Expenditures and Information Disclosure in Two-Stage Political Contests

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Abstract

This laboratory experiment studies two-stage contests between political parties. In the first stage, parties run their primaries and in the second stage the winners of the primaries compete in the general election. The resource expenditures in the first stage by the winning candidates are partially or fully carried over to the second stage. Experimental results support all major theoretical predictions: the first stage expenditures and the total expenditures increase, while the second stage expenditures decrease in the carryover rate. Consistent with the theory, the total expenditures increase in the number of candidates and the number of parties. Contrary to the theory, however, expenditures in both stages of the competition exceed theoretical predictions. Disclosing information about the opponent's expenditures in the first stage increases the second stage expenditures and decreases the first stage expenditures.

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1. Introduction

Multi-stage contests are commonly characterized by the number of stages and the extent to which the expenditures in one stage affect the probability of winning in another stage. The US presidential race and many other political competitions fall into the category of multi-stage elimination contests. At each stage, candidates use self-promotion and campaign advertisement in order to advance to the final stage and win the election. Campaign advertising in earlier stages enhances the candidate's image and thus increases the probability of winning the final stage of the election. Another prominent example of multi-stage elimination contests is the international competition for hosting the Olympic Games. In this contest, countries are eliminated at each stage and the resources expended by each country in earlier stages affect the probability of winning the competition in later stages.

In this study, we are interested in the following questions: What is the effect of expenditure carryover on the behavior of contestants? How does information about the expenditures by the opponent affect behavior in different stages of the contest? To answer these questions we study a two-stage elimination contest between two political parties. In the first stage, parties run their primaries to select one candidate who proceeds to the final stage. The resource expenditures in the first stage by the winning candidates are partially or fully carried over to the second stage. These expenditures carried over to the second stage may be interpreted as gaining name recognition or enhancing own image. In the second stage, the two finalists compete against each other in the general election. The winner of the second stage receives an "election prize".

Experimental results support all major predictions of the theory: the first stage expenditures and the total expenditures increase, while the second stage expenditures decrease in

the carryover rate. Consistent with the theory, the total expenditures increase in the number of candidates and the number of parties in the contest. Contrary to the theory, however, expenditures in both stages of the competition exceed theoretical predictions. Such high levels of expenditures can be explained by the fact that subjects have a non-monetary utility of winning (i.e., subjects are willing to pay money just to be winners). Most interestingly, we find that information about the expenditures of opponents in the first stage has an effect on expenditures of all candidates in both stages, which is not predicted by the theory. In particular, disclosing information about the opponent's expenditures in the first stage increases the second stage expenditures and decreases the first stage expenditures of all candidates. Our findings suggest that the 1972 Federal Election Campaign Act (FECA), requiring all candidates to disclose their campaign expenditures, may have reduced socially wasteful expenditures. Our findings also speak in favor of the 1974 FECA Amendments that impose spending limits on expenditures in Presidential elections.

To place our study into the context of previous literature, the following is a brief review of theoretical and experimental studies on contests. Major theories in contest literature are based on the seminal model of rent-seeking introduced by Tullock (1980). This model assumes that contests last for only one stage. However, in the real world, most political, economic and litigation contests last for multiple stages (Gradstein and Konrad 1999; Baik and Lee 2000; Stein and Rapoport 2005; Kaplan and Sela 2008).[1] In such multi-stage contests, contestants expend costly resources in each stage in order to advance to the final stage and win the prize. The expenditures made in earlier stages often affect the expenditures in latter stages. For example, in many political competitions, candidates who spend more money in early stages are often faced with budget constraints in the final stage of the competition (Parco, Rapoport and Amaldoss

2005). Stein and Rapoport (2005) formally introduce such budget constraints into a two-stage contest. They derive the conditions under which the budget constraint is binding and show how it may affect the expenditures in both stages. The expenditures made in earlier stages also may affect the outcomes in latter stages. For example, in the US presidential race, candidates enhancing their own image through advertising in the primary stage carry over the beneficial effects of their advertising to the general election. Such carryover comes in the form of name recognition, favorability, and committed supporters. Baik and Lee (2000) capture such environment by allowing the first stage expenditures to be carried over to the second stage. In their model, contestants from two groups compete in a two-stage contest to win a prize. In the first stage, each group selects a finalist who competes for the prize in the second stage. First-stage expenditures are partially (or fully) carried over to the second stage. Baik and Lee (2000) demonstrate that the total expenditures increase in the carryover rate and they are equal to the value of the prize when the first stage expenditures are fully carried over to the second stage.

