

Social Loss Aversion and Optimal Contest Design

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ABSTRACT

When designing a contest to motivate effort by salespeople, service employees, franchisees or product development teams, one of the key questions faced by managers is: What should be the optimal proportion of winners and losers? Prevailing marketing theory predicts that the proportion of winners in a contest should always be lower than the proportion of losers. Not only has this theory not been empirically tested, it is also based on the assumption that contestants care solely about the value of the prizes they receive. This self-interested assumption has been increasingly challenged in marketing and economics.

This paper uses a behavioral economics model to formalize the idea that if contestants also care about their contest outcomes relative to other contestants, changing the proportion of winners in a contest can alter the reference points that contestants use to make these social comparisons. Consequently, a contest with a higher proportion of winners than losers can yield greater effort than one with fewer winners than losers if the degree of social loss aversion in the contestants is sufficiently strong. Two incentive-aligned experiments show that this prediction can be valid in situations with public announcements of contest outcomes.

Keywords: Contests, Sales Management, Loss Aversion, Social Preferences, Behavioral Economics, Experimental Economics.

Marketing managers often use contests to motivate their sales forces, service employees, franchisees, or product development teams for two main reasons. First, contests can generate competitive excitement because the contestants' outcomes depend solely on whether they perform better than other contestants, and not on their individual level of performance benchmarked against some absolute criterion (e.g., a sales target). Second, because the total payout in contests is known in advance, they are preferred by managers with strict budget limits. In a contest, contestants are ranked according to a specified metric and prizes of higher values are awarded to those with higher ranks. Because prize values differ across ranks, there are always "winners" and "losers" in every contest. Thus, a critical question that every manager has to confront when designing a contest is: How many winners and losers should there be? Does the proportion of winners in a contest matter?

There is very little research that addresses these questions in marketing and economics. The prevailing theoretical understanding of optimal contest design relies on the results of two studies, both of which are mathematical models that assume that contestants are rational actors who are self-interested, that is, they will choose actions to maximize their utility which depends solely on the monetary value of the prize outcomes they receive from the contest. Specifically, Krishna and Morgan (1998) study contests with up to four contestants and show that the optimal number of winners is one, except when the four contestants all are risk averse, in which case there should be two winners. In an important study on sales contests, Kalra and Shi (2001) allow the number of contestants to vary and demonstrate: (1) There should be only one winner in a sales contest if salespeople are risk neutral; (2) the optimal contest has only one winner whenever sales follow a uniform distribution, regardless of whether the contestants are risk neutral or risk averse; and (3) when

there are more than three contestants, the optimal number of winners can be greater than one only if salespeople are risk averse and when sales are logistically distributed. Even in these conditions though, the authors state that the optimal numbers of winners should never exceed half the number of contestants. That is, the general prediction of extant marketing models is that an optimal contest should have fewer winners than losers and that the optimal number of winners may be as low as one. However, this prediction has not been empirically tested.

Moreover, the current models of contest design lack ready explanations for some of the “empirical puzzles” that are observed in practice when companies implement sales contests. For example, why do some companies spend money to recognize contest winners in award ceremonies to which both the contestants and non-contestants are invited? Why do others display charts of the productivity metrics of customer service representatives in call centers, or structure their performance reporting systems to allow salespeople participating in a sales contest to access the performance data of other contestants? Why do some organizations give out a plethora of employee awards (sometimes resulting in very fine categorizations of awards) with practically no monetary value, instead of giving only one award with a large monetary value?¹ Existing theory also is agnostic regarding whether a manager should design contests with varying numbers of winners and losers for different groups of salespeople with distinct characteristics, including their propensities to make social comparisons. For example, in a field sales force, salespeople are stationed in distinct geographic areas and do not interact frequently, whereas in an inside sales team, salespeople may be located together in an office and thus are more familiar with one another.

¹ Because these awards often carry almost no monetary value (e.g., a plaque or a certificate), explaining multiple awards on the basis of risk aversion over wealth cannot be a compelling argument.

To answer these questions, it may be important to account for and understand the effects of social comparisons on contestants' behavior. This paper contributes to an understanding of optimal contest design in two ways: First, it employs the tools of behavioral economics to mathematically capture the idea that contestants also care about social comparisons (in addition to the value of the prize they receive) by specifying a social utility function that generalizes the standard self-interested model. The basic premise underlying the social comparison model is that the proportion of winners and losers in a contest can influence the psychological reference points that contestants use when they make social comparisons. Specifically, losing in a contest with fewer winners than losers (a low-winners contest) may not be coded psychologically as a loss compared with others because most people lose anyway, whereas losing may hurt in a contest with more winners than losers (a high-winners contest) because most people win. Similarly, receiving a winner's prize in the low-winners contest may bring added joy (or sometimes guilt, depending on the relationships among contestants) because most other people do not win, but winning in the high-winners contest may not generate the same psychological effect because most people win anyway. Based on these ideas, this paper introduces a social utility function that assumes the modal prize in a contest as the reference point for social comparisons. The model shows that contrary to conventional wisdom, a high-winners contest can yield greater effort relative to a low-winners contest when the contestants' degree of social loss aversion, that is, their psychological distaste for being perceived as a loser when compared with others, is sufficiently strong. The modeling approach offers the advantage of generating point predictions of contestants' effort levels, which allows one to benchmark the predictions of the social comparison model against

the self-interested model quantitatively. Moreover, this method can rule out some alternative utility specifications through formal mathematical reasoning.

Second, this paper presents two experiments that compare effort levels in the low-versus high-winners contests. These experiments align subjects' decisions with pecuniary outcomes, such that departures from the predictions of the self-interested model carry financial consequences and thus represent deliberate violations of that utility model. Because the experimental methodology translates utility into monetary terms, one can obtain monetary estimates of the value that contestants place on social comparisons, as implied by the experimental data. The results across the two experiments strongly support the social comparison model and demonstrate that effort in the high-winners contest may be greater than that in the low-winners contest, but only in contest environments where the contestants are more likely to make social comparisons. That is, a contest with more winners than losers is optimal only when coupled with activities that publicize the contest outcomes and promote familiarity among the contestants.

This study relates to some previous marketing literature, including work that applies social comparison theory (Festinger 1954) to study marketing problems. Zhou and Soman (2003) demonstrate that consumers are less likely to leave a queue when the number of people behind them increases, because they gain comfort from their downward comparisons. Argo, White, and Dahl (2006) also show that when consumers receive threatening social comparison information, they are more likely to lie to protect their self-evaluations. Amaldoss and Jain (2005a; 2005b; 2008) incorporate the effects of social comparison by consumers to study how managers should make pricing and product line decisions for luxury goods using mathematical models that capture the fact that consumers' well-being depends not only on

intrinsic valuations of products, but also on which other consumer groups (and how many of them) purchase the products. This paper extends the literature by examining the implications of social comparisons among marketing employees for designing optimal incentive contracts.

In the area of sales contests, Lim, Ahearne and Ham (2009) examine the efficacy of various contest prize structures using laboratory and field experiments, but they do not study contests with a higher proportion of winners than losers. Although the model used herein is based on principal–agent models that underpin analytical models of sales force compensation, it also has broad similarities with other models of contests in which firms compete in product development races (Amaldoss et al. 2000) or design sweepstakes to induce consumers to purchase their products (Kalra and Shi, forthcoming). Finally, this research follows recent marketing articles that incorporate bounded rationality into marketing models (Che, Sudhir, and Seetharaman 2007; Ho, Lim, and Camerer 2006; Ho and Su, forthcoming; Meyer, Zhao, and Han 2008) and employ incentive-aligned experiments to test marketing theories (Ding et al. 2005; Ho and Zhang 2008; Krishna and Ünver 2008; Lim and Ho 2007; Srivastava, Chakravarti, and Rapoport 2000).

