with scores between five and ten were matched roughly evenly with stronger and weaker opponents, as reflected in an approximately equal number of points above and below the line. High-performance participants (green and orange dots, scores above ten) typically faced weaker opponents, with most observations falling below the line. This pattern is consistent across both gain and loss framings and is in line with the overall distribution of quiz scores.

Panels C and D of Figure 8 present binned scatter plots in which the horizontal axis shows participants' quiz scores and the vertical axis shows the mean quiz scores of their opponents. Across both framings, the mean opponent score remains close to six for participants at all performance levels. The shaded grey band marks the threshold score used in the control groups, which is identical at six. Thus, in both competition and control treatments, the average performance level that participants needed to surpass is approximately the same. The key difference is that in the control treatments, all participants faced a predetermined target score of exactly six, whereas in the competition treatments, some faced opponent scores above six and others below, although the average was close to six.[18] Moreover, throughout the quiz, participants in the competition treatments observed a noisy signal of their opponent's score evolving in real time, whereas control participants

[18]The purpose of Figure 8 is to illustrate the matching pattern in performance, a proxy for ability. In the actual experiment, participants did not observe their opponent's final score; they only saw the opponent's final *raw score* near the end of the quiz. The matching pattern of raw scores relative to participants' own scores is shown in Appendix B.1 and is very similar to that of the final scores.

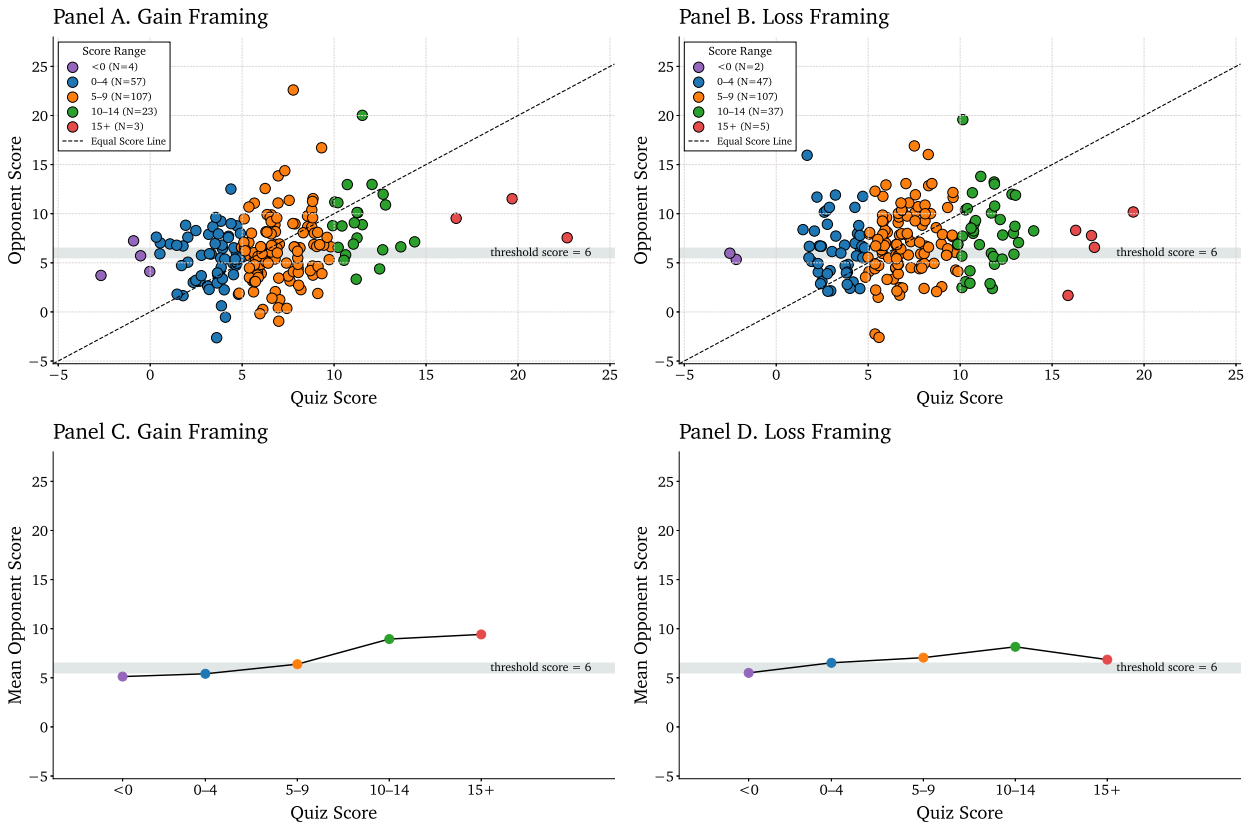


Figure 8: Matching Patterns

Notes: This figure plots opponent scores versus participants' quiz scores under Gain (A,C) and Loss (B,D) framings. Panels A–B show scatterplots; points are colored by quiz-score bins (< 0, 0–4, 5–9, 10–14, 15+) with bin counts in the legend. The dashed 45° line indicates equal scores; the shaded band at 6 marks the fixed threshold from the non-competitive reference. Panels C–D display bin means by quiz-score bin; lines connect means for readability. Patterns are comparable across framings.

faced an unchanging target score of six, with no variation during the task.

Figure 9 further illustrates the dynamic nature of the competitive environment by showing how participants in the competition treatments observed their opponent's score changing over time. The solid black line plots the gain framing condition, and the dashed grey line plots the loss framing condition. The figure reports the average increase in the opponent's raw score within successive 30-second intervals of the four-minute quiz. The patterns are highly similar across framings. In the first 30 seconds, opponents' scores increased by about 0.5 points on average. Thereafter, in most intervals, the average increase was roughly one point, equivalent to one correct answer, until approximately the 210-second mark. In the final 30 seconds, the average increase fell back to about 0.5 points, likely reflecting time pressure near the end of the quiz.

In summary, the score bar design in the competition treatments introduces two fundamental differences relative to the control group. First, competition participants faced vari-

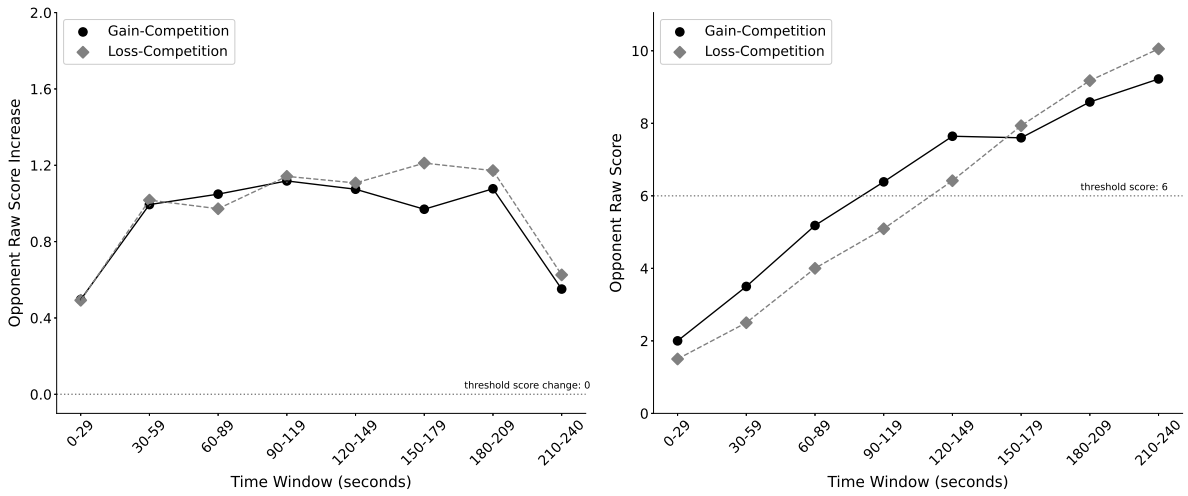


Figure 9: Opponent Raw Score over Time

Notes: The figure plots the opponent's performance in the two competition treatments over the 4-minute IQ quiz, binned into non-overlapping 30-second windows. Gain-Competition is shown with solid black circles; Loss-Competition with dashed gray diamonds. The left panel reports the average within-window increase in the opponent's raw score; the dotted line at 0 indicates the non-competitive comparison group's benchmark (no change). The right panel reports the cumulative opponent score by the end of each window; the dotted line indicates the non-competitive comparison group's fixed threshold score of 6 points.

ation in the performance of their opponent, with some opponents scoring above six and others below, whereas all control participants faced the same predetermined target score of six. Second, competition participants experienced the opponent's score accumulation in real time, observing changes approximately every 30 seconds, while control participants faced a static target score with no variation. These two features, variation in the performance of the opponent and dynamic score updates, together with the presence of another participant, jointly define the competitive environment in the experiment.

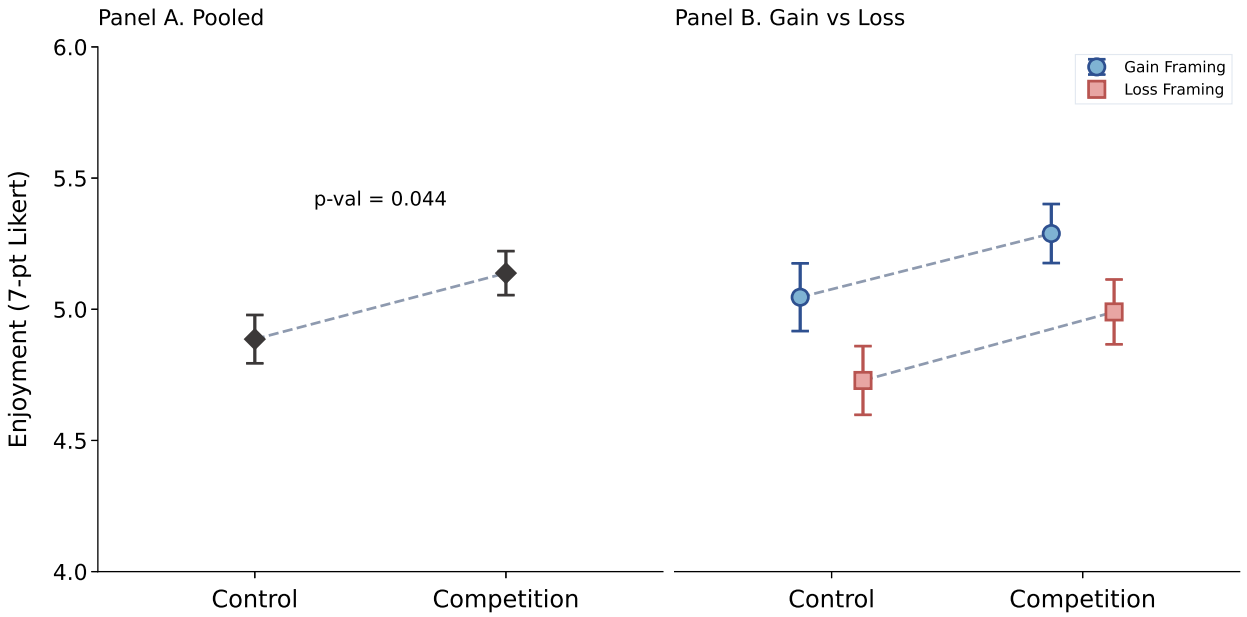
5 Results: Competition and Utility

Individuals derive utility directly from the act of competing, independent of realized outcomes. This section documents this finding in detail. Section 5.1 presents the average treatment effect of competition on utility. Section 5.2 and Section 5.3 examine two underlying mechanisms: a negative belief channel, in which competition reduces utility by lowering winning expectations, and a positive intrinsic utility channel, in which individuals enjoy competing for its own sake. Section 5.4 and Section 5.5 extend the analysis to additional dimensions, such as heterogeneity and the emotional components of utility. An important implication is that positive experiences in competition raise individuals' preference for the task performed through attribution bias.

5.1 Effects of Competition on Utility

Figure 10 illustrates the average treatment effects of competition on utility. In the competition condition, payment was based on relative performance in pairwise contests, whereas in the control condition, payoff depended on whether participants exceeded a median performance threshold. Payment structures were identical across conditions. Importantly, participants were unaware of their task performance and of whether they had defeated their opponent or passed the threshold when completing the utility survey. As shown in the figure, participants in the competitive treatments experienced significantly higher utility than those in the non-competitive treatments.[19]

Figure 10: Treatment Effects of Competition on Utility



Notes: This figure plots the treatment effects of competition on utility. Panel A presents pooled results, while Panel B shows results separately for the gain and loss framing conditions. In both panels, the horizontal axis indicates the treatment groups (Control vs.Competition), and the vertical axis presents the average response to the survey question: "On a scale from 1 (not at all enjoyable) to 7 (extremely enjoyable), how enjoyable was the IQ quiz (or IQ quiz competition)?" Each point in the figure represents the mean enjoyment within the corresponding group, with 95% confidence intervals indicated. Only the p-value for the pooled comparison is displayed in the figure (p-val= 0.044); the differences in Panel B are not statistically significant (p-val = 0.157 for Gain Framing and p-val = 0.148 for Loss Framing). To avoid visual clutter, only the p-value for statistically significant comparisons is marked. Full regression results are provided in Table 2.

Panel A of Figure 10 pools observations across the gain- and loss-framing treatments, combining the respective control groups into a single control condition and the competition groups into a single competition condition. Pooling is appropriate because expected

[19] Appendix Figure B.2 shows the distribution of utility by treatment and framing condition.

payoffs are identical across gain and loss framing, leaving competition as the only dimension of variation. In the pooled sample, mean enjoyment was 4.89 in the control group and 5.14 in the competition group, a 5.1 percent increase ($p = 0.044$). Panel B of Figure 10 presents the results for gain and loss framing separately. Under gain framing, enjoyment rises from 5.05 to 5.29 ($p = 0.157$), and under loss framing, from 4.73 to 4.99 ($p = 0.148$). While not statistically significant, the differences mirror the pooled pattern. The lack of significance may therefore reflect limited statistical power rather than the absence of an effect. Columns (1), (3), and (5) provide regression estimates that corroborate these results. Overall, the evidence suggests that the act of competing raises utility. Consistent with expectations, average enjoyment is significantly higher under gain than under loss framing ($p = 0.014$). Somewhat unexpectedly, however, the difference in treatment effects across framings is negligible ($p = 0.941$).

RESULT 1. *Competition generates utility, independently of realized outcomes.*

5.2 Belief Channel

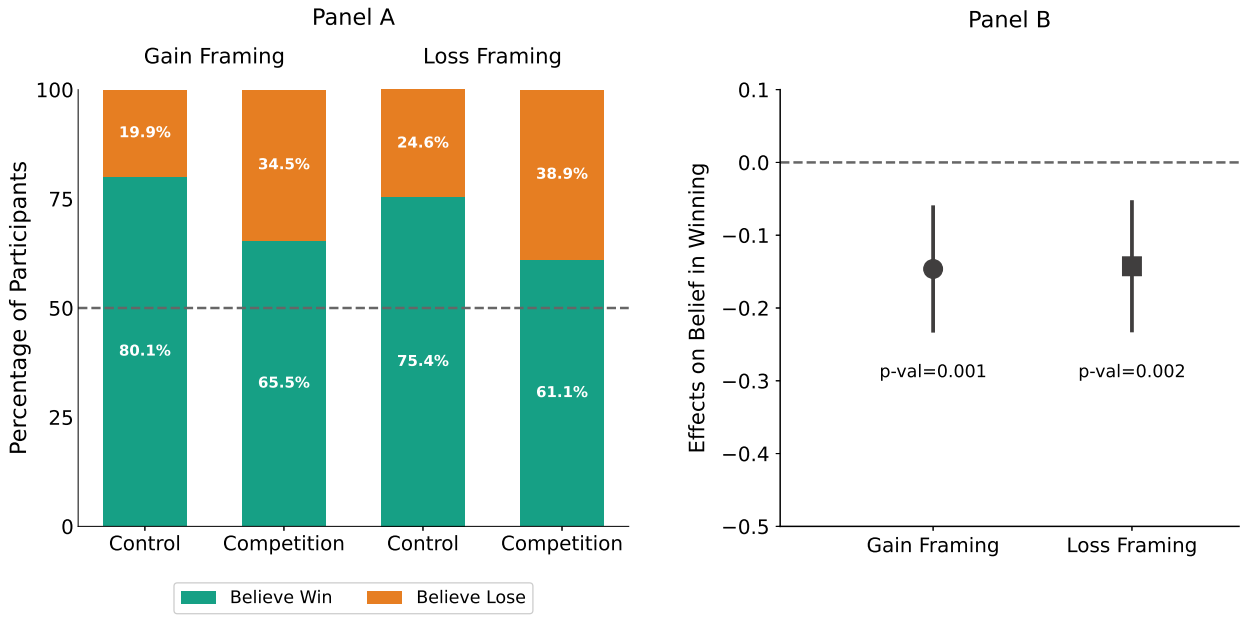
The act of competing affects utility through two channels: a belief channel that lowers utility, and an intrinsic utility channel that raises it. This section focuses on the belief channel; the intrinsic utility channel will be addressed in the next section.

Competition reduces utility by lowering winning expectations.[20] This can be seen from the regression results in Table 2. Once 'belief in winning' is included as a control, the coefficient on competition rises substantially, while the coefficient on 'belief in winning' is positive and statistically significant. This pattern holds under both gain and loss framing, as well as in the pooled sample. Guided by this finding, I next examine the link between competition and beliefs about winning, and between those beliefs and utility. Figure 11 illustrates the negative impact of competition on individuals' beliefs about their winning probabilities, and Figure 12 shows the positive association between winning expectations and experienced utility.

Panel A of Figure 11 displays the distribution of winning beliefs across treatments. The winning belief is defined as expecting to beat the opponent in competition groups or to surpass the median threshold in control groups. In both gain and loss frames, the share of participants expecting to win is lower under competition than under control. Under gain framing, the share falls from 80.1% to 65.5%; under loss framing, from 75.4% to 61.1%.

[20] In the competition groups, "winning" refers to outperforming the paired opponent; in the control groups, it refers to surpassing a performance threshold. For simplicity, both cases are referred to as "winning."

Figure 11: Effect of Competition on Belief in Winning



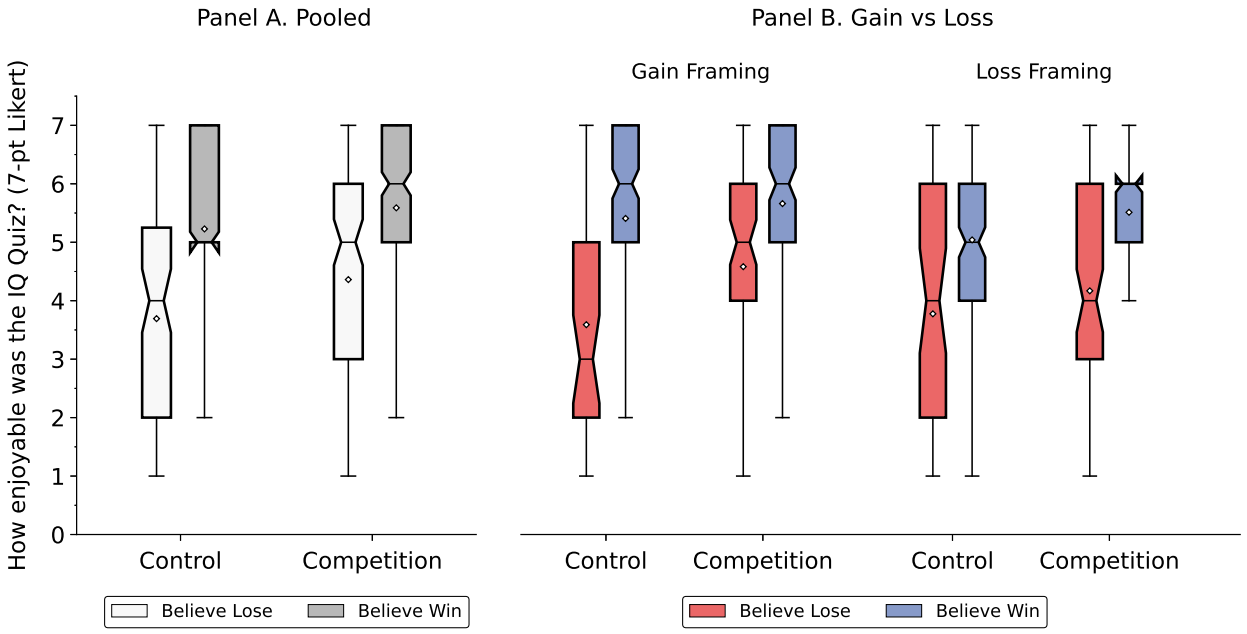
Notes: This figure illustrates the effect of competition on participants' beliefs about winning, measured as an indicator equal to 1 if the participant expects to win and 0 otherwise. In the control group, a belief in winning corresponds to the expectation of surpassing the median threshold score. Panel A displays the distribution of participants who believe they will win (green) versus lose (orange) across experimental conditions (competition vs. control, under gain and loss framing). The dashed line indicates the 50 percent threshold. Panel B shows the estimated effects of competition on the belief in winning, with point estimates and 95% confidence intervals. Under gain framing, competition reduces the belief in winning by 0.146 ($p = 0.001$); under loss framing, the effect is –0.143 ($p = 0.002$). Corresponding regression estimates are reported in Appendix Table B.1.

Panel B shows that these differences are statistically significant: competition reduces the probability of expecting to win by 14.6 percentage points under gain framing (p=0.001) and by 14.3 percentage points under loss framing (p=0.002). Regression estimates are reported in Appendix Table B.1.

This raises the question of why competition lowers individuals' expectations of winning. I propose two hypotheses. First, the opponent score bar, a key feature of the experiment, likely played an important role. This bar, shown only in the competition condition, displayed the opponent's raw score, which rose monotonically over time as it counted only correct but not incorrect answers. By contrast, participants in the control condition faced a fixed median threshold that remained constant throughout the task. Given that participants received no feedback on their own performance, the ever-rising opponent score bar is very likely to bias participants toward more pessimistic beliefs about their chances of success. Second, competition inherently ties one's payoff to others' performance. In the competition condition, outcomes depended on an unpredictable opponent, adding per-

ceived uncertainty that may have undermined confidence in one's ability to succeed. In contrast, the control group's fixed threshold provided a transparent and attainable target, enabling participants to calibrate effort more effectively. Taken together, the dynamic opponent score bar and the opponent-dependent payoff provide a plausible explanation for why competition reduced participants' subjective probability of winning.

Figure 12: Belief in Winning and Utility



Notes: This figure plots self-reported enjoyment by winning beliefs ("believe lose" vs. "believe win") across experimental conditions (competition vs. control). Enjoyment was measured on a 7-point Likert scale in response to the question: "On a scale of 1 (not at all enjoyable) to 7 (extremely enjoyable), how enjoyable was the IQ Quiz Competition (or IQ Quiz)?" Winning belief is defined as an indicator equal to 1 if the participant expects to win and 0 otherwise. Panel A pools observations across gain and loss frames, while Panel B reports them separately. Diamonds indicate mean values.

Figure 12 shows how utility varies with winning beliefs across competition and control conditions. Panel A pools data from gain and loss framings, while Panel B presents them separately. Across all groups, participants who believed they would win experienced significantly higher enjoyment than those who believed they would lose. In the pooled sample, mean enjoyment in the control group is 3.69 for losing beliefs versus 5.23 for winning beliefs, and in the competition group 4.36 versus 5.59. Under gain framing, the corresponding means are 3.59 versus 5.41 in the control group and 4.58 versus 5.66 in the competition group; under loss framing, they are 3.78 versus 5.04 in the control group and 4.17 versus 5.51 in the competition group. Regression estimates confirm these differences: the coefficient on the winning-belief is 1.28 ($p < 0.001$), with corresponding values

of 1.30 ($p < 0.001$) under gain framing and 1.24 ($p < 0.001$) under loss framing.[21] Overall, these results show that believing one will win is strongly and positively associated with higher enjoyment. An interesting pattern is that, regardless of winning or losing beliefs, participants in the competition group derive higher utility than those in the control group.

To explain the positive relationship between winning expectations and utility, two theories are plausible. The first is belief utility: individuals derive utility directly from beliefs about future outcomes (Caplin and Leahy, 2001). For instance, a child may feel anxious when anticipating a dentist appointment, or excited when anticipating a trip to Disneyland. In the experiment, participants may similarly derive utility from anticipating a win. The higher their perceived probability of winning, the greater the utility they experience, and vice versa. The second explanation relates to effort provision. Lower expectations of winning reduce the subjective expected payoff, which can either discourage effort (due to weaker incentives) or motivate greater effort (to improve the chances of winning and securing the reward). As effort changes, utility may also change.

Therefore, the negative impact of competition on utility through the belief channel can be explained via two subchannels. First, competition lowers winning expectations, which directly reduces utility through anticipatory utility. Second, it alters effort provision, which in turn affects utility. Ultimately, the overall effect of the belief channel on utility depends on the relative strength of these two forces. Empirically, however, the effort channel does not appear to play a significant role in the experiment, as competition did not have a statistically significant influence on effort ($p = 0.122$) .[22] Thus, the decline in utility through the belief channel is entirely driven by reduced winning expectations. In short, anticipatory utility is the main driver.

This framework also helps explain why individuals often feel unhappy in highly competitive environments. For instance, students in Indian cram schools or those preparing for the Chinese Gaokao may experience substantial disutility. In such settings, perceived winning probabilities drop sharply, leading to steep declines in utility.

RESULT 2. *Competition affects utility through a belief channel: it reduces utility by lowering individuals' expected probability of winning.*

[21] Regression estimates are obtained from specifications regressing utility on a binary indicator for winning belief (equal to 1 if the participant believes they will win, and 0 otherwise).

[22] The corresponding regression estimates are shown in Appendix Table B.2.

5.3 Intrinsic Utility Channel

Competition can raise utility through an intrinsic utility channel: individuals derive enjoyment directly from the act of competing, independent of outcomes. As shown in Table 2, the baseline specification (columns 1, 3, and 5) captures the overall effect of competition on utility, which reflects both the positive intrinsic utility channel and the negative belief channel. When beliefs are included as controls (columns 2, 4, and 6), the estimated coefficient on competition nearly doubles. This pattern implies that, once the belief channel is netted out, the utility derived purely from competing is positive and sizable. The estimates in columns 2, 4, and 6 thus isolate the intrinsic utility from competition.[23] This effect is robust across both gain and loss framings, and there is no statistically significant difference between the two.

Table 2: Treatments Effects of Competition on Utility

	Dependent Variable: Enjoyment					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	0.25**	0.45***	0.24	0.45***	0.26	0.45***
	(0.12)	(0.12)	(0.17)	(0.16)	(0.18)	(0.17)
Belief in Winning		1.36***		1.39***		1.31***
		(0.14)		(0.20)		(0.20)
Control mean	4.89	4.89	5.05	5.05	4.73	4.73
Observations	787	787	390	390	397	397
R^2	0.01	0.13	0.01	0.13	0.01	0.12

Notes: This table summarizes OLS estimates of the effect of competition on utility, both overall and net of the belief-updating channel. The dependent variable is participants' responses to the question: "On a scale of 1 (not at all enjoyable) to 7 (extremely enjoyable), how enjoyable was the IQ Quiz Competition (or IQ Quiz)?" Competition is a binary indicator equal to 1 for participants in the competitive treatment and 0 for those in the control group. Belief in Winning is an indicator based on post-treatment responses to "Do you think you were the top performer in the IQ Quiz competition?" (or "Do you think you scored 6 or higher on the IQ Quiz?"). The cutoff of 6 corresponds to the median score in the competition group. Columns (1)–(2) use pooled data, while columns (3)–(4) and (5)–(6) report estimates separately for the gain and loss framing conditions. Control means refer to average enjoyment in the control group. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

RESULT 3. *Competition affects utility through an intrinsic utility channel: individuals derive enjoyment from the act of competing itself.*

[23] The logic for attributing this effect to intrinsic utility follows directly from the structure of the channels. The belief channel is tied to subjective expectations of monetary payoffs. Shutting it down implies that the remaining effect must be unrelated to payoffs.

5.4 Discussion

A. Belief versus intrinsic utility channels

The impact of competition on utility depends on the relative strength between two mechanisms: a negative belief channel, which lowers utility by reducing expectations of success, and a positive intrinsic utility channel, which raises utility through the enjoyment of competing. In the IQ quiz competition examined in the experiment, the intrinsic utility channel dominates, leading to a net increase in utility.

More generally, this two-channel framework provides a useful lens for understanding when competition enhances well-being and when it diminishes it. Holding constant factors such as stakes and the importance individuals attach to outcomes, a dominant belief channel tends to make competition feel oppressive and unpleasant. This helps explain why highly competitive job markets often generate stress and dissatisfaction: a sharp decline in the perceived probability of success translates into a steep drop in utility. Conversely, when the intrinsic utility channel dominates, competition becomes a source of pleasure. This explains why casual games with competitive elements are often engaging. The intrinsic enjoyment of competing outweighs the utility costs associated with diminished beliefs about winning.