Empirical studies of multi-stage contests are hard to conduct since it is difficult to measure individual abilities and expenditures without error (Ehrenberg and Bognanno 1990; Bognanno 2001). With this in mind, several researchers have turned to experimental tests of multi-stage contests in a laboratory setting. Parco, Rapoport and Amaldoss (2005) and Amaldoss and Rapoport (2009) report the results of experiments on two-stage contest with budget constraints. Their findings reject the equilibrium model of Stein and Rapoport (2005) because of significant over-expenditures in the first stage. Both experimental studies conjecture that the non-monetary value of winning plays a crucial role in explaining excessive over-expenditures in the first stage.[2] This experimental study builds on a game theoretical model of Baik and Lee (2000) to investigate the effects of carryover and information disclosure on the individual

behavior in two-stage political contests. In Section 2 we describe in details the theoretical model. Section 3 provides experimental design and testable hypotheses. Section 4 reports the results of the experiment and Section 5 concludes.

2. Theoretical Model

Consider a two-stage contest with a total of $N \times K$ players (candidates). In the first stage, all players are split evenly between K groups (parties) and each group consists of N players. Each player i chooses his expenditures level e_{i1} to influence the probability p_{i1} of winning the first stage. This probability is defined by a lottery contest success function:

$$p_{i1}(e_{i1}, e_{-i1}) = \frac{e_{i1}}{\sum_{j=1}^{N} e_{j1}}. \tag{1}$$

The contestant's probability of winning depends on his own expenditures relative to the total expenditures by all players. The winner in each group proceeds to the second stage. In the second stage, K players compete for a prize of value V (election prize). The probability that contestant i wins in the second stage is given by:

$$p_{i2}(e_{i1}, e_{i2}, e_{-i1}, e_{-i2}) = \frac{e_{i2} + \alpha e_{i1}}{\sum_{j=1}^{K} (e_{j2} + \alpha e_{j1})}. \tag{2}$$

In addition to the second stage expenditures e_{i2}, a fraction of the first stage expenditures e_{i1} is carried over to the second stage. The carryover parameter $\alpha \in [0,1]$ denotes the extent to which the first stage expenditures are carried over to the second stage. This parameter is the same for all players and is common knowledge. In terms of a political contest, one may interpret the expenditures carried over from the first stage as name recognition or enhanced image. A candidate who expends more resources on advertisement in the first stage receives better name recognition in the second stage, and thus has a higher chance of winning in the second stage.

To analyze the two-stage contest, we apply backward induction. In the second stage, the first stage expenditures are already determined. Therefore, the second stage expected payoff of a risk-neutral player i, $E(\pi_{i2})$, is derived by multiplying player i's probability of winning the second stage, p_{i2}, by prize value, V, minus the second stage expenditures, e_{i2}.

$$E(\pi_{i2}) = \frac{e_{i2}+\alpha e_{i1}}{\sum_{j=1}^{K}(e_{j2}+\alpha e_{j1})} V - e_{i2} \tag{3}$$

Taking first order conditions with respect to e_{i2} for all $i = 1, \dots, K$ and solving them simultaneously we obtain

$$e_{i2} + \alpha e_{i1} = e_{j2} + \alpha e_{j1} = \frac{(K-1)}{K^2} V, \quad \forall i, j \tag{4}$$

From equations (4) and (2), the equilibrium probability of player i winning the second stage is given by $p_{i2} = \frac{1}{K}$. Furthermore, the expected payoff in the second stage is $E(\pi_{i2}) = \frac{1}{K^2} V + \alpha e_{i1}$. We can now analyze the contest in the first stage between N players. Assuming each player i has correct expectations about the second stage expected payoff, the first stage expected payoff, $E(\pi_{i1})$, can be derived by multiplying player i's probability of winning the first stage, p_{i1}, by the expected payoff from the second stage, $E(\pi_{i2})$, minus the first stage expenditures, e_{i1}.

$$E(\pi_{i1}) = \frac{e_{i1}}{\sum_{j=1}^{N} e_{j1}} \left(\frac{1}{K^2} V + \alpha e_{i1} \right) - e_{i1}. \tag{5}$$

