CENTRE FOR DECISION RESEARCH & EXPERIMENTAL ECONOMICS

The University of Nottingham

UNITED KINGDOM · CHINA · MALAYSIA

Discussion Paper No. 2016-05

Francesco Fallucchi and
Elke Renner

February 2016

Reputational Concerns in Repeated Rent-Seeking Contests

CeDEx Discussion Paper Series
ISSN 1749 - 3293

CENTRE FOR DECISION RESEARCH & EXPERIMENTAL ECONOMICS

The Centre for Decision Research and Experimental Economics was founded in 2000, and is based in the School of Economics at the University of Nottingham.

The focus for the Centre is research into individual and strategic decision-making using a combination of theoretical and experimental methods. On the theory side, members of the Centre investigate individual choice under uncertainty, cooperative and non-cooperative game theory, as well as theories of psychology, bounded rationality and evolutionary game theory. Members of the Centre have applied experimental methods in the fields of public economics, individual choice under risk and uncertainty, strategic interaction, and the performance of auctions, markets and other economic institutions. Much of the Centre's research involves collaborative projects with researchers from other departments in the UK and overseas.

Please visit http://www.nottingham.ac.uk/cedex for more information about the Centre or contact

Suzanne Robey
Centre for Decision Research and Experimental Economics
School of Economics
University of Nottingham
University Park
Nottingham
NG7 2RD
Tel: +44 (0)115 95 14763
Fax: +44 (0) 115 95 14159
suzanne.robey@nottingham.ac.uk

The full list of CeDEx Discussion Papers is available at

http://www.nottingham.ac.uk/cedex/publications/discussion-papers/index.aspx

REPUTATIONAL CONCERNS IN REPEATED RENT-SEEKING CONTESTS

Francesco Fallucchi[a], University of East Anglia
Elke Renner[b], University of Nottingham

3rd February 2016

Abstract

We experimentally investigate how reputational concerns affect behavior in repeated Tullock contests by comparing expenditures of participants interacting in fixed groups with the expenditures of participants interacting with randomly changing opponents. When participants receive full information about the choices and earnings of all contestants at the end of each contest we find no difference between contest expenditures in fixed and randomly changing groups. However, when participants only observe their own earnings at the end of each contest they are significantly more aggressive when they interact in fixed groups. This result can be explained by a dominance or status seeking motive.

Keywords: Contests, experiments, matching protocol, information feedback
JEL Classification Codes: C70; C91, C92, D72

[a]School of Economics, Arts 3/3.69, Norwich NR4 7TJ, United Kingdom.
E-mail: f.fallucchi@uea.ac.uk

[b]Corresponding author. School of Economics, Sir Clive Granger Building, University Park, Nottingham NG7 2RD, United Kingdom.
E-mail: elke.renner@nottingham.ac.uk

1. Introduction

We examine the role of reputational concerns in repeated rent-seeking contests. Our study is based on the seminal model of rent-seeking developed by Tullock (1980), which has been used to model a variety of contest settings, including political races and lobbying, sports competitions, tournament incentives in firms and grant seeking contests (Konrad, 2009). In many of these settings contestants compete repeatedly against the same set of opponents (for example in sport contests like Formula 1). In other cases the set of opponents changes from contest to contest (for example in some grant-seeking competitions). We use controlled laboratory experiments to examine whether and how the type of repetition affects contest behavior. If contestants interact repeatedly with the same opponents they might, for example, attempt to cooperate on collusive outcomes and reciprocal or reputational concerns might affect contestant's choices. The impact of such concerns however, might also crucially depend on the feedback available to competitors (Stigler, 1964). In some contests (like in many grant seeking competitions) competitors only learn whether their own bid was successful, but receive no feedback about their opponents' contest expenditures or earnings. In such low information environments it is difficult for competitors to signal willingness to collude or to interpret others' past behavior as aggressive or cooperative.

In experimental Tullock contests players typically overspend relative to the Nash equilibrium, often to a degree that leads to socially inefficient outcomes.[1] Few studies have examined the form of interaction and whether repeated interaction with the same opponents facilitates collusion or if it affects contest behavior in any other way. To our knowledge only Baik et al. (2015) have explicitly investigated the role of the matching protocol in Tullock contest experiments.[2] They study contests with groups of two and three players where players are informed about total expenditures in their group after each contest.[3] They find that two player groups are slightly less aggressive in a treatment where they interact in fixed pairings compared with a treatment using random matching, and they find no effect of matching protocol in contests with three players. Sheremeta (2013) conducts a meta-analysis on contest experiments and finds no significant effects of the matching protocol on expenditures.