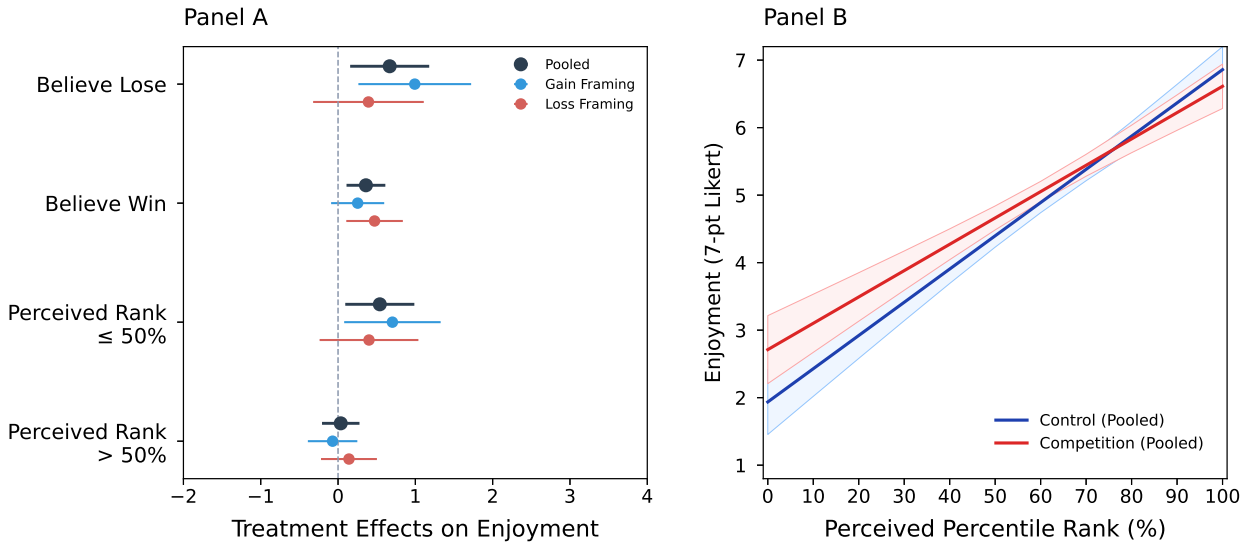
B. Heterogeneity

This subsection analyzes heterogeneity in the effects of competition on utility. In addition to the average treatment effect, I examine whether competition exerts heterogeneous effects within each of two channels: the belief channel and the intrinsic utility channel. The theoretical framework suggests two determinants of utility from competition: (i) individuals' beliefs about their likelihood of winning and (ii) their perceived relative ability.[24] Accordingly, I mainly investigate heterogeneity along these two dimensions and also explore heterogeneity by demographic characteristics, including age, gender, education, and income.

Heterogeneity in Utility. Figure 13 and Table 3 show heterogeneous treatment effects of competition on utility by beliefs about winning and by perceived relative ability. Panel A of Figure 13 shows that competition increases enjoyment for both those who expect to win and those who expect to lose. In the pooled sample, the effect is somewhat larger among those who believe they will lose, though the difference between the two groups is not statistically significant (p=0.242). By contrast, heterogeneity is more pronounced

[24] Relative to their opponent in the competition group or to the median threshold in the control group.

Figure 13: Heterogeneity in Utility by Beliefs in Winning and Perceived Ability



Notes: This figure shows the heterogeneous effects of competition on enjoyment by participants' beliefs about winning and their perceived performance rank. Panel A presents treatment effects for the pooled sample, gain framing, and loss framing. Black markers represent pooled estimates, blue markers represent gain framing, and red markers represent loss framing. Each point corresponds to the estimated mean, with horizontal bars denoting 95% confidence intervals. Panel B plots predicted enjoyment against perceived percentile rank for the pooled sample, ranging from zero to one hundred in increments of ten. Figures for gain and loss framing are provided in Appendix Figure B.4.

when conditioning on perceived ability. Participants who rate themselves below the 50th percentile experience a significant increase in enjoyment under competition, while those who consider themselves above the median show no such effect; the difference between these groups is statistically significant (p=0.034). Regression estimates in Table 3 reinforce these findings and provides additional details. Panel B of Figure 13 offers a more granular depiction of how utility varies with perceived ability in competition and control groups. The results mirror the main takeaway from Panel A: participants who view themselves as relatively low-ranked derive substantially more enjoyment from competition than from the control condition, whereas those who perceive themselves as high-ranked exhibit similar levels of enjoyment across both settings. Gain- and loss-framing treatments have similar patterns, shown in the Appendix Figure B.4.

Figure 14 further documents heterogeneity across demographic groups. With respect to age, the effect of competition on enjoyment is concentrated among individuals aged 40–59 (p = 0.053, pooled sample), whereas the effects for younger participants (18–39) and older participants (60–80) are small and statistically insignificant. By gender, competition significantly increases enjoyment among women (p = 0.040, pooled sample), but not among men; however, the gender difference is not statistically distinguishable (p =

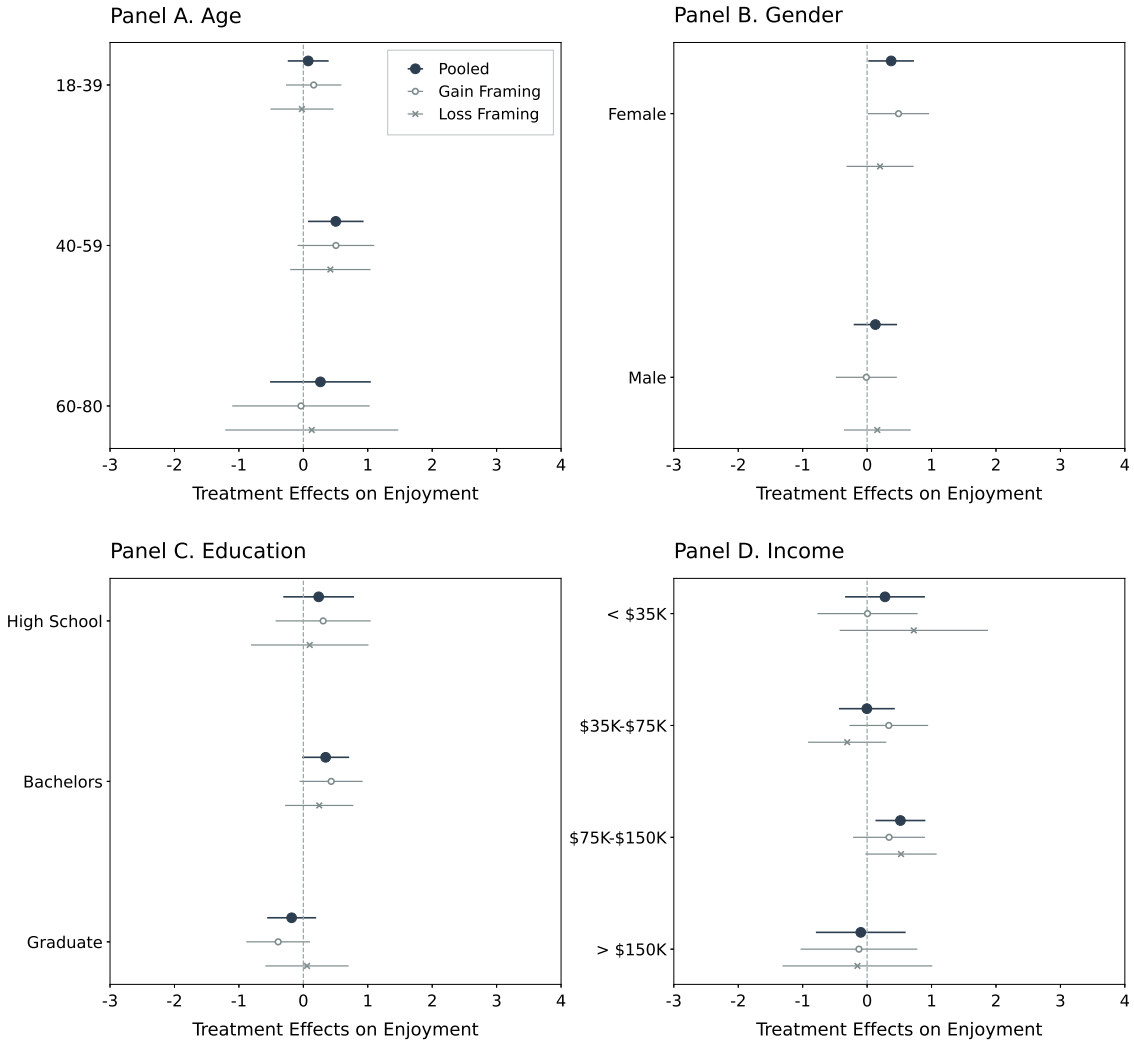
Table 3: Heterogeneity by Beliefs and Perceived Ability

	Dependent Variable: Enjoyment		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Panel A: Belief in Winning			
Competition	0.67**	0.99***	0.39
	(0.26)	(0.37)	(0.36)
Believe Win	1.53***	1.82***	1.26***
	(0.23)	(0.33)	(0.32)
Competition × Believe Win	-0.31	-0.74*	0.08
	(0.29)	(0.41)	(0.41)
Control mean	3.69	3.59	3.78
Observations	787	390	397
R^2	0.13	0.14	0.12
Panel B: Perceived Rank			
Competition	0.54**	0.70**	0.40
	(0.23)	(0.32)	(0.33)
Perceived High Rank	1.81***	2.07***	1.55***
	(0.18)	(0.25)	(0.27)
Competition × Perceived High Rank	-0.51*	-0.77**	-0.26
	(0.26)	(0.36)	(0.37)
Control mean	3.72	3.69	3.76
Observations	787	390	397
R^2	0.19	0.24	0.15

Notes: This table shows heterogeneous treatment effects of competition on utility. The dependent variable is enjoyment, measured on a 7-point Likert scale, with higher values indicating greater enjoyment. Competition is an indicator equal to one if the participant was assigned to the competition condition. In Panel A, heterogeneity is examined by whether participants believed they would win (Believe Win = 1 if the participant expected to win, 0 otherwise). In Panel B, heterogeneity is based on perceived relative rank (Perceived High Rank = 1 if the participant perceived their performance to be above the median, 0 otherwise). Interaction terms capture differential treatment effects by beliefs and perceived ability. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

0.327, pooled sample). Education patterns show that the treatment effect is strongest among respondents with a bachelor's degree (p = 0.063, pooled sample), , while those with only a high school degree or with graduate training exhibit weaker and insignificant effects. Finally, heterogeneity by income reveals that competition significantly increases

Figure 14: Heterogeneity in Utility Across Demographic Groups



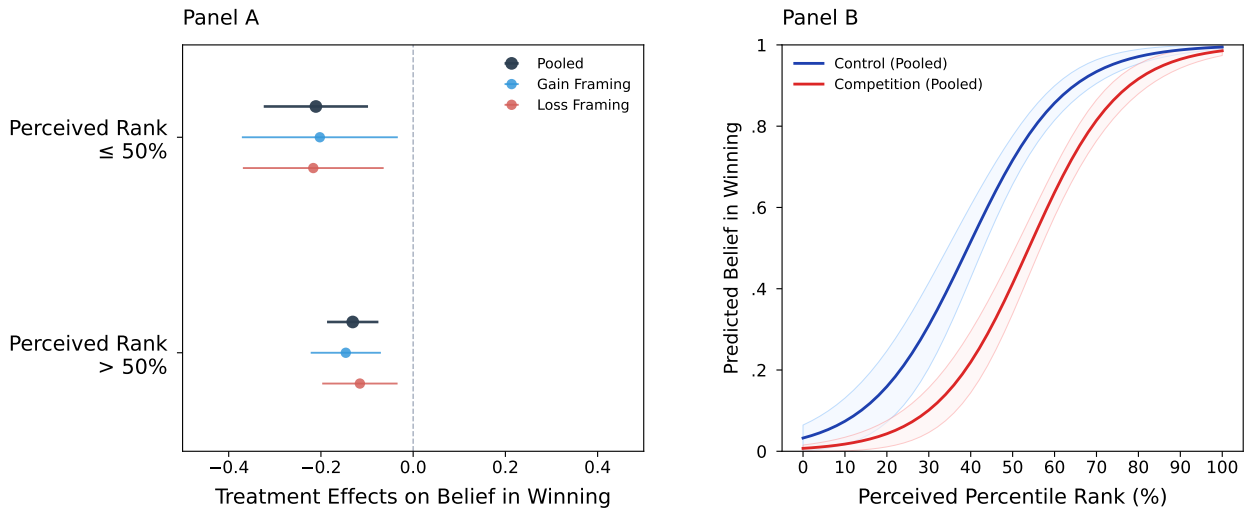
Notes: This figure shows the heterogeneous effects of competition on enjoyment across demographic groups. Enjoyment is measured by asking participants to rate, on a scale from 1 (not at all enjoyable) to 7 (extremely enjoyable), how enjoyable they found the IQ quiz in the control group or the IQ quiz competition in the treatment group. The filled circle denotes the treatment effect for the pooled sample, the hollow circle the gain framing condition, and the star the loss framing condition. All estimates are reported with 95% confidence intervals. Panel A presents results by age groups (18–39, 40–59, and 60–80), Panel B by gender, Panel C by education level (high school, bachelor's, and graduate), and Panel D by income categories ($<$\$35K, \$35K–\$75K, \$75K–\$150K, and $>$\$150K).

enjoyment for individuals with household incomes between \$75,000 and \$150,000 ($p = 0.009$, pooled sample), but not for those with lower or higher income levels.

Heterogeneity in Winning Expectations. As shown above, participants with lower perceived ability experience greater enjoyment from competition than those who consider themselves higher ranked. As discussed in Section 5.2, competition can influence utility

through a belief channel by shaping individuals' expectations of winning. A natural question, therefore, is whether the observed heterogeneity across ability groups arises because competition differentially affects their winning expectations. Figure 15 suggests this is not the case.

Figure 15: Heterogeneity in Belief in Winning by Perceived Ability

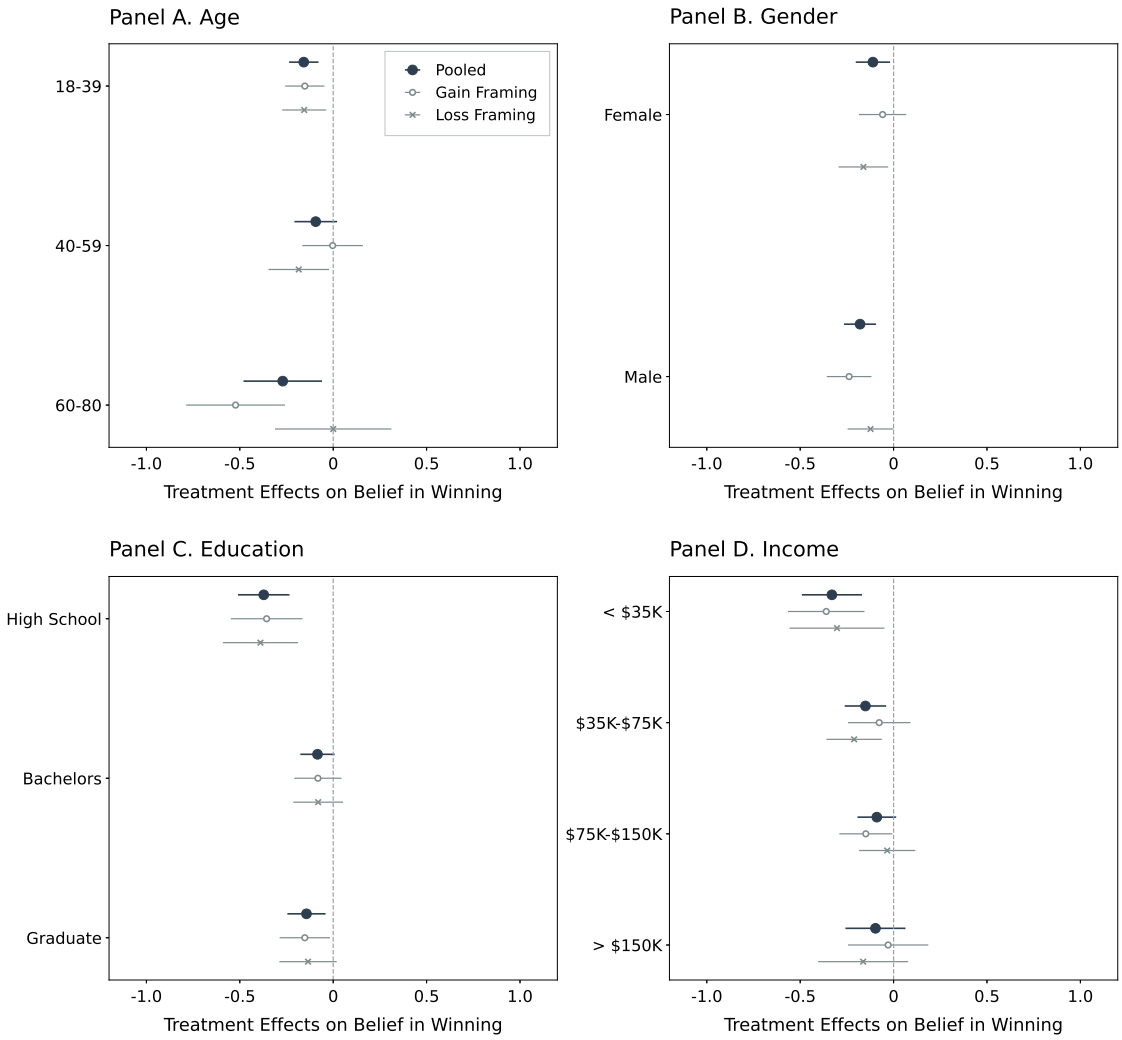


Notes: This figure presents the effect of competition on belief in winning by perceived ability. Panel A shows estimated mean treatment effects with 95% confidence intervals for the pooled sample, the gain-framing condition, and the loss-framing condition. Results are reported separately for individuals who perceived their performance rank to be below or above the median. Belief in winning is a binary variable equal to one if participants believed they would win the IQ quiz competition in the treatment group or pass the threshold score in the control group. Perceived rank is elicited by asking participants to estimate the rank of their performance relative to others. Panel B plots predicted probabilities of belief in winning against perceived percentile rank for the pooled sample, based on estimates from a logit model. Results for the gain- and loss-framing conditions are similar; see Appendix Figure B.5.

Panel A of Figure 15 shows that competition significantly reduces winning expectations for both high- and low-ability participants ($p < 0.001$ for both groups, pooled sample), and the difference between them is not statistically significant ($p = 0.166$, pooled sample). This suggests that the heterogeneity in utility is more likely to come through the intrinsic utility channel, whereby individuals with lower perceived relative ability derive greater enjoyment from competition than their higher-ranked counterparts. This inference is confirmed by the intrinsic-channel heterogeneity evidence presented later in this subsection. Panel B of Figure 15 provides a more detailed view of the relationship between perceived rank and winning expectations across competition and control groups. Consistent with Panel A, participants in the competition condition hold systematically lower beliefs in winning, regardless of whether they view themselves as high or low ability. This pattern appears

not only in the pooled sample but also within both the gain- and loss-framing treatments, as shown in Appendix Figure B.5.[25]

Figure 16: Effect of Competition on Belief in Winning by Demographic Group



Notes: This figure presents the heterogeneous effects of competition on the belief in winning across demographic groups. Belief in winning is a binary variable equal to 1 if participants report expecting to beat their paired opponent in the competition treatment, or to surpass the threshold score in the control group, and 0 otherwise. The filled circle represents the treatment effect for the pooled sample, the hollow circle for the gain-framing condition, and the star for the loss-framing condition. All estimates are shown with 95% confidence intervals. Panel A reports results by age group (18–39, 40–59, and 60–80), Panel B by gender, Panel C by educational attainment (high school, bachelor's, and graduate), and Panel D by income categories (<$35K, $35K–$75K, $75K–$150K, and >$150K).

Figure 16 explores heterogeneity in the effect of competition on winning expectations across demographic subgroups. By age, competition substantially lowers winning expec-

[25]Panel B plots predicted probabilities of winning as a function of perceived rank for the pooled sample, based on estimates from a logit model, since belief in winning is a binary variable.

Table 4: Heterogeneity in Intrinsic Enjoyment by Perceived Ability

	Dependent Variable: Enjoyment		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Competition	0.69***	0.84***	0.56*
	(0.23)	(0.31)	(0.33)
Perceived Rank	1.49***	1.77***	1.21***
	(0.19)	(0.26)	(0.28)
Competition × Perceived Rank	-0.56**	-0.81**	-0.33
	(0.26)	(0.35)	(0.37)
Belief in Winning	0.70***	0.66***	0.73***
	(0.15)	(0.20)	(0.23)
Observations	787	390	397
R^2	0.21	0.26	0.18

Notes: This table reports OLS regressions of enjoyment on competition, perceived performance rank, their interaction, and belief in winning. The dependent variable is enjoyment, measured on a 7-point Likert scale, with larger values indicating greater utility. Competition is a treatment indicator equal to one for participants assigned to the competition group and zero for those in the control group. Perceived Rank denotes participants' self-assessed percentile rank of performance. Columns (1), (2), and (3) present results for the pooled sample, the gain-framing condition, and the loss-framing condition, respectively. Heterogeneity is captured by the interaction between competition and perceived rank. Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

tations among younger participants aged 18–39 ($p < 0.001$, pooled sample)[26] and among older participants aged 60–80 ($p = 0.014$), while the effect for those aged 40–59 is smaller and statistically insignificant ($p = 0.106$). By gender, both women ($p = 0.018$) and men ($p < 0.001$) show declines in winning expectations, with no statistically significant difference between the two groups ($p = 0.284$). In terms of education, the reduction is strongest among participants with a high school degree or less ($p < 0.001$) and among those with graduate training ($p = 0.008$), whereas the effect is smaller and only marginally significant among those with a bachelor's degree ($p = 0.075$). Finally, the income gradient is clear: participants in the lower income groups, earning below $35,000 ($p < 0.001$) or between $35,000 and $75,000 ($p = 0.007$) , exhibit pronounced declines in winning expectations. In contrast, the effect is weaker and statistically insignificant among participants with higher incomes ($75,000–$150,000: $p = 0.100$; above $150,000: $p = 0.245$).

[26] All p-values reported in this paragraph are for the pooled sample.

Table 5: Heterogeneity in Intrinsic Enjoyment Across Demographic Groups

	Dependent Variable: Enjoyment			
	(1)	(2)	(3)	(4)
Competition	0.28*	0.37**	0.70***	0.72**
	(0.15)	(0.17)	(0.26)	(0.29)
Competition × Age (40-59)	0.34			
	(0.26)			
Competition × Age (≥60)	0.34			
	(0.41)			
Competition × Female		0.15		
		(0.23)		
Competition × Bachelor Degree			-0.24	
			(0.31)	
Competition × Graduate Degree			-0.69**	
			(0.32)	
Competition × Income ($35K-$75K)				-0.51
				(0.36)
Competition × Income ($75K-$150K)				-0.10
				(0.34)
Competition × Income (>$150K)				-0.69
				(0.44)
Observations	787	787	787	787
R^2	0.13	0.13	0.15	0.14

Notes: This table reports heterogeneous treatment effects of competition on utility using the pooled sample. Results by gain and loss framing are presented in the Appendix Tables B.3 and B.4. The dependent variable is enjoyment, measured on a 7-point scale where higher values indicate greater enjoyment. Competition is a treatment indicator equal to one for participants assigned to the competition group and zero otherwise. Each column corresponds to a separate regression where competition is interacted with the indicated subgroup characteristic. All specifications include belief in winning as a control. The omitted categories are age 18–39, male, high school or less, and income below $35K, which are coded as zero within their respective groups. For example, age is coded as 0 for ages 18–39, 1 for ages 40–59, and 2 for ages 60 and above; other subgroup variables follow a similar coding scheme. Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Heterogeneity in Intrinsic Enjoyment. The preceding results indicate that heterogeneity in enjoyment across ability groups cannot be explained by differences in winning expectations (belief channel), pointing instead to the intrinsic utility channel as the underlying source. Table 4 provides direct evidence supporting this interpretation. The regression specifications include winning beliefs as controls, effectively shutting down the belief channel and allowing the competition coefficient to be cleanly interpreted as capturing intrinsic enjoyment. The interaction terms are statistically significant, confirming that individuals

who perceive themselves as lower ability derive greater intrinsic enjoyment from competition than those who view themselves as higher ability. This pattern holds in the pooled sample and under gain framing. Under loss framing, the interaction coefficient is not statistically significant, though its magnitude points in the same direction.

Table 5 explores the heterogeneity in intrinsic enjoyment across demographic groups using the pooled sample. Results for the gain and loss framing samples are presented in Appendix Tables B.3 and B.4, which show broadly similar patterns. Among age groups, younger participants (under 40) experience positive enjoyment from competition, with no significant differences relative to those aged 40–59 or 60 and above. For gender, both men and women derive intrinsic enjoyment from competition, and the difference between them is not statistically significant. By education, individuals with a high school degree or less obtain substantial enjoyment, while those with a bachelor's or graduate degree experience lower levels. The reduction relative to bachelor's degree holders is not statistically significant, but the lower enjoyment among graduate degree holders is significant. In terms of income, participants with incomes below $35,000 experience strong and significant enjoyment from competition, while higher-income groups gain somewhat lower enjoyment, though the differences are not statistically significant.

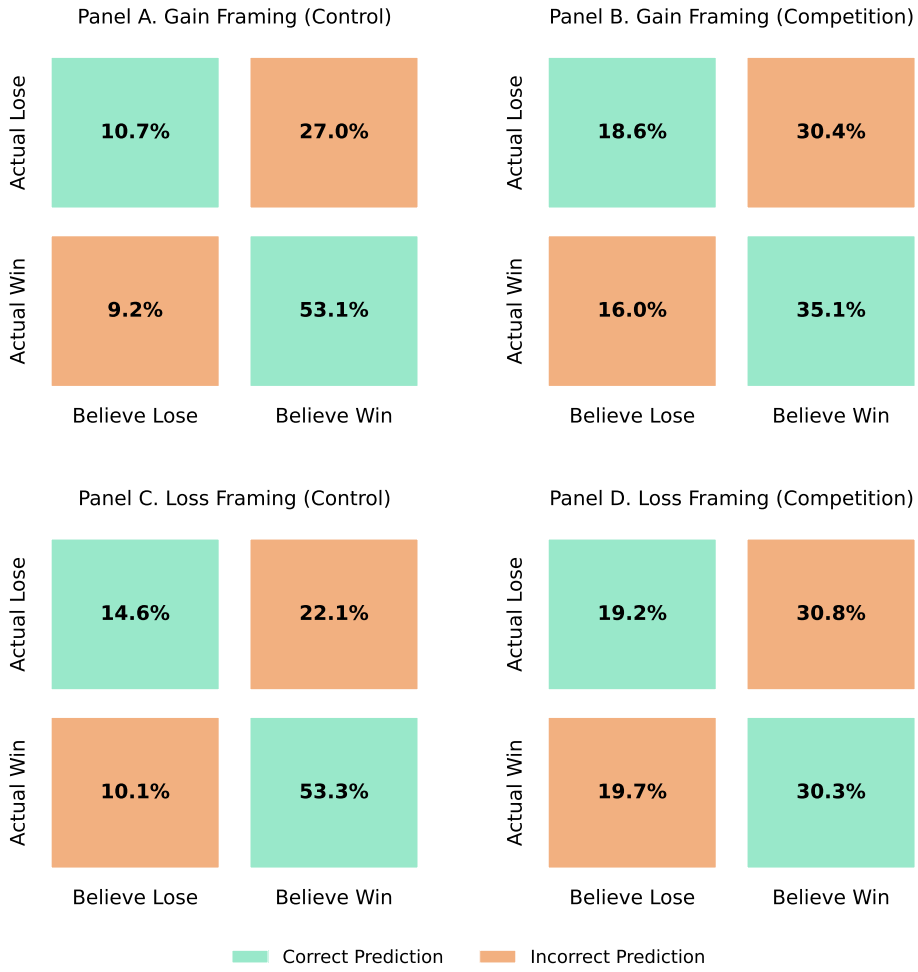
C. Expected versus Actual Outcomes

Welfare assessments should account not only for the utility derived from actual outcomes, but also for the utility generated by the act of competing itself. The utility participants experience from their expectations and the competitive process may differ substantially from the utility they obtain from realized outcomes. Figure 17 illustrates this distinction by comparing anticipated versus actual outcomes: believing one would win vs. actually winning, and believing one would lose vs. actually losing.[27] In the competition group, a correct prediction means participants believed they would beat their opponent and indeed did so; in the control group, it means they expected their score to exceed the threshold and it did. Incorrect predictions capture the opposite cases. Green cells denote accurate predictions, while orange cells denote inaccurate ones.