Taking first order conditions with respect to e_{i1}, and assuming a symmetric pure strategy equilibrium, we obtain the first stage equilibrium expenditures level:

$$e_1^* = \frac{V}{K^2} \frac{(N-1)}{(N^2 - 2\alpha N + \alpha)}. \tag{6}$$

Combining (4) and (6), the equilibrium solution for the second stage expenditures is

$$e_2^* = \frac{V}{K^2} \left(K - \frac{(N^2 - \alpha N)}{(N^2 - 2\alpha N + \alpha)} \right). \tag{7}$$

Formulas (6) and (7) demonstrate how the first and second stage expenditures depend on the prize value, the carryover rate, and the number of contestants in each stage. Simple comparative statics reveal that the first stage equilibrium expenditures e_1^* increase, while the second stage equilibrium expenditures e_2^* decrease in the carryover rate α ($\frac{\partial e_1^*}{\partial \alpha} > 0$ and $\frac{\partial e_2^*}{\partial \alpha} < 0$).[3]

Next, we compute the total expenditures of the entire two-stage contest as the sum of all individual expenditures in the first and second stage:

$$E^* = NKe_1^* + Ke_2^* = V - \frac{V}{K}\frac{N(1-\alpha)}{(N^2-2\alpha N+\alpha)}. \quad (8)$$

The comparative statics of the model predict that the total expenditures E^* are increasing in the carryover rate α ($\frac{\partial E^*}{\partial \alpha} > 0$), number of groups K ($\frac{\partial E^*}{\partial K} > 0$), and number of players N ($\frac{\partial E^*}{\partial N} > 0$). The general model described in this section can be viewed as a link between the models of Amegashie (1999) and Baik and Lee (2000). When placing the restriction $\alpha = 0$, the current model converges to the two-stage contest of Amegashie (1999). On the other hand, when $K = 2$ and $\alpha > 0$, the model converges to original contest of Baik and Lee (2000).

3. Experimental Design and Procedures

3.1. Experimental Design and Hypotheses

To test the theoretical predictions of our model, we design a laboratory experiment. Experiments are particularly useful in testing formal models of behavior, and in identifying conditions under which these models succeed or fail. For a review on political science experiments see Kinder and Palfrey (1993) and Morton and Williams (2008). The advantage of using a lab experiment is that it allows us to create an environment that precisely resembles the

theoretical model described in the previous section. Moreover, the lab experiment allows us to observe individual expenditures without error.

Table 1: Experimental Design and Equilibrium Expenditures

Treatment	Carryover rate, α	Groups, K	Players, N	Prize, V	Stage	Equilibrium Expenditures	Total Expenditures
N-FI	0	2	2	120	1	7.5	30
					2	30	60
P-FI (P-NI)	0.5	2	2	120	1	12	48
					2	24	48
F-FI (F-NI)	1	2	2	120	1	30	120
					2	0	0
N-FI23	0	2	3	120	1	6.7	40
					2	30	60
N-FI32	0	3	2	120	1	3.3	20
					2	26.7	80

The outline of the experimental design and theoretical predictions for each treatment are shown in Table 1. Each treatment studies a two-stage contest with a different number of groups, i.e. $K = 2$ or $K = 3$, and with a different number of players per group, i.e. $N = 2$ or $N = 3$. The first stage winner of each group proceeds to the second stage and the winner of the second stage receives the prize. The financial incentive of $V = 120$ experimental francs (equivalent to $2) is used to induce the value of winning a political contest.

In the *no* carryover treatment N-FI ("N" stands for *no* carryover and "FI" stand for *full information*), the first stage winner's expenditures are not carried over to the second stage ($\alpha = 0$). In *partial* carryover treatments P-FI and P-NI ("P" stands for *partial* carryover and "NI" stand for *no information*), half of the first stage winner's expenditures are carried over to the second stage ($\alpha = 0.5$). In *full* carryover treatments F-FI and F-NI ("F" stands for *full* carryover), all first stage winner's expenditures are carried over to the second stage ($\alpha = 1$). The theoretical model generates several intuitive predictions. As the extent of carryover increases, the

expenditures made in the first stage increase and the expenditures made in the second stage decrease. From Table 1, the first stage expenditures increase from 7.5 to 12 and then to 30, and the second stage expenditures decrease from 30 to 24 and then to 0, as we move from $\alpha = 0$ to $\alpha = 0.5$ and then to $\alpha = 1$. Based on these predictions we formulate the following hypothesis.