[1] See Dechenaux et al. (2014) for a comprehensive literature review.

[2] In the wider contest literature there is a small number of studies that examine the role of the matching protocol. For example, Lugovskyy et al. (2014) examine the role of the matching protocol in all-pay auctions. They find that partners bid less than strangers, but are unable to collude on levels below the Nash equilibrium. Lacomba et al. (2014) examine variations of the Hirshleifer-Skaperdas conflict game and find that strangers' conflict expenditures are significantly higher than partners'.

[3] Note that this implies that in groups of two subjects can infer the other contestant's expenditures, while in groups of three they can only infer the average expenditures of the other two contestants.

Fallucchi et al. (2013) study how information feedback affects expenditure dynamics in contests but they only consider fixed groups. They find that when feedback on others' expenditures and earnings is available, contestants initially spend substantially more than equilibrium predicts but they adjust their expenditures downwards. Without feedback expenditures remain persistently high. Mago et al. (2014) also compare treatments with and without feedback information about rivals expenditures and success. They find no difference in aggregate levels of expenditure, but they do find that the information feedback affects the dynamics of individual behavior.

To examine the role of the matching protocol and how it interacts with information feedback we conduct a repeated Tullock contest experiment in a 2x2 design where i) group composition stays fixed ('partners') or changes ('strangers') from contest to contest and ii) contestants receive feedback only on their own or also on competitors' expenditures and earnings at the end of each contest.

We find no evidence of successful collusion in any of our treatments. With full information feedback, the most favorable condition for collusion, partners' and strangers' expenditure patterns are very similar and well above the Nash equilibrium. Surprisingly, however, the matching protocol has a pronounced effect in our low information treatments where partners bid more aggressively than strangers. This finding can be explained by social comparison and a status seeking motive.

2. Experimental design and procedures

The experiment consisted of 60 periods. In each period each subject was endowed with 1000 points and competed in a three-person Tullock contest for a prize of 1000 points. Subjects simultaneously chose a level of rent-seeking expenditure. Let x_i denote subject i's expenditure and $X = \sum_{j=1}^{n} x_j$ denote the aggregate expenditure in a group. The probability that contestant i wins the prize is given by her expenditure relative to aggregate expenditure, $p_i = x_i / X$.[4] A subject's one-period payoff function therefore is:

$$\pi_i = \begin{cases} 1000 - x_i + 1000 & \text{with probability } p_i \\ 1000 - x_i & \text{with probability } (1 - p_i). \end{cases}$$

[4] In the case that X = 0 the prize was not awarded.

Our four treatments vary the matching protocol (PARTNERS or STRANGERS) and the information provided to subjects at the end of each period (OWN or FULL). Partner groups were randomly matched at the beginning of a session and the group composition stayed fixed.[5] Stranger groups were randomly re-matched at the beginning of each period. At the end of each period subjects in OWN information treatments were reminded of their own expenditure choice and informed of their own earnings. In FULL information treatments subjects were additionally informed about the expenditure choices and earnings of the other group members. Table 1 provides a treatment summary. The experiment was programmed in z–tree (Fischbacher, 2007). The original instructions (including screenshots of feedback screens) are reproduced in appendix B. The instructions were handed out to participants at the beginning of a session and read aloud by the experimenter.

Treatments	STRANGERS	PARTNERS
FULL	87 subjects, 12-15 per session 6 independent sessions	30 subjects, 15 per session 10 independent groups
OWN	90 subjects, 15 per session 6 independent sessions	30 subjects, 15 per session 10 independent groups

Table 1. Summary of treatments.

Subjects were 237 University of Nottingham students, recruited through ORSEE (Greiner, 2015). None of the participants had taken part in previous contest experiments and participants took part in no more than one session. Each session lasted about 60 minutes and subjects were paid based on their accumulated earnings from all 60 periods. Average earnings were £ 9.24.

3. Theoretical predictions and contest behavior

The Nash equilibrium of the stage game, assuming risk-neutrality, predicts individual expenditures of $x_i = 1000(n-1)/n^2$. Since the game is finitely repeated the subgame perfect Nash equilibrium benchmark predicts individual (group) expenditures of approximately 222 (667) in each period of all treatments.