Overall, participants' predictive accuracy was relatively low, with accuracy rates in the competition groups even lower than in the control groups. As shown in the figure, approximately 65% of participants in the control conditions (both gain and loss framing) predicted correctly, whereas only about 50% of those in the competition conditions did so. This suggests that participants form more accurate expectations when evaluated against a fixed threshold than when competing against an uncertain opponent.

[27] A comparison of expected and actual performance rank in the IQ quiz is in Appendix Figure B.16.

Figure 17: Anticipated versus Actual Outcomes



Notes: This figure presents confusion matrices of participants' anticipated versus actual outcomes across the four experimental conditions (control vs. competition; gain vs. loss framing). Each cell shows the percentage of participants in that category. Green cells denote correct predictions (believing one would win and actually winning; believing one would lose and actually losing), while orange cells denote incorrect predictions (believing one would win but actually losing; believing one would lose but actually winning).

A noteworthy pattern is that around 60% of participants in the competition conditions (gain and loss framing) believed they would win, whereas roughly 80% of participants in the control groups believed they would exceed the threshold. In reality, however, only half of participants in competition could win by design, and as Appendix Figure B.3 shows, nearly 40% of control participants failed to reach the threshold. These findings point to a general tendency toward overconfidence, consistent with prior literature (Niederle and Vesterlund, 2007; Deaves et al., 2010; Bhatt and Smith, 2025). Interestingly, competition appears to attenuate this bias: although participants remained overly optimistic, the gap between expected and actual outcomes was smaller under competition than under

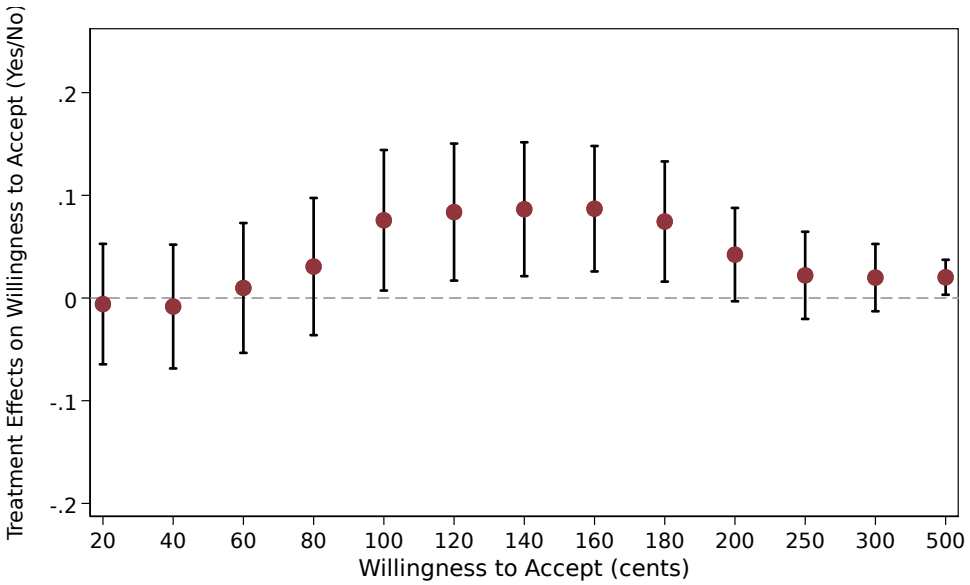
non-competition. This attenuation likely reflects the additional perceived uncertainty introduced by competing against an opponent rather than facing a fixed benchmark.

5.5 Implications and Supplemental Analyses

A. Effects on Task Preference through Attribution Bias

Attribution bias refers to the tendency to misattribute the influence of a temporary state to a stable property of an object or activity. For example, individuals who visit a new restaurant while very hungry may later judge the restaurant as high quality, even if the food itself is mediocre (Haggag et al., 2019). I hypothesize that a similar attribution bias can arise in competitive settings: individuals who feel pleasure during competition may perceive the underlying task as enjoyable and express great willingness to engage in it again, even if they would otherwise find the task only moderately appealing. Conversely, those who experience distress during competition may evaluate the task as less enjoyable and seek to avoid it in future situations. This subsection investigates whether such attribution bias emerges in competitive contexts.

Figure 18: Effects on Task Preference through Attribution Bias



Notes: This figure shows the effect of competition on willingness to perform the experimental task again at different monetary amounts. For each listed amount, the outcome is a binary indicator equal to one if participants stated that they would accept performing the task again for that payment and zero otherwise. The offered amounts are $0.20, $0.40, $0.60, $0.80, $1.00, $1.20, $1.40, $1.60, $1.80, $2.00, $2.50, $3.00, and $5.00. The figure reports results for the pooled sample. Results for the gain- and loss-framing conditions are provided in Appendix Figure **??**.

Table 6: Effects on Task Preference through Attribution Bias

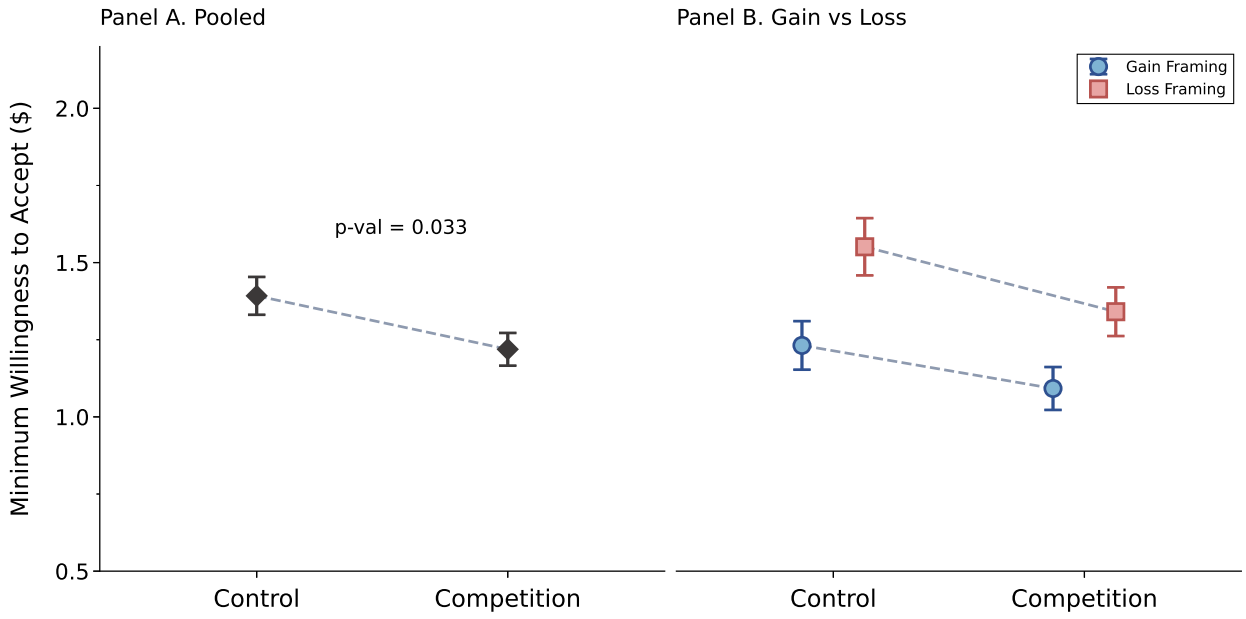
	Competition	Control	Difference	p-value
	(1)	(2)	[(1)-(2)]	(4)
Minimum Willingness to Accept ($)	1.22	1.39	-0.17**	0.03
	(0.05)	(0.06)	(0.08)	
Willing to Accept for 20 cents	0.22	0.23	-0.01	0.84
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 40 cents	0.24	0.25	-0.01	0.79
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 60 cents	0.29	0.28	0.01	0.76
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 80 cents	0.37	0.34	0.03	0.37
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 100 cents	0.64	0.56	0.08**	0.03
	(0.02)	(0.03)	(0.03)	
Willing to Accept for 120 cents	0.69	0.60	0.09**	0.01
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 140 cents	0.72	0.63	0.09**	0.01
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 160 cents	0.78	0.70	0.08**	0.01
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 180 cents	0.81	0.73	0.08**	0.01
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 200 cents	0.90	0.86	0.04*	0.07
	(0.02)	(0.02)	(0.02)	
Willing to Accept for 250 cents	0.91	0.89	0.02	0.31
	(0.01)	(0.02)	(0.02)	
Willing to Accept for 300 cents	0.95	0.93	0.02	0.23
	(0.01)	(0.01)	(0.02)	
Willing to Accept for 500 cents	0.99	0.97	0.02**	0.02
	(0.00)	(0.01)	(0.01)	

Notes: This table reports the effects of competition on willingness to perform the experimental task again at different monetary amounts for the pooled sample. Columns (1) and (2) present mean acceptance rates in the competition and control groups, respectively. Column (3) reports the difference between the two groups, and column (4) provides the associated p-values. Standard errors are shown in parentheses. The outcome variable is a binary indicator equal to one if participants accepted performing the task again at the specified payment amount and zero otherwise. The first row reports the estimated minimum willingness to accept (WTA) in dollars. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 18 presents evidence of attribution bias in competitive scenarios using the pooled sample. Appendix Figure B.6 shows separate results for gain and loss framing, which follow a similar pattern. When participants were offered between $1.00 and $1.80 to repeat

the IQ quiz, acceptance rates in the competition groups were significantly higher than in the non-competition groups. Regression estimates in Table 6 confirm these differences.[28] This suggests that individuals perceive the task as more appealing under competition than under non-competition conditions, consistent with the finding that utility is higher in competitive settings. Detailed acceptance rates at each monetary amount are shown in Table 6. For smaller incentives ($0.20–$0.80), roughly 20–30 percent of participants accepted the task, with no difference between competition and control groups. For higher incentives ($2.00 and above), acceptance rates exceeded 90 percent in both groups, and again no statistically significant difference between competition and control groups.

Figure 19: Effects on Task Preference through Attribution Bias



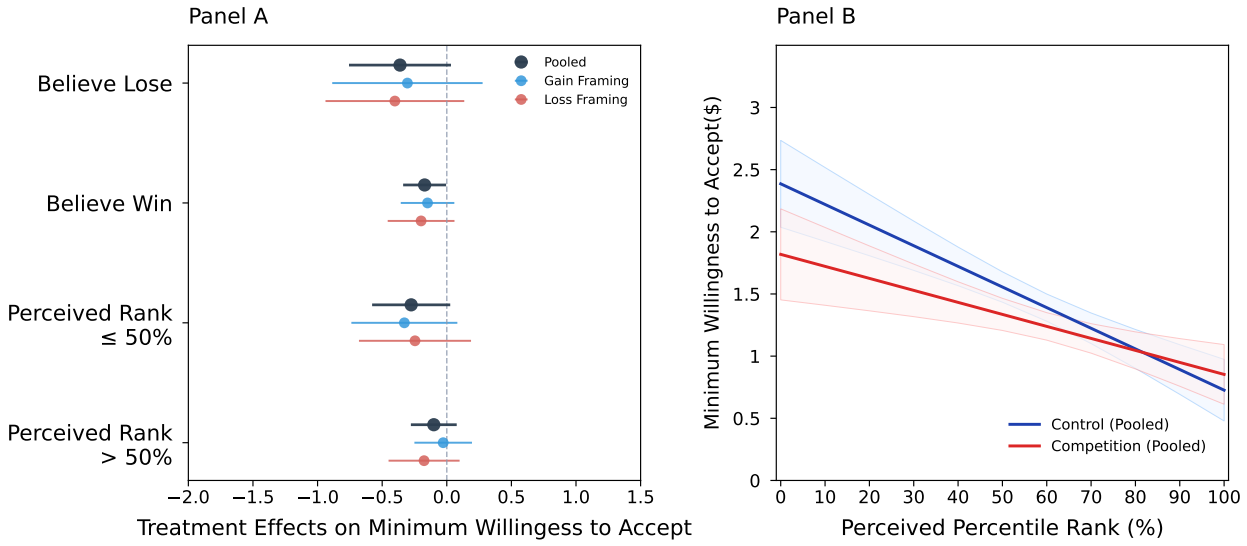
Notes: This figure shows the effect of competition on task preference. Panel A presents pooled results, and Panel B reports results separately for the gain- and loss-framing conditions. The horizontal axis indicates the treatment groups (Control vs. Competition), and the vertical axis reports the minimum willingness to accept (WTA), measured as the minimum amount of money required to perform the task again. The exact survey wording is provided in Appendix Section C.6. Each point represents the mean minimum WTA for the corresponding group, with 95% confidence intervals. The pooled comparison is statistically significant ($p = 0.033$). The differences in Panel B are not statistically significant ($p = 0.185$ for gain framing and $p = 0.085$ for loss framing).

Another useful measure of participants' willingness to repeat the IQ quiz after exposure to competition or non-competition is the minimum Willingness to Accept (WTA).[29] This

[28] Appendix Tables B.5 and B.6 show analogous results for gain and loss framing scenarios.

[29] A supplementary measure of task preference is an unincentivized question that asked participants, on a scale from 1 to 7, how likely they were to take another similar IQ quiz without monetary rewards. The corresponding figure and regression results for this measure are shown in the Appendix Figure B.10 and Appendix Table B.8.

Figure 20: Heterogeneity in Task Preference by Beliefs and Perceived Ability



Notes: This figure shows the heterogeneous effects of competition on minimum willingness to accept (WTA) to perform the experimental task again, by participants' beliefs about winning and their perceived performance rank. Panel A reports treatment effects for the pooled sample, the gain-framing condition, and the loss-framing condition. Black markers represent pooled estimates, blue markers represent gain framing, and red markers represent loss framing. Each point corresponds to the estimated mean, with horizontal bars denoting 95% confidence intervals. Panel B plots predicted minimum WTA as a function of perceived percentile rank, ranging from 0 to 100 in increments of 10. Results for the gain- and loss-framing conditions are provided in Appendix Figure B.4.

measure is defined as the lowest monetary amount at which an individual switches from rejecting to accepting the task and subsequently accepts all higher offers. A higher minimum WTA indicates that participants find the task less enjoyable, as they require greater monetary compensation to perform it again. Conversely, a lower minimum WTA suggests that participants find the task more appealing, as they require less financial compensation. Figure 19 shows that the average minimum WTA was \$1.39 in the control group and \$1.22 in the competition group using the pooled data, demonstrating that competition reduces the min WTA ($p = 0.033$). This implies that participants perceive the IQ quiz as more enjoyable in competitive than in non-competitive settings, consistent with the evidence from Figure 18. Panel B shows the results by framing: overall, the minimum WTA was lower under gain framing than under loss framing ($p < 0.001$), consistent with earlier findings that utility is higher under gain framing. However, the treatment effects did not differ significantly across frames ($p = 0.660$).

Regarding heterogeneity in the impact of competition on task preferences, Table 3 shows that regardless of whether participants expect to win or lose, those in competition groups are more willing to repeat the IQ quiz than those in non-competition groups.

This aligns with earlier findings that competition raises utility regardless of expected outcomes. Moreover, the positive impact of competition on task preference is stronger among participants with low perceived ability than among those with high perceived ability. This result is also consistent with earlier evidence that competition increases utility more for individuals with lower perceived ability. While some of these heterogeneous effects on task preferences are estimated with limited statistical power,[30] their consistency with prior evidence on utility strengthens the main results in Section 5.4 and further supports the presence of attribution bias.

RESULT 4. *Participants who enjoy competition rate the task as more appealing, indicating the presence of attribution bias in strategic contexts of competition.*

B. Effects on Emotional Components of Utility

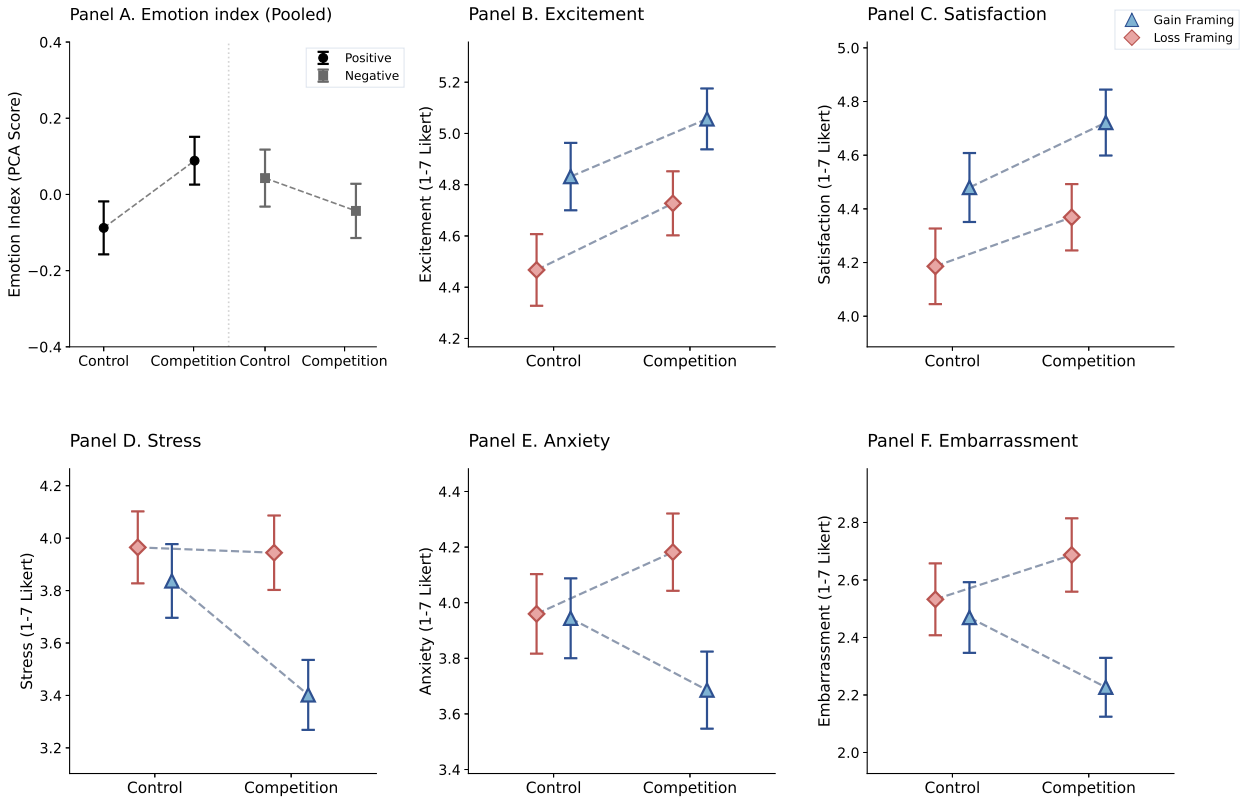
Utility, as a measure of overall happiness, can be decomposed into specific emotional components. Figure 21 illustrates how competition affects excitement, satisfaction, stress, anxiety, and embarrassment. Excitement and satisfaction are classified as positive emotions, whereas stress, anxiety, and embarrassment are classified as negative. All emotions were measured on a 7-point Likert scale, with higher values indicating stronger intensities. Panel A of Figure 21 documents the general pattern that competition increases positive emotions while reducing negative ones using the pooled sample. Panels B and C show that competition raises excitement and satisfaction in the IQ quiz, irrespective of whether the payoff is framed as a gain or a loss. Panels D, E, and F indicate that competition reduces stress, anxiety, and embarrassment under gain framing, while potentially increasing them under loss framing. Individuals are generally more excited and satisfied, and less stressed, anxious, and embarrassed, when payoffs are framed as gains rather than losses. While these findings provide valuable insights into the emotional consequences of competition, it should be noted that some effects are estimated with limited statistical power. The specific regression estimates are in Appendix Tables B.9 and B.10.[31]

Columns 1, 3, 5, and 7 of Table 7 shows the treatment effects of competition on positive and negative emotions under gain and loss framing, respectively. Together with columns 2, 4, 6, and 8, these specifications illustrate the belief and intrinsic utility channels discussed in Section 5.2 and Section 5.3. Introducing the "belief in winning" variable shuts down the

[30] The relevant regression estimates are shown in Appendix Table B.7

[31] Appendix Figure B.7 shows bar graphs for each emotional component using the pooled sample. Appendix Figures B.8 and B.9 present the distribution of emotional components under gain and loss framing, respectively.

Figure 21: Treatment Effects of Competition on Emotional Components of Utility



Notes: This figure shows the treatment effects of competition on the emotional components of utility, including positive emotions (excitement, satisfaction) and negative emotions (stress, anxiety, embarrassment). These emotions are measured using 7-point Likert scale questions administered after the experimental task. Higher values indicate stronger experiences of the respective emotion. Panels B–F display mean values of participants' responses to each emotion question across the four experimental treatments (control vs. competition, under gain vs. loss framing), with 95% confidence intervals. Panel A summarizes these measures into an overall emotion index constructed using principal component analysis (PCA). Detailed regression estimates of the effects of competition on each emotional component of utility are provided in Table 7, and Appendix Table B.9 and B.10.

belief channel and isolates the intrinsic emotional effect of competition on specific emotional components. The change in the competition coefficients after controlling for belief in winning suggests that competition, through the belief channel, lowers expectations of winning, which reduces positive emotions and increases negative emotions. The intrinsic utility channel, however, indicates that competition itself generates positive emotions under both gain and loss framing, and mitigates negative emotions under gain framing, though less so under loss framing.

Figure 22 illustrates heterogeneity in the effect of competition on positive and negative emotions by beliefs about winning and perceived relative ability. Panel A shows that competition raises positive emotions regardless of whether participants expect to win or lose.

Table 7: Treatment Effects of Competition on Positive and Negative Emotions

	Positive Emotion Index				*Negative Emotion Index*			
	Gain Framing		Loss Framing		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Competition	0.18	0.33***	0.17	0.31**	-0.29**	-0.37***	0.11	0.02
	(0.13)	(0.12)	(0.14)	(0.13)	(0.14)	(0.14)	(0.15)	(0.15)
Belief in Winning		1.03***		0.95***		-0.56***		-0.60***
		(0.15)		(0.14)		(0.17)		(0.17)
Control mean	0.04	0.04	-0.21	-0.21	0.04	0.04	-0.21	-0.21
Observations	390	390	397	397	390	390	397	397
R^2	0.01	0.13	0.00	0.11	0.01	0.04	0.00	0.04

Notes: This table reports the treatment effects of competition on the emotion index. The positive emotion index (columns 1–6) is constructed from measures of excitement and satisfaction, while the negative emotion index (columns 7–10) is constructed from measures of stress, anxiety, and embarrassment, using principal component analysis (PCA). Estimates are reported separately for the gain-framing and loss-framing conditions. "Competition" is an indicator for assignment to the competition treatment. "Believe Win" captures participants' belief that they would win the competition. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

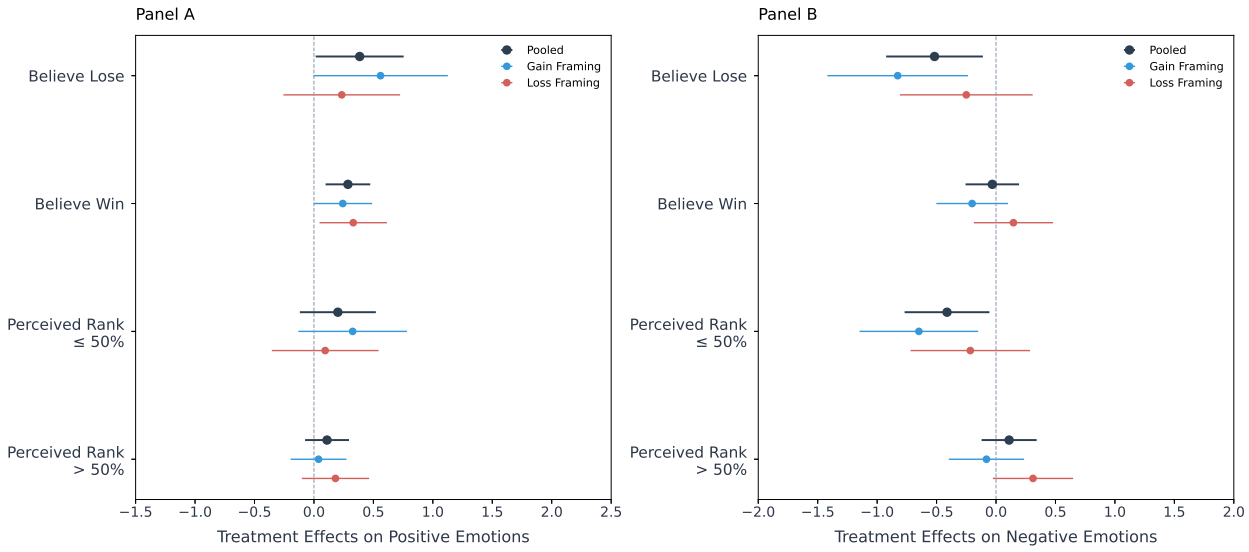
Panel B indicates that competition lowers negative emotions when participants expect to lose, but has no such effect when they expect to win. With respect to perceived ability, measured by participants' self-assessed percentile rank in task performance, competition reduces negative emotions only among those who view their relative ability as low, while effects are negligible for participants who perceive high relative ability.

RESULT 5. *Through the belief channel, competition reduces positive emotions and increases negative ones, whereas through the intrinsic utility channel, it does the opposite: it generates positive emotions and reduces negative ones.*

6 Results: Competition and Social Preferences

This section investigates whether exposure to a competitive environment leaves a lasting imprint on individuals, shaping their preferences and beliefs even after the competition has ended. I focus on altruistic behavior and zero-sum thinking. Section 6.1 shows that competition fosters greater altruism, while Section 6.2 demonstrates that competition reduces zero-sum thinking.

Figure 22: Heterogeneity in Emotional Components by Beliefs and Perceived Ability

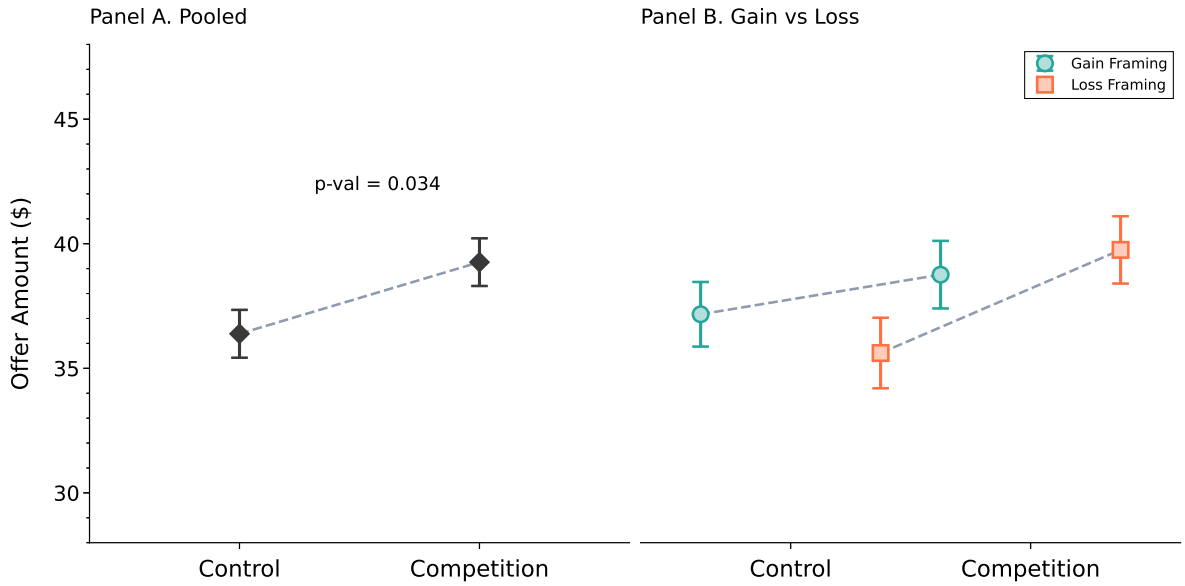


Notes: This figure shows the heterogeneous treatment effects of competition on positive and negative emotions. Positive emotions include excitement and satisfaction, while negative emotions include stress, anxiety, and embarrassment. All emotions are measured on a 7-point Likert scale. Panel A reports the effects on positive emotions for the pooled sample as well as under gain and loss framing, and Panel B reports the corresponding effects on negative emotions. Dots represent mean estimates, and horizontal bars indicate 95% confidence intervals.