Hypothesis 1. The first stage expenditures increase and the second stage expenditures decrease in the carryover rate.

The logic behind this hypothesis is intuitive. The higher the extent of carryover, the more attractive it is for players to make higher expenditures in the first stage since players know that these expenditures will be carried over to the second stage. On the other hand, since all major expenditures are made in the first stage, there is no need for further expenditures in the second stage. Note that the total expenditures also depend on the carryover rate. According to the model, the total expenditures unambiguously increase in the carryover rate and they are equal to the value of the prize when $\alpha = 1$. Table 1 shows that the total expenditures increase from 90 to 96 and then to 120 as α increases from 0 to 0.5 and then to 1.

Hypothesis 2. The total expenditures increase in the carryover rate.

We also study two information conditions: *full information* and *no information*. In *full information* treatments P-FI and F-FI ("FI" stands for *full information*), subjects receive full information about the opponent's expenditures carried over from the first stage. In *no information* treatments P-NI and F-NI ("NI" stands for *no information*), subjects receive no information about the opponent's expenditures carried over from the first stage. If subjects behave according to the subgame perfect equilibrium, there should be no difference in expenditures between the two conditions.

Hypothesis 3. The information about the expenditures carried over by the opponent from the first stage does not affect individual behavior.

Finally, we study the effect of number of groups and number of players per group on total expenditures in the two-stage political contests. For that reason, in treatment N-FI23, we hold the number of groups constant at $K = 2$ (as in N-FI treatment); however, we increase the number of players to $N = 3$. On the other hand, in treatment N-FI32, we hold the number of players constant at $N = 2$ (as in N-FI treatment), and increase the number of groups to $K = 3$. The prediction of the theory is that the total expenditures increase both in the number of groups and in the number of players per group.

Hypothesis 4. The total expenditures increase in the number of groups and in the number of players per group.

3.2. Experimental Procedures

The experiment involved 132 undergraduate students. All students participated in only one session of this study. The computerized experimental sessions were run using z-Tree (Fischbacher 2007). We study seven treatments as in Table 1 in eleven sessions, with 12 subjects per each session. Each experimental session proceeded in several parts. Subjects were given instructions at the beginning of each part and the experimenter read the instructions aloud (the instructions can be found online at this journal's Web site). The wording in the instructions was written to induce a neutral environment. Before the actual experiment, subjects completed a quiz on the computer to verify their understanding of the instructions. The experiment started only after all subjects had answered all quiz questions. In the first part, subjects made 15 choices in simple lotteries, similar to Holt and Laury (2002).[4] This method was used to elicit individual

subjects' risk preferences. The consecutive parts of the experiment corresponded to different treatments described in Table 1.[5] Each treatment had 30 periods. In each period, subjects were randomly and anonymously placed either into a 2-player or a 3-player group (depending on the treatment). Subjects were randomly re-grouped after each period. At the beginning of each period, each subject received an endowment of 120 experimental francs.[6] Subjects could use their endowments to submit expenditures. After all subjects submitted their expenditures in the first stage, the computer then informed them if they were chosen to proceed to the second stage. The computer chose the winner of each group by implementing a simple lottery rule. The finalists of each group again submitted expenditures in the second stage. At the end of the second stage the computer chose the winner of the prize.

In the final part of the experiment, subjects were given an endowment of 120 francs and were asked to submit expenditures in a one-stage contest for a prize value 0. Subjects were told that they would be informed whether they won the contest or not. We used this procedure to receive an indication of how important it is for subjects to win when winning is costly and there is no monetary reward for winning.[7]

4. Results of the Experiment

Table 2 summarizes the average expenditures and average payoffs in treatments N-FI, P-F(N)I and F-F(N)I. The striking feature of the data is that, in all two-stage contests, subjects exert significantly higher expenditures than the equilibrium prediction.[8] As a result, average payoffs are negative. This finding is consistent with previous experimental studies of Davis and Reilly (1998), Sheremeta (2010b) and Sheremeta and Zhang (2010). In all three studies, the total expenditures exceeded the prize value and subjects earned, on average, negative payoffs.