The extant experimental literature suggests that we should expect actual contest expenditures to exceed the Nash equilibrium level, in particular in early periods. Various

[5] The partners sessions were previously reported as the LOTTERY-OWN and LOTTERY-FULL sessions in Fallucchi et al. (2013).

factors might influence expenditures dynamics: Under full information contestants under both matching protocols can react to competitors' choices and outcomes in previous rounds and might follow (boundedly rational) learning rules. For example, contestants might imitate the most successful player or they might best respond to previous period expenditures. The former would lead to convergence to levels above the Nash equilibrium; the latter to the Nash equilibrium.[6] Note, however, that a convergence to levels *below* the Nash equilibrium is not supported by learning dynamics but would require contestants to cooperate on collusive outcomes. For example, if contestants coordinate on a common expenditure level that is positive but below the Nash equilibrium they could preserve the same equal winning probability of p=1/3 as in the Nash equilibrium benchmark, but at lower costs.[7] Such collusive behavior is seen in other settings when players interact in fixed groups, but not when players are randomly matched (e.g. Holt, 1985, Huck et al., 2001). Thus, we are interested to see if collusion results in lower expenditures in our PARTNERS treatments. Further, the ability to sustain collusive outcomes may depend on the information available to contestants. Without information feedback about others' behavior it is difficult for players to signal a willingness to collude or to observe deviations from implicit collusive agreements, making it difficult to sustain collusion. We are therefore also interested to see if collusion is more frequently observed in our FULL information treatments.

4. Results

Table 2 shows average group contest expenditures over all periods. It is striking that in all four treatments average group expenditures are well above the Nash equilibrium level of 667. Thus, we find no evidence for successful collusion in any of our treatments.

Average Expenditures	STRANGERS	PARTNERS	Difference	MWU-test*
FULL	878.13	834.22	-43.91	p=0.745
OWN	915.13	1131.04	+215.90	p=0.030

Table 2. Average group expenditures over all 60 periods.
*Mann-Whitney U-tests (two-sided) use the group average (PARTNERS) and session average (STRANGERS) as the unit of observation.

[6] For a detailed discussion of various learning dynamics see Fallucchi et al. (2013).
[7] The socially efficient outcome would be reached if one contestant in a group spends 1 point and the other two spend 0 points, because the prize is only awarded if at least one contestant's expenditures are positive. The group member who spends one point wins the prize for sure and by alternating contestants could, in principle, equalize the number of victories over the course of the repeated game.

With full information feedback, the most favorable condition for collusion, partners' average expenditures are only slightly lower than strangers'. A Mann-Whitney U-test (p=0.745, two-sided) fails to reject the null-hypothesis that expenditures in the two treatments are equal. If partners were more inclined to collude we would also expect to observe a higher fraction of expenditure choices below the Nash equilibrium. The data shows that the opposite is the case: individuals in a partner matching spend less than 222 points in only 42% of their contests, while strangers do so in 51%.

Figure 1 depicts average group expenditures over time for FULL (left panel) and OWN (right panel) treatments.

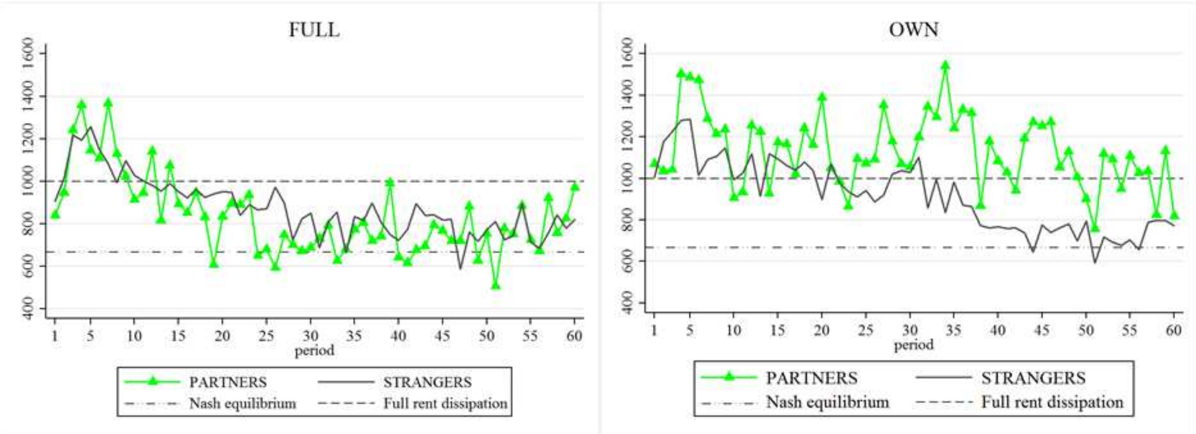


Figure 1: Average group expenditures across periods.