The remainder of this article is organized as follows: The next section presents both the self-interested and social comparison models and their predictions regarding the optimal proportion of winners in a contest. Following these predictions, this article presents the design and results of the two laboratory experiments. The final section concludes with some managerial implications, limitations of the current work, and directions for further research.

Theory: The Optimal Proportion of Winners in a Contest

Consider a contest in which $N \geq 3$ contestants get ranked according to a specified metric (e.g., dollar sales) from highest to lowest. Contestants ranked from 1 to m each receive a winner's prize with a monetary value of P_W , whereas contestants ranked from $m + 1$ to N each receive a smaller loser's prize of $P_L \geq 0$. The manager has a fixed budget B to spend on total prize money and must decide the number of winners that will motivate contestants to expend the greatest effort. The contestants are assumed to be risk neutral and homogeneous in their abilities and preferences. Each contestant i expends an effort level e_i (which is costly) that maximizes his or her utility (measured in monetary terms). The output metric for ranking the contestants is $s(e_i) = e_i + \varepsilon_i$, where ε_i is uniformly distributed in $[-V, V]$ and independent across contestants. The stochastic term ε_i reflects the uncertainty in contest outcomes faced by the contestant and captures the effect of environmental shocks (e.g., unanticipated changes in customer demand) outside the contestant's control on output. The utility of contestant i is separable in the utility from the contest outcomes and the cost of effort $c(e_i)$, with the latter assumed to be strictly increasing and convex. The utility from winning and losing equals $U_i(Win)$ and $U_i(Lose)$, respectively. Each contestant evaluates the trade-off between the utility from winning and expending effort and chooses the effort that will maximize his or her expected utility, given by

$$EU_i = \text{Prob}(Win) \times U_i(Win) + (1 - \text{Prob}(Win)) \times U_i(Lose) - c(e_i). \quad (1)$$

The symmetric pure-strategy Nash equilibrium effort e^* is the solution to the following first-order condition:²

² For contestants to expend effort, the participation constraint, which is $(m/N) \times U_i(Win) + (1 - m/N) \times U_i(Lose) - c(e^*)$, must be equal to or exceed some reservation level. The discussion herein is always restricted to the cases in which this condition is satisfied.

$$\frac{\partial \text{Prob}(\text{Win})}{\partial e_i}(e_i=e^*) \times [U_i(\text{Win}) - U_i(\text{Lose})] - c'(e^*) = 0. \quad (2)$$

Kalra and Shi (2001) and Orrison, Schotter, and Weigelt (2004) show that when $\varepsilon_i \sim U[-V, V]$, the marginal probability of winning ($\partial \text{Prob}(\text{Win})/\partial e_i$), evaluated at $e_i = e^*$, is $1/(2V)$. Furthermore, assuming that $c(e_i) = ke_i^2$, the equilibrium effort expended by a contestant reduces to

$$e^* = [U_i(\text{Win}) - U_i(\text{Lose})]/4kV. \quad (3)$$

The next step therefore requires examining the predictions of two different models regarding the optimal proportion of winners in a contest. The first makes the standard economic assumption that contestants are self-interested and care only about the payoffs of prizes they receive. The second model accounts for the possibility that contestants make social comparisons, so their utility also depends on the contest outcomes they earn relative to others.

Self-Interested Model

In the self-interested model, contestants' utilities depend solely on the monetary payoffs they receive. Because contestants are assumed to be risk neutral, $U_i(\text{Win}) = P_W$ and $U_i(\text{Lose}) = P_L$, so the expression for equilibrium effort is $e^* = (P_W - P_L)/4kV$, from Equation 3. Because the budget constraint $B = m \times P_W + (N - m) \times P_L$ can be rewritten as $B - NP_L = m(P_W - P_L)$, for any given P_L , $(P_W - P_L)$ and hence e^* must decrease as m increases. The intuition here is that because the budget is fixed, increasing the number of winners decreases the value of the winner's prize and the incentive to expend effort. Consequently, the optimal number of winners in this simple setting is one, consistent with the general prediction that an optimal

contest must have fewer winners than losers. Allowing for risk aversion in the contestants' utility does not alter this prediction, as discussed subsequently. Finally, if contestants are risk neutral, the prediction of the self-interested model holds, even when the stochastic component ε_i is logistically distributed (Kalra and Shi 2001).

Social Comparison Model

What happens if contestants care about whether they feel like a “winner” or “loser” compared with other contestants? We utilize the tools of behavioral economics to construct a simple model of social comparison that generates the alternative prediction that the high-winners contest yields greater effort than a low-winners contest in certain conditions. In modeling social comparisons, the critical question that arises is: what is the reference point that contestants use to make comparisons? A natural possibility is that contestants evaluate the value of their own prize against the outcome received by most contestants in the contest (i.e., modal prize value P_{Mode}). In turn, the reference point would change, depending on whether the number of winners is greater or smaller than the number of losers.

Consider the following social utility function, adapted from Fehr and Schmidt (1999), and assume that $U_i(Win) = P_W + \alpha \times (P_W - P_{Mode})$ and $U_i(Lose) = P_L - \beta \times (P_{Mode} - P_L)$.³ This specification generalizes the self-interested model by introducing two social preference parameters, α and β . Some assumptions about α and β are possible, derived from previous research. First, α can either be positive or negative, because a value of $\alpha > 0$ captures the status-seeking preferences for winning relative to the typical contestant (Frank 1985), whereas

³ The social utility function of Fehr and Schmidt (1999) is in turn based on one developed by Loewenstein, Bazerman and Thompson (1989), which uses participants' satisfaction ratings of different payoff splits in a negotiation to compare different specifications of social preference functions. The best-fitting specification depends on three variables: own payoffs, difference in payoffs (relative to the other party) when coming out ahead, and difference in payoffs when coming in behind.

$\alpha < 0$ captures the aversion or guilt that results from coming out ahead of others (Fehr and Schmidt 1999). Loewenstein, Bazerman, and Thompson (1989) confirm that the sign of α can vary depending on the nature of the social relationship among the contestants—typically negative when the relationship is friendly or neutral but positive when the relationship is adversarial. Moreover, the magnitude of α is usually very small. Second, $\beta > 0$, because contestants dislike losing compared with others, and $\beta > \alpha$, which reflects social loss aversion (Camerer 1998; Loewenstein, Bazerman, and Thompson 1989).⁴ The social utility function also builds in the sensible feature that the contestant’s utility depends on the difference between the prize value received by the contestant and the reference outcome, such that $(P_W - P_{Mode})$ and $(P_{Mode} - P_L)$ can be interpreted as utility components analogous to the gain–loss utility functions of Prospect Theory (Kahneman and Tversky 1979; Koszegi and Rabin 2006). We also assume a linear relationship between utility and these social utility components for parsimony’s sake – although there is some evidence that incorporating a quadratic term into the social utility function can explain behavior better in some contexts (Bellemare, Kroger and Van Soest 2008; Loewenstein, Bazerman and Thompson 1989), the linear social utility function is sufficient to explain the main results of this paper. From Equation 3, using the social utility functions yields an equilibrium effort level of

$$e^* = [(P_W - P_L) + \alpha(P_W - P_{Mode}) + \beta(P_{Mode} - P_L)]/4kV. \quad (4)$$

We now compare effort levels between the low-winners and high-winners contests for a fixed budget B under this social comparison model. To begin, fix P_L to be identical across

⁴ The term “social loss aversion” was first introduced by Camerer (1998, p.61) to describe the stronger disutility employees experience when they come in behind relative to their peers compared to the utility they derive from coming out ahead.

the contests. In a low-winners contest with fewer winners than losers, there are m_L winners ($1 \leq m_L < N - m_L$), and $P_{Mode} = P_L$. Rewriting P_W as $[B - (N - m_L)P_L]/m_L$,

$$[U_i(Win) - U_i(Lose)]_{\text{Low-winners}} = (1 + \alpha) \left(\frac{B - (N - m_L)P_L}{m_L} - P_L \right) + \beta \times 0. \quad (5)$$

In a high-winners contest with more winners than losers, there are m_H winners ($m_H > m_L$, and $m_H > N - m_H$, by assumption). In this contest, $P_W = [B - (N - m_H)P_L]/m_H$ and $P_{Mode} = P_W$, so

$$[U_i(Win) - U_i(Lose)]_{\text{High-winners}} = (1 + \beta) \left(\frac{B - (N - m_H)P_L}{m_H} - P_L \right) + \alpha \times 0. \quad (6)$$

Comparing the expressions in Equations 5 and 6 yields the result that if social loss aversion is sufficiently strong, the optimal proportion of winners in a contest should be higher than the proportion of losers.