Result 1. Significant over-expenditures are observed in all contests.

Table 2: Average Statistics for Treatments N-FI, P-F(N)I and F-F(N)I

Treatment	Stage	Average Expenditures, e			Total Expenditures	Average Payoff, π		
		Equilibrium	Actual			Equilibrium	Actual	
N-FI	1	7.5	13.0	(0.7)	132.4	7.5	-3.1	(2.2)
	2	30	40.2	(1.7)				
P-FI	1	12.0	18.2	(0.6)	148.2	6.0	-7.0	(1.2)
	2	24.0	37.7	(0.9)				
F-FI	1	30.0	21.0	(0.7)	152.5	0.0	-8.1	(1.1)
	2	0.0	34.3	(1.1)				
P-NI	1	12.0	22.0	(0.7)	153.1	6.0	-8.3	(1.2)
	2	24.0	32.6	(0.9)				
F-NI	1	30.0	33.4	(0.9)	171.6	0.0	-12.9	(1.2)
	2	0.0	18.9	(0.9)				

Standard error of the mean in parentheses.

One possible explanation for such over-expenditures is that subjects may have a non-monetary value for winning. In terms of a political competition, one may argue that, in addition to monetary incentives, candidates value winning itself and thus their overall value of the election prize is higher. In our experiment, we elicited a non-monetary value of winning. At the end of each session, all subjects were given 120 francs and were asked to submit expenditures for a prize value 0. We were surprised to discover that about 47% of subjects made positive expenditures: 25% of these subjects chose expenditures between 0.5 and 20, 10% chose between 20.5 and 60, and 12% chose expenditures higher than 60 (60 francs is equivalent to $1). The average expenditure of subjects who chose to compete in a contest with no prize is 35.9 francs (equivalent to $0.6). This finding serves as a direct evidence of an earlier conjecture by Morton (1993) that subjects may "value winning the elections in spite of the monetary rewards of the experiment." Moreover, we find that subjects who make higher expenditures in a contest with no prize, indicating higher non-monetary value of winning, also make higher expenditures in contests with a prize.[9] One may argue that such correlation can be explained by confusion; i.e.

subjects who make positive expenditures in a contest with no prize are confused, and thus they make irrationally high expenditures in contests with prize. There are two problems with such an argument. First, subjects participated in the contest with no prize at the very end of the experiment, after they played other contests for many periods. Second, before the actual experiment, subjects completed a quiz to verify their understanding of the contest game. Controlling for understanding of the contest, we still find significant correlation between expenditures for no prize and expenditures in contests with prize.[10] Therefore, this finding suggests that the non-monetary value of winning is a good explanation for significant over-expenditures in contests.[11] It also highlights the importance of incorporating non-monetary incentives into models of political competition.

Another point worth noting is the substantial variance in expenditures. Figures 1 and 2 display the full distribution of the first and second stage expenditures in treatments PF(N)I and FF(N)I. Note that, instead of following a symmetric equilibrium, individual expenditures are distributed on the entire strategy space between 0 and 120.

Result 2. There is substantial variance in individual expenditures.

High variance in individual expenditures is consistent with previous experimental findings of the contest literature (Davis and Reilly 1998; Potters, De Vries and Van Linden 1998). Several explanations have been offered. The first is that subjects make mistakes that cause some variance in expenditures. A second explanation is that subjects have different preferences towards risk which affect their behavior. In our experiment we elicited a measure of risk attitudes from a series of lotteries. We find substantial evidence that the measurement of risk attitude is a good predictor of subject's behavior in a two-stage contest: more risk-averse subjects make lover expenditures than less risk-averse subjects.[12] Finally, it is also possible that the distribution of

expenditures reflects individual learning. Subjects may want to test different strategies and how these strategies affect the probability of winning. However, we do not find evidence for this explanation, since the variances of expenditures are very similar when comparing the first 15 periods and the last 15 periods of the experiment.[13]

Figure 1: Distribution of Expenditures in Stage 1 for Treatments P-F(N)I and F-F(N)I