The left panel shows that with full feedback expenditure dynamics are very similar. Partners and strangers both start with high expenditures, typically above the value of the prize (full rent dissipation), but they rapidly decrease and stabilize in later periods below full dissipation but above the Nash equilibrium. We therefore summarize:

Result 1: *Partners and strangers exhibit similar expenditure patterns when feedback about other contestants' choices and earnings is provided. There is no evidence that contestants are able to successfully collude: Expenditure levels are similarly high in both treatments and well exceed the Nash equilibrium level.*

In the absence of feedback, however, the matching protocol has a pronounced impact. Table 2 shows that, overall, partners spend significantly *more* than strangers (p=0.030, MWU-test, two-sided) and their average expenditures well exceed the value of the prize. The right panel of figure 1 shows that both partners and strangers start with high expenditure levels in early periods. Strangers' expenditures steadily decrease and stabilize just above the Nash equilibrium level, while partners' expenditures remain persistently high.

Result 2*: With feedback only on own choices and outcomes partners' expenditures are persistently high and, overall, partners play more aggressivley than strangers.*

Why does the absence of feedback foster aggressiveness among competitors in fixed groups? Note that, despite being unable to directly compare own and competitors' payoffs and choices, contestants still can make some inference about their relative performance in their group: Contestants know whether or not they won the contest and it is obvious that the contest winner is the person with the highest payoff in a group.[8] It is well established in the behavioral literature that players in competitive settings care strongly about relative outcomes and their ranking in the social hierarchy.[9] It therefore seems plausible that the overly competitive behavior in fixed groups is driven by a status or dominance seeking motive. In fixed groups contestants can keep track how often they won relative to their opponents over the course of the repeated game. With higher expenditures contestants can aim at increasing their chances of winning in order to improve their position in their group's performance ranking. If the group composition changes each period, however, contestants are unable to make any relative comparison because they don't know how their record of wins compares to that of their current opponents. Moreover, they also know that their opponents are unaware of their past success rates.

We find some supportive evidence for a status seeking motive in our data. Table 3 shows that, on average, contestants increase their expenditures in the period after a loss and decrease after a win in the previous period.

Average change in expenditures	**STRANGERS**		**PARTNERS**	
	after a loss	**after a win**	**after a loss**	**after a win**
FULL	+33.42	-68.53	+55.03	-107.84
OWN	+32.76	-69.70	+46.67	-97.58

Table 3. Average change in expenditures after a loss or win.

[8] A winner's earnings are at least 1000 points and a loser's earnings are at most 1000 points; a tie for highest earnings is only possible if the winner spends her entire endowment on contest tokens and another contestant did not purchase any tokens.

[9] See, for example, Rustichini (2008), Clark et al. (2008) or chapter 9 in Frank (1999).

Figure 2, however, reveals an interesting difference in reactions to success rates in the previous three periods. We consider success rates over three periods because a failure to secure a win in three consecutive periods implies a proportionately low success rate for a contestant in a group of three.[10] In each panel we show the changes in expenditures for contestants who failed to win and those who secured at least one win in the previous three periods.