6.1 Effects of Competition on Altruism

Competition increases altruism. Figure 23 illustrates the effect of competition on altruism, measured through a dictator game. Following Enke et al. (2023)'s approach for the dictator game, participants were asked to decide how to allocate $100 between themselves and another participant. The decision was presented in an vivid interface to ensure clarity and engagement (see Figure C.8). Higher transfers indicate greater altruism. Panel A of Figure 23 presents results for the pooled sample. Participants in the control group offered an average of $36.38 to their randomly matched partner, while those in the competition group offered $39.26, indicating an increase of 7.92 percent ($p = 0.034$). Panel B of Figure 23 shows the results by framing condition separately. Under gain framing, offer amounts increased from $37.16 to $38.75 ($p = 0.397$). Under loss framing, offers rose from $35.61 to $39.75 ($p = 0.035$). While the effect under gain framing is not statistically significant, it points in the same direction as the pooled estimate. The lack of significance is likely due to limited statistical power rather than the absence of an effect. Full regression estimates are provided in columns 1, 3, and 5 of **??**. Although the treatment effects differ in magnitude across gain and loss framing, their difference is not statistically significant ($p = 0.347$).

Figure 23: Treatment Effects of Competition on Altruism

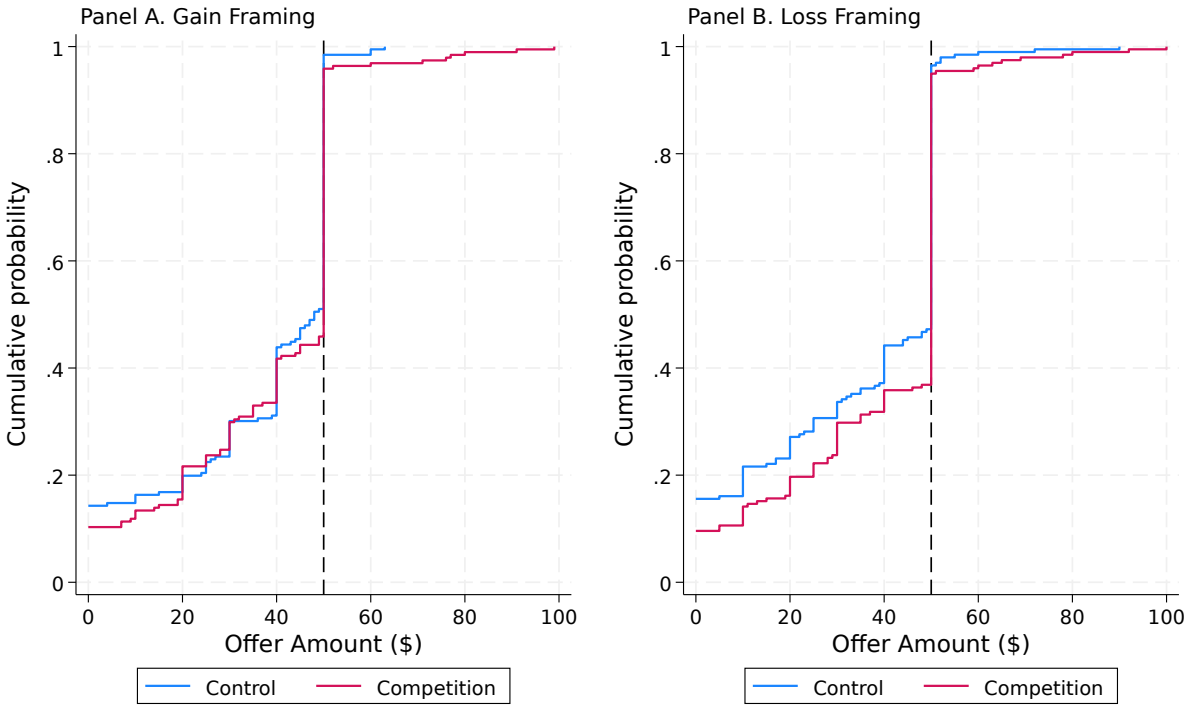


Notes: This figure shows the effect of competition on altruism, measured using a dictator game in which participants allocated $100 between themselves and another participant. The outcome is the amount offered to the partner. The figure illustrates mean offers across the four treatment groups (gain framing vs. loss framing; control vs. competition) with 95% confidence intervals. Panel A shows results for the pooled sample, and Panel B shows results separately by gain and loss framing. Corresponding regression estimates are provided in Appendix Table B.13.

Furthermore, Figure 24 shows the cumulative distribution of offer amounts. Overall patterns are broadly similar across gain and loss framing, with some notable differences. Under gain framing (Panel A), the distributions for the control and competition groups nearly coincide: about half of participants in each group allocated exactly $50, the equal split, while the rest offered less than $50. Under loss framing (Panel B), however, approximately 60 percent of participants in the competition group chose the equal split, compared to 50 percent in the control group. This suggests that competition increases generosity under loss framing. This distributional pattern is consistent with the results in Panel B of Figure 23, which shows a stronger effect of competition under loss framing than under gain framing. The distribution for the pooled sample is shown in Appendix Figure B.12.

Figure 25 illustrates the heterogeneous effects of competition on altruism by participants' beliefs about winning and by their perceived ability. Panel A of Figure 25 indicates that participants who believed they would win, or who rated their ability above the median, offered significantly more amounts in the competition condition than in the control group. In contrast, participants who expected to lose or who rated their ability below the median showed no significant differences. One interpretation for this pattern is that enjoyable competing experience motivates more altruistic behavior when individuals expect

Figure 24: Cumulative Distribution of Offer Amounts by Treatment Condition

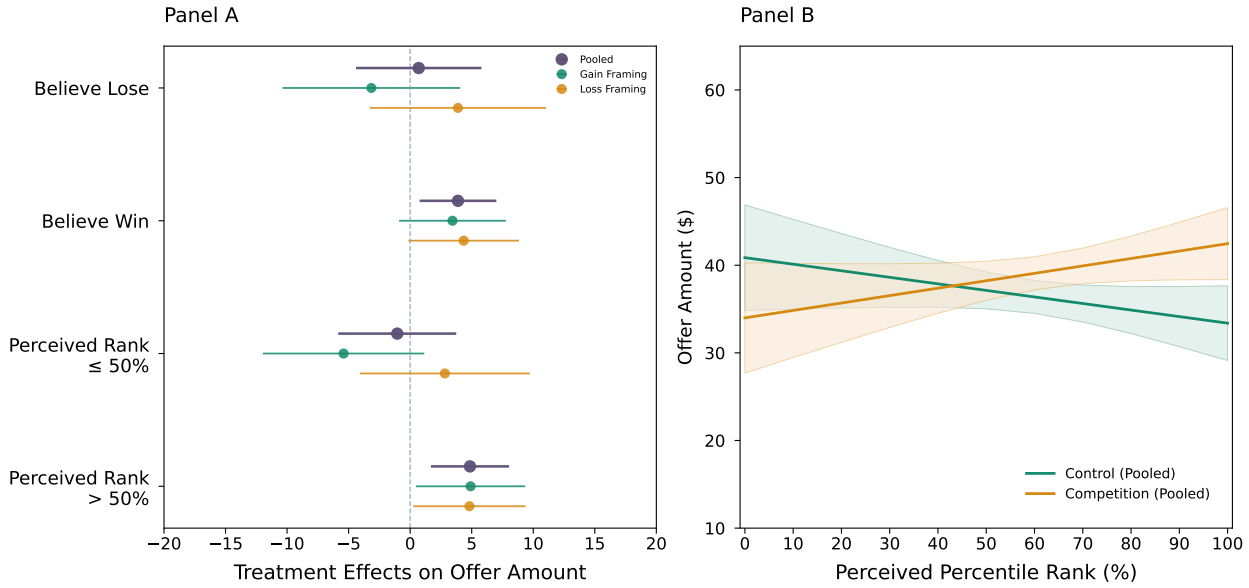


Notes: This figure displays the cumulative distribution of offer amounts in the dictator game by treatment condition. In the game, participants allocated $100 between themselves and another participant. Panel A shows the distribution under gain framing, and Panel B shows the distribution under loss framing. Blue lines represent the control group and red lines represent the competition group. The pooled distribution is provided in Appendix Figure B.13.

monetary payoff. Detailed regression results are shown in the Appendix Table B.12 and B.11. Panel B of Figure 25 provides a more detailed view of altruism in the control and competition groups across the distribution of perceived ability. The same pattern emerges: among participants who rated their ability above the median, those in the competition group gave substantially more than those in the control group. The results are similar under both gain- and loss-framing, as shown in Appendix Figure B.14. By contrast, little heterogeneity is observed across age, gender, education, or income (Appendix Figure B.15).

Finally, I examine prosocial behavior in a public goods game, where individuals decide whether to contribute their endowment to a common pool and are then asked about the percentage of others they believe choose not to contribute. Results show that competition does not have a statistically significant effect on either contribution decisions or beliefs about the share of others not contributing. Regression estimates are in Appendix Table

Figure 25: Heterogeneous Effects on Altruism by Beliefs in Winning and Perceived Ability



Notes: This figure shows the heterogeneous effects of competition on altruism by participants' beliefs about winning and their perceived performance rank. Panel A presents treatment effects for the pooled sample, the gain-framing condition, and the loss-framing condition. Black markers indicate pooled estimates, green markers indicate gain framing, and orange markers indicate loss framing. Each marker shows the estimated mean, with horizontal bars denoting 95 percent confidence intervals. Panel B plots predicted altruism, measured by the offer amount in the dictator game, as a function of perceived percentile rank (0–100, in increments of 10). Shaded areas indicate 95% confidence intervals. Results for the gain- and loss-framing conditions are reported in Appendix Figure B.14.

B.15.[32]

RESULT 6. *Enjoyable competing experience increases post-competition altruism, compared to non-competitive scenarios where outcomes depend solely on meeting a fixed threshold.*

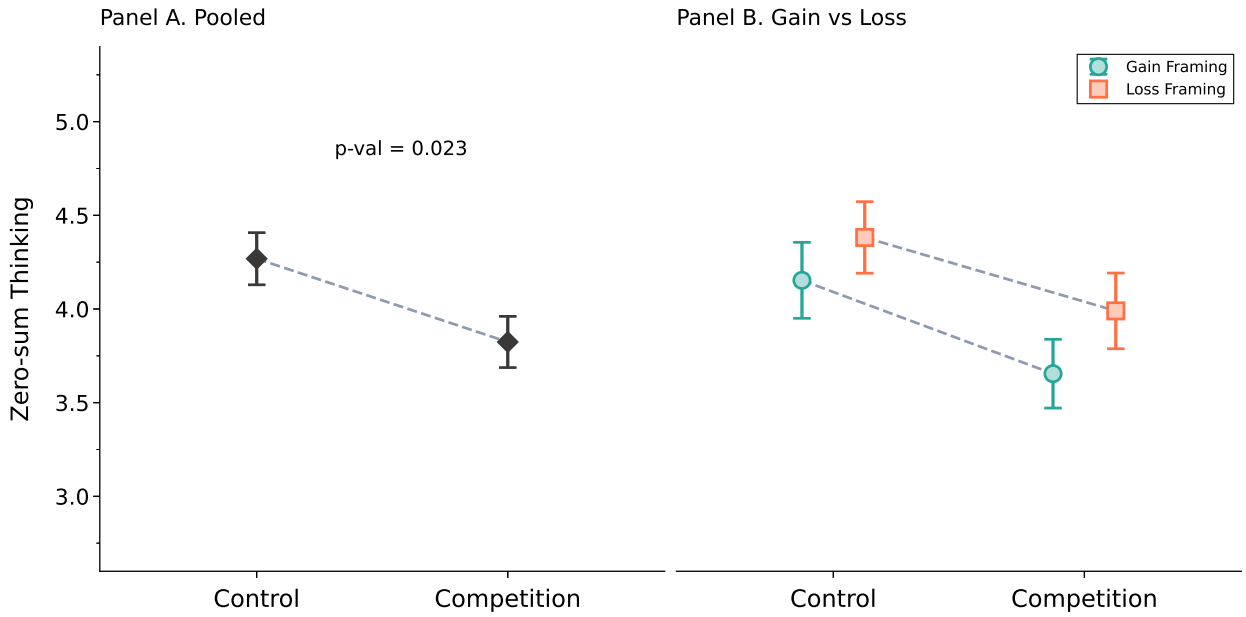
6.2 Effects of Competition on Zero-sum Thinking

Competition reduces zero-sum thinking. I measure zero-sum thinking using an item from the World Values Survey (Inglehart et al., 2014), administered after the competition ended. Respondents rated their agreement on a scale from 1 to 10, where 1 corresponds to the non–zero-sum statement 'Wealth can grow so there's enough for everyone,' and 10 corresponds to the zero-sum statement 'People can only become wealthy at the expense of others.' Higher values indicate stronger zero-sum thinking.

Panel A of Figure 26 shows the results for the pooled sample. The control group mean is

[32]The distribution of beliefs is presented in Appendix Figure B.17.

Figure 26: Treatment Effects of Competition on Zero-sum Thinking

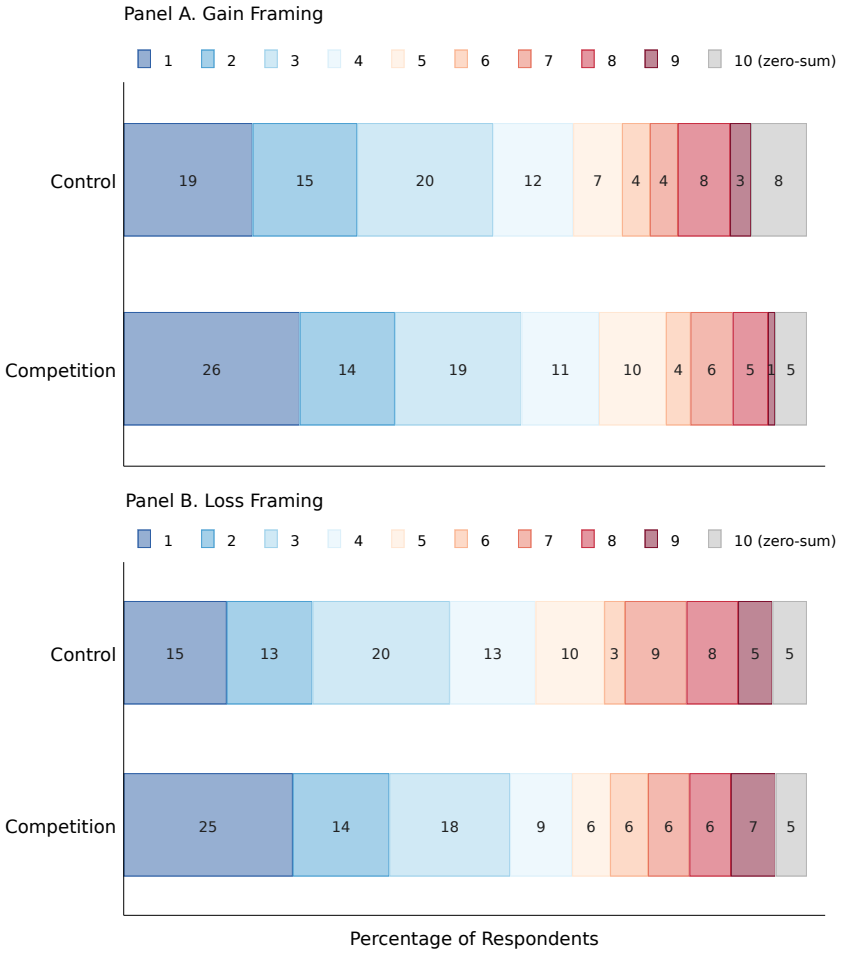


Notes: This figure shows the effect of competition on zero-sum thinking. Zero-sum thinking is measured using a World Values Survey question (Inglehart et al., 2014) in which respondents rate their agreement, on a 1–10 scale, between two statements: "Wealth can grow so there's enough for everyone" (1, indicating minimal zero-sum thinking) and "People can only become wealthy at the expense of others" (10, indicating strong zero-sum thinking). Higher values on the y-axis therefore represent stronger zero-sum thinking. The figure displays the average response values for the four treatment groups (gain framing vs. loss framing; control vs. competition), with 95% confidence intervals. Panel A presents results for the pooled sample, while Panel B show results by gain and loss framing separately. Regression estimates are reported in Appendix Table B.13.

4.24, compared to 3.85 in the competition group ($p = 0.023$), indicating that competition reduces zero-sum thinking. Panel B of Figure 26 presents the results separately for the gain- and loss-framing conditions. The same pattern appears: under gain framing, the mean falls from 4.12 to 3.69 ($p = 0.069$); under loss framing, it falls from 4.36 to 3.99 ($p = 0.159$). While these differences are not statistically significant, they point in the same direction as the pooled results. An interesting pattern is participants display somewhat stronger zero-sum beliefs under gain framing than under loss framing ($p = 0.150$), but the difference is not statistically significant ($p = 0.150$). Finally, the difference in the effect of competition on zero-sum thinking between gain- and loss-framing conditions is negligible ($p = 0.785$). Corresponding regression estimates are in Appendix Table B.13.

Besides average treatment effects, it is informative to examine the distribution of responses across the 1–10 scale. Figure 27 displays these distributions under gain and loss framing. The overall patterns are quite similar across the two framings, but the differences between competition and control groups are pronounced. In both framings, a larger

Figure 27: Zero-Sum Thinking Distribution by Treatment and Framing Condition



Notes: The figure displays the distribution of responses on the zero-sum scale under gain framing (Panel A) and loss framing (Panel B). Zero-sum beliefs are measured using a World Values Survey item (Inglehart et al., 2014), where respondents rate their agreement on a 1–10 scale between the statements: "Wealth can grow so there's enough for everyone" (1, indicating minimal zero-sum thinking) and "People can only become wealthy at the expense of others" (10, indicating strong zero-sum thinking). Higher values correspond to stronger endorsement of zero-sum beliefs. Percentages indicate the share of respondents selecting each scale point within the control and competition groups.

share of participants in the competition group select the non–zero-sum endpoint. Under gain framing, 26% of competition participants fully endorsed the non–zero-sum view, compared to 19% in the control group. Under loss framing, the shares are 25% versus 15%. These shifts suggest that competition reduces zero-sum thinking by shifting more participants toward non–zero-sum beliefs. The distribution for the pooled data is shown in Appendix Figure B.12.

A caveat is in order: this conclusion may not generalize. While the World Values Survey item indicates that competition reduces zero-sum thinking, an alternative measure based

on the immigrant–local job tradeoff described in Section 3.1 shows no significant treatment effects.The corresponding results are presented in Appendix Figure B.11, with regression estimates in Appendix Table B.14.

7 Conclusion

In this paper, I study the utility effects of competition itself, independent of any utility derived from competition outcomes. Using a simple conceptual framework and a series of pre-registered experiments, I show that competition influences utility through two opposing channels. The belief channel lowers expected chances of success and thereby reduces utility, while the intrinsic-utility channel generates positive utility from the very act of competing. When the intrinsic channel dominates, competition raises overall utility. This explains contexts such as electronic games, where competition enhances enjoyment. Conversely, when the belief channel dominates, competition reduces utility. This can be illustrated by settings such as cram schools, where competitive pressure diminishes well-being. Experimental evidence further indicates that framing outcomes in terms of gains or losses does not materially alter the effect of competition on utility.

These findings carry several implications. First, competitive experiences shape individuals' beliefs about the enjoyment of tasks. The evidence reveals an attribution bias in competitive contexts: individuals who enjoy competing also report greater anticipated enjoyment of the underlying task, likely misattributing the utility of competition to the task itself. Second, the results show that enjoyable competitive experiences can foster altruism and reduce zero-sum thinking. Notably, these effects do not differ significantly by gender.

In sum, the act of competing itself constitutes an important source of utility, with broad consequences for welfare. Competition not only allocates resources and shapes effort, but also transforms how individuals experience economic interactions, with lasting implications for beliefs, preferences, and social behavior.

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APPENDIX

A Theoretical Appendix

A.1 Optimal Effort

This subsection derives the optimal effort $e^{*,f}_{i,s}$ for any incentive structure $s \in \{T, C\}$ and frame $f \in \{G, L\}$. For brevity, suppress the subscript i. Under (s, f), the utility $U^{s,f}(e)$ is,

$$P^s(e) \cdot v\big(w^{win,f}\big) + \big(1 - P^s(e)\big) \cdot v\big(w^{lose,f}\big) - c(e) \; + \; u(P^s(e)) \; + \; \psi^f \, \mathbf{1}_{\{s=T\}} \tag{A.1}$$

Collect the two terms that are linear in $P^s(e)$ and rearrange the equation,

$$P^s(e) \cdot (v\big(w^{win,f}\big) - v\big(w^{lose,f}\big)) - c(e) \; + \; u(P^s(e)) \; + \; \psi^f \, \mathbf{1}_{\{s=T\}} + v\big(w^{lose,f}\big) \tag{A.2}$$

The last two terms do not depend on e. Assume P^s is continuously differentiable and strictly increasing (i.e., $P^{s\prime}(e) > 0$), u is continuously differentiable, and c is continuously differentiable, strictly increasing, and convex, with $c(0) = 0$, $c'(\cdot) > 0$ and $c''(\cdot) \geq 0$. The first order condition for an optimal effort level e^* is

$$c'(e^*) = P^{s\prime}(e^*)\Big(v\big(w^{win,f}\big) - v\big(w^{lose,f}\big) + u'\big(P^s(e^*)\big)\Big) \tag{A.3}$$

Optimal effort equalizes marginal cost with marginal improvement in success probability multiplied by the sum of the monetary payoff spread and the marginal belief utility. Consider the reference-dependent value function

$$v(x) = \begin{cases} x, & x \geq 0, \\ \lambda x, & x < 0, \end{cases} \qquad (\lambda > 1)$$

and the payoff structure $(w^{win,G}, w^{lose,G}) = (w^{win}, 0)$, $(w^{win,L}, w^{lose,L}) = (0, -w^{win})$, the optimal effort under a gain frame satisfies

$$c'(e^*) = P^{s\prime}(e^*)\Big(w^{win} + u'\big(P^s(e^*)\big)\Big) \tag{A.4}$$

and the optimal effort under a loss frame satisfies

$$c'(e^*) = P^{s\prime}(e^*)\Big(\lambda w^{win} + u'\big(P^s(e^*)\big)\Big) \tag{A.5}$$

A.2 Belief Channel

This subsection proves Prediction 1. Fix $f \in \{G, L\}$. Under Assumption 1, I show that, when evaluated at the respective optima, the competitive setting yields (weakly) lower expected utility from monetary payoffs and belief utility, as stated in Section 2.

Proposition 1. *Fix a frame $f \in \{G, L\}$. Under Assumptions 1, the expected utility from monetary payoffs is (weakly) lower in the competitive setting than in the non-competitive setting when evaluated at the respective optima:*

$$U_{i,money}^{T,f}\big(e_T^{*,f}\big) \;\le\; U_{i,money}^{C,f}\big(e_C^{*,f}\big).$$

Proof. Fix $f \in \{G, L\}$ and define, for $s \in \{T, C\}$,

$$U_{\text{money}}^{s,f}(e) = \Delta v^{\,f}\, P^s(e) - c(e) + v\big(w^{lose,f}\big),$$

$$\Delta v^{\,f} := v\big(w^{win,f}\big) - v\big(w^{lose,f}\big) > 0.$$

By Assumption 1, for every effort level $e \ge 0$, $P^T(e) \le P^C(e)$. Hence, for the *same* e,

$$U_{\text{money}}^{T,f}(e) - U_{\text{money}}^{C,f}(e) = \Delta v^{\,f}\big(P^T(e) - P^C(e)\big) \le 0,$$

because the cost term $c(e)$ and the constant $v(w^{lose,f})$ cancel. Therefore $U_{\text{money}}^{T,f}(e) \le U_{\text{money}}^{C,f}(e)$ for all $e \ge 0$. Moreover, evaluating at $e = e_T^{*,f}$, and using the optimality of $e_C^{*,f}$ for the competitive setting gives

$$U_{\text{money}}^{C,f}\big(e_C^{*,f}\big) \ge U_{\text{money}}^{C,f}\big(e_T^{f}\big) \ge U_{\text{money}}^{T,f}\big(e_T^{*,f}\big)$$

where the first inequality is by optimality of $e_C^{*,f}$ and the second by the pointwise dominance $U_{\text{money}}^{T,f}(e) \le U_{\text{money}}^{C,f}(e)$ at $e = e_T^{*,f}$. Hence,

$$U_{\text{money}}^{T,f}\big(e_T^{*,f}\big) \;\le\; U_{\text{money}}^{C,f}\big(e_C^{*,f}\big).$$

Proposition 2. *Fix a frame $f \in \{G, L\}$. Under Assumptions 1, belief utility is (weakly) lower in the competitive setting than in the non-competitive setting when evaluated at the respective optima:*

$$u\big(P_i^T(e^{*,T,f})\big) \;\le\; u\big(P_i^C(e^{*,C,f})\big).$$

Proof. Fix $f \in \{G, L\}$. By Assumption 1, the perceived success probability at the respective optima is weakly lower in the competitive setting:

$$P_i^T\big(e_T^{*,f}\big) \;\le\; P_i^C\big(e_C^{*,f}\big).$$

Since $u(\cdot)$ is nondecreasing, it follows immediately that

$$u\big(P_i^T(e_T^{*,f})\big) \;\le\; u\big(P_i^C(e_C^{*,f})\big).$$

A.3 intrinsic utility channel

This subsection proves Prediction 2. The intrinsic component differs across settings only through ψ_i^f: it enters additively in the competitive setting and is zero otherwise. Holding the belief channel fixed, I show that under Assumption 2, this yields a positive intrinsic premium in the gain frame and a negative one in the loss frame, as stated in Section 2.

Proposition 3. *Fix $f \in \{G, L\}$ and hold the belief channel fixed. Under Assumption 2, the competitive setting, relative to the non-competitive benchmark, yields higher intrinsic utility in the gain frame,*

$$U_{i,\textit{intrinsic}}^{T,G} \ge U_{i,\textit{intrinsic}}^{C,G},$$

and lower intrinsic utility in the loss frame,

$$U_{i,\textit{intrinsic}}^{T,L} \le U_{i,\textit{intrinsic}}^{C,L}.$$

Proof. Fix a frame $f \in \{G, L\}$ and hold the belief channel fixed. By construction, the intrinsic term enters additively only in the competitive setting:

$$U_{i,\text{intrinsic}}^{T,f} = \psi_i^f \qquad \text{and} \qquad U_{i,\text{intrinsic}}^{C,f} = 0.$$

This difference is effort-invariant. Under Assumption 2, $\psi^G > 0$ and $\psi^L < 0$, which implies

$$U_{i,\text{intrinsic}}^{T,G} \ge U_{i,\text{intrinsic}}^{C,G} \quad \text{and} \quad U_{i,\text{intrinsic}}^{T,L} \le U_{i,\text{intrinsic}}^{C,L}.$$

A.4 Supplemental Proofs

This subsection analyzes optimal effort under the competitive and non-competitive settings. A further assumption is introduced to deliver a directional prediction.

Assumption 3 *Fix a frame $f \in \{G, L\}$. At the optimal effort in each setting, perceived success is (weakly) less sensitive to effort in the competitive setting than in the non-competitive setting:*

$$P^{T\prime}\big(e_T^{*,G}\big) \leq P^{C\prime}\big(e_C^{*,G}\big)$$

Complementing Assumption 1's level effect, the competitive setting makes the success benchmark endogenous and moving. This strategic uncertainty reduces how effectively a marginal increase in own effort translates into perceived success,, making the belief–effort map locally flatter at the competitive optimum than at the non-competitive optimum. Intuitively, when the target can shit with opponents' actions, marginal effort "buys" less perceived progress.