Proposition 1. Let $m_L < (N/2) < m_H$. Equilibrium effort in the high-winners contest is greater than in the low-winners contest if $\beta > [(1 + \alpha)(m_H/m_L)] - 1$. Otherwise, effort in the low-winners contest is greater.

From the model setup, the implication of Proposition 1 for the question of optimal contest design is evident: Because the budget B is fixed and the manager chooses the contest that maximizes the firm's profit $N \times s(e^*) - B$ (assuming zero variable costs), the contest that yields the highest effort is the optimal one. Next, it is important to observe that the competing prediction of the above social comparison model holds only for $m_L < (N/2) < m_H$ (equivalently, when $m_L < N - m_L$ and $m_H > N - m_H$), that is, when the modal prize differs across the low-winners and high-winners contests. Increasing the proportion of winners in a contest does not reverse

the prediction of the self-interested model if it does not change the proportion of winners from one that is lower than the proportion of losers to one that is higher. (When the modal prize is fixed, increasing the number of winners decreases effort, a result that also occurs in the self-interested model.) Finally, the social comparison model nests the self-interested model as a special case. When $\alpha = \beta = 0$, then $e^* = (P_W - P_L)/4kV$, and the low-winners contest is optimal.

Alternative Models of Social Comparison

Alternative models of social comparison also might generate the result that a high-winners contest yields greater effort than a low-winners contest. Although the assumption of homogeneous contestants rules out a large set of alternative models (e.g., different contestants have different reference points), it is important to examine the predictions of other natural candidate models. For example, what if the reference point is the average value of all prizes? In this case, the utility specifications become $U_i(\text{Win}) = P_W + \alpha \times (P_W - P_{\text{Avg}})$ and $U_i(\text{Lose}) = P_L - \beta \times (P_{\text{Avg}} - P_L)$, so that $[U_i(\text{Win}) - U_i(\text{Lose})] = [(P_W - P_L) + \alpha(P_W - P_{\text{Avg}}) + \beta(P_{\text{Avg}} - P_L)]$. Noting $P_{\text{Avg}} = B/N$ and using the same approach, it becomes clear that $[U_i(\text{Win}) - U_i(\text{Lose})]_{\text{High-winners}} > [U_i(\text{Win}) - U_i(\text{Lose})]_{\text{Low-winners}}$ only when $\alpha < -1$. In other words, contestants must dislike earning more than the average value of prizes to such an extent that they would forgo receiving a larger winner's prize P_W . This preference is probably not plausible in contests among peers.

Using a social utility specification in which a contestant evaluates his or her outcome compared with the outcomes of each of the other contestants in the contest (Fehr and Schmidt 1999) also leads to the prediction that the high-winners contest dominates only when $\alpha < -(N - 1)/N$, which again requires the assumption that contestants have a significant

dislike for winning. (These details are available in a Web Appendix.) Therefore, this analysis of alternative social comparison models highlights that predictions of greater effort in the high-winners contest depend not only on the strength of social loss aversion but also on the plausibility of the model that assumes the modal prize as the reference point contestants use to compare their outcomes. Nevertheless, this study makes no claims that the social utility specification is the only one that can predict that the high-winners contest induces more effort or has predictive superiority over other social comparison models in other contexts.

In summary, the preceding theoretical discussion yields competing hypotheses:

H₁: Effort is greater in the low-winners contest relative to the high-winners contest if contestants care solely about the payoffs they receive.

H_{1alt}: Effort is greater in the high-winners contest than in the low-winners contest if social loss aversion is sufficiently strong ($\beta > [(1 + \alpha)(m_H/m_L)] - 1$).

We proceed to test these predictions experimentally using incentive-aligned methods, such that the participants' decisions map directly onto their utility in monetary terms. Because the experimental methodology translates utility into monetary terms, the social preference parameters α and β can be interpreted as monetary weights.

Experiment 1

Design and Procedure

The first laboratory experiment compares effort decisions in the low- versus high-winners contests across three social settings, with six treatments in total. The three social settings differ in the degree to which social comparisons may be salient, as described in further detail subsequently. The parameter values used to design the contests are $N = 3$, $B =$

\$10, $P_L = \$2$, $k = .00062$, and $V = 35$ for every decision round. That is, the prize values corresponding to the low- and high-winners contests from the first to third ranks are $\{\$6, \$2, \$2\}$ and $\{\$4, \$4, \$2\}$, respectively. The resultant equilibrium effort predictions from the self-interested model for the low- and high-winners contests are $e_L^* = 46.1$ and $e_H^* = 23.0$, respectively. The rationale for selecting these parameter values is as follows: First, we choose $N=3$ because this yields the simplest contest structure that allows us to test theory – if either prediction is correct it must be validated in the simplest possible contests. Second, we set $P_L=\$2$ because we want to test if social loss aversion is present even if losers receive prizes with positive values (as the social comparison model predicts).⁵ Third, the values of k and V ensure that (1) the equilibrium effort predictions in the two contests are not focal numbers, (2) there is a significant spread between the predictions across the two contests, and (3) the participation constraints, given the equilibrium effort levels in the self-interested model, are satisfied. The design and predictions for the experiment appear in the left-hand panel of Table 1.

[Insert Table 1 about here]

The subjects were business undergraduates at a large public research university in the United States. They received course credit and cash earnings that ranged from \$2 to \$20. Each subject received a start-up payment of \$5 and participated in three decision rounds (after a practice round with no monetary consequences). The number of decision rounds was deliberately kept low to minimize the potential effects of dynamic adjustments of subjects' reference points. For example, even if subjects have social preferences, they may become desensitized to winning and losing if they experience both outcomes many times; conversely,

⁵ Thus, this test is more conservative, because the disutility of losing may be attenuated if losers receive prizes with a positive value.

they may make decisions to preserve a winning streak or break a losing streak. These effects are interesting in their own right but not the main focus of this study.

The experiment used z-Tree software (Fischbacher 2007), with a procedure similar to Bull, Schotter, and Weigelt's (1987) and Lim, Ahearne, and Ham's (2009). In all six treatments, subjects were told that their task was to select a *Decision Number* (e_i) from 0 to 70. Every *Decision Number* carries a *Decision Cost* ($.00062e_i^2$), which increases with the *Decision Number* chosen. The *Decision Cost* corresponding to each *Decision Number* appeared on a "Decision Cost Table." Subjects were next told that they were to enter their *Decision Number* into the computer program, and once they had done so the program would generate a *Random Number* (ε_i) that ranges from -35 to 35 . Subjects were told that each *Random Number* in this range had an equal chance of being drawn. The computer would then add the *Decision Number* to the *Random Number* to form a *Final Number* ($s(e_i)$), by which the subjects would be ranked from highest (Rank 1) to lowest (Rank 3).