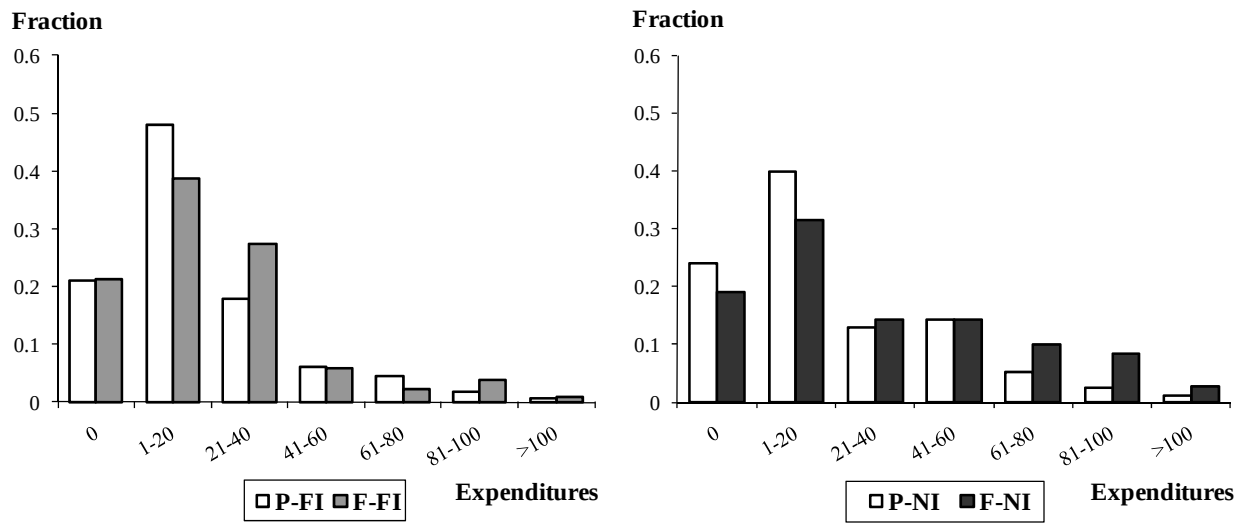
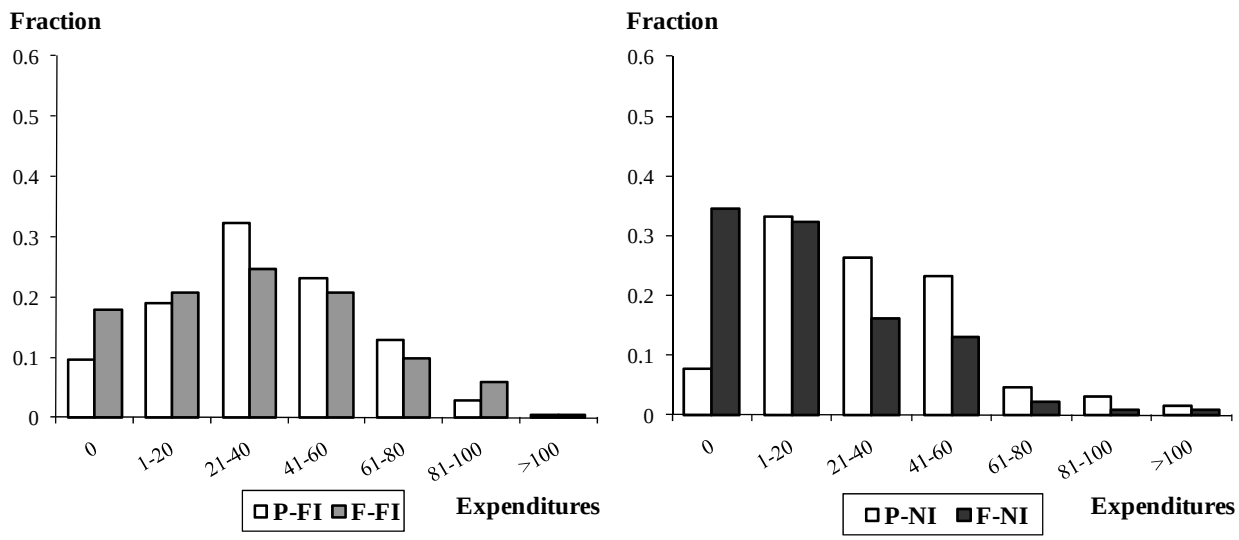


Figure 2: Distribution of Expenditures in Stage 2 for Treatments P-F(N)I and F-F(N)I