Proposition 4. *Fix a frame $f \in \{G, L\}$. The optimal effort is (weakly) lower in the competitive setting than in the non-competitive setting:*

$$e_T^{f,*} \;\leq\; e_C^{f,*}.$$

Proof. Consider first the gain frame ($f = G$). The optimal effort in setting $s \in \{T, C\}$ solves

$$c'(e_s^{*,G}) = P^{s\prime}(e_s^{*,G})\Big(w^{win} + u'\big(P^s(e_s^{*,G})\big)\Big). \tag{A.6}$$

Define the marginal–benefit for any effort level e by

$$MB_s(e) \;:=\; P^{s\prime}(e)\Big(w^{win} + u'\big(P^s(e)\big)\Big). \tag{A.7}$$

By Assumption 1, $P^T(e) \leq P^C(e)$ at all effort e. Since $u''(\cdot) \geq 0$, we have

$$u'\big(P^T(e)\big) \;\leq\; u'\big(P^C(e)\big) \tag{A.8}$$

Moreover, Assumption 3 yields

$$P^{T\prime}\big(e_T^{*,G}\big) \leq P^{C\prime}\big(e_C^{*,G}\big)$$

Combining these inequalities with (A.8), we obtain

$$\begin{aligned} MB_T\big(e_T^{*,G}\big) &= P^T{}'\big(e_T^{*,G}\big)\Big(w^{win} + u'\big(P^T(e_T^{*,G})\big)\Big) \\ &\le P^T{}'\big(e_T^{*,G}\big)\Big(w^{win} + u'\big(P^C(e_C^{*,G})\big)\Big) \\ &\le P^C{}'\big(e_T^{*,G}\big)\Big(w^{win} + u'\big(P^C(e_C^{*,G})\big)\Big) = MB_C\big(e_C^{*,G}\big), \end{aligned} \tag{A.11}$$

From (A.6), optimal effort satisfies $c'(e_s^{*,G}) = MB_s(e_s^{*,G})$. Since $c(\cdot)$ is strictly increasing and convex, $c'(\cdot)$ is strictly increasing; and with P and u differentiable, $MB_C(\cdot)$ is continuous. Hence,

$$c'\big(e_T^{*,G}\big) = MB_T\big(e_T^{*,G}\big) \le MB_C\big(e_C^{*,G}\big) = c'\big(e_C^{*,G}\big). \tag{A.12}$$

This implies

$$c'\big(e_T^{*,G}\big) \le c'\big(e_C^{*,G}\big). \tag{A.13}$$

Therefore,

$$e_T^{*,G} \;\le\; e_C^{*,G}.$$

The loss frame ($f = L$) is analogous: replace w^{win} by $\lambda\, w^{win}$ in (A.6)–(A.7); the remainder of the argument is unchanged. Hence, for either frame $f \in \{G, L\}$,

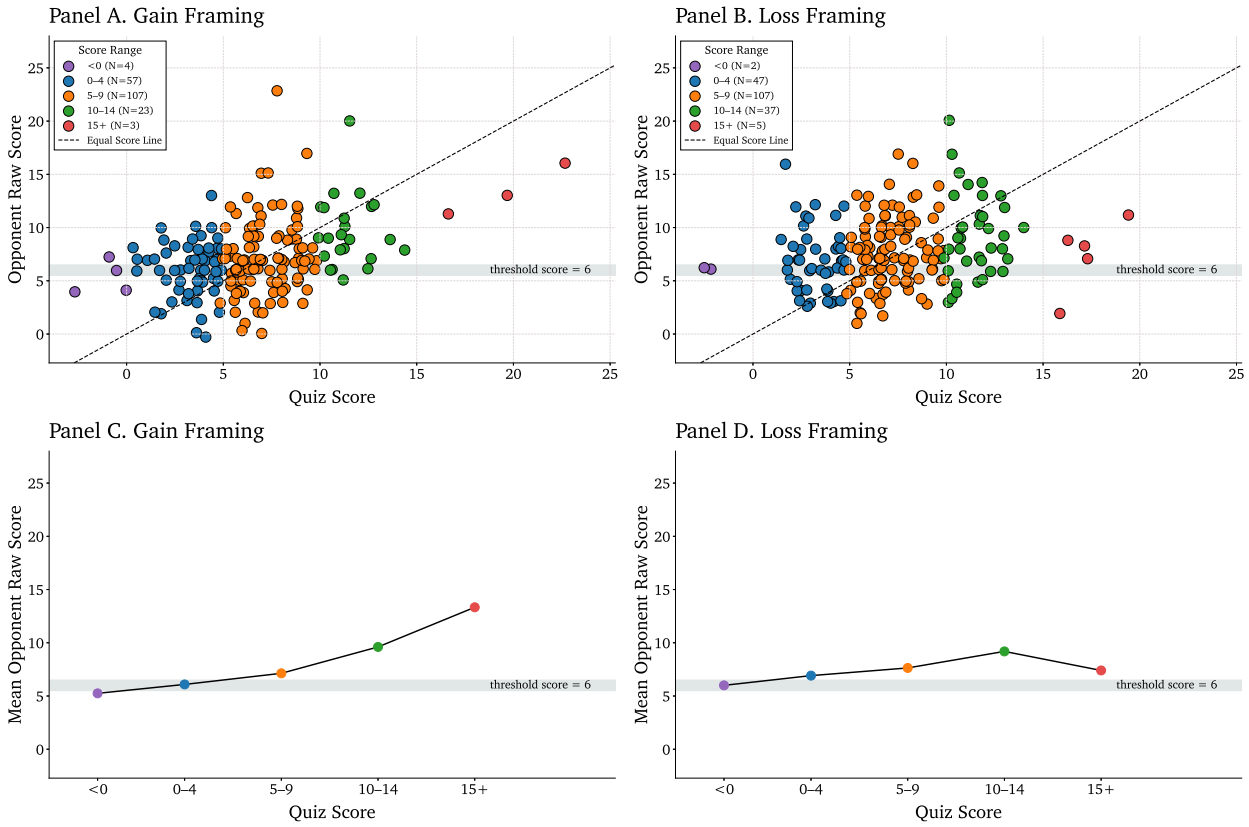
$$e_T^{*,f} \;\le\; e_C^{*,f}$$

as claimed.

B Additional Figures and Tables

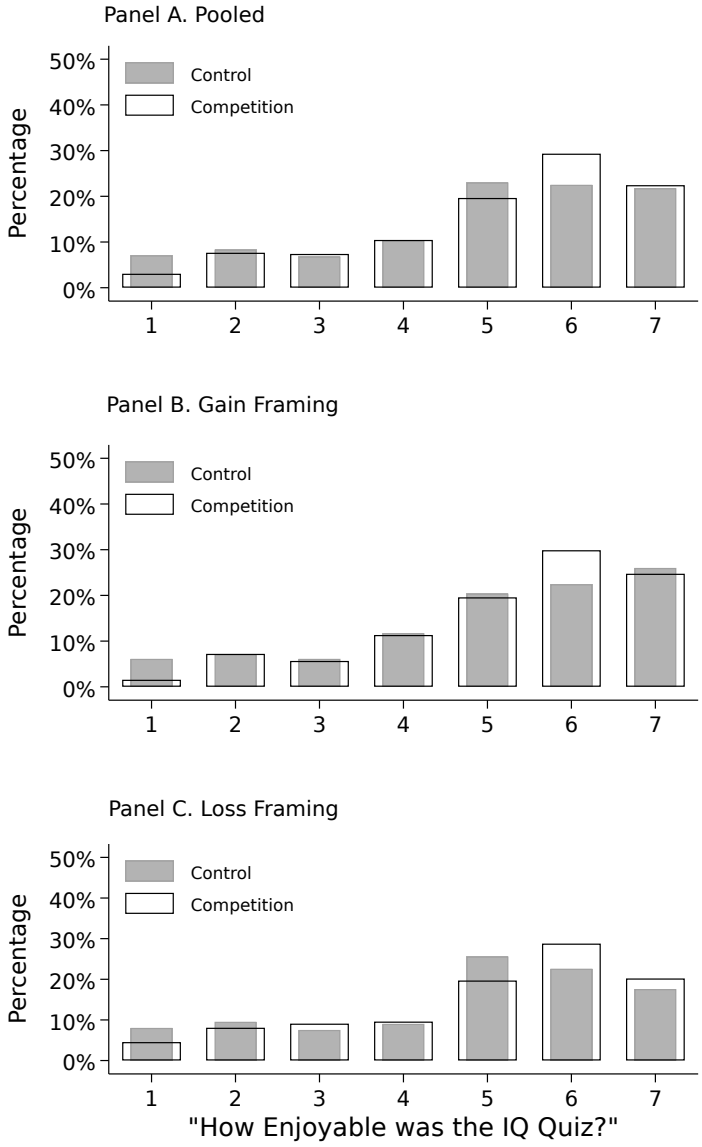
B.1 Additional Figures

Appendix Figure B.1: Own Scores vs. Raw Opponent Scores



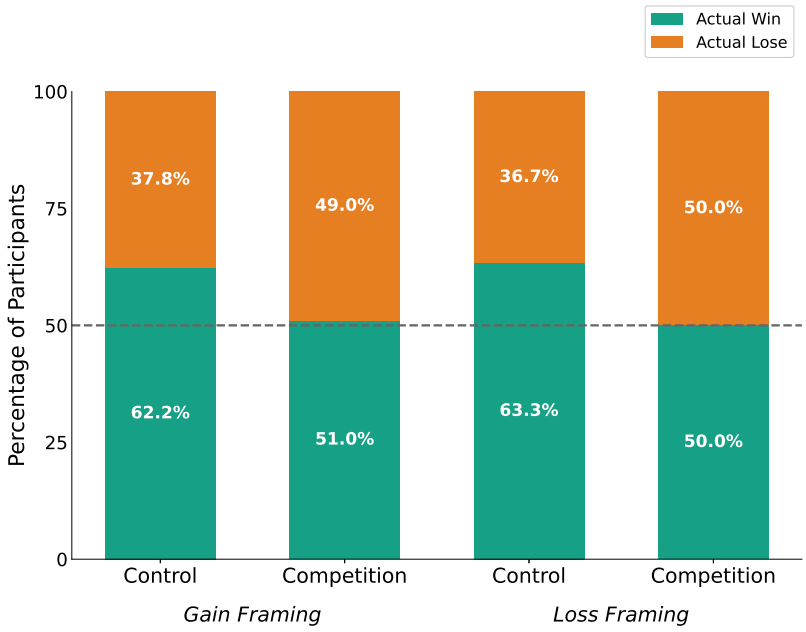
Notes: This figure plots *raw opponent scores* versus participants' quiz scores under *Gain* (A, C) and *Loss* (B, D) framings. Panels A–B show scatterplots; points are colored by quiz-score bins (< 0, 0–4, 5–9, 10–14, $15+$) with bin counts in the legend. The dashed $45°$ line indicates equal scores. The shaded band at 6 marks the fixed threshold from the non-competitive reference. Panels C–D display bin means by quiz-score bin; lines connect means for readability. Patterns are comparable across framings; values on the y-axis are unadjusted (raw) opponent scores.

Appendix Figure B.2: Distribution of Utility by Treatment and Framing Condition



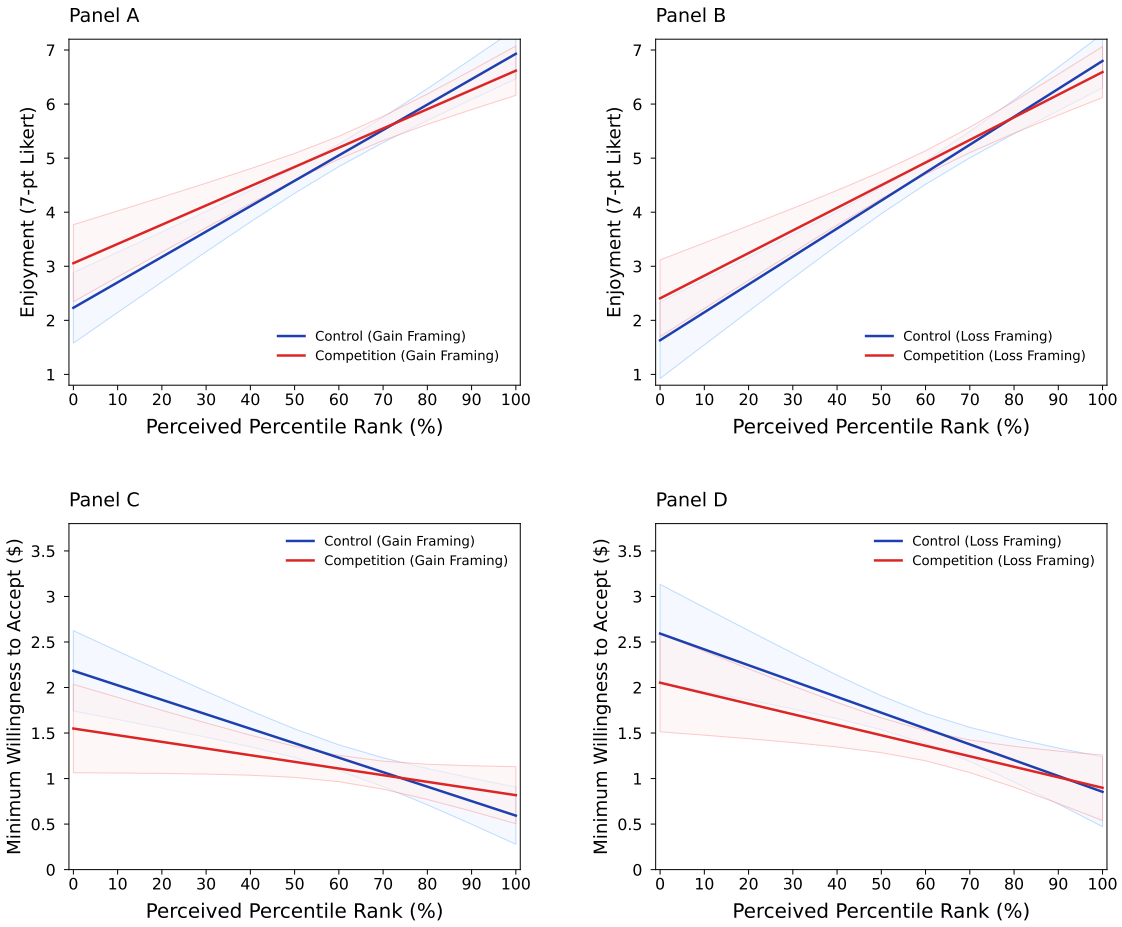
Notes: This figure plots the distribution of utility across treatment and framing conditions. Utility was measured on a 7-point scale in response to the question, "How enjoyable was the IQ Quiz?" Panel A reports pooled results for treatment and control groups. Panels B and C report results separately for the gain and loss framing conditions, respectively. Gray bars correspond to the control condition, in which payment depended on exceeding the median performance threshold. White bars correspond to the competition condition, in which payment was based on relative performance in pairwise contests.

Appendix Figure B.3: Actual Win–Loss Outcomes by Framing and Treatment Condition



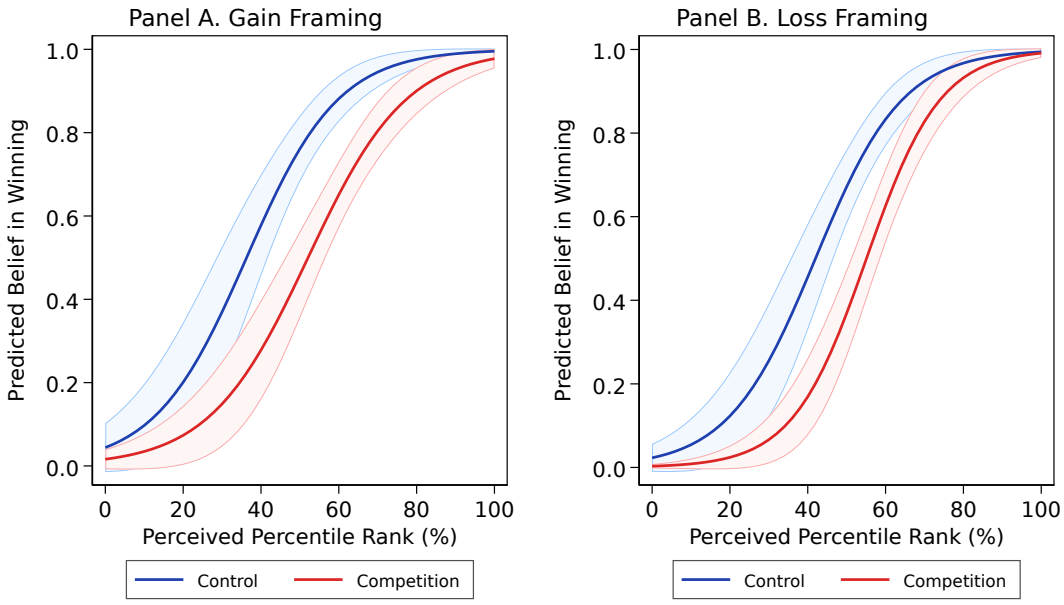
Notes: This figure shows the distribution of actual win–loss outcomes across control and competition conditions under gain and loss framing. In the control condition, a "win" is defined as achieving a score on the IQ quiz above the threshold score, while a "loss" indicates performance below the threshold. In the competition condition, a "win" denotes that a participant outperformed their paired opponent on the IQ quiz, while a "loss" indicates the opposite. Under gain framing, participants were endowed with $2; winners earned an additional $2 (totaling $4), while losers received no additional reward. Under loss framing, participants were endowed with $6; winners retained the full endowment, while losers forfeited $4 from the initial amount. The distribution of beliefs about winning and losing across conditions is displayed in the Panel A of Figure 11.

Appendix Figure B.4: Heterogeneity by Framing Condition and Perceived Ability



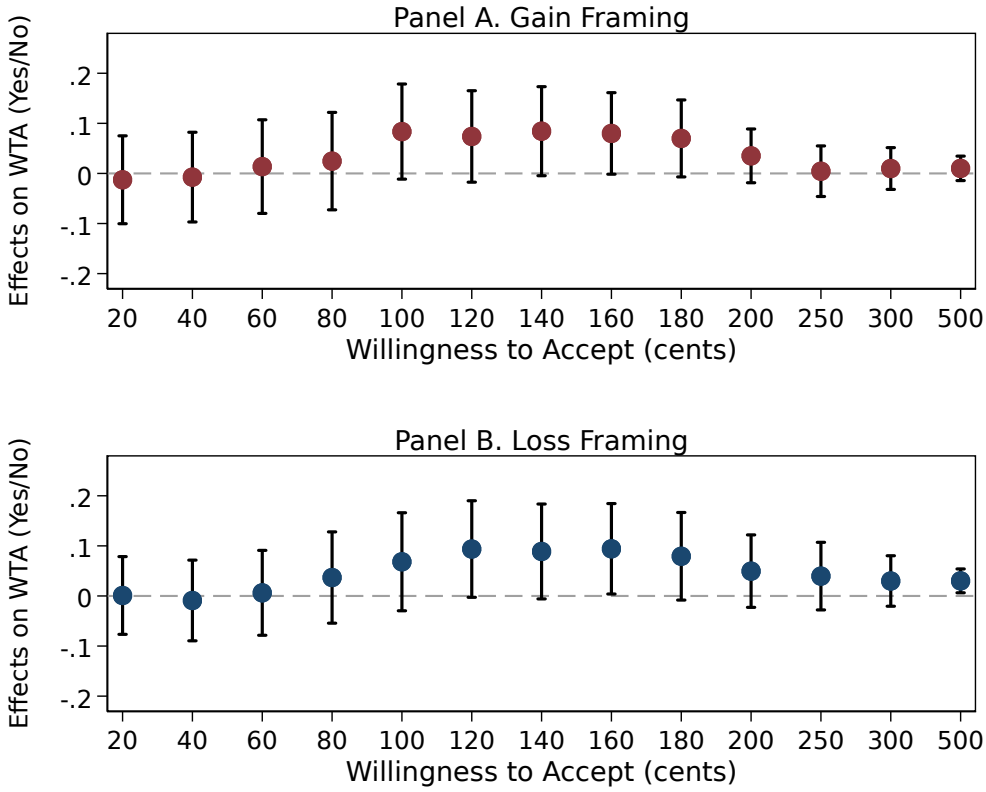
Notes: This figure shows the heterogeneous effects of competition by framing condition and perceived performance rank. Panels A and B plot predicted enjoyment (measured on a 7-point Likert scale) against perceived percentile rank for the gain- and loss-framing conditions, respectively. Panels C and D report predicted minimum willingness to accept (WTA) to perform the task again, also by perceived percentile rank, for the gain- and loss-framing conditions. Blue lines represent the control group and red lines represent the competition group, with shaded areas denoting 95% confidence intervals.

Appendix Figure B.5: Heterogeneity in Belief in Winning by Perceived Ability



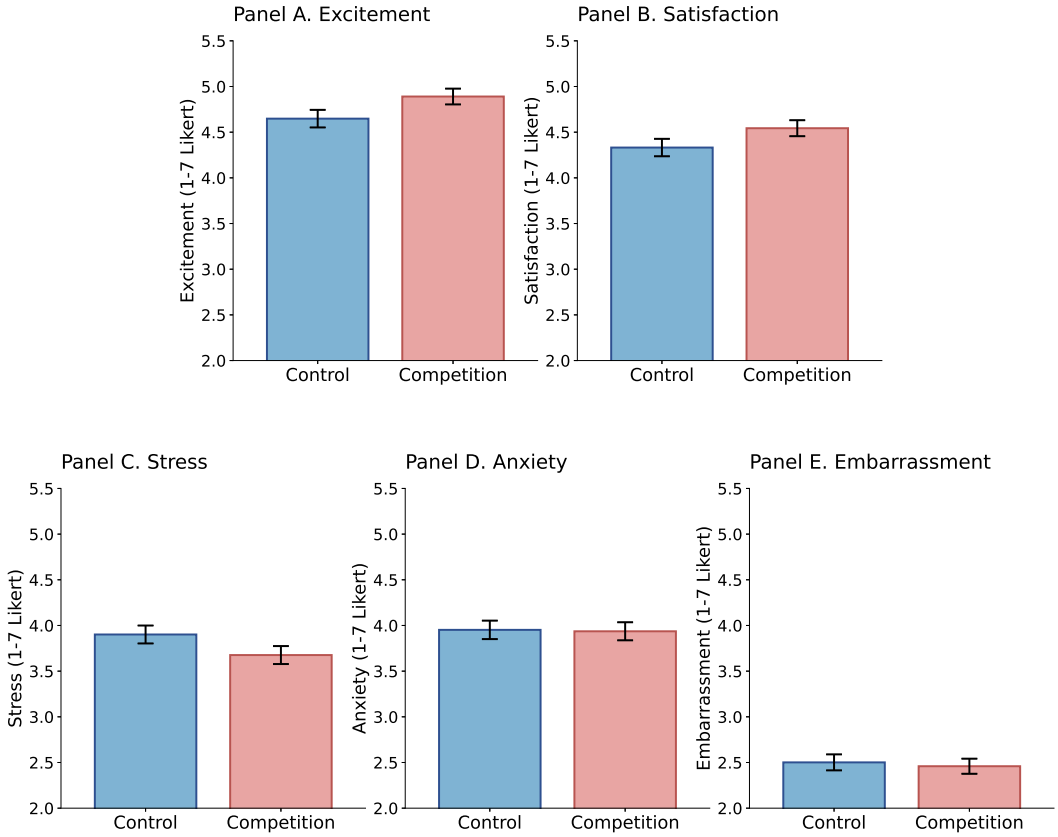
Notes: This figure plots predicted probabilities from logit regressions of participants' belief in winning on a competition treatment dummy, perceived percentile rank of performance, and their interaction. Panel A shows predicted probabilities for the gain-framing sample, and Panel B for the loss-framing sample. Blue lines correspond to the control group and red lines to the competition treatment. Shaded areas indicate 95 percent confidence intervals.

Appendix Figure B.6: Treatment Effects on Task Preference by Framing Condition



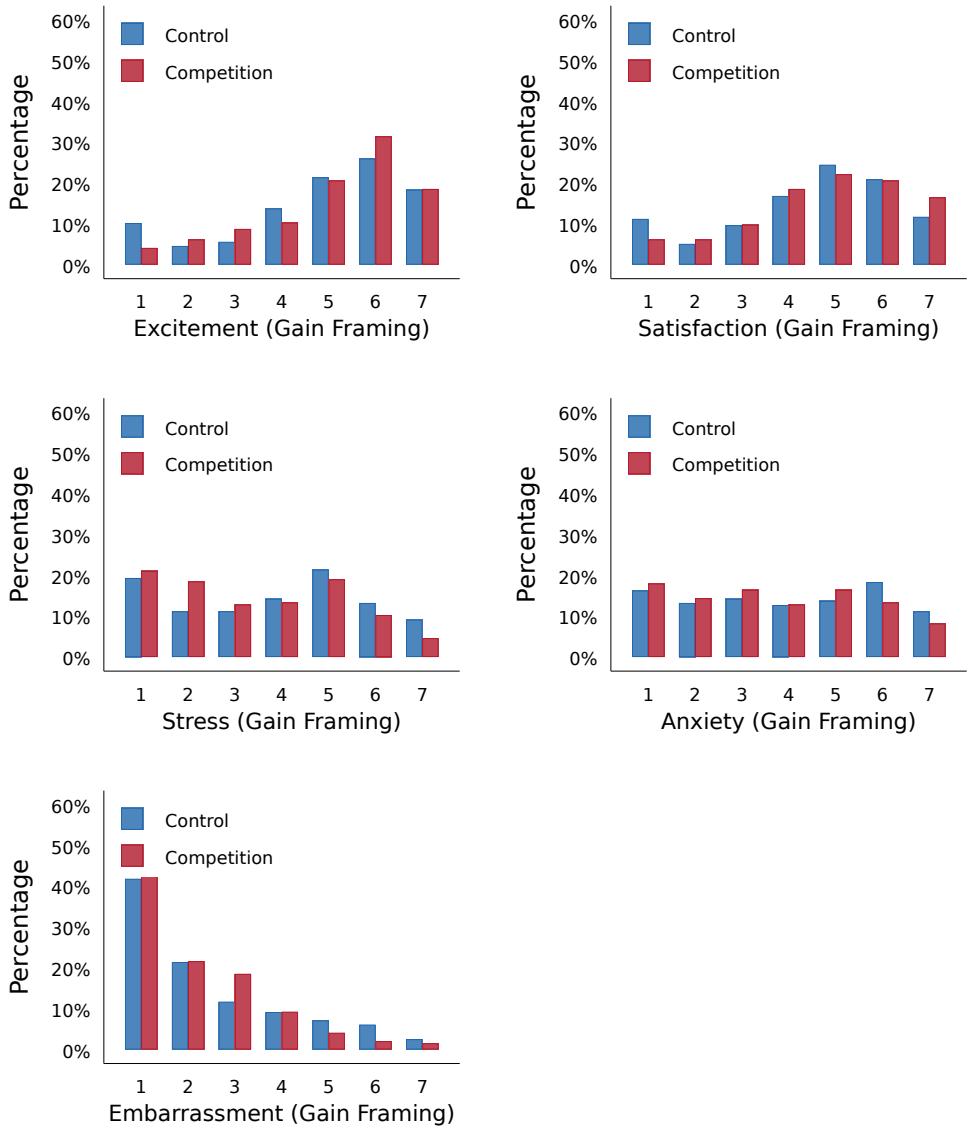
Notes: This figure presents the treatment effects of competition on minimum willingness to accept (WTA) performing the experimental task again, separately by framing condition. The outcome is a binary indicator equal to one if participants accepted the task at the specified payment amount and zero otherwise. Panel A reports results for the gain-framing condition, and Panel B for the loss-framing condition. Offered amounts range from \$0.20 to \$5.00. Point estimates are shown with 95% confidence intervals.

Appendix Figure B.7: Effect of Competition on Emotional Components of Utility



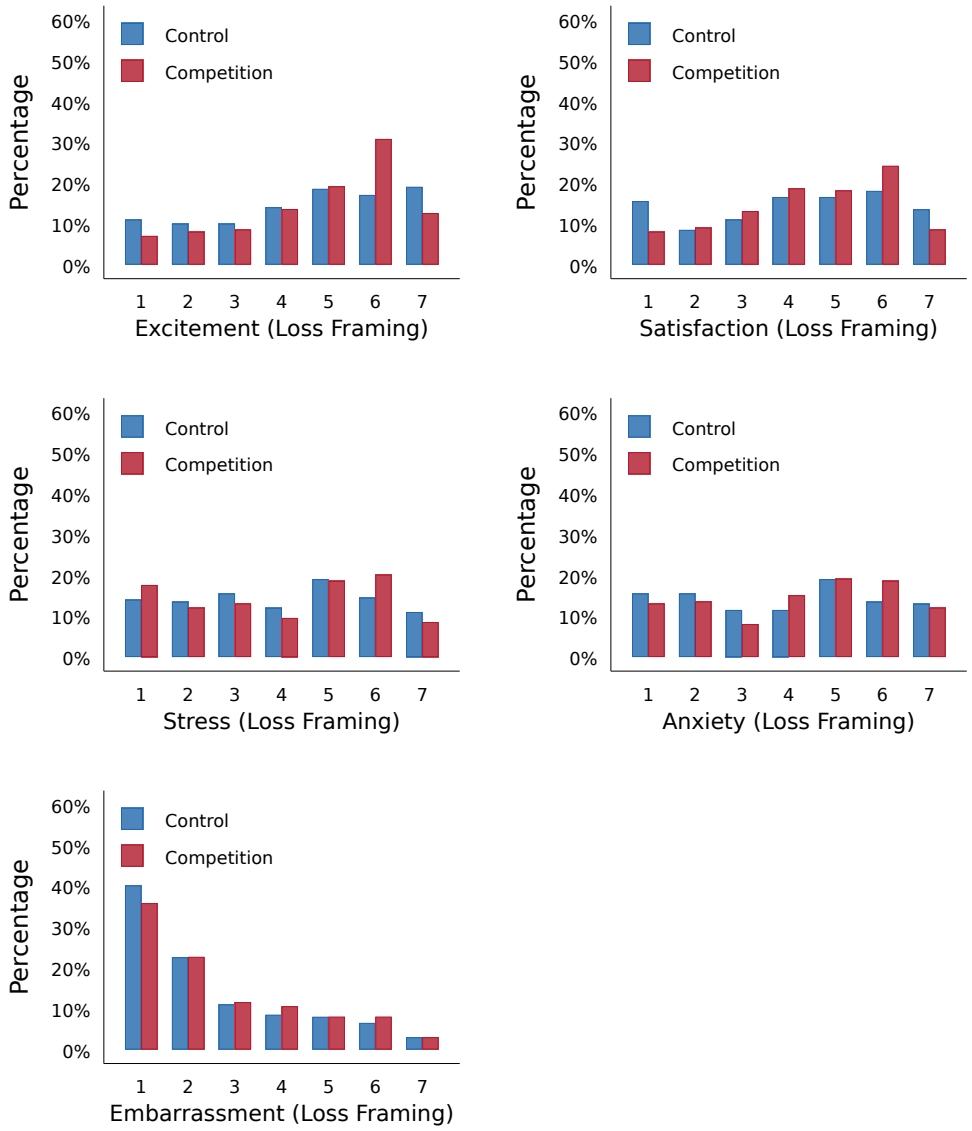
Notes: This figure shows the effect of competition on the emotional components of utility in the pooled sample. Emotions were measured on a 7-point Likert scale, with higher values indicating greater intensity. Panel A reports excitement, Panel B satisfaction, Panel C stress, Panel D anxiety, and Panel E embarrassment. Bars represent group means with 95% confidence intervals.