At this point, the instructions that described the subjects' earnings differed depending on the social settings. The first setting, the "no social pressure" condition, was similar to the environment of most laboratory economic experiments. That is, there was no mention of a contest, subjects came from a subpopulation in which they likely did not know each other well (i.e., a large class with more than 500 students), the contest groups of three participants each were randomly and anonymously matched in every round, and the contest outcomes of individuals were private. In the low-winners (high-winners) contest, subjects were told that they would earn \$6 (\$4) minus their *Decision Cost* if their *Final Number* ranked first (first or second) or \$2 minus their *Decision Cost* if their *Final Number* ranked second or third (third). We ran three experimental sessions for both contests, with 12 subjects in each session.

The second social setting, or the “low social pressure” condition, differs significantly. Again, each contest contains three experimental sessions, with 12 subjects per session, and the subjects came from the same subpopulation of students (large class with more than 500 students). However, at the start of each session, subjects sat in a circle and stated their names, academic majors, and the most interesting event in their lives that had occurred more than five years ago. Subjects then voted on the most interesting story they had heard, and the subject with the story that received the most votes received \$5. Only then were the instructions for the contest handed out and read. These instructions described the study as a contest, in which the subjects would compete with two other contestants. In the low-winners contest, subjects were told “one of you will win, and two of you will lose,” whereas in the high-winners contest, the instructions stated, “two of you will win, and one will lose.” Each contest group competed sequentially (i.e., the three contestants were seated at computer terminals while subjects in other contest groups watched silently), so that contestants could see against whom they and others were competing. The *Decision Numbers* chosen by each subject were private, but after the *Final Numbers* had been ranked and the computer returned the contest outcomes, each subject announced his or her contest outcome to the experimenter, who stood about 15 feet away from the computer terminals, simply by saying either “win” or “lose.” Thus, the contest outcomes of every individual became public to both the experimenter and the other subjects in the room. For the low-winners (high-winners) contest, subjects were told that they would earn \$6 (\$4) minus their *Decision Cost* if they “win the contest [ranked first]” (“win the contest [ranked first or second]”) or \$2 minus their *Decision Cost* if they “lose the contest [ranked second or third]” (“lose the contest [ranked third]”).

Finally, the social setting labeled “moderate social pressure” was identical to the low social pressure condition except that the subjects came from a subpopulation of business undergraduates who knew one another relatively well. These subjects represented the same cohort in a specialized academic program in the business school, and at the time of the experiment, they had known one another for about six months through taking the same set of classes together and participating in common social activities. Because these subjects already knew one another, they did not introduce themselves or share personal stories but instead proceeded immediately to the instructions for the contests. In the two experimental sessions for each of the two contests for this condition, there were 18 participants each. The full set of instructions for the high-winners contest across the three different social settings appears in Appendix A.

This paper study the low and moderate social pressure conditions to test the theoretical predictions in environments closer to those that mark many contests in the corporate world—that is, contestants usually know whom they are competing against, and the contest outcomes are known by all contestants and frequently non-contestants as well. In the low and moderate social pressure conditions though, the nature of the social interaction was friendly rather than adversarial, and there was no direct pressure to win, nor was there any form of feedback given to the contestants after they had announced their contest outcomes. Other participants observing the contest were instructed to observe the proceedings silently.

We also conducted a simple survey to study if the three social settings described above generated different degrees of social pressure to win in contests. Specifically, 127 business undergraduates (who did not participate in the laboratory experiments) were randomly assigned one of the three social scenarios and asked to imagine that they were participants in a

contest in that setting (the exact proportion of winners and losers in the contest was not mentioned). They indicated their responses to two items on a seven-point scale: “I would feel pressure to win the contest” and “Losing the contest would be embarrassing” (1 = strongly disagree, 7 = strongly agree). The responses from the two items were collapsed into a single measure of social pressure (Cronbach’s $\alpha=0.74$). The mean responses for the no, low, and moderate social pressure conditions are 2.68, 3.84, and 5.37 respectively. An ANOVA shows that the level of social pressure differs across the three conditions ($F_{2,124} = 47.4, p = .000$), and the pairwise comparison tests are significantly different for all three social settings ($p = .000$). The same pattern of results emerges from analyzing the two response items separately. The survey results thus suggest that the features of the contest environment that increase the salience of how well contestants perform relative to one another (e.g., how well they know one another, whether contest outcomes are revealed) also increase the pressure on contestants to win the contest.

Finally, note that effort in the self-interested model is predicted to be invariant to the social setting. Also, while one would expect that the high-winners contest is more likely to dominate the low-winners contest (if at all) in the low and moderate social pressure conditions, we do not have point predictions for the social comparison model in this experiment because there is currently no formal theory of how the magnitudes of the social preference parameters α and β might vary with the social setting.

Results

The summary results for the six treatments appear in the right-hand panel of Table 1. There are 108 (36 subjects \times 3 rounds) effort decisions in each treatment. For the low-winners contest, the average effort is 43.0, 39.5, and 38.6 in the no, low, and moderate social pressure

conditions, respectively. For the high-winners contest, the corresponding averages are 34.0, 40.6, and 48.7. Furthermore, the average effort levels appear close to but slightly below the rational prediction of 46.1 in the low-winners contest; they also do not differ greatly across the three social settings. In the high-winners contest, the average effort in all three social settings is significantly higher than the rational prediction of 23.0, and it rises with the level of social pressure. Finally, the average effort in the low-winners contest is directionally higher than in the high-winners contest in the no social pressure condition, but the reverse relationship holds in the moderate social pressure condition.

[Insert Table 2 about here]

We proceed to formally test the hypotheses on the optimal proportion of winners in a contest. Because subjects make multiple decisions, we cluster the standard errors at the subject level in all the statistical tests to account for potential within-subject correlation. Table 2 displays the results of ordinary least squares (OLS) regressions of effort on the proportion of winners in a contest for each of the three social settings. In each regression, the low-winners contest was chosen as the base, with a dummy variable for the high-winners contest. In the no social pressure condition, effort is greater in the low-winners contest ($p = .015$), in support of the prediction of the self-interested model. However, this prediction is not supported in the low social pressure condition, because there is no difference in the effort decisions between the low- and high-winners contests ($p = .759$). Strikingly, in the moderate social pressure condition, effort appears greater when there are more winners than losers ($p = .003$), as predicted by the social comparison model when the effect of social loss aversion is sufficiently strong.⁶ Finally, though there is no statistical difference in effort across the three

⁶ In the low and moderate social pressure conditions, the experimenter also discerned a more enthusiastic and louder tone when participants announced “Win” and a more hesitant and softer “Lose.”

social pressure conditions for the low-winners contest, effort in the high-winners contests increases from the no social pressure to the low social pressure condition ($p = .055$) and then to the moderate social pressure condition ($p = .005$).

Next, we estimate the behavioral parameters α and β that is implied by the experimental data. For the low-winners contest, effort by contestant i in decision round t is assumed to be normally distributed with a mean that corresponds to the equilibrium effort, as predicted by the social comparison model, or $e_L^* = [(6 - 2) + \alpha(6 - 2) + \beta(2 - 2)]/4kV$ (see Equation 4), with variance τ_L^2 . Similarly, for the high-winners contest, $e_{it} \sim N(e_H^*, \tau_H^2)$, where $e_H^* = [(4 - 2) + \alpha(4 - 4) + \beta(4 - 2)]/4kV$. Recall that the value of $4kV = 4 \times .00062 \times 35 = .0868$ and that $P_{Mode} = \$2$ and $\$4$ in the low-winners and high-winners contests, respectively. The results in Table 3 reveal no evidence of a “joy of winning” effect in the low-winners contest. On the contrary, there appears to be a very mild aversion to being the sole winner ($\alpha < 0$) among friends and acquaintances when the contest outcomes are publicly revealed. Effort is also clearly driven by an aversion to being a “loser” in all three social settings ($\beta > 0$, $p = .000$), which causes contestants to choose significantly higher effort levels relative to the self-interested benchmark in the high-winners contest. For example, in the low social pressure condition, a difference of \$1 between the loser and the winner prizes in the high-winners contest carries a monetary cost of 76 cents. Social loss aversion is evident across all three social settings ($\beta > \alpha$). The degree of social loss aversion relates positively to the environmental features that make social comparisons more salient, such as whether the contest outcomes are publicly revealed and how well the contestants know one another. Finally, the data strongly reject the self-interested hypothesis (nested case of $\alpha = \beta = 0$). Thus, understanding how social loss aversion varies with the contest environment appears critical, because its

magnitude (not just whether it exists) influences whether the optimal proportion of winners in a contest changes. Although social loss aversion exists in the no social pressure condition, its effect is not strong enough to override the prescription of the self-interested model.