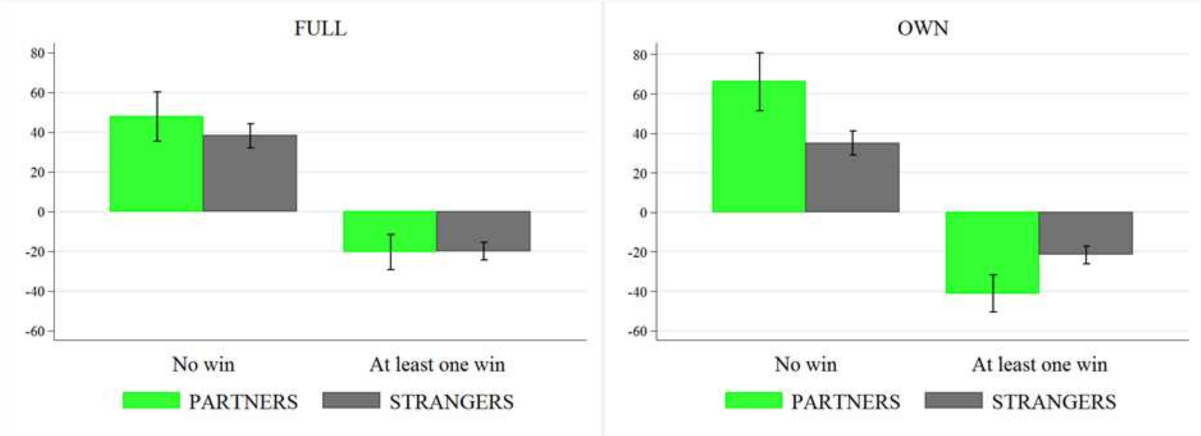


Figure 2: Average change in expenditures (± SEM) from period t to t+1 subject to contest success in previous three periods (t, t-1 and t-2).

The left panel shows that reactions by partners and strangers in the FULL treatments are quite similar. In contrast, the right panel shows that in the OWN treatments partners react with a particularly high increase in expenditures after three consecutive losses (+66.1), almost double the increase of strangers' (+35.0). Regression results (for details see appendix A) also confirm that this difference in reactions is significant. This sharp increase in the partners treatment is remarkable, because subjects are already spending more, on average, than in the strangers treatment. This pattern is consistent with competitors in fixed groups being particularly concerned about winning the next contest round when they are trailing in their winning rate.

5. Conclusions

In this paper we investigate reputational concerns in repeated Tullock contests. We find no evidence of successful collusion in any of our treatments, and contest expenditures are substantially above the stage game equilibrium in all treatments. When contestants are fully

[10] Subjects received information feedback after each contest period, but they were not provided with a full history of past contest outcomes. It is therefore likely that they can well remember the outcomes of the most recent periods, but may not accurately remember the full history.

informed about the choices and earnings of all competitors at the end of each contest we find no significant difference in contest expenditures between fixed and randomly changing groups of contestants. However, when contestants only learn about their own earnings at the end of a contest we find substantial differences between fixed and randomly changing groups. In particular, contestants are more aggressive when they compete repeatedly against the same opponents.[11] Our data suggests that this overly competitive behavior is driven by social comparison and a status seeking motive. Without feedback, the only measure contestants can employ to compare their own performance with that of their rivals is their past winning record. Our results are consistent with competitors in fixed groups being strongly concerned about their recent success rate: they are stepping up their expenditures if their winning rate does not keep up with that of their rivals and they do so, even if they would be better off not competing.

These findings add to previous findings from the experimental contest literature indicating the importance of social comparisons in contests. The experimental literature has identified a variety of factors that can explain overbidding in Tullock contests (Sheremeta, 2013). Closely related to status seeking are disadvantageous inequality aversion or spiteful preferences and a non-monetary utility of winning. They all have in common that players care about their relative payoff and, thus, can explain overbidding and players' inclination to compete, even if they incur monetary losses. Mago et al. (2014), for example, propose a theoretical model that incorporates both a status seeking parameter and a parameter that represents a non-monetary utility of winning. We find it interesting that our results suggest that in the context of a dynamic game the desire to gain status is not a constant, but seems to depend on a players' past success history and their (perceived) current rank in their group's performance hierarchy. This path dependency is mirrored in recent biological research into competitiveness and status seeking. For example, Zilioli et al. (2014) examine the impact of contest outcomes on contestants' testosterone levels, a hormone which is linked to competitiveness and dominance behavior. They find that in unstable social hierarchies losers show an increase and winners a fall in testosterone levels after a competition.[12] Zilioli et al. (2014) do not elicit post-competition behavior, but hypothesize that the elevated testosterone level in lower status individuals should promote dominance behavior in future encounters and

[11] Engel (2012) reports a similar result in a meta-analysis on oligopoly experiments, where he also finds that in low information environments partners are more aggressive than strangers.

[12] Unstable hierarchies are characterized by competitions that are close or where the outcome is uncertain, which are features of our contest experiment. It is important to note, that in stable or established hierarchies the reverse relation usually holds and higher testosterone levels are associated with higher status (Mazur, 1985).

encourage attempts to gain status. The increased aggressiveness we observe after losses corroborates this hypothesis.