Appendix Figure B.8: Distribution of Emotional Components of Utility under Gain Framing



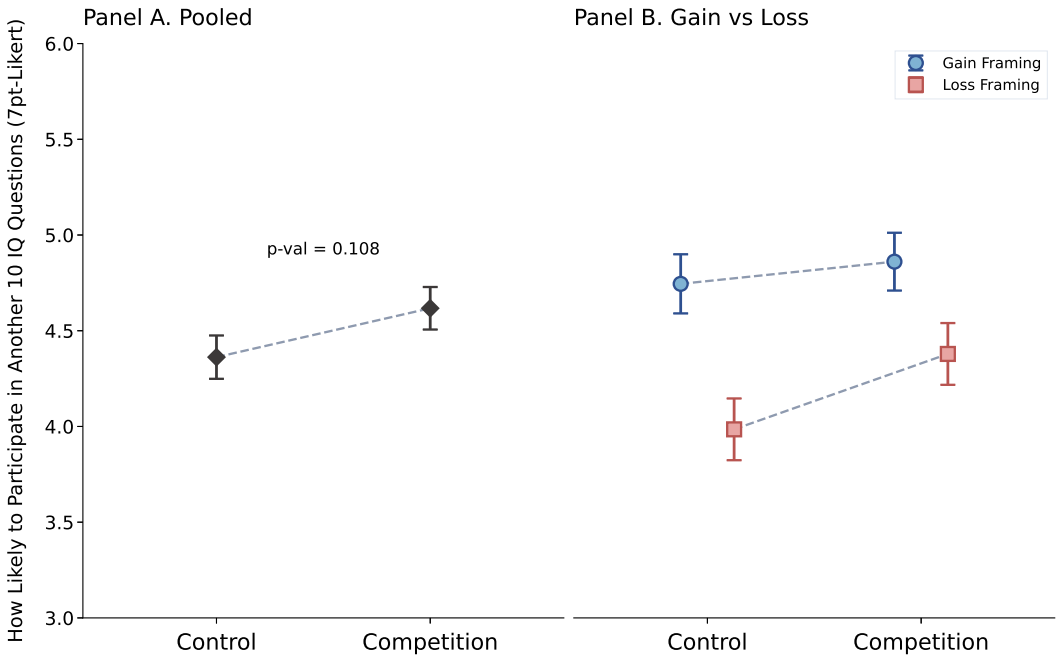
Notes: This figure displays the distribution of emotional responses under gain framing for control and competition groups. Emotions were measured on a 7-point Likert scale, with higher values indicating greater intensity. Each panel reports the percentage of participants selecting each response option for excitement, satisfaction, stress, anxiety, and embarrassment.

Appendix Figure B.9: Distribution of Emotional Components of Utility under Loss Framing



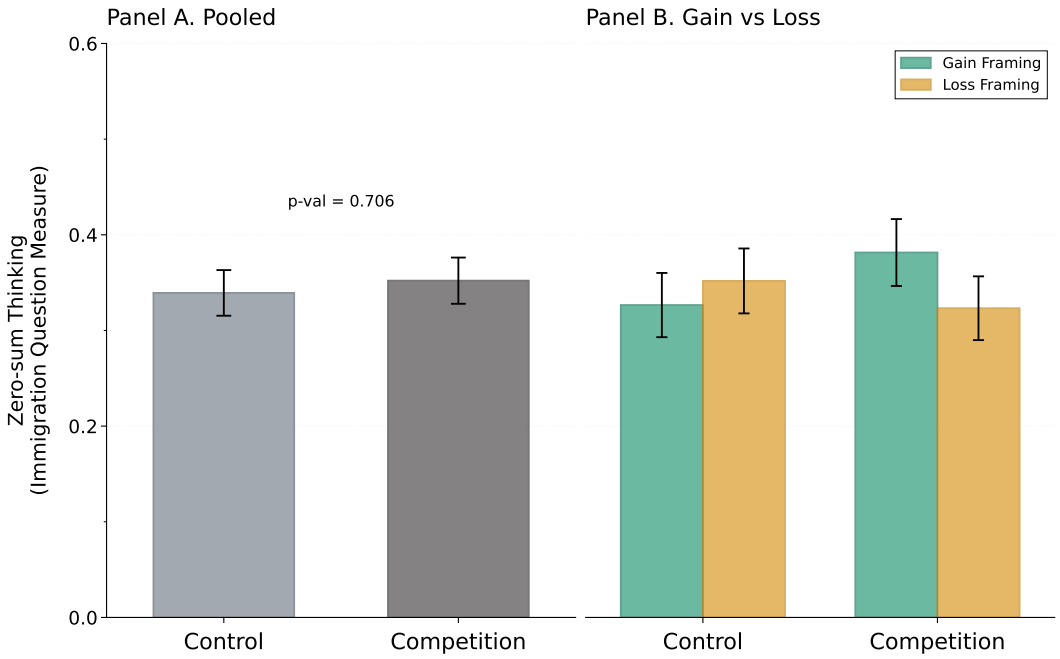
Notes: This figure displays the distribution of emotional responses under loss framing for control and competition groups. Emotions were measured on a 7-point Likert scale, with higher values indicating greater intensity. Each panel reports the percentage of participants selecting each response option for excitement, satisfaction, stress, anxiety, and embarrassment.

Appendix Figure B.10: Effects of Competition on Task Preference (Alternative Measure)



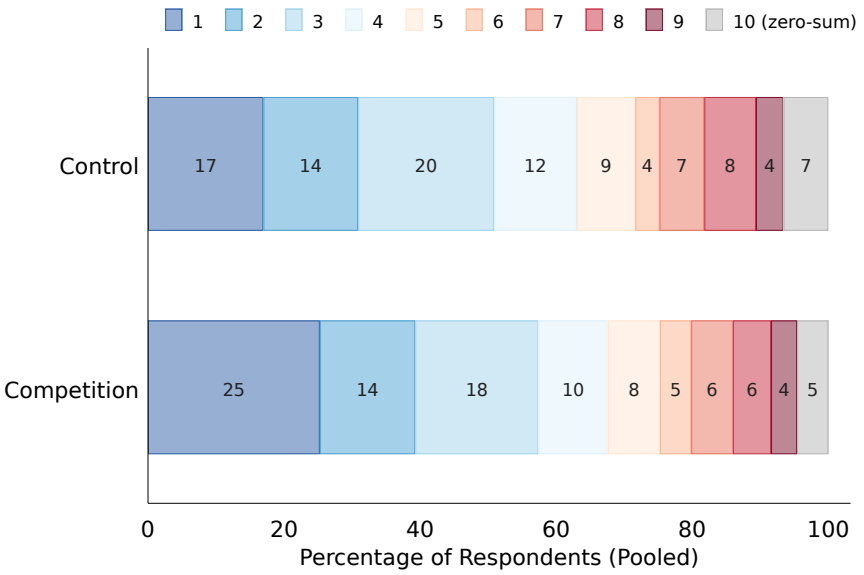
Notes: This figure shows treatment effects of competition on task preference, measured by an unincentivized question asking participants, on a 7-point Likert scale, how likely they would be to take another 10 IQ questions without monetary rewards. Panel A shows the estimates for the pooled data, and Panel B shows the results separately for gain and loss framing. Markers indicate mean values, with 95% confidence intervals.

Appendix Figure B.11: Treatment Effects on Zero-sum Thinking (Alternative Measure)



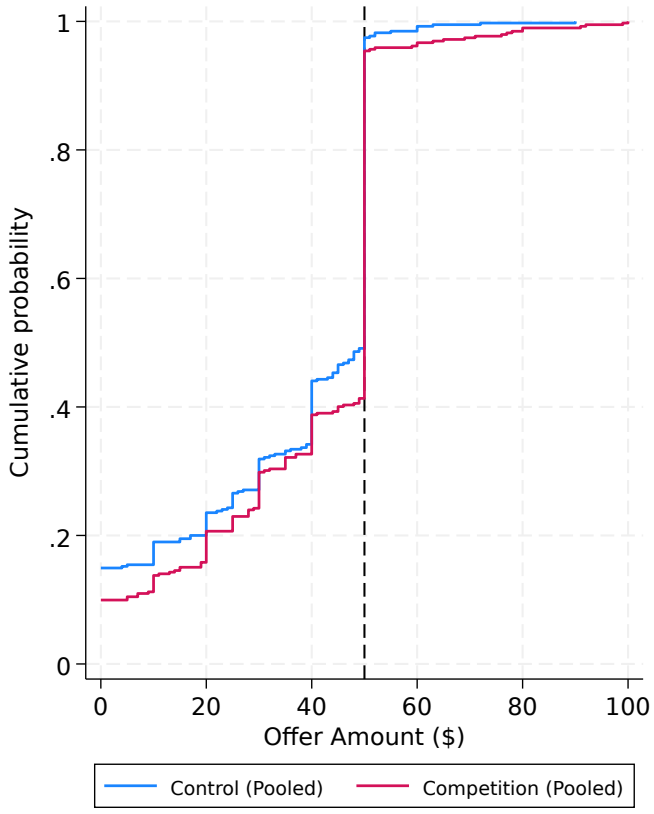
Notes: This figure illustrates the estimated treatment effects of competition on zero-sum thinking using the immigration measure. Zero-sum thinking is measured with a scenario-choice question in which both immigrants and locals work as day laborers. On Day 1, immigrant workers find 20 jobs and local workers 40 jobs. On Day 2, immigrant workers again find 40 jobs, and respondents then choose whether local workers find 20 or 80 jobs. Choosing 20 reflects zero-sum thinking (coded as 1), while choosing 80 reflects non–zero-sum thinking (coded as 0). Panel A presents results for the pooled sample, and Panel B shows results separately for gain- and loss-framing conditions. Bars indicate mean values with error bars representing robust standard errors.

Appendix Figure B.12: Distribution of Zero-Sum Thinking by Treatment (Pooled)



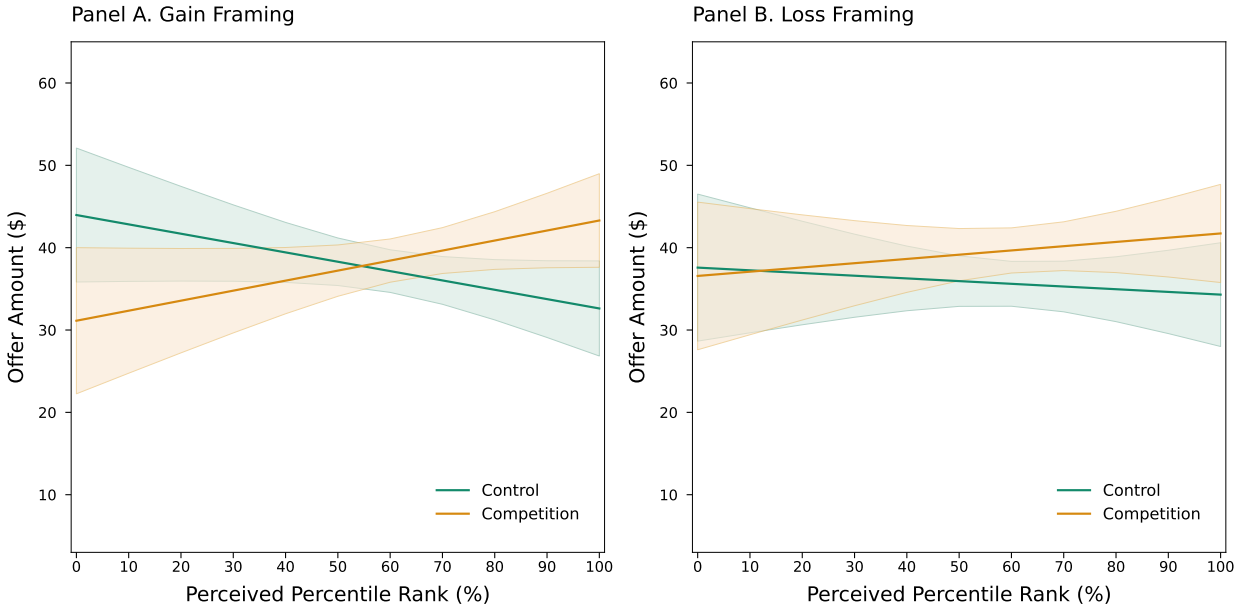
Notes: The figure displays the distribution of responses on the zero-sum scale using the pooled sample. Zero-sum beliefs are measured using a World Values Survey item (Inglehart et al., 2014), where respondents rate their agreement on a 1–10 scale between the statements: "Wealth can grow so there's enough for everyone" (1, indicating minimal zero-sum thinking) and "People can only become wealthy at the expense of others" (10, indicating strong zero-sum thinking). Higher values correspond to stronger endorsement of zero-sum beliefs. Percentages indicate the share of respondents selecting each scale point within the control and competition groups.

Appendix Figure B.13: Cumulative Distribution of Offer Amounts



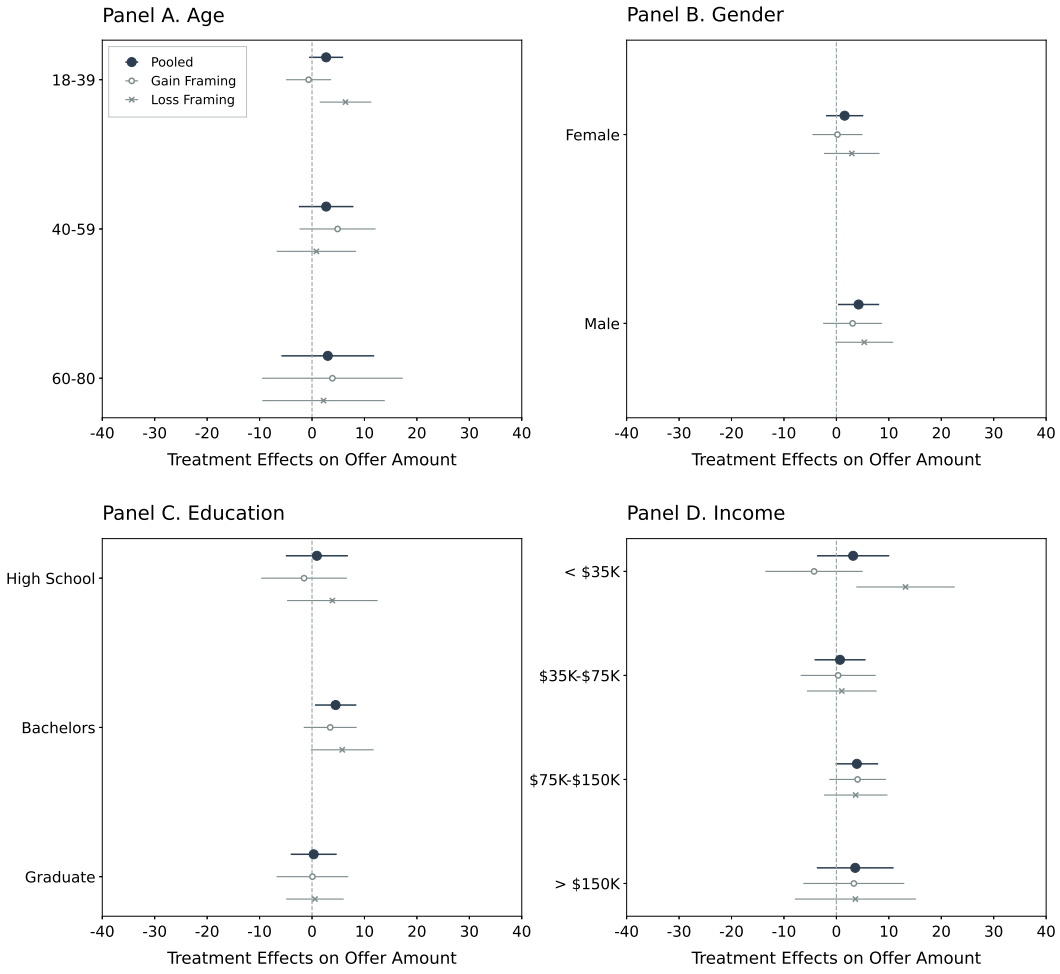
Notes: This figure displays the cumulative distribution of offer amounts in the dictator game by treatment condition using the pooled sample. In the game, participants allocated $100 between themselves and another participant. Blue lines represent the control group and red lines represent the competition group.

Appendix Figure B.14: Effects of Competition on Altruism by Perceived Ability



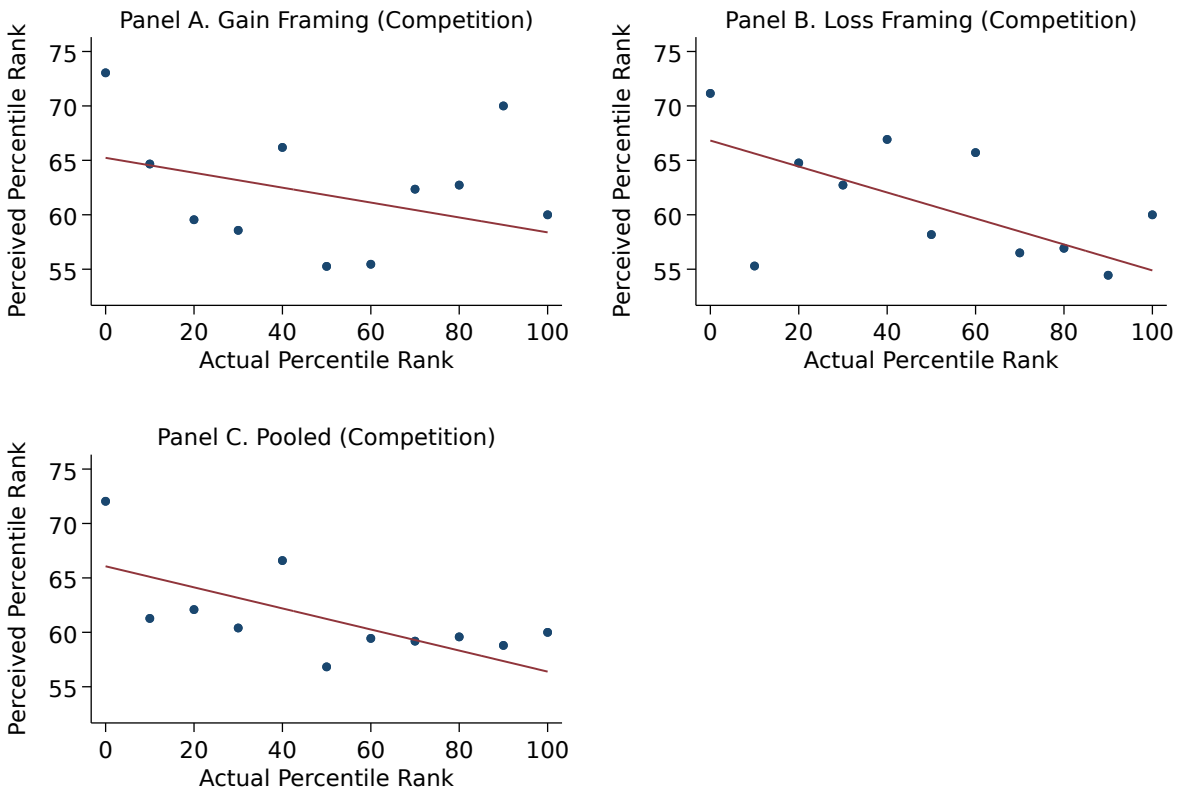
Notes: This figure shows the heterogeneous effects of competition on altruism by participants' beliefs about winning and their perceived performance rank under gain and loss framing. Panel A displays results for the control and competition groups under gain framing, and Panel B displays the corresponding results under loss framing. The figure plots predicted altruism, measured by the offer amount in the dictator game, as a function of perceived percentile rank (0–100, in increments of 10). Shaded areas indicate 95% confidence intervals.

Appendix Figure B.15: Effects of Competition on Altruism across Demographic Groups



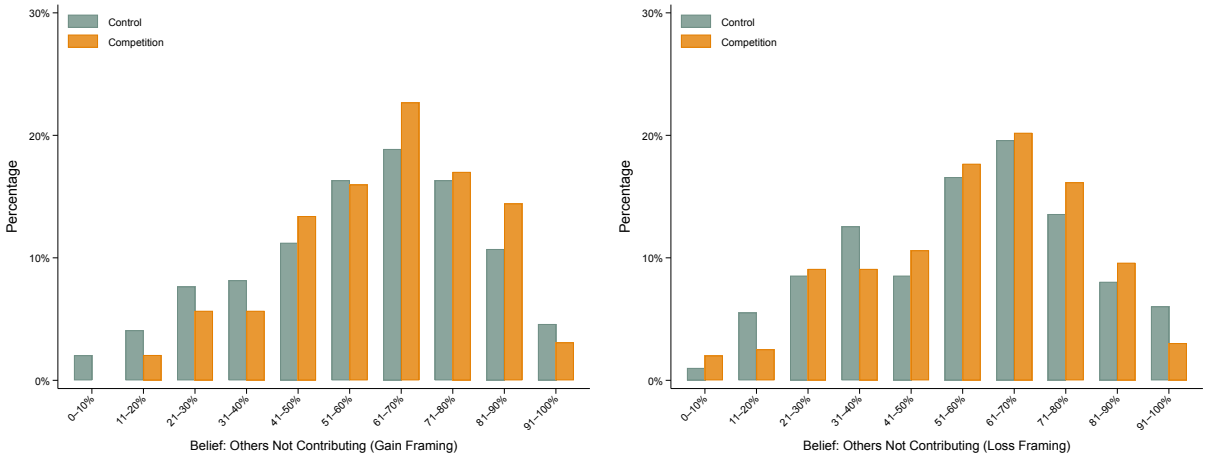
Notes: This figure shows the heterogeneous effects of competition on altruism by participants' beliefs about winning and their perceived performance rank under gain and loss framing. Panel A displays results for the control and competition groups under gain framing, and Panel B displays the corresponding results under loss framing. The figure plots predicted altruism, measured by the offer amount in the dictator game, as a function of perceived percentile rank (0–100, in increments of 10). Shaded areas indicate 95% confidence intervals.

Appendix Figure B.16: Expected vs Actual Rank in IQ Quiz



Notes: This figure plots participants' perceived percentile rank against their actual percentile rank in the IQ quiz under competition. Panel A shows results for gain framing, Panel B for loss framing, and Panel C for the pooled sample for the competition condition. Each dot represents the mean perceived rank within an actual rank decile. The fitted line is estimated using ordinary least squares.

Appendix Figure B.17: Belief Distribution in Public Goods Game



Notes: This figure shows the distribution of participants' beliefs about the share of others not contributing in the public goods game. The left panel reports results under gain framing, and the right panel under loss framing. Within each panel, the bars compare the control group (green) and the competition group (orange).

B.2 Additional Tables

Appendix Table B.1: Effects of Competition on Belief in Winning

	Dependent Variable: Belief in Winning		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Competition	-0.14***	-0.15***	-0.14***
	(0.03)	(0.04)	(0.05)
Control mean	0.78	0.80	0.75
Observations	787	390	397
R^2	0.03	0.03	0.02

Notes: This table reports the effect of competition on belief in winning. The dependent variable is an indicator equal to 1 if the participant believes they will win and 0 otherwise. The key independent variable is a binary indicator for competition (1 = competition group, 0 = control group). Column (1) presents results for the pooled sample, while Columns (2) and (3) report results separately for the gain-framing and loss-framing conditions. Robust standard errors are in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.2: The Impact of Competition on Performance

	Dependent Var.: IQ Quiz Score		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Competition	-0.41	-0.78**	-0.04
	(0.26)	(0.37)	(0.37)
Observations	787	390	397
R^2	0.00	0.01	0.00

Notes: This table reports the effect of competition on IQ quiz score. Competition is a binary indicator equal to 1 for participants in the competition group and 0 for those in the control group. Column (1) presents results for the pooled sample, while Columns (2) and (3) report results separately for the gain-framing and loss-framing conditions. Robust standard errors are reported in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.3: Heterogeneity in Intrinsic Enjoyment Across Demographic Groups

Sample: Gain Framing	*Dependent Variable: Enjoyment*			
	(1)	(2)	(3)	(4)
Competition	0.36*	0.32	0.71**	0.50
	(0.22)	(0.24)	(0.34)	(0.38)
Competition × Age (40-59)	0.15			
	(0.34)			
Competition × Age ($\geq$60)	0.29			
	(0.57)			
Competition × Female		0.25		
		(0.33)		
Competition × Bachelor Degree			-0.17	
			(0.41)	
Competition × Graduate Degree			-0.91**	
			(0.42)	
Competition × Income ($35K-$75K)				-0.06
				(0.47)
Competition × Income ($75K-$150K)				0.04
				(0.46)
Competition × Income (>$150K)				-0.59
				(0.56)
Observations	390	390	390	390
R^2	0.15	0.14	0.18	0.15

Notes: This table reports heterogeneous treatment effects of competition on utility using the gain framing sample. The dependent variable is enjoyment, measured on a 7-point scale where higher values indicate greater enjoyment. Competition is a treatment indicator equal to one for participants assigned to the competition group and zero otherwise. Each column corresponds to a separate regression where competition is interacted with the indicated subgroup characteristic. The omitted categories are age 18–39, male, high school or less, and income below $35K, which are coded as zero within their respective groups. For example, age is coded as 0 for ages 18–39, 1 for ages 40–59, and 2 for ages 60 and above; other subgroup variables follow a similar coding scheme. Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.4: Heterogeneity in Intrinsic Enjoyment Across Demographic Groups

Sample: Loss Framing	*Dependent Variable: Enjoyment*			
	(1)	(2)	(3)	(4)
Competition	0.24	0.42*	0.67*	1.02**
	(0.22)	(0.23)	(0.41)	(0.46)
Competition × Age (40-59)	0.45			
	(0.38)			
Competition × Age (≥60)	0.35			
	(0.59)			
Competition × Female		0.05		
		(0.34)		
Competition × Bachelor Degree			-0.27	
			(0.48)	
Competition × Graduate Degree			-0.48	
			(0.49)	
Competition × Income ($35K-$75K)				-1.00*
				(0.55)
Competition × Income ($75K-$150K)				-0.32
				(0.53)
Competition × Income (>$150K)				-0.82
				(0.71)
Observations	397	397	397	397
R^2	0.12	0.12	0.13	0.13

Notes: This table reports heterogeneous treatment effects of competition on utility using the loss framing sample. The dependent variable is enjoyment, measured on a 7-point scale where higher values indicate greater enjoyment. Competition is a treatment indicator equal to one for participants assigned to the competition group and zero otherwise. Each column corresponds to a separate regression where competition is interacted with the indicated subgroup characteristic. The omitted categories are age 18–39, male, high school or less, and income below $35K, which are coded as zero within their respective groups. For example, age is coded as 0 for ages 18–39, 1 for ages 40–59, and 2 for ages 60 and above; other subgroup variables follow a similar coding scheme. Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.5: Treatment Effects on Task Preference (Gain Framing)

Sample: Gain Framing	Competition	Control	Difference	p-value
	(1)	(2)	[(1)-(2)]	(4)
Minimum Willingness to Accept ($)	1.09	1.23	-0.14	0.18
	(0.07)	(0.08)	(0.11)	
Willing to Accept for 20 cents	0.26	0.27	-0.01	0.78
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 40 cents	0.28	0.29	-0.01	0.87
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 60 cents	0.34	0.32	0.02	0.78
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 80 cents	0.41	0.38	0.03	0.62
	(0.04)	(0.03)	(0.05)	
Willing to Accept for 100 cents	0.69	0.60	0.09*	0.09
	(0.03)	(0.04)	(0.05)	
Willing to Accept for 120 cents	0.73	0.66	0.07	0.11
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 140 cents	0.76	0.68	0.08*	0.06
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 160 cents	0.82	0.74	0.08*	0.06
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 180 cents	0.85	0.78	0.07*	0.08
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 200 cents	0.94	0.90	0.04	0.20
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 250 cents	0.93	0.93	0.00	0.86
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 300 cents	0.96	0.95	0.01	0.65
	(0.01)	(0.02)	(0.02)	
Willing to Accept for 500 cents	0.99	0.98	0.01	0.42
	(0.01)	(0.01)	(0.01)	