[Insert Table 3 about here]

We also conducted a follow-up experiment that investigates whether introducing a contest frame in the no social pressure condition affects social loss aversion. The contest design and parameter values are identical to those in Experiment 1, but participants were told that they were competing with two others in a contest, using words like “win” and “lose” to describe the contest outcomes. Participants were still randomly and anonymously matched (though they competed in the same contest group for all three rounds), and the contest outcomes were private. The results from two experimental sessions (with 12 participants per session) reveal an average effort in the low-winners contest of 47.4, which is not significantly different from the self-interested prediction of 46.1 ($t = .47, p = .640$) and the effort level of 43.0 in the no social pressure condition ($t = 1.16, p = .252$). In the high-winners contest, the average effort is 34.04, virtually identical to the effort level without the contest frame ($t = .01, p = .989$) and significantly higher than the self-interested benchmark of 23.0 ($t = 3.27, p = .002$). Moreover, effort remains higher in the low-winners contest ($t = 3.04, p = .004$). The implied estimates of α and β , at 0 and .48, respectively, are virtually identical to those treatments without the contest frame. That is, injecting a contest context into the no social pressure condition yields no significant difference in effort, which suggests that the degree of social loss aversion results from whether contest outcomes are evident to others and how well contestants know one another (and hence how strongly they care about their outcomes relative to others’).

In summary, Experiment 1 demonstrates that the social comparison model yields a superior explanation than the self-interested model that underpins the standard theory of contests (even in the no social pressure condition, because $\beta = .47$). It also demonstrates that the degree of social loss aversion depends on the social environment faced by participants in a contest and that the high-winners contest can dominate when social loss aversion is sufficiently strong. Finally, the experimental results yield estimates of the behavioral parameters α and β , which can be used to conduct robustness tests of the social comparison hypothesis, as in Experiment 2.

Experiment 2

To test the predictions of the social comparison model as stated in Proposition 1 further, we design another experiment with two main objectives in mind: First, we want to check if the values of the social preference parameters α and β estimated in Experiment 1 are robust. If they are, one should obtain similar estimates in the same social pressure conditions even if the contest design is different. Second, we want to provide further evidence that the high-winners contest can yield greater effort than the low-winners contest.

[Insert Table 4 about here]

Design

We compare effort decisions in the low-winners and high-winners contests across the no social pressure and low social pressure conditions. The design and the effort predictions of the self-interested and the social comparison models are presented in Table 4 – the effort predictions for the latter model are generated using the values of α and β estimated from Experiment 1. The experimental parameters were $N = 5$, $B = \$28$, $P_L = \$2$, $m_L = 2$, $m_H = 3$, $k = .001$, and $V = 60$ for every decision round. Therefore, in the low-winners contest, there were

two winners, and contestants ranked first to fifth received their respective prize values of {\$11, \$11, \$2, \$2, \$2}. The high-winners contest provided for three winners and two losers, and the corresponding prize values were {\$8, \$8, \$8, \$2, \$2}.⁷ In the two sessions with 15 participants per session conducted for each contest, subjects made effort decisions over five rounds, following the same experimental procedure as in Experiment 1.

The theoretical predictions are as follows: The self-interested model ($\alpha = \beta = 0$) predicts that effort in the low- and high-winners contests will be 37.5 and 25, respectively, so that the low-winners contest should strongly dominate. The predictions of the social comparison model differ significantly and depend on the social pressure condition. In the no social pressure condition, the model predicts that the effort level in the high-winners contest will be 36.9 (assuming $\hat{\beta} = .475$), extremely close to the predicted effort of 37.5 (assuming $\hat{\alpha} = 0$) in the low-winners contest. In the low social pressure condition, the social comparison model predicts an effort of 44 in the high-winners contest (assuming $\hat{\beta} = .76$), greater than the predicted effort level of 32.3 (assuming $\hat{\alpha} = -.14$) in the low-winners contest.

[Insert Table 5 about here]

Results

Table 5 reports the average effort in the two contests and the estimates of α and β from the experimental data. For the low-winners contest, the average effort is 41.5 in the no social pressure condition. The implied value of α , .106, is similar to the estimate in Experiment 1 and not significantly different from 0 at the 5% level ($p = .067$). In the low social pressure condition, the average effort in the low-winners contest is 38.5, and the estimated value of α again does not significantly differ from 0 ($p = .638$). Although α is not

⁷ In Experiment 2, the prize values and cost of effort were described in dollar terms in the instructions. However, at the end of the instructions, subjects discovered that ultimately they would receive 60% of their total dollar earnings across the five decision rounds.

negative, it is not far from the estimate of $-.14$ in Experiment 1. For the high-winners contest, average effort in the no social pressure condition is 35.8, much higher than the 25 predicted by the self-interested model. The implied value of β is .43, which is significantly different from 0 ($p = .000$) and equal to a difference of less than 5 cents relative to the estimate of .475 from Experiment 1 in monetary terms. In the low social pressure condition, the average effort in the high-winners contest is 45.5, with an implied β of .82, indicating a small difference of only 6 cents compared with the estimate of .76 obtained in Experiment 1. Finally, for the high-winners contest, the average effort is significantly higher in the low than in the no social pressure condition ($p = .009$).

To compare the effort levels between the low-winners and high-winners contests for each social pressure condition, we again utilize dummy variable OLS regressions, with the standard errors clustered at the subject level to account for within-subject correlations. The results in Table 6 show no difference in effort between the low-winners and high-winners contests in the no social pressure condition ($t = -1.65$, $p = .105$), as predicted by the social comparison model but in contrast with the self-interested model. In the low social pressure condition, effort in the high-winners contest is higher than in the low-winners contest ($t = 2.13$, $p = 0.038$), as predicted by the social comparison model using the estimates of α and β from Experiment 1.

Overall, the results of Experiment 2 provide further evidence that the social comparison model predicts effort decisions in contests much better than does the self-interested model. The social preference parameters α and β in both social pressure conditions appear fairly robust across experimental contexts. The results also confirm that as long as the

parametric conditions of Proposition 1 are satisfied, the high-winners contest can yield greater effort than the low-winners contest, even in the low social pressure environment.

Discussion and Conclusion

This study examines a critical question that managers face when they design contests to motivate their sales force, service employees, channel partners, or product design teams: What is the optimal proportion of winners, and should there be more winners or losers? Using a simple behavioral economics model, this investigation shows that if contestants make social comparisons and evaluate their prize outcomes against the typical outcome (i.e., modal prize), a contest that has more winners than losers can yield greater effort than one with fewer winners than losers, if the disutility that contestants suffer from not receiving a typical outcome is sufficiently strong. This result challenges standard economic models that rely on the self-interested assumption, which instead predicts that the optimal contest should include fewer winners than losers. Two experiments consistently demonstrate that the prediction of the social comparison model prevails when contest outcomes are publicly announced to other contestants. Moreover, the estimates of the social preference parameters, which measure the monetary value that contestants place on social comparisons, appear fairly stable across the two experiments.