Acknowledgements

We thank the Centre for Decision Research and Experimental Economics (CeDEx), the University of Nottingham and the ESRC Network for Integrated Behavioural Science (NIBS) ES/K002201/1 for financial support.

References

Baik, K.H., Chowdhury, S.M., Ramalingam, A., 2015. Group size and matching protocol in contests. CBESS Discussion Paper 13-11R.

Clark, A., Frijters, P., Shields, M., 2008. Relative income, happiness, and utility: an explanation for the Easterlin Paradox and other puzzles. Journal of Economic Literature 46, 95-144.

Dechenaux, E., Kovenock, D., Sheremeta, R.M., 2014. A survey of experimental research on contests, all-pay auctions and tournaments. Experimental Economics 18, 1386-4157.

Engel, C. (2007). How much collusion? A meta-analysis of oligopoly experiments. Journal of Competition Law and Economics 3, 491-549.

Fallucchi, F., Renner, E., Sefton, M., 2013. Information feedback and contest structure in rent-seeking games. European Economic Review 64, 223-240.

Fischbacher, U., 2007. z-Tree: Zurich toolbox for readymade economic experiments. Experimental Economics, 10(2), 171-178.

Frank, R. 1999. Luxury fever: Weighing the cost of excess. Princeton University Press.

Greiner, B., 2015. Subject pool recruitment procedures: organizing experiments with ORSEE. Journal of the Economic Science Association 1 (1), 114-125.

Holt, C. A., 1985. An experimental test of the consistent-conjectures hypothesis. The American Economic Review 75(3), 314–325.

Huck, S., Muller, W., Normann, H.T., 2001. Stackelberg Beats Cournot — On Collusion and Efficiency in Experimental Markets. The Economic Journal 111, 749-765.

Konrad, K.A., 2009, Strategy and dynamics in contests. Oxford University Press.

Lacomba, J.A., Lagos, F.M., Reuben, E., van Winden, F., 2014. On the escalation and de-escalation of conflict. Games and Economic Behavior 86, 40-57.

Lugovskyy, V., Puzzello, D., Tucker, S., 2010. An experimental investigation of overdissipation in the all pay auction. European Economic Review 54, 974-997.

Mago, S.D., Samak, A.C., Sheremeta, R.M., 2014. Facing your opponent: social identification and information feedback in contests. Journal of Conflict Resolution, forthcoming.

Mazur, A., 1985. A Biosocial Model of Status in Face-to-Face Primate Groups. Social Forces 64, 377-402.

Rustichini, A., 2008. Dominance and competition. Journal of the European Economic Association 6, 647–656.

Sheremeta, R.M., 2013. Overbidding and heterogeneous behavior in contest experiments. Journal of Economic Surveys 27, 491-514.

Stigler, G.J., 1964. A theory of oligopoly. The Journal of Political Economy, 44-61.

Tullock, G., 1980. Efficient rent-seeking. In: Buchanan, J.M., Tollison, R.D., Tullock, G. (eds.) Toward a Theory of Rent-Seeking Society, pp 97-112. College Station: Texas A&M University Press.

Zilioli, S., Mehta, P.H., Watson, N.V., 2014. Losing the battle but winning the war: Uncertain outcomes reverse the usual effect of winning on testosterone. Biological Psychology 103, 54-62.

Appendix A

Random effects mixed model estimates of changes in expenditures on time trend, recent history of victories and treatments dummies. Nested random effects at session and individual levels.

Dependent variable, change in expenditures	**OWN**	**FULL**
Time trend [1/ period]	34.11 (72.42)	-54.11 (70.54)
Partners [1 if PARTNERS treatment]	-30.35 (26.90)	-26.49 (32.63)
NO [1 if no win in three previous periods]	64.12*** (15.71)	61.89*** (16.99)
NO * Partners	61.57** (29.74)	36.15 (35.22)
ONE [1 if one win in the three previous periods]	-19.25 (15.85)	12.00 (16.91)
ONE * -Partners	1.80 (30.21)	37.61 (34.75)
TWO [1 if two wins in the three previous periods]	-17.13 (16.60)	-20.17 (17.65)
TWO * -Partners	32.71 (31.89)	5.06 (36.43)
Constant	-30.85** (14.76)	-20.95 (16.04)
	N=6840	N=6669

Significance at 10%*

Significance at 5%**

Significance at 1%***

Appendix B

Experimental Instructions

Below are the instructions that were given to the experimental subjects. Differences between treatments are indicated in square brackets.