Notes: This table reports the effects of competition on willingness to accept (WTA) performing the experimental task again, restricted to the gain-framing condition. Column (1) shows mean acceptance rates in the competition group, and column (2) shows mean acceptance rates in the control group. Column (3) reports the difference between the two groups, and column (4) provides the associated p-values. Standard errors are reported in parentheses. The outcome variable is a binary indicator equal to one if participants accepted performing the task again at the specified payment amount and zero otherwise. The first row reports the estimated minimum WTA in dollars. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.6: Treatment Effects on Task Preference (Loss Framing)

Sample: Loss Framing	Competition	Control	Difference	p-value
	(1)	(2)	[(1)-(2)]	(4)
Minimum Willingness to Accept ($)	1.34	1.55	-0.21*	0.08
	(0.08)	(0.09)	(0.12)	
Willing to Accept for 20 cents	0.19	0.19	0.00	0.98
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 40 cents	0.21	0.22	-0.01	0.83
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 60 cents	0.25	0.24	0.01	0.88
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 80 cents	0.33	0.29	0.04	0.43
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 100 cents	0.59	0.52	0.07	0.17
	(0.04)	(0.04)	(0.05)	
Willing to Accept for 120 cents	0.64	0.55	0.09*	0.06
	(0.03)	(0.04)	(0.05)	
Willing to Accept for 140 cents	0.68	0.59	0.09*	0.07
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 160 cents	0.74	0.65	0.09**	0.04
	(0.03)	(0.03)	(0.05)	
Willing to Accept for 180 cents	0.77	0.69	0.08*	0.08
	(0.03)	(0.03)	(0.04)	
Willing to Accept for 200 cents	0.86	0.81	0.05	0.18
	(0.02)	(0.03)	(0.04)	
Willing to Accept for 250 cents	0.88	0.84	0.04	0.25
	(0.02)	(0.03)	(0.03)	
Willing to Accept for 300 cents	0.94	0.91	0.03	0.25
	(0.02)	(0.02)	(0.03)	
Willing to Accept for 500 cents	1.00	0.97	0.03**	0.01
	(0.00)	(0.01)	(0.01)	

Notes: This table reports the effects of competition on willingness to accept (WTA) performing the experimental task again, restricted to the loss-framing condition. Column (1) shows mean acceptance rates in the competition group, and column (2) shows mean acceptance rates in the control group. Column (3) reports the difference between the two groups, and column (4) provides the associated p-values. Standard errors are reported in parentheses. The outcome variable is a binary indicator equal to one if participants accepted performing the task again at the specified payment amount and zero otherwise. The first row reports the estimated minimum WTA in dollars. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.7: Heterogeneity in Task Preference by Perceived Ability

	Dependent Variable: Minimum WTA					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	-0.17**	-0.28*	-0.14	-0.33	-0.21*	-0.25
	(0.08)	(0.15)	(0.10)	(0.21)	(0.12)	(0.22)
Perceived Rank		-0.47***		-0.47**		-0.45**
		(0.14)		(0.19)		(0.20)
Competition × Perceived Rank		0.18		0.30		0.07
		(0.18)		(0.24)		(0.26)
Control mean	1.39	1.69	1.23	1.54	1.55	1.83
Observations	772	772	381	381	391	391
R^2	0.01	0.03	0.00	0.03	0.01	0.04

Notes: This table reports the heterogeneous treatment effects of competition on task preference by perceived ability. Task preference is measured by the minimum Willingness to Accept (WTA) to repeat the IQ quiz, defined as the lowest monetary amount at which a participant switches from rejecting to accepting the task and subsequently accepts all higher offers. Perceived ability is measured by the participant's self-assessed rank in the IQ quiz. Columns (1)–(2) present pooled estimates, Columns (3)–(4) restrict to gain framing, and Columns (5)–(6) restrict to loss framing. Robust standard errors are in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.8: Treatment Effects on Task Preference (Alternative Measure)

	Dependent Variable: Another 10 questions without reward		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Competition	0.26	0.12	0.39*
	(0.16)	(0.22)	(0.23)
Control mean	4.36	4.74	3.98
Observations	787	390	397
R^2	0.00	0.00	0.01

Notes: This table shows the effect of competition on task preference, measured by an unincentivized question asking participants, on a scale from 1 to 7, how likely they were to take another 10 IQ questions, similar to the ones in the IQ quiz, but without monetary rewards. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.9: Treatment Effects on Positive Emotions

	Panel A. Dependent Variable: Excitement					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	0.24*	0.42***	0.23	0.41**	0.26	0.42**
	(0.13)	(0.12)	(0.18)	(0.17)	(0.19)	(0.18)
Believe Win		1.21***		1.24***		1.14***
		(0.15)		(0.22)		(0.20)
Control mean	4.65	4.65	4.83	4.83	4.47	4.47
Observations	787	787	390	390	397	397
R^2	0.00	0.09	0.00	0.10	0.00	0.08
	Panel B. Dependent Variable: Satisfaction					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	0.21	0.41***	0.24	0.45***	0.18	0.37**
	(0.13)	(0.12)	(0.18)	(0.17)	(0.19)	(0.18)
Believe Win		1.37***		1.41***		1.30***
		(0.14)		(0.21)		(0.20)
Control mean	4.33	4.33	4.48	4.48	4.19	4.19
Observations	787	787	390	390	397	397
R^2	0.00	0.12	0.00	0.13	0.00	0.11

Notes: This table reports the treatment effects of competition on positive emotions. Panel A presents results for excitement, and Panel B presents results for satisfaction. Each panel shows estimates for the pooled sample (columns 1–2), the gain-framing condition (columns 3–4), and the loss-framing condition (columns 5–6). Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.10: Treatment Effects of Competition on Negative Emotions

	Panel A. Dependent Variable: Stress					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	-0.23	-0.32**	-0.43**	-0.53***	-0.02	-0.11
	(0.14)	(0.14)	(0.19)	(0.20)	(0.20)	(0.20)
Believe Win		-0.65***		-0.67***		-0.60***
		(0.16)		(0.22)		(0.22)
Control mean	3.90	3.90	3.84	3.84	3.96	3.96
Observations	787	787	390	390	397	397
R^2	0.00	0.03	0.01	0.04	0.00	0.02
	Panel B. Dependent Variable: Anxiety					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	-0.02	-0.09	-0.26	-0.32	0.22	0.13
	(0.14)	(0.14)	(0.20)	(0.20)	(0.20)	(0.20)
Believe Win		-0.53***		-0.40*		-0.62***
		(0.16)		(0.23)		(0.21)
Control mean	3.95	3.95	3.94	3.94	3.96	3.96
Observations	787	787	390	390	397	397
R^2	0.00	0.01	0.00	0.01	0.00	0.02
	Panel C. Dependent Variable: Embarrassment					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	-0.04	-0.15	-0.24	-0.35**	0.15	0.05
	(0.12)	(0.12)	(0.16)	(0.16)	(0.18)	(0.18)
Believe Win		-0.75***		-0.74***		-0.74***
		(0.14)		(0.19)		(0.21)
Control mean	2.50	2.50	2.47	2.47	2.53	2.53
Observations	787	787	390	390	397	397
R^2	0.00	0.04	0.01	0.05	0.00	0.04

Notes: This table reports the treatment effects of competition on negative emotions. Panel A presents results for stress, Panel B presents results for anxiety, and Panel C for embarrassment. Each panel shows estimates for the pooled sample (columns 1–2), the gain-framing condition (columns 3–4), and the loss-framing condition (columns 5–6). Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.11: Treatment Effects on Altruism by Perceived Percentile Rank

	Dependent Variable: Altruism					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	2.88**	-1.05	1.59	-5.41	4.14**	2.82
	(1.36)	(2.44)	(1.88)	(3.34)	(1.96)	(3.52)
Perceived Rank		-1.45		-4.82*		1.64
		(2.02)		(2.61)		(3.03)
Competition × Perceived Rank		5.91**		10.32**		2.00
		(2.93)		(4.03)		(4.22)
Control mean	36.38	37.32	37.17	40.34	35.61	34.58
Observations	787	787	390	390	397	397
R^2	0.01	0.01	0.00	0.02	0.01	0.02

Notes: The table shows the effect of competition on altruism, measured by the amount offered to a randomly matched partner in the dictator game. It also shows heterogeneous effects by perceived percentile rank. Columns (1)–(2) presents results for the pooled sample, while Columns (3)–(4) for gain framing and Columns (5)–(6) for loss framing. Perceived Rank is the self-assessed percentile rank in the IQ quiz. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.12: Effects on Altruism by Belief in Winning

	Dependent Variable: Altruism					
	Pooled		Gain Framing		Loss Framing	
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	2.88**	0.70	1.59	-3.15	4.14**	3.88
	(1.36)	(2.59)	(1.88)	(3.66)	(1.96)	(3.64)
Belief in Winning		-1.13		-2.93		0.19
		(2.25)		(3.20)		(3.17)
Competition × Belief in Winning		3.19		6.59		0.47
		(3.04)		(4.28)		(4.30)
Control mean	36.38	37.26	37.17	39.51	35.61	35.47
Observations	787	787	390	390	397	397
R^2	0.01	0.01	0.00	0.01	0.01	0.01

Notes: The table shows the effect of competition on altruism, measured by the amount offered to a randomly matched partner in the dictator game. It also presents heterogeneous effects by Belief in Winning, a binary variable equal to 1 if the participant expected to win and 0 otherwise. Columns (1)–(2) presents results for the pooled sample, while Columns (3)–(4) for gain framing and Columns (5)–(6) for loss framing. Perceived Rank is the self-assessed percentile rank in the IQ quiz. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.13: Treatment Effects on Zero-sum Thinking

	Dependent Variable: Zero-sum Thinking (World Values Survey Measure)		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Competition	-0.44**	-0.50*	-0.39
	(0.20)	(0.27)	(0.28)
Control mean	4.27	4.15	4.38
Observations	787	390	397
R^2	0.01	0.01	0.01

Notes: This table reports the estimated treatment effects of competition on zero-sum thinking. Zero-sum thinking is measured using a World Values Survey question (Inglehart et al., 2014) in which respondents rate their agreement, on a 1–10 scale, between two statements: "Wealth can grow so there's enough for everyone" (1, indicating minimal zero-sum thinking) and "People can only become wealthy at the expense of others" (10, indicating strong zero-sum thinking). Higher values on the y-axis therefore represent stronger zero-sum thinking. Each column presents results from an OLS regression of zero-sum thinking on a treatment indicator for competition. Column (1) pools all observations, while Columns (2) and (3) report results separately for gain framing and loss framing. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.14: Treatment Effects on Zero-sum Thinking (Alternative Measure)

	Dependent Variable: Zero-sum Thinking (Immigration Measure)		
	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)
Competition	0.01	0.05	-0.03
	(0.03)	(0.05)	(0.05)
Control mean	0.34	0.33	0.35
Observations	787	390	397
R^2	0.00	0.00	0.00

Notes: This table shows the estimated treatment effects of competition on zero-sum thinking. Zero-sum thinking is measured with a scenario-choice question in which both immigrants and locals work as day laborers. On Day 1, immigrant workers find 20 jobs and local workers 40 jobs. On Day 2, immigrant workers find 40 jobs. Respondents then choose whether local workers find 20 or 80 jobs on Day 2. Choosing 20 reflects zero-sum thinking (coded as 1), while choosing 80 reflects non-zero-sum thinking (coded as 0). Column (1) presents results for the pooled sample, while Columns (2) and (3) present results for gain and loss framing, respectively. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B.15: Effects on Contribution Decisions and Beliefs in a Public Goods Game

	Contribution to Public Pool			*Belief: Others Not Contributing (%)*		
	Pooled	Gain Framing	Loss Framing	Pooled	Gain Framing	Loss Framing
	(1)	(2)	(3)	(4)	(5)	(6)
Competition	-0.05	-0.05	-0.05	0.23	0.37*	0.09
	(0.04)	(0.05)	(0.05)	(0.15)	(0.21)	(0.22)
Control mean	0.60	0.57	0.63	6.17	6.25	6.09
Observations	787	390	397	787	390	397
R^2	0.00	0.00	0.00	0.00	0.01	0.00

Notes: This table reports the effect of competition on contribution decisions and beliefs in a public goods game. Competition is a binary indicator equal to 1 for participants in the competition group and 0 for those in the control group. The dependent variable in Columns (1)–(3) is a binary indicator for contributing to the public pool, while the dependent variable in Columns (4)–(6) is the participant's belief (in percent) about the share of others not contributing (i.e., keeping the money for themselves). Columns (1) and (4) pool all treatments, whereas Columns (2)–(3) and (5)–(6) report results separately for the gain- and loss-framing conditions. Robust standard errors are reported in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Experimental Materials

C.1 Recruitment

Participants were recruited via the Prolific platform for a study titled 'A short quiz and a set of survey questions (15–25 minutes).' The study description varied slightly depending on the contextual framing. Participants were randomly assigned to one of four experimental groups.

GAIN FRAMING: COMPETITION AND CONTROL GROUPS

In this study, you will complete a short quiz followed by a set of survey questions. The base payment for participating in the study is $2.00. You can earn a bonus of up to $4.00 in the first section, and additional bonuses in later sections, depending on your performance and decisions. The entire study will take approximately 15-25 minutes.

LOSS FRAMING: COMPETITION AND CONTROL GROUPS

In this study, you will complete a short quiz followed by a set of survey questions. The base payment for participating in the study is $6.00. You may lose up to $4.00 of this amount in the first section. Bonuses are available in later sections. Your final payment will depend on your performance and decisions. The entire study will take approximately 15-25 minutes.

To qualify for the study, participants had to be at least 18 years old, reside in the United States, have a task approval rate above 95%, and have completed at least 100 tasks on Prolific. Each participant could only take part in one experimental group.

C.2 Welcome and Consent

Welcome! Thank you for participating in our study! We are academic researchers from Boston University. This study will take approximately 15–25 minutes to complete. Your participation contributes to valuable academic research. After completing the study, you will receive a completion code for payment.

Important Guidelines. (1) Engagement: Your careful attention is essential for the success of this research. Please read all instructions carefully, engage thoroughly in the tasks, and answer questions truthfully. The study includes multiple checks to ensure par-

ticipants are engaging properly. Responses that show signs of inattention may be flagged as low quality and excluded from our analysis. (2) Commitment: We kindly ask that you complete the entire study once you begin, as some sections involve interactions with other participants. Your participation is entirely voluntary, and you may withdraw at any point without penalty. However, please note that if you leave the study before finishing, your session will end, and you may not be able to resume later. (3) Anonymity: This study is completely anonymous. Your Prolific ID will be used only to process your payment. No one will know your decisions or performance, and you will never be personally identified.

GAIN FRAMING: COMPETITION AND CONTROL GROUPS

Compensation. The base payment for participating in the study is $2.00. You can earn a bonus of up to $4.00 in the first section, and additional bonuses in later sections, depending on your performance and decisions.

LOSS FRAMING: COMPETITION AND CONTROL GROUPS

Compensation. The base payment for participating in the study is $6.00. You may lose up to $4.00 of this amount in the first section. Bonuses are available in later sections. Your final payment will depend on your performance and decisions.

Contact. If you have any questions, you may contact us at jiaruiw@bu.edu.

After the welcome page, participants are presented with an informed consent form. To proceed, they must agree to the following statement by checking a box: "I consent to participate in this study. By checking this box, I confirm that I have read and understood the information provided about the purpose, risks, and benefits of this study. I understand that my participation is voluntary and I agree to the use of my data as described in the study information." Once consent is given, participants are asked to enter their Prolific ID and complete a reCAPTCHA verification to confirm they are not automated bots. They can then begin the study.

C.3 Instructions

A. Gain Framing

This study consists of Competition and Survey Sections. You will receive a base payment of $2.00 for participating. You can earn a bonus of up to $4 in the Competition Section (or Quiz Section for the control group), and additional bonuses in the Survey Section. The

exact amount will depend on your performance and decisions. The entire study will take approximately 15 to 25 minutes to complete.

GAIN FRAMING: COMPETITION GROUP

Competition section. You will be randomly paired with another participant for an IQ Quiz Competition (Intelligence Quotient Quiz Competition). Only one of you will earn a $4 reward. The participant with the higher score will be the top performer and receive the $4. The one with the lower score will be the bottom performer and receive $0. If both participants have the same score, one will be randomly selected to receive the $4 reward. In the IQ Quiz Competition, you will earn 1 point for each correct answer, lose 0.25 points for each incorrect answer, and neither earn nor lose any points for skipped questions. Once you submit an answer or skip a question, you cannot go back to it. The quiz consists of fifty questions, and you will have 4 minutes to answer as many as possible. Throughout the competition, you will see your opponent's raw score in real time, which shows only the number of questions they have answered correctly (without any deductions for wrong answers). You will not see your own score during the competition. Your final score and competition results will be revealed at the end of the study. Before the competition begins, you will have the opportunity to answer a practice question to get familiar with the quiz format.

GAIN FRAMING: CONTROL GROUP

Quiz section. You will take an IQ Quiz (Intelligence Quotient Quiz). If you score 6 points or higher, you will receive a $4 reward. In a previous session of the experiment, about half of the participants scored 6 points or higher. If you score below 6 points, you will receive $0. In the IQ Quiz, you will earn 1 point for each correct answer, lose 0.25 points for each incorrect answer, and neither earn nor lose any points for skipped questions. Once you submit an answer or skip a question, you cannot go back to it. The quiz consists of fifty questions, and you will have 4 minutes to answer as many as possible. At the end of the study, you will see your score and the quiz results. Before the quiz begins, you will have the opportunity to answer a practice question to get familiar with the format.

Survey section. You will answer six survey questions and complete a decision-making task, followed by a few final survey questions. Some questions offer bonuses and will be clearly marked.

Comprehension question. Before we proceed, let's ensure you understand the instructions clearly. Please answer the following question correctly to continue.

GAIN FRAMING: COMPETITION GROUP

In the 4-minute IQ Quiz competition, Emily answers 20 questions (14 correct, 6 incorrect) while Lucy answers 12 questions (8 correct, 4 incorrect). Who receives the $4 reward? A. Lucy B. Emily C. It's a tie. One of them will be randomly selected to receive the reward.

GAIN FRAMING: CONTROL GROUP

In the 4-minute IQ Quiz, Lucy answers 18 questions (14 correct, 4 incorrect). Does she receive the $4 reward? A. No B. Yes C. Not enough information.

B. Loss Framing

This study consists of Competition and Survey Sections. You will receive a base payment of $6.00 for participating. You may lose up to $4 of this amount in the Competition Section (or Quiz Section for the control group). Bonuses are available in the Survey Section. Your final payment will depend on your performance and decisions. The entire study will take approximately 15 to 25 minutes to complete.

LOSS FRAMING: CONTROL GROUP

Quiz section. You will take an IQ Quiz (Intelligence Quotient Quiz). If you score 6 points or higher, you will keep the initial payment of $6. In a previous session of the experiment, about half of the participants scored 6 points or higher. If you score below 6 points, you will lose $4 from the initial payment. In the IQ Quiz, you will earn 1 point for each correct answer, lose 0.25 points for each incorrect answer, and neither earn nor lose any points for skipped questions. Once you submit an answer or skip a question, you cannot go back to it. The quiz consists of fifty questions, and you will have 4 minutes to answer as many as possible. At the end of the study, you will see your score and the quiz results. Before the quiz begins, you will have the opportunity to answer a practice question to get familiar with the format.

LOSS FRAMING: COMPETITION GROUP

Competition section. You will be randomly paired with another participant for an IQ Quiz Competition (Intelligence Quotient Quiz Competition). Only one of you will keep the initial payment of $6. The participant with the higher score will be the top performer and keep the $6. The one with the lower score will be the bottom performer and lose $4 from their initial payment. If both participants have the same score, one will be randomly selected to lose $4. In the IQ Quiz Competition, you will earn 1 point for each correct answer, lose 0.25 points for each incorrect answer, and neither earn nor lose any points for skipped questions. Once you submit an answer or skip a question, you cannot go back to it. The quiz consists of fifty questions, and you will have 4 minutes to answer as many as possible. Throughout the competition, you will see your opponent's raw score in real time, which shows only the number of questions they have answered correctly (without any deductions for wrong answers). You will not see your own score during the competition. Your final score and competition results will be revealed at the end of the study. Before the competition begins, you will have the opportunity to answer a practice question to get familiar with the quiz format.

Survey section. You will answer six survey questions and complete a decision-making task, followed by a few final survey questions. Some questions offer bonuses and will be clearly marked.

Comprehension question. Before we proceed, let's ensure you understand the instructions clearly. Please answer the following question correctly to continue.

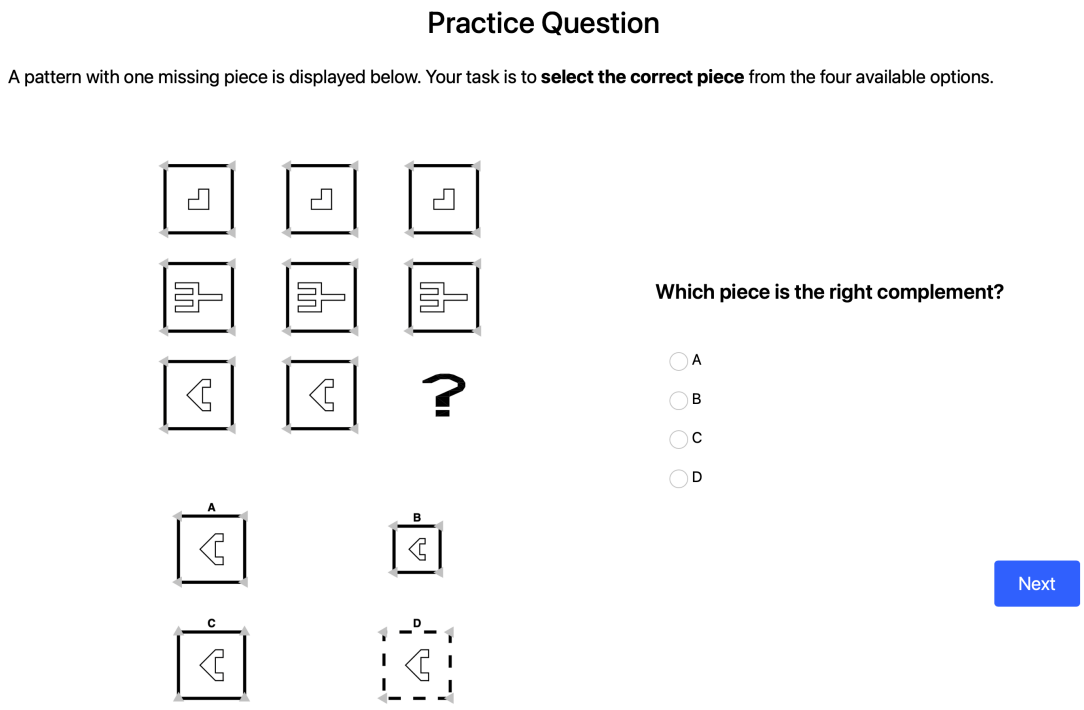
LOSS FRAMING: CONTROL GROUP

In the 4-minute IQ Quiz, Emily answers 10 questions (6 correct, 4 incorrect). Does she lose $4 from the initial payment of $6? A. No B. Yes C. Not enough information.

LOSS FRAMING: COMPETITION GROUP

In the 4-minute IQ Quiz competition, Lucy answers 20 questions (14 correct, 6 incorrect) while Emily answers 12 questions (8 correct, 4 incorrect). Who loses $4 from the initial payment of $6? A. Lucy B. Emily C. It's a tie. One of them will be randomly selected to lose $4.

C.4 Practice Question



Appendix Figure C.1: Practice Question Interface

C.5 IQ Quiz

A. A Few Reminders

Before the IQ quiz begins, participants are presented with a reminder page that lists the following points: (1) This study is completely anonymous. Neither the organizers nor other participants will know your identity, and no one will know your performance or decisions. (2) To ensure high-quality research, please take the quiz in a quiet environment without distractions. Turn off notifications or other potential interruptions before starting.

GAIN FRAMING: COMPETITION GROUP

During the competition, you will see your opponent's real-time raw score (number of correct answers) and a 4-minute timer. You will not see your own score. Competition results will be revealed at the end of the study. Only the top performer receives the $4 reward, while the bottom performer receives nothing. Once you submit an answer or skip a question, you cannot go back to it. When you are ready, click 'Next' to begin matching and start the competition.

GAIN FRAMING: CONTROL GROUP

During the quiz, you will see a 4-minute timer. Quiz results will be revealed at the end of the study. If you score 6 points or higher, you will receive a $4 reward. If not, you will receive nothing. Once you submit an answer or skip a question, you cannot go back to it. When you are ready, click 'Next' to start the quiz.

LOSS FRAMING: COMPETITION GROUP

During the competition, you will see your opponent's real-time raw score (number of correct answers) and a 4-minute timer. You will not see your own score. Competition results will be revealed at the end of the study. Only the top performer keeps the full initial payment of $6, while the bottom performer loses $4. Once you submit an answer or skip a question, you cannot go back to it. When you are ready, click 'Next' to begin matching and start the competition.

LOSS FRAMING: CONTROL GROUP

During the quiz, you will see a 4-minute timer. Quiz results will be revealed at the end of the study. If you score 6 points or higher, you will keep the full initial payment of $6. If not, you will lose $4. Once you submit an answer or skip a question, you cannot go back to it. When you are ready, click 'Next' to start the quiz.

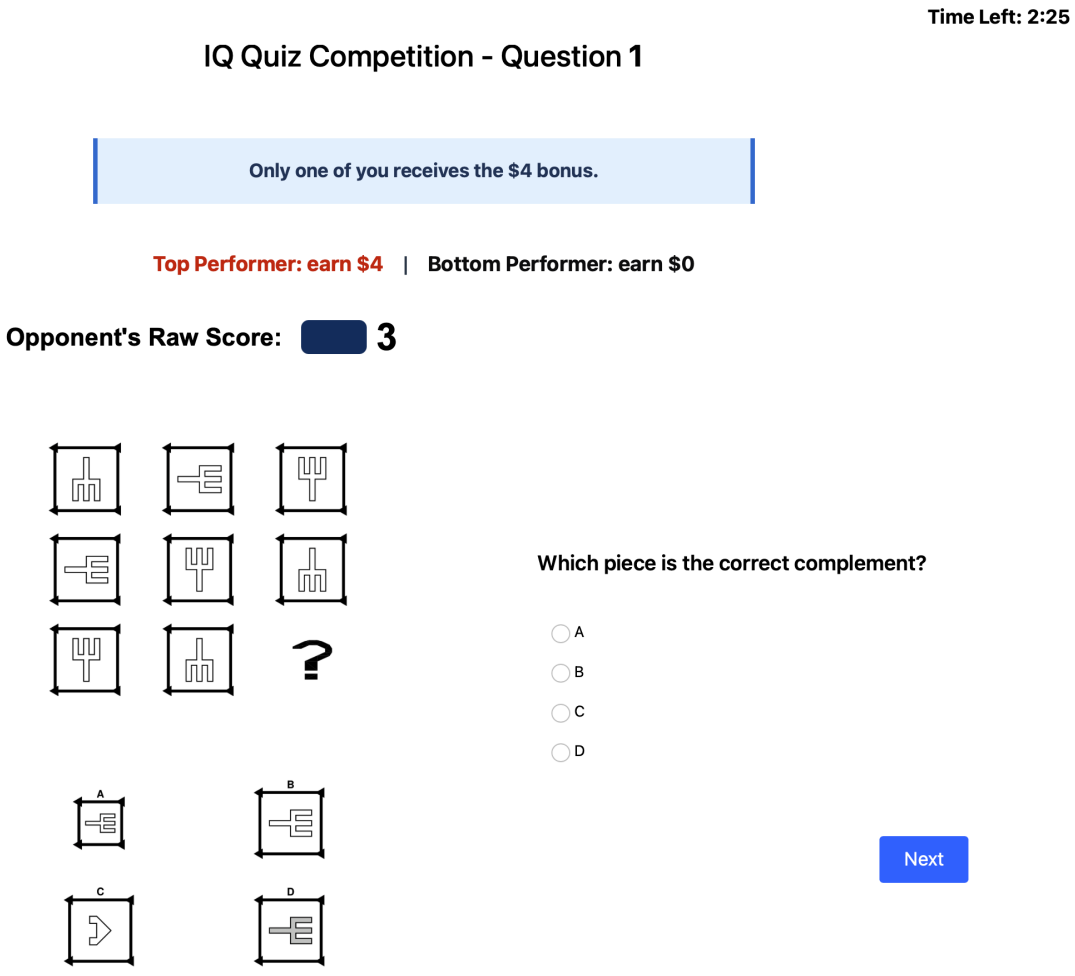
B. Matching

Following the reminder page, participants in the competition groups proceed to the matching page, where they wait to be paired in real time with another online participant.