Although the social comparison model specified herein explains behavior quite well, it is important to recognize the possible existence of other models that might generate the prediction that the high-winners contest dominates in these contests and explain behavior even better in other strategic situations. We view our model as one that provides a psychologically plausible explanation for how losing in a contest can generate more aversion

when there are more winners than losers, and this explanation relies on the well-established concept of reference-dependence and does not represent any radical departure from the social comparison models in the social psychology and behavioral economics literature. The behavioral economics approach also allows us to rule out some alternative explanations analytically. However, other social comparison models, including those that depend on the number of winners and losers, or even models that do not incorporate reference points, still may provide superior explanations of behavior in other contest environments.⁸ Finally, the proposed model contains a trade-off between the number of winners and the monetary prize spreads, because the manager has a fixed budget. It therefore cannot capture contests in which increasing the number of winners does not reduce the monetary value of the winner's prize, such as those in which winners receive only public recognition and no monetary prizes. However, social comparisons likely play an even more dominant role in such contests, such that the high-winners contest may be even more likely to yield greater effort.

The signs and magnitudes of the behavioral parameters α and β estimated in the two experiments are consistent with findings from other studies. As Loewenstein, Bazerman, and Thompson (1989) find, subjects experience lower utility when they lose the contest ($\beta > 0$), and there is some evidence of a very slight disutility when they win ($\alpha < 0$ and close to 0). The experiments also corroborate their findings that social loss aversion exists—people care much more about coming in behind than coming out ahead. In a recent article, Delgado and colleagues (2008) present fMRI evidence of a stronger decrease in blood oxygen level-dependent (BOLD) signals in the striatum of subjects who lost in a two-person sealed bid

⁸ Section A4 of the Web Appendix describes two utility specifications that do not rely on the assumption that contestants use reference points to evaluate their outcomes. One of them can generate a prediction that the high-winners contest will yield greater effort, but it does not predict the pattern of results across the two experiments as well as the social comparison model presented in this paper does.

auction compared with those who lost in a lottery (subjects met their competitors briefly before the experiment). However, they observe no difference in the BOLD responses across the auction or lottery when subjects win. Similarly, this study reveals no significant “joy of winning” effect, because the estimates of α are either 0 or slightly negative. The relationships among the participants in the two experiments are non-adversarial, and the contest environments (especially in the low and moderate social pressure conditions) are quite friendly. Furthermore, the experiments do not use prizes that likely elicit status-seeking preferences in the subjects, such as free parking in an exclusive parking spot or a feature in the college newsletter. Positive values of α might be more likely if such “status goods” were the prizes or if the relationships among contestants were adversarial, but this supposition does not automatically imply that the low-winners contest will be optimal. That is, the “joy of winning” effect might occur, but contestants still may suffer more disutility if they fail to win the status object or lose to people they dislike.

Next, we discuss whether the experimental data can be better explained by risk aversion instead of the social comparison model. They cannot. From the expression for equilibrium effort in Equation 3, if $\alpha = \beta = 0$, effort depends solely on the prize spread $P_W - P_L$, which decreases with the number of winners, given a fixed budget. Allowing for risk aversion attenuates the utility derived from the prize spread and results in lower effort in the contest compared with the risk-neutral prediction, as well as a narrowing of effort between the low-winners and high-winners contests. However, the contest with a larger prize spread (and by assumption, fewer winners) always dominates. For example, the constant relative risk aversion utility specification $U_i(P_i) = P_i^\gamma / \gamma$ (where $0 < \gamma < 1$) leads to predictions of $e_L^* = 23.9$ and $e_H^* = 13.5$ in the contest designs of Experiment 1 with $\gamma = .5$. Furthermore, actual

effort in the high-winners contest is significantly higher than the risk-neutral prediction, not lower, as would be predicted by risk aversion.

The managerial implications relate to the answers to the empirical puzzles and questions raised at the beginning of this article. This research highlights the important role of social comparisons in motivating marketing employees such as salespeople or customer service representatives through incentive contracts, and furthers our understanding of how environmental factors can affect the degree of social comparisons. For example, if a manager is designing a contest for a field sales force that spans many geographic territories, so that salespeople may not know one another well, a low-winners contest may be optimal. However, if the contest is for an inside sales team whose members share the same office and interact frequently, a contest with more winners than losers may motivate the contestants more. Similarly, to motivate better customer service among service employees, a manager should tap into the effects of social loss aversion and give out more service awards with smaller values, as well as recognize the award winners publicly, so that employees want to avoid being one of the few that everyone knows did not receive an award. Managers can actively influence the factors that affect the salience of social comparisons by organizing activities that allow contestants to get to know one another better and featuring contest winners during special award events. This research also helps explain why many companies regularly publicize performance metrics (e.g., sales revenue, number of customer calls, sales to new customers, whether sales targets have been met) achieved by all employees; they are exploiting the effects of social pressure to improve performance. Because the level of social pressure in many corporate environments is greater than that in the low and moderate social pressure conditions in the laboratory experiments, the high-winners contest likely induces

more effort in many settings in “the wild.” Moreover, a high-winners contest is similar to an employee ranking system that eliminates the bottom 10% of a company’s workforce, a policy adopted by companies such as General Electric and Sun Microsystems. This research shows that due to social loss aversion, such a policy can result in greater employee effort compared with a ranking system that focuses only on promoting the top-performing employees. Finally, at a broader level, this research highlights the possibility that there are psychological reference points in incentive structures that people use to evaluate their outcomes. Managers might influence these reference points by changing the design of the incentive programs. For example, in contests, managers can manipulate the reference points by changing the proportion of winners and losers.

It is important to reiterate that the prescriptions for the optimal proportion of winners apply for managers who are interested in maximizing profits and returns on investment. As mentioned previously, with a fixed budget, higher effort in a contest translates directly into higher profits and returns. Of course, managers should always ensure that the participation constraints of the contestants will be satisfied when designing the contest.⁹

Because this study is the first to consider whether social comparisons among contestants and social loss aversion exist in contests, the focus remains restricted to contests with simple prize structures and few contestants. However, this characteristic does not necessarily limit the applicability of the findings for managers, because many contests contain few contestants (e.g., sales contests at the regional level instead of the salesperson level). Managers may prefer to keep the number of contestants small because they want to match

⁹ This condition is always satisfied in our experiments. For the moderate social pressure condition in Experiment 1, the expected utilities (given the estimated values of α and β) are 1.12 and 2.19 for the high-winners and low-winners contests, respectively. For the high-winners contest in this condition, the participation constraint will always be satisfied as long as $\beta < 1.62$.

contestants who are more homogeneous so that everyone has a roughly equal chance of winning. Yet future research should extend the social comparison model to incorporate multiple reference points that might arise from additional prize tiers and more contestants.¹⁰ Furthermore, though the social comparison model is useful in explaining the aggregate results, it does not explain the variation in individual effort decisions. These results should encourage additional investigations into the psychological correlates of motivation and effort in people who participate in contests. Finally, this investigation does not study contests in which salespeople compete against a sales target set by managers or those that rank salespeople by how much they exceed their territory-specific sales target, both of which provide promising avenues for research that considers how the degree of social loss aversion may vary with perceptions of sales targets, such as whether they are attainable or fair.

¹⁰ The current model can accommodate multiple prize tiers by specifying the utility from obtaining a prize for the j^{th} rank to be $U(P_j, P_{Mode}) = P_j + \alpha \times \max\{0, P_j - P_{Mode}\} - \beta \times \max\{0, P_{Mode} - P_j\}$.

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Table 1: Design and Summary Results of Experiment 1

| Design | | | Results | | |
|-----------------------|---|--|--------------------------------------|--------------------------------------|--------------------------------------|
| Proportion of Winners | Prize Structure $N=3, B=\$10, P_L=\2 | Self-Interested Prediction ($\alpha=\beta=0$) | Average Effort | | |
| | | | No Social Pressure | Low Social Pressure | Moderate Social Pressure |
| Low-Winners | {6, 2, 2} $m_L=1, N - m_L=2$ | 46.1 | 43.0 (20.1) $t=-1.20, p=0.233$ | 39.5 (20.0) $t=-2.29, p=0.024$ | 38.6 (19.9) $t=-2.61, p=0.010$ |
| High-Winners | {4, 4, 2} $m_H=2, N - m_H=1$ | 23.0 | 34.0 (20.1) $t=4.30, p=0.000$ | 40.6 (16.2) $t=7.78, p=0.000$ | 48.7 (13.4) $t=16.33, p=0.000$ |

Notes: Numbers in parentheses are the standard deviations. The t-statistics and p -values refer to the tests of effort compared with the predictions of the self-interested model.