Instructions

Welcome! You are about to participate in an experiment in the economics of decision making. Please do not talk to any of the other participants until the experiment is over. If you have a question at any time please raise your hand and an experimenter will come to your desk to answer it.

The experiment will consist of 60 periods. In each period you will have the chance to earn points. At the end of the experiment each participant's accumulated point earnings from all periods will be converted into cash at the exchange rate of 0.015 pence per point. Each participant will be paid in cash and in private.

[**PARTNERS**: At the beginning of the experiment you will be matched with two other people, randomly selected from the participants in this room, to form a group of three. The composition of the group will stay the same throughout the experiment, i.e. you will form a group with the same two other participants during the whole experiment. Your earnings will depend on the decisions made within your group, as described below. Your earnings will not be affected by decisions made in other groups.]

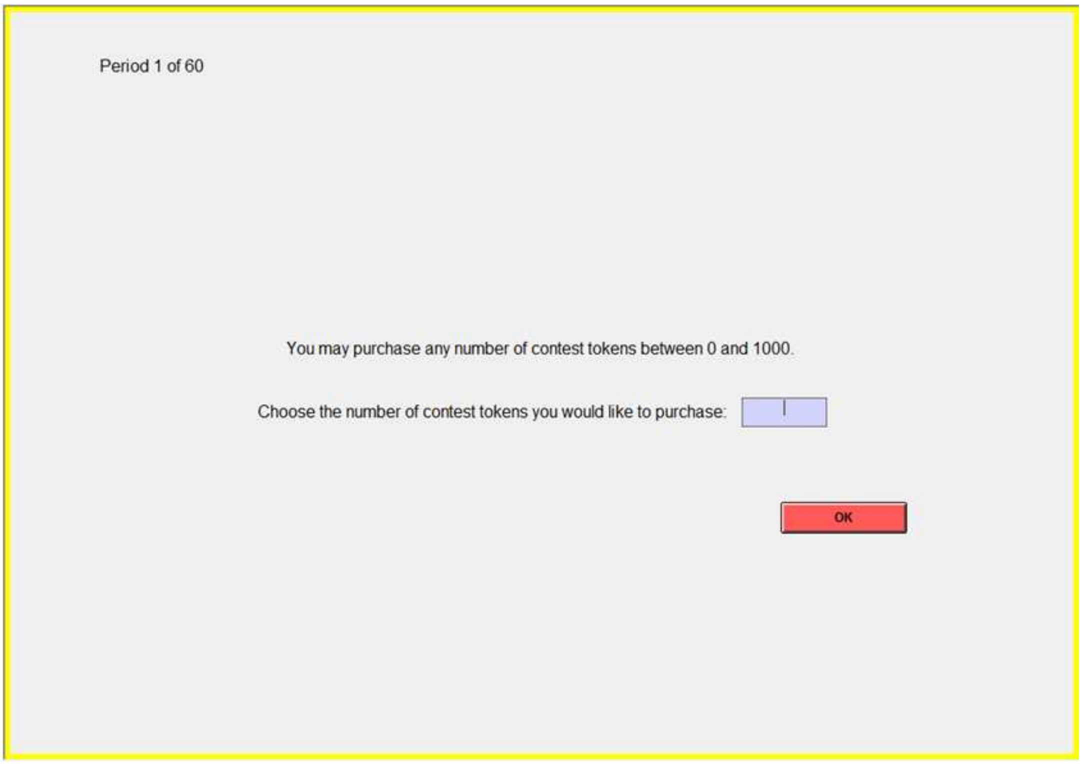
[**STRANGERS**: At the beginning of each period you will be matched with two other people, randomly selected from the participants in this room, to form a group of three. Thus, the composition of your group will change each period. Your earnings in a period will depend on the decisions made within your group, as described below. Your earnings in a period will not be affected by decisions made in other groups.]

All decisions are made anonymously and you will not learn the identity of the other participants in your group.

Decision task in each period

Each period has the same structure. In each period the three participants in each group will be competing for a prize of 1000 points.

At the beginning of the period each participant will be given **an endowment of 1000 points**. Each participant has to decide how many of these points they want to use to buy "contest tokens". Each contest token costs 1 point, so each participant can purchase up to 1000 of these tokens. **Any part of the endowment that is not spent on contest tokens is kept by the participant**. Each participant must enter his or her decision via the computer. An example screenshot is shown below.