4.1. The Effect of Carryover

It is well documented in political science that candidates often expend resources during the primaries in order to carry over the benefits to the general election (Glantz, Abramowitz and Burkart 1976). The unique feature of our experiment is that it captures the dynamic aspect of a political contest, allowing us to study the effect of carryover on the first and second stage expenditures. The equilibrium derived from the theoretical model predicts that, as the extent of carryover increases, the expenditures made in the first stage increase and the expenditures made in the second stage decrease. Table 2 shows that in N-FI treatment with no carryover the first stage expenditures are 13.0. These expenditures increase to 18.2 (22) in P-F(N)I treatment with partial carryover and they further increase to 21 (33.4) in F-F(N)I treatment with full carryover. This finding is consistent with *Hypothesis* 1, indicating that the first stage expenditures increase in the carryover rate.[14] Table 2 also shows that in N-FI treatment the second stage expenditures are 40.2, and they decrease to 37.7 (32.6) in P-F(N)I treatment, and further decrease to 34.3 (18.9) in F-F(N)I treatment. This finding is also consistent with *Hypothesis* 1, indicating that expenditures in the second stage decrease in the carryover rate.[15]

Result 3. The first stage expenditures increase while the second stage expenditures decrease in the carryover rate.

Another theoretical prediction concerns the effect of carryover on the total expenditures. Theory predicts that the total expenditures should increase in the carryover rate. Table 2 indicates that this theoretical prediction is supported. In the N-FI treatment the total expenditures are 132.4 and they increase to 148.2 in the P-FI treatment, and further increase to 152.2 in the F-FI treatment. Similarly, in the P-NI treatment the total expenditures are 153.1 and they increases to 171.6 in the F-NI treatment. This finding is consistent with *Hypothesis* 2.[16]

Result 4. The total expenditures increase in the carryover rate.

In summary, general theoretical predictions with regard to the effect of carryover on the first stage expenditures, the second stage expenditures, and the total expenditures are supported by our experiment (Results 3 and 4). While qualitative predictions are supported by the data, the quantitative predictions of the theory are clearly rejected. This is mainly because of significant over-expenditures (Result 1) and substantial variation in individual behavior (Result 2). The potential application of these findings we discuss in the concluding Section 5.

4.2. The Effect of Information Disclosure

Often in political contests candidates are required to reveal the information about their campaign expenditures. However, it is not obvious how such policy affects the expenditures of individual candidates. One of the purposes of this study is to investigate how the information about the expenditures carried over by the opponent affects the behavior in the two-stage political contest. Our null hypothesis is that there should be no difference in the expenditures between *full information* and *no information* conditions. Contrary to *Hypothesis* 3, Table 2 reveals a strong difference in the aggregate behavior under the two information conditions. In particular, subjects expend less in the first stage and more in the second stage when they receive the information about the expenditures carried over by the opponents.[17]

Result 5. The first stage expenditures are higher under the *no information* condition and the second stage expenditures are higher under the *full information* condition.

It is also interesting to note that the total expenditures (148.2 and 152.5) under the *full information* treatments P-FI and F-FI are lower than the total expenditures (153.1 and 171.6) under the *no information* treatments P-NI and F-NI.

Result 6. The total expenditures are lower under the *full information*.

In summary, our findings suggest that the information about campaign expenditures affects a political contest in two important ways. First, information disclosure shifts the campaign expenditures from the first stage to the second stage. Second, it reduces the total expenditures of all candidates, thus increasing social welfare.

4.3. The Effect of Number of Groups and Number of Players

To investigate the effects of number of groups (parties) and number of players (candidates) per group we conducted additional treatments N-FI23 and N-FI32. The summary statistics of these two treatments and the NFI treatment is shown in Table 3. As predicted by the theory, the total expenditures increase in the number of groups K. In particular, when comparing treatments N-FI and N-FI23, as the number of groups increases from $K = 2$ to $K = 3$, the total expenditures increase from 132.4 to 176.7. Similarly, the total expenditures increase in the number of players per group: the expenditures of 132.4 in treatment N-FI ($N = 2$ and $K = 2$) increase to 179.7 in treatment N-FI32 ($N = 3$ and $K = 2$). These findings are consistent with *Hypothesis* 4.

Result 7. Total expenditures increase in the number of groups and in the number of players per group.