Table 2: Contest Dominance Across Social Pressure Conditions

| | Coefficient | Robust Standard Errors | t-Statistic | p-Value |
|---|--------------------|-----------------------------------|--------------------|----------------|
| No Social Pressure $R^2 = .049$ | | | | |
| Constant (Base=Low-Winners) | 43.0 | 2.57 | 16.76 | .000 |
| High-Winners | -9.04 | 3.62 | -2.50 | .015 |
| Low Social Pressure $R^2 = .001$ | | | | |
| Constant (Base=Low-Winners) | 39.5 | 2.88 | 13.71 | .000 |
| High-Winners | 1.13 | 3.67 | .31 | .759 |
| Moderate Social Pressure $R^2 = .081$ | | | | |
| Constant (Base=Low-Winners) | 38.6 | 2.88 | 13.42 | .000 |
| High-Winners | 10.05 | 3.28 | 3.06 | .003 |

Notes: In each of the three regressions, there are 216 observations and 72 clusters.

Table 3: Social Loss Aversion Magnitude Across Social Settings

| Parameters | No Social Pressure | Low Social Pressure | Moderate Social Pressure |
|---|-------------------------------|--------------------------------|-------------------------------------|
| α | -.07 (.055) | -.14* (.062) | -.16* (.062) |
| β | .47* (.110) | .76* (.098) | 1.11* (.068) |
| τ_L | 19.99* (1.26) | 19.92* (1.48) | 19.84* (1.75) |
| τ_H | 20.04* (1.15) | 16.16* (1.32) | 13.32* (1.07) |
| Log Likelihood Full Model: -2792.6 Nested Models: i. Common α and β : -2814.2 ($\chi^2 = 43.2, p = .000$) ii. Constrain $\alpha = \beta = 0$: -2946.5 ($\chi^2 = 307.8, p = .000$) | | | |

*Significant at the 5% level.

Notes: Numbers in parentheses are the robust standard errors. There are a total of $108 \times 6 = 648$ observations and 216 subject clusters.

Table 4: Design and Predictions for Experiment 2

| Contest | Prize Structure $N=5, B=\$28, P_L=\2 | Theory Predictions | | |
|--------------|---|---|--|---|
| | | Self-Interested Model | Social Comparison Model | |
| | | Both No and Low Social Pressure ($\alpha = \beta = 0$) | No Social Pressure ($\hat{\alpha} = 0, \hat{\beta} = .475$) | Low Social Pressure ($\hat{\alpha} = -.14, \hat{\beta} = .76$) |
| Low-Winners | {11, 11, 2, 2, 2} $m_L=2, N-m_L=3$ | 37.5 | 37.5 | 32.3 |
| High-Winners | {8, 8, 8, 2, 2} $m_H=3, N-m_H=2$ | 25 | 36.9 | 44 |

Table 5: Average Effort and Estimates of α and β for Experiment 2

| Proportion of Winners | Average Effort and Estimates of Social Preference Parameters α and β | |
|-----------------------|---|--|
| | No Social Pressure | Low Social Pressure |
| Low-Winners | 41.5 (18.47) $\alpha = .106$ ($t = 1.83, p = .067$) | 38.5 (19.22) $\alpha = .03$ ($t = .47, p = .638$) |
| High-Winners | 35.8 (17.98) $\beta = .43$ ($t = 4.07, p = .000$) | 45.5 (17.10) $\beta = .82$ ($t = 8.66, p = .000$) |

Notes: Numbers in parentheses are the standard deviations. The t-statistics and p-values reported reflect the tests of the social preference parameter against the predictions of the self-interested model ($\alpha = 0$ and $\beta = 0$).

Table 6: Experiment 2 Validates the Predictions of Social Comparison Model

| | Coefficient | Robust Standard Errors | t-Statistic | <i>p</i>-Value |
|---|--------------------|-----------------------------------|--------------------|-----------------------|
| No Social Pressure <i>R</i> ² =.024 | | | | |
| Constant (Base=Low-Winners) | 41.5 | 2.20 | 18.87 | .000 |
| High-Winners | -5.71 | 3.47 | -1.65 | .105 |
| Low Social Pressure <i>R</i> ² =.036 | | | | |
| Constant (Base=Low-Winners) | 38.5 | 2.23 | 17.27 | .000 |
| High-Winners | 6.96 | 3.27 | 2.13 | .038 |

Notes: In each of the two regressions, there are 300 observations and 60 clusters.

Web Appendix

A1. Instructions for the High-Winners Contest in Experiment 1

Notes: The words in standard font are those for the no social pressure condition. For the low and moderate social pressure conditions, the modifications to the instructions are in italics within square brackets.

1. Introduction

This is an experiment in decision making. The instructions are simple; if you follow them carefully and make good decisions, you could earn a considerable amount of money which will be paid to you in cash immediately and privately after the experiment. What you earn today partly depends on your decisions, partly on the decisions of others, and partly on chance. Do not look at the decisions of others, talk, laugh or engage in any activities unrelated to the experiment. You will be warned if you violate this rule the first time. If you violate this rule twice, we will cancel the experiment immediately and your earnings will be \$0.

2. Decision Steps

Each of you will be randomly and anonymously assigned to a group consisting of 3 participants. You will take part in 3 decision rounds. In each decision round, we will rank all 3 members in the group according to their Final Numbers (from highest to lowest).

[Each of you will be assigned to a group consisting of 3 participants. Each group will take part in 3 decision rounds. If your group is not participating in a particular set of decisions, we ask that you stay in your seats and observe the proceedings quietly. In each decision round, the three members in your group will participate in a contest. Two of you will win the contest, and one will lose. We will rank all 3 members according to their Final Numbers (from highest to lowest). The members who are ranked 1st and 2nd will win the contest. The member who is ranked 3rd will lose the contest.]

Your Final Number is calculated as follows:

$$\text{Final Number} = \text{Your Decision Number} + \text{Your Random Number}$$

Your task in every round is to select a Decision Number, which ranges from 0 to 70. This is given in the first column of the Decision Cost Table. Associated with each Decision Number is a Decision Cost, which is listed on the same row in the second column. If you choose a higher Decision Number, your Final Number will be higher. However, choosing a higher Decision Number also means that you will have to pay a higher Decision Cost. We will ask you to enter your Decision Number into a computer program.

The computer will generate your Random Number after you have selected your Decision Number. The Random Number ranges from -35 to 35. Each number in this range has an equal chance of being drawn.

The computer will then compute your Final Number and reveal your rank (1st, 2nd or 3rd).

[The computer will then compute your Final Number and reveal both your rank (1st, 2nd or 3rd) and whether you win or lose the contest. We ask that you announce whether you win or lose to the experimenter, who will record the information. If you win the contest (ranked 1st or 2nd), simply say "Win". If you lose the contest (ranked 3rd), simply say "Lose".]

3. Determining Your Cash Earnings

Your cash earnings in each round will be:

\$4 minus Your Decision Cost, if your Final Number is ranked 1st or 2nd,

\$2 minus Your Decision Cost, if your Final Number is ranked 3rd.

[\$4 minus Your Decision Cost, if you win the contest (ranked 1st or 2nd),]

[\$2 minus Your Decision Cost, if you lose the contest (ranked 3rd).]