Once everybody has chosen how many contest tokens to purchase, the computer will determine which participant in your group wins the prize of 1000 points. Your chances of winning the prize will depend on how many contest tokens you have purchased and the total number of contest tokens purchased in your group.

If nobody in your group purchases any contest tokens, none of you will win the prize. Otherwise, the computer will determine which participant wins the prize in a way that will ensure that **the probability that you will win the prize is equal to the number of contest tokens that you have purchased divided by the total number of contest tokens purchased in your group**. That is, if you buy a number of *X* contest tokens and if the other two participants in your group buy *Y* and *Z* contest tokens each, then the probability that you win the prize will be $X/(X+Y+Z)$. **Your contest earnings will be either 0 (if you do not win the prize), or 1000 (if you win the prize).]**

Your point earnings for the period will be calculated as follows:

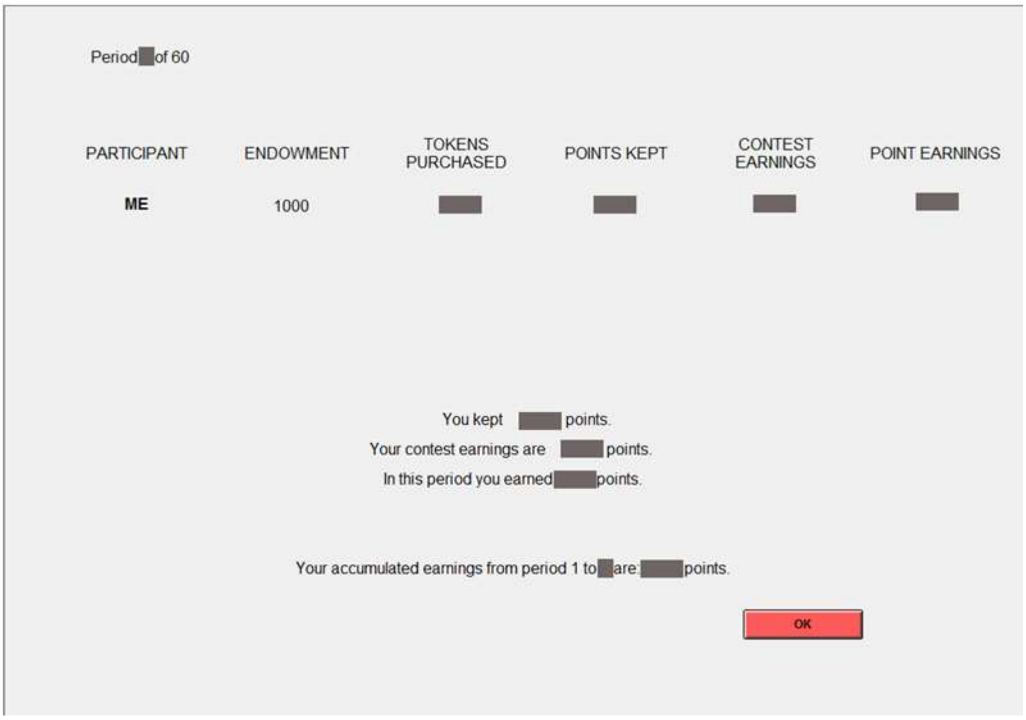
point earnings = 1000 – contest tokens purchased + contest earnings

After all participants have made a decision, a result screen will appear. An example screenshot is shown below. This is like the screen you will see during the experiment except that the blacked out fields will be filled in according to the decisions made and the outcome of the contest in that round.

[FULL:

Each participant will be informed of the number of contest tokens they and the other two participants have purchased, the points remaining from their respective endowments, their respective contest earnings, and their respective point earnings for the period. The information is listed according to contest tokens purchased in descending order (with the participant who purchased most contest tokens listed first). Thus a participant's information may be listed on different lines in different periods.**]**

[OWN:



Each participant will be informed of the number of contest tokens they have purchased, the points remaining from their endowment after making their purchase, their contest earnings, and their point earnings for the period.]

In addition, the results screen will inform each participant of his or her accumulated points from all periods so far.

Beginning the experiment

If you have any questions please raise your hand and an experimenter will come to your desk to answer it.

We are now ready to begin the decision-making part of the experiment. Please look at your computer screen and begin making your decisions.