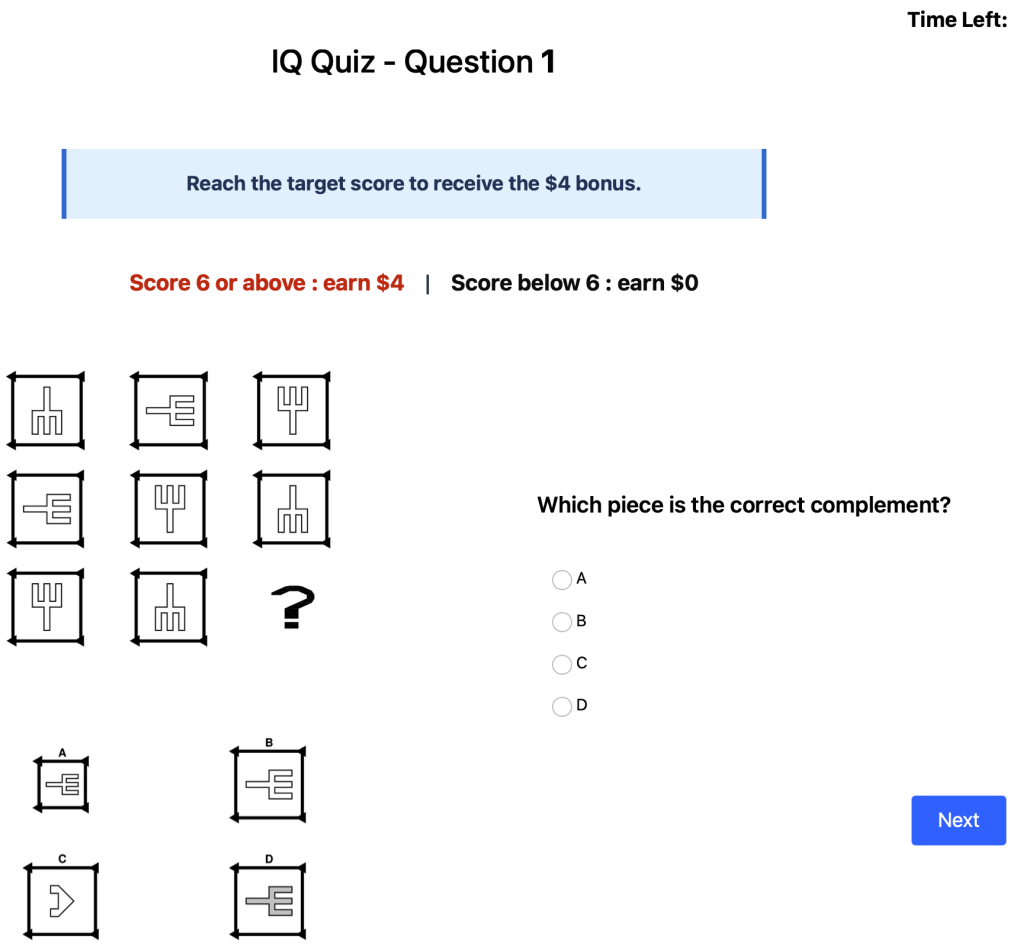
C. *IQ Quiz Question*

Below are screenshots of IQ quiz questions from each of the four experimental groups: Gain Framing–Competition, Gain Framing–Control, Loss Framing–Competition, and Loss Framing–Control.

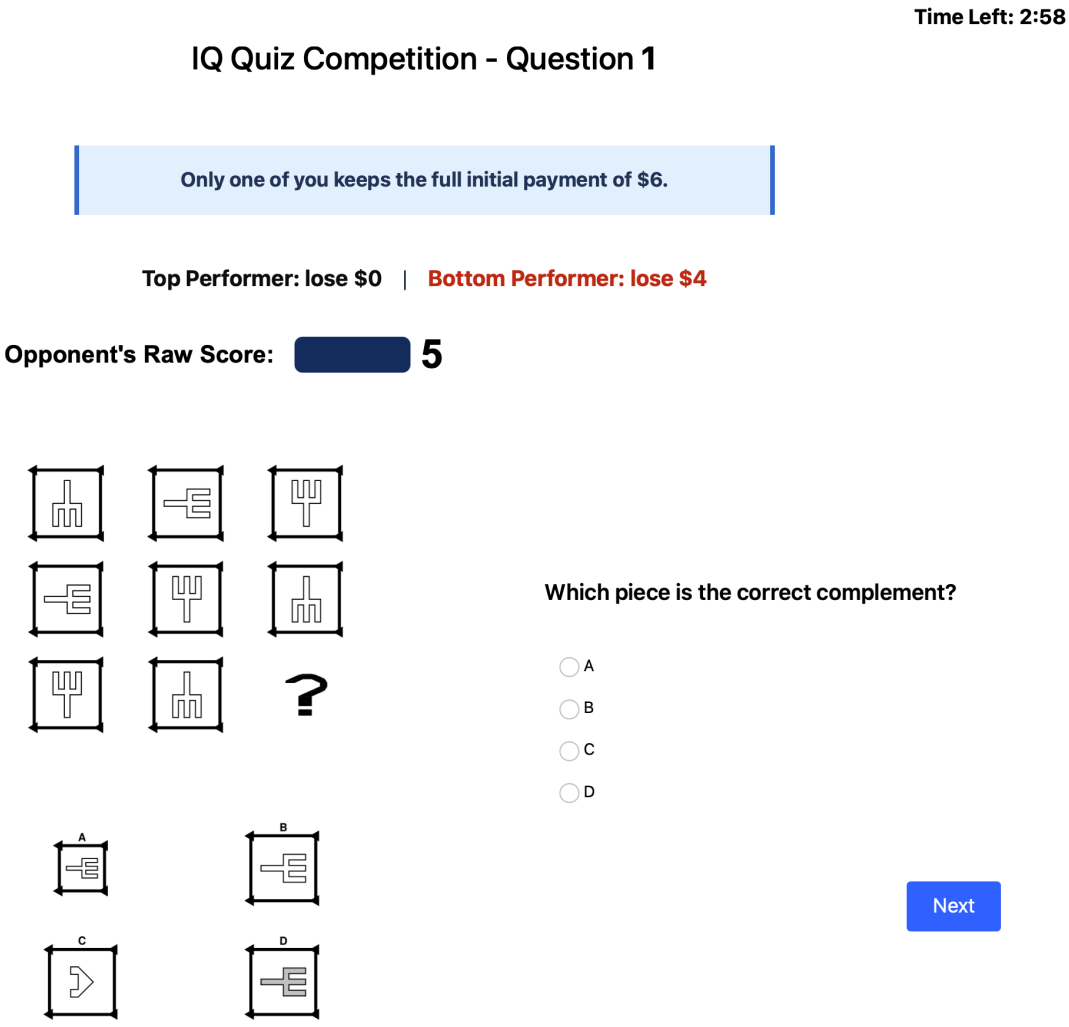
Appendix Figure C.2: Sample IQ Quiz Question – Gain Framing (Competition Group)



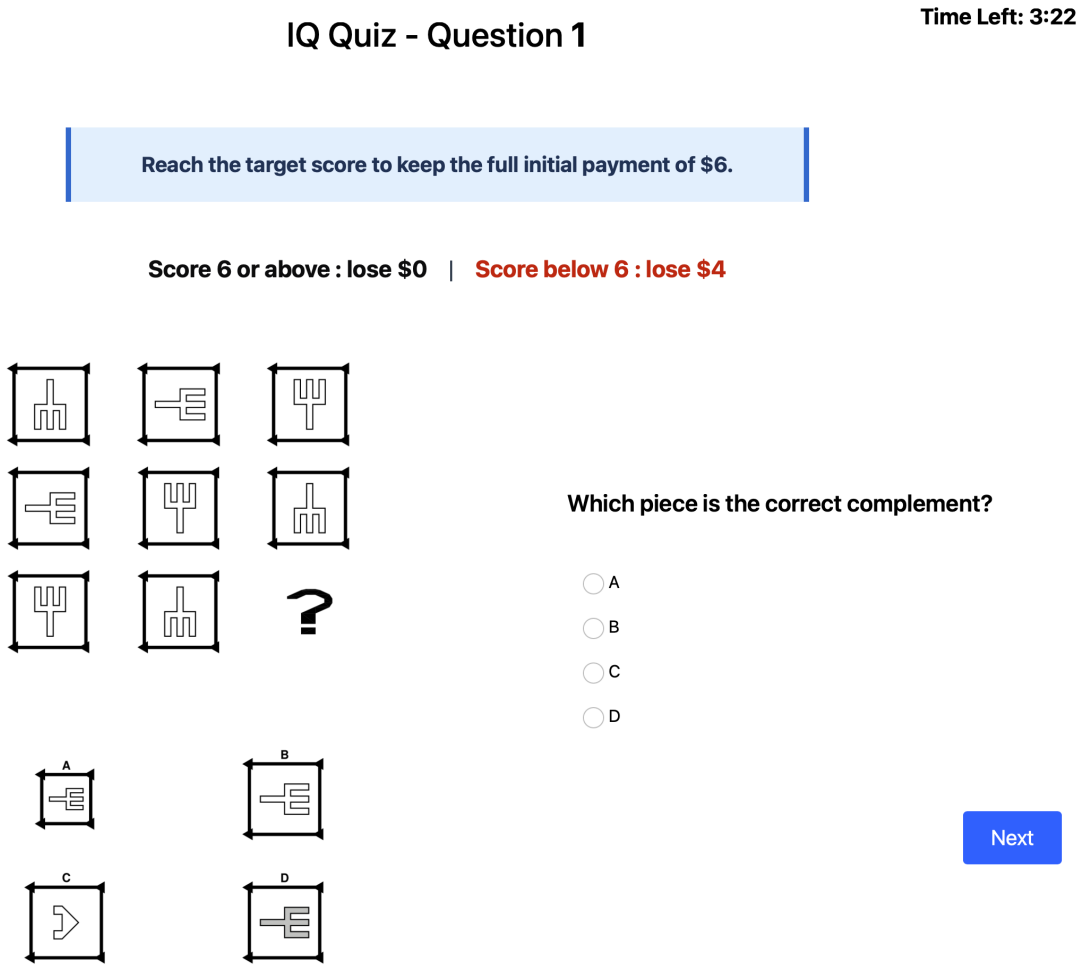
Appendix Figure C.3: Sample IQ Quiz Question – Gain Framing (Control Group)



Appendix Figure C.4: Sample IQ Quiz Question – Loss Framing (Competition Group)



Appendix Figure C.5: Sample IQ Quiz Question – Loss Framing (Control Group)



C.6 Main Survey

GAIN FRAMING: COMPETITION GROUP

Survey Introduction. The IQ Quiz Competition is complete. You will see the results at the end of the study. As a reminder, only the top performer will receive a $4 bonus, while the bottom performer will receive nothing.

GAIN FRAMING: CONTROL GROUP

Survey Introduction. The IQ Quiz is complete. You will see the results at the end of the study. As a reminder, if you score 6 points or higher, you will earn a $4 bonus. Otherwise, you will receive nothing.

LOSS FRAMING: COMPETITION GROUP

Survey Introduction. The IQ Quiz Competition is complete. You will see the results at the end of the study. As a reminder, only the top performer will keep the full initial payment of $6, while the bottom performer will lose $4.

LOSS FRAMING: CONTROL GROUP

Survey Introduction. The IQ Quiz is complete. You will see the results at the end of the study. As a reminder, if you score 6 points or higher, you will keep the full initial payment of $6. Otherwise, you will lose $4.

Next, you will answer six survey questions and complete a decision-making task, followed by a few final survey questions. You can earn a bonus of up to $1.30 in this section, depending on your performance and decisions. Bonus-eligible questions will be clearly marked.

Please note that your responses will remain anonymous. Your honest responses are greatly appreciated. To ensure high-quality research, attention checks are included throughout the survey. Responses indicating inattention may be excluded from the analysis.

A. Utility

Question1. On a scale from 1 (not at all enjoyable) to 7 (extremely enjoyable), how enjoyable was the IQ Quiz Competition (or *IQ Quiz* for the control group)? [Options: 1 (not at all enjoyable), 2, 3, 4, 5, 6, 7 (extremely enjoyable)]

Question2. Thinking back to how you felt during the IQ Quiz Competition (or *IQ Quiz* for the control group), please indicate to what extent you were experiencing the following, on a scale from 1 (not at all) to 7 (extremely) [Stress, Excitement, Satisfaction, Embarrassment, Anxiety. Options: 1 (not at all), 2, 3, 4, 5, 6, 7 (extremely)]

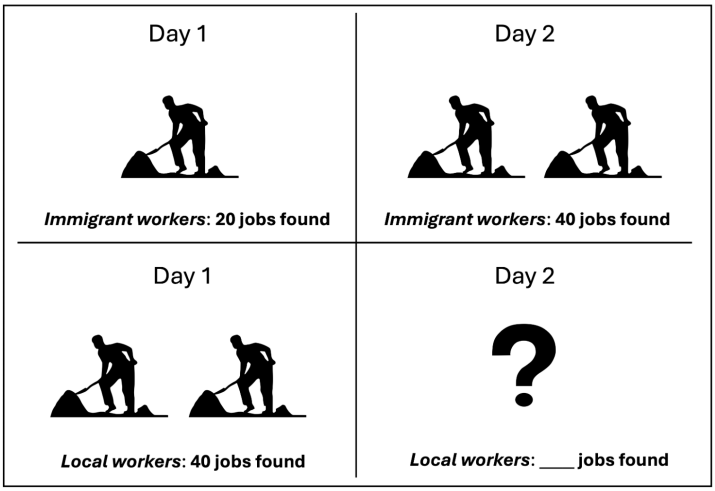
B. Task Preference

Question1. On a scale from 1 (not at all likely) to 7 (extremely likely), how likely would you be to voluntarily take another 10 IQ questions, similar to the ones you just saw in the IQ quiz, with no monetary rewards? [Options: 1 (not at all likely), 2, 3, 4, 5, 6, 7 (extremely likely)]

Question2. Imagine you have another IQ quiz in front of you right now, similar to the one you just completed, but with a different set of fifty questions. You again have 4 minutes to answer as many as possible. If you get at least 6 questions correct within the 4 minutes, you will receive a payment. Below is a list of payment amounts. For each amount, please indicate 'Yes' if you would be willing to take the quiz for that payment, or 'No' if you would not. [$0.20, $0.40, $0.60, $0.80, $1.00, $1.20, $1.40, $1.60, $1.80, $2.00, $2.50, $3.00, $5.00. Options: Yes, I would take; No, I would not take.]

C. Zero-sum Thinking

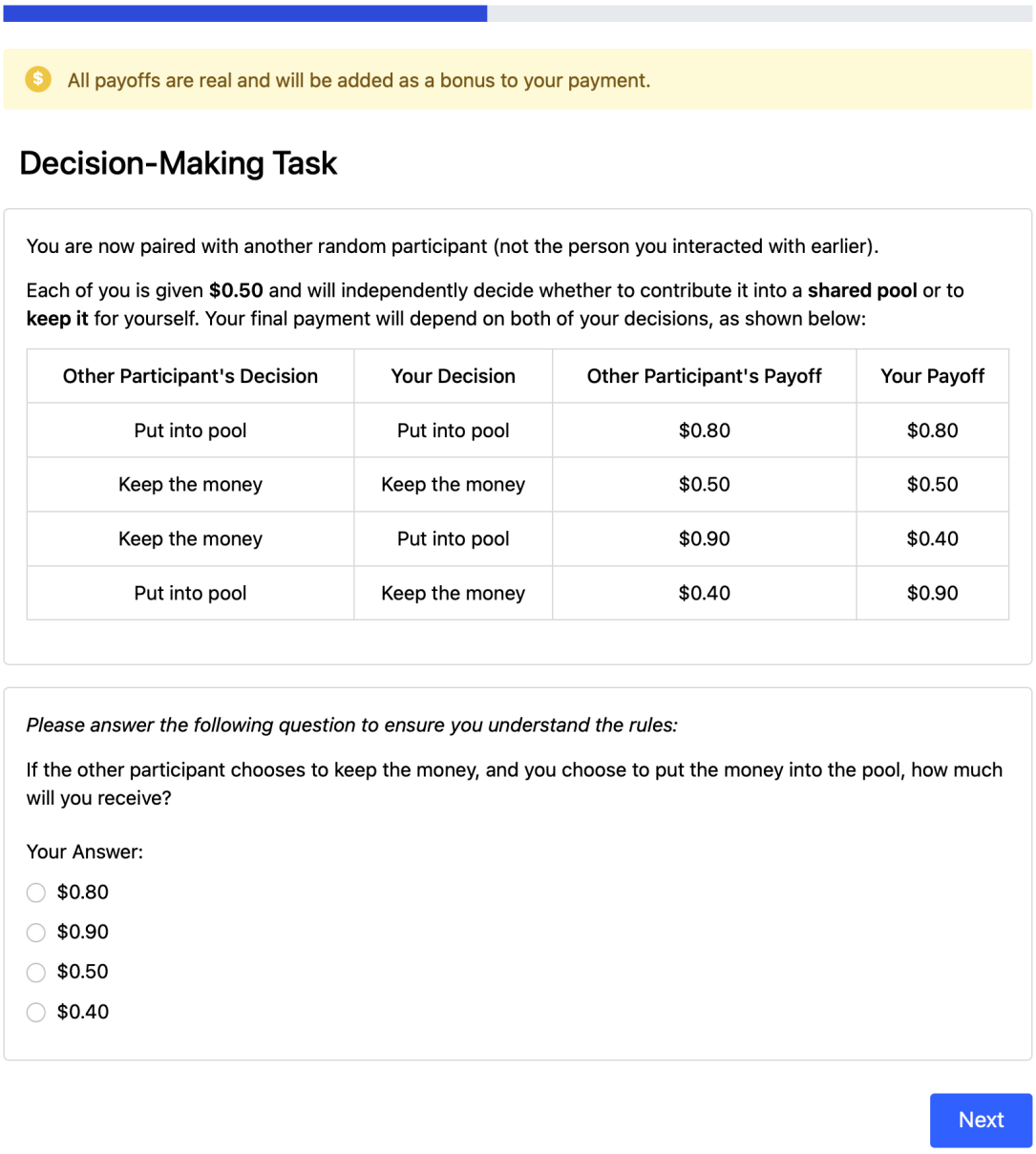
Question1. Consider a local job market where both immigrants and locals work as day laborers. On Day 1, immigrant workers found 20 jobs, while local workers found 40 jobs. On Day 2, immigrant workers found 40 jobs. Which of the following estimates is more likely to be accurate regarding the number of jobs local workers found on Day 2? [Options: 20 jobs, 80 jobs]



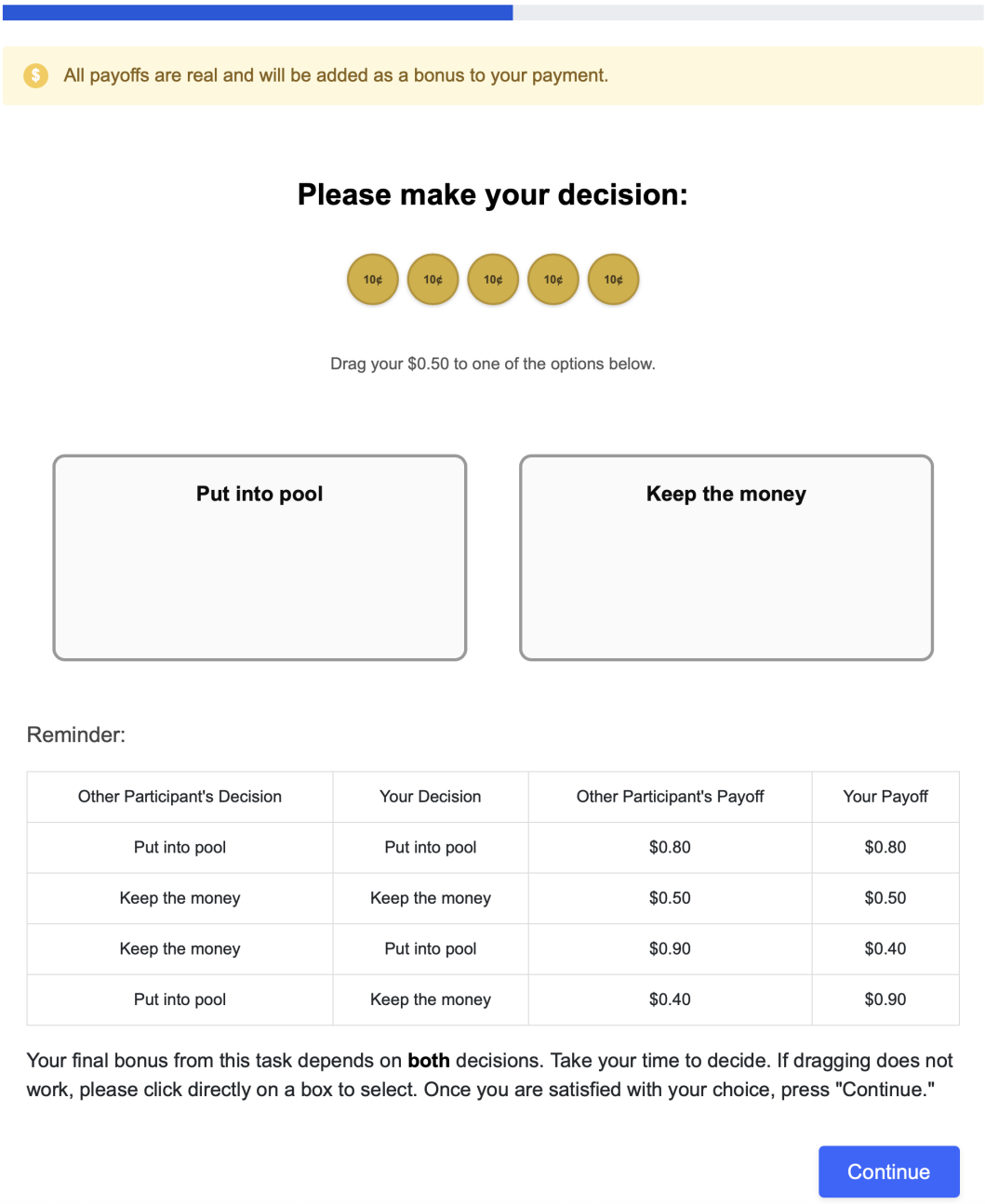
Question2. Below are two statements. Where do your views fall on a scale from 1 to 10? 1 means you agree completely with the statement 1; 10 means you agree completely with the statement 2. *Statement 1*: People can only become wealthy at the expense of others. *Statement 2*: Wealth can grow so there's enough for everyone. If your views fall somewhere in between, you can choose any number in between. [Options: 1 (statement1), 2, 3, 4, 5, 6, 7, 8, 9, 10 (statement2)]

D. Public Goods Game

Appendix Figure C.6: Public Goods Game Instructions



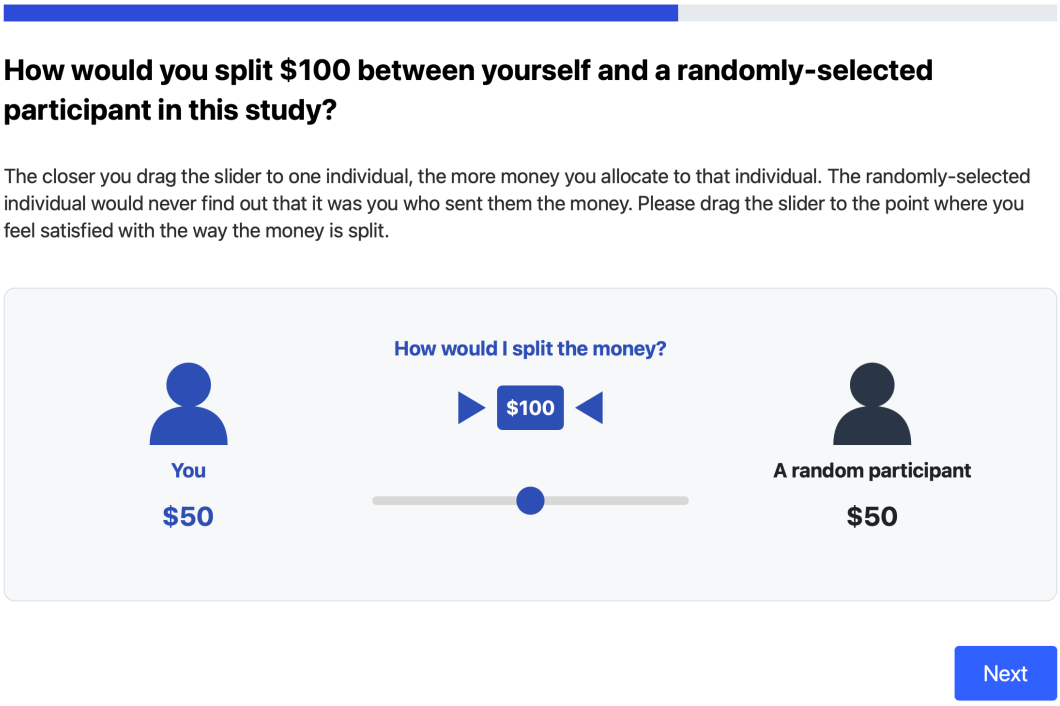
Appendix Figure C.7: Public Goods Game-Decision Page



Question. Approximately 800 participants are taking part in this study today. What percentage of them do you think choose to keep the money? If your answer is correct, you will receive a $0.20 bonus. [Options: 0–10%, 11–20%, 21–30%, 31–40%, 41–50%, 51–60%, 61–70%, 71–80%, 81–90%, 91–100%.]

E. Dictator Game

Appendix Figure C.8: Interface of the Dictator Game



F. Attention Check

Question. This is not a question that needs to be answered. Instead, the goal of this question is to check whether you are reading all instructions carefully. To indicate this, please click the next button without selecting any of the options below. You must click next without making any selections in order to have your response approved. [Options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

C.7 Supplemental Survey

A. Belief in Winning

COMPETITION GROUPS
Do you think you were the top performer in the IQ Quiz Competition? [Options: Yes, No.]

CONTROL GROUPS
Do you think you scored 6 or higher on the IQ Quiz? [Options: Yes, No.]

B. Perceived Percentile Rank

Question. Based on your experience in the IQ Quiz, how well do you think you performed compared to all other participants in this study, on a scale from 0 to 10? The lowest value (0) indicates that you believe you performed worse than almost everyone else, and the highest value (10) indicates that you believe you performed better than nearly all other participants. For example, if you think you performed better than approximately 70% of all other participants, you should select 7. Please make your choice. [Options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

C. Competition Preferences

Question1. On a scale from 1 (not at all like me) to 7 (exactly like me), please indicate the extent to which the following statement describes you: ”Competition brings the best out of me.” [Options: 1 (not at all like me), 2, 3, 4, 5, 6, 7 (exactly like me)]

Question2. On a scale from 1 (not at all like me) to 7 (exactly like me), please indicate the extent to which the following statement describes you: ”I enjoy competing against others.” [Options: 1 (not at all like me), 2, 3, 4, 5, 6, 7 (exactly like me)]

D. Understanding of Instructions

Question. Did you understand the instructions throughout the study? [Options: I fully understood them, I understood them almost fully, I only partly understood them, I did not understand them]

E. Demographics

Question1. Which year were you born? [Options: 1920 to 2010]
Question2. What's your gender? [Options: Male, Female, Other]
Question3. How would you describe your race or ethnicity? [Options: White, African-American, Hispanic, American Indian or Alaska Native, Asian, Other]
Question4. How would you describe your educational attainment? [Options: No high school graduation, High school graduate, Bachelor's degree, Graduate or professional degree]
Question5. What's your approximate annual household income before taxes? [Options: Below $10,000, $10,000–$14,999, $15,000–$24,999, $25,000–$34,999, $35,000–$49,999, $50,000–$74,999, $75,000–$99,999, $100,000–$149,999, $150,000–$199,999, $200,000 or more]
Question6. Are you employed full-time? [Options: Yes, No]
Question7. On economic policy matters, where do you see yourself on the left–right spectrum? [Options: Extreme Left, Leaning Left, Center, Leaning Right, Extreme Right]

F. Comments

Thank you for participating in our study! We would appreciate any comments or feedback about your experience. If any part of the instructions was unclear or if you ran into any issues during the study, please let us know. Your valuable feedback will help us improve our research." After this page, participants are shown their IQ Quiz results and informed whether they were the top performer in the competition (or scored 6 or higher).