We will repeat the same procedure for 2 more rounds. That is, choose a Decision Number again (though of course you may pick the same one). Your **total cash earnings** will be \$5 plus the sum of the cash earnings across the 3 rounds. Also, note that the computer will generate a Random Number separately in every round and that the values of numbers that have been drawn do not affect the values of future numbers that will be drawn. *[After the 3 rounds, please return to your seats and observe the proceedings quietly while another group participates in the contest.]*

We will pay everyone privately after the 3 decision rounds are completed.

A2. Summary Results of the Model Under Alternative Assumptions

| No. | Current Assumption | Alternative Assumption | Summary Result |
|-----|--|---|--|
| 1 | Stochastic component ε_i is uniformly distributed. | Stochastic component ε_i is logistically distributed. | Effort in the low-winners contest is higher as long as contestants are risk neutral (Kalra and Shi 2001), as assumed in the model. |
| 2 | Contestants are risk neutral. | Contestants are risk averse. | Effort in the low-winners contest is higher as long as ε_i is uniformly distributed (Kalra and Shi 2001). Moreover, the experimental results cannot be explained by risk aversion. |
| 3 | In the social comparison model, the reference point is the modal prize | The reference point is the average value of the prizes. | Effort in the low-winners contest is higher except when $\alpha < -1$, which requires contestants to dislike earning |

| | | | |
|---|---|--|---|
| | value. | | more than the average prize, such that they would rather forgo receiving the winner prize P_W . |
| 4 | In the social comparison model, the reference point is the modal prize value. | Contestants compare their outcomes with the outcomes of all the contestants (Fehr and Schmidt 1999). | Effort in the low-winners contest is higher except when $\alpha < -(N-1)/N$, which requires contestants to feel high levels of guilt from winning. See A3 of the Web Appendix for more detail. |
| 5 | Contestants use reference points to evaluate their outcomes. | Two simple utility specifications assume social loss aversion but do not rely on reference-dependence. | A4 of the Web Appendix shows that these specifications cannot explain the pattern of results across the two experiments as well as can the social comparison model. |

A3. Utility Specification Assuming that Contestants Compare Outcomes with All Other Contestants (Fehr and Schmidt 1999)

Assuming a utility specification in which a contestant makes social comparisons with all the contestants in the contest (Fehr and Schmidt 1999), the high-winners contest will dominate only if contestants have an intense dislike for coming out ahead, that is, when $\alpha < -(N-1)/N$. The terms $U_i(Win)$ and $U_i(Lose)$ in this case are:

$$U_i(Win) = P_W + [\alpha \times (N - m) \times (P_W - P_L)/(N - 1)] + [\beta \times m \times (P_W - P_W)/(N - 1)], \text{ and}$$

$$U_i(Lose) = P_L + [\alpha \times (N - m) \times (P_L - P_L)/(N - 1)] - [\beta \times m \times (P_W - P_L)/(N - 1)].$$

Fehr and Schmidt (1999) included the normalization term $(N - 1)$ to ensure that the relative effect of social comparison is independent of the number of contestants. From this specification and given the other assumptions of this study,

$$U_i(Win) - U_i(Lose) = (P_W - P_L) \left(1 + \alpha \frac{N - m}{N - 1} + \beta \frac{m}{N - 1} \right) = \left(\frac{B - NP_L}{m} \right) \left(1 + \alpha \frac{N - m}{N - 1} + \beta \frac{m}{N - 1} \right).$$

Consider two contests with m_L and m_H winners, where $m_L < m_H$. From Equation 3, for $e_H^* > e_L^*$ to hold, it must be that

$$\left(\frac{B - NP_L}{m_H} \right) \left(1 + \alpha \frac{N - m_H}{N - 1} + \beta \frac{m_H}{N - 1} \right) > \left(\frac{B - NP_L}{m_L} \right) \left(1 + \alpha \frac{N - m_L}{N - 1} + \beta \frac{m_L}{N - 1} \right).$$

$$\begin{aligned}
\Rightarrow m_L \left(1 + \alpha \frac{N - m_H}{N - 1} + \beta \frac{m_H}{N - 1}\right) &> m_H \left(1 + \alpha \frac{N - m_L}{N - 1} + \beta \frac{m_L}{N - 1}\right) \\
\Rightarrow \alpha \frac{N(m_L - m_H)}{N - 1} &> (m_H - m_L) \\
\Rightarrow \alpha &< -(N - 1)/N.
\end{aligned}$$

A4. Utility Specifications without Reference Points

We examine the predictions of two simple utility specifications with social loss aversion but do not rely on the property of reference dependence. For the first and simplest specification, the terms $U_i(\text{Win})$ and $U_i(\text{Lose})$ can be written as $U_i(\text{Win}) = P_W + \kappa$ and $U_i(\text{Lose}) = P_L - \lambda$, where κ captures the (dis)utility of winning (because κ can be positive or negative, depending on whether the contestant likes or dislikes winning), and $\lambda > 0$ captures the disutility of losing. Social loss aversion implies that $\lambda > \kappa$. Using the same assumptions and the reasoning as in the main text, it is easy to show that the low-winners contest will always dominate.

Next, consider a utility specification in which $U_i(\text{Win}) = P_W + \kappa \times (N - m)$ and $U_i(\text{Lose}) = P_L - \lambda \times m$, where N and m are the number of contestants and number of winners, respectively. This utility specification can generate the theoretical result that the high-winners contest can yield greater effort than a low-winners contest if there is sufficient social loss aversion. However, this model cannot predict the pattern of outcomes in Experiment 2 as well as the social comparison model. Note that with this utility specification,

$$U_i(\text{Win}) - U_i(\text{Lose}) = (P_W - P_L) + \kappa \times (N - m) + \lambda \times m = [(B - NP_L)/m] + \kappa \times (N - m) + \lambda \times m.$$

Consider two contests with m_L and m_H winners, where $m_L < m_H$. From Equation 3, for $e_H^* > e_L^*$ to hold,

$$\begin{aligned}
[(B - NP_L)/m_H] + \kappa \times (N - m_H) + \lambda \times m_H &> [(B - NP_L)/m_L] + \kappa \times (N - m_L) + \lambda \times m_L. \\
\Rightarrow \lambda \times (m_H - m_L) &> (B - NP_L) \left(\frac{1}{m_L} - \frac{1}{m_H}\right) + \kappa \times (m_H - m_L) \\
\Rightarrow \lambda &> [(B - NP_L)/(m_H m_L)] + \kappa.
\end{aligned}$$

This utility specification has a curious property, in that whether the high-winners contest is better than the low-winners contest depends also on P_L .

To check if this utility specification explains the data in our paper well, we estimate the values of κ and λ for the no social and low social pressure conditions using the data from Experiment 1, and use these estimates to predict the pattern of outcomes for the corresponding social pressure conditions in Experiment 2. From Experiment 1, $\kappa = -.494$ and $\lambda = .722$ for the no social pressure condition, and $\kappa = -.89$ and $\lambda = 1.21$ for the low

social pressure condition. Table A1 displays the predicted outcomes using these sets of estimates and contrasts them with the actual outcomes in Experiment 2. Although this utility specification tracks the actual outcomes of the low-winners contest relatively well, it does not predict the important result that effort in the high-winners contest is higher than the low-winners contest in the low social pressure condition. In contrast, the social comparison model with the modal prize as a reference point is able to capture this feature (in addition to other patterns of the data) very well.

Table A1: Predictions of the Utility Specification without Reference Points for Experiment 2

| Contest | No Social Pressure ($\hat{\kappa} = -.494, \hat{\lambda} = .722$) | Low Social Pressure ($\hat{\kappa} = -.89, \hat{\lambda} = 1.21$) |
|---------------------|---|---|
| Low-Winners | Predicted = 37.3 Actual = 41.5 | Predicted = 36.5 Actual = 38.5 |
| High-Winners | Predicted = 29.9 Actual = 35.8 | Predicted = 32.7 Actual = 45.5 |