This intuitive result points out an important feature of political contests. As the total number of candidates increases, either through increase in the party size or through increase in the number of candidates per each party, the total expenditures increase. It is important to emphasize, however, that the increase in the number of parties has a different effect than the increase in the number of candidates per each party. In particular, higher number of candidates

per each party implies higher competition in the first stage, while higher number of parties implies higher competition in the second stage. In our experiment the total expenditures in the first stage are much higher in the N-FI23 treatment (112.2=18.7×6) than in the N-FI32 treatment (63=10.5×6). On the other hand, the total expenditures in the second stage are much lower in the N-FI23 treatment (67.8=33.9×2) than in the N-FI32 treatment (113.7=37.9×3). In summary, the intensity of political competition in the first and second stage crucially depends on the number of candidates in each party and the number of parties. Therefore, depending on the objective, one can re-structure the contest in order to maximize (or minimize) expenditures made in the first and second stage of the competition (Gradstein and Konrad, 1999; Moldovanu and Sela, 2006).

Table 3: Average Statistics for Treatments N-FI, N-FI23, and N-FI32

Treatment	Stage	Average Expenditures, e			Total Expenditures	Average Payoff, π		
		Equilibrium	Actual			Equilibrium	Actual	
N-FI	1	7.5	13.0	(0.7)	132.4	7.5	-3.1	(2.2)
	2	30	40.2	(1.7)				
N-FI23	1	6.7	18.7	(1.0)	179.7	3.3	-8.4	(1.9)
	2	30	33.9	(1.5)				
N-FI32	1	3.3	10.5	(0.5)	176.7	3.3	-9.5	(2.1)
	2	26.7	37.9	(1.3)				

Standard error of the mean in parentheses.

5. Conclusion

The use of controlled experiments is a fruitful methodology in political science which has attracted the attention of many prominent scholars (Green and Gerber, 2003; Druckman, Green, Kuklinski and Lupia 2006; Battaglini, Morton and Palfrey 2007; Levine and Palfrey, 2007; Morton and Williams, 2008). The appeal of laboratory experiments is based on two major factors. First, laboratory experiments provide a great control over the experimental environment. Second, by randomly assigning human subjects to control and treatment groups, experiments

offer a unique opportunity to test a wide range of hypotheses about human behavior and how different policies affect such behavior.

In this study we use a laboratory experiment to investigate the effects of expenditure carryover, information disclosure, number of candidates, and number of parties on the individual behavior in two-stage political contests. Experimental results support all major theoretical predictions: the first stage expenditures and the total expenditures increase in the carryover rate, and the second stage expenditures decreases in the carryover rate. Also, consistent with the theory, the total expenditures increase in the number of candidates and the number of parties in the contest. Disclosing information about the opponent's carryover expenditures increases the second stage expenditures and decreases the first stage expenditures. Although the analogies between our laboratory experiment and naturally-occurring political contests are imperfect, we believe that our findings provide valuable insights. For example, we find that by manipulating the information and the extent of carryover rate, the designer can minimize socially wasteful expenditures in the first stage and encourage the winning candidates to incur all major expenditures in the second stage. The still widely debated 1972 FECA requires all candidates to disclose their campaign expenditures. Our findings suggest that such a policy shifts the campaign expenditures from the first stage to the second stage, reducing socially wasteful resource expenditures.

The results of the experiment also indicate that expenditures are much higher than the equilibrium prediction. This finding is different from the findings of Parco, Rapoport and Amaldoss (2005) and Amaldoss and Rapoport (2009), who find significant over-expenditures only in the first stage of a two-stage contest with budget constraints, and not in the second stage. The disparity between our findings and the two studies mentioned above implies that removing

the budget constraints results in wasteful over-expenditures. One policy implication of this finding is that the designer of a political contest should impose budget constraints on candidates' expenditures in order to reduce wasteful over-expenditures. Such argument speaks in favor of the 1974 FECA Amendments, which are designed to lower the cost of campaigning by setting limits on expenditures in Presidential elections.

This study provides contributions to the literature on political spending (Levitt, 1994; Gerber, 1998), by explicitly investigating expenditures in different two-stage political contests. Also, the design of our experiment allows us to document that candidates have non-monetary values for winning. This finding contributes to the rapidly developing experimental literature trying to explain over-expenditures in rent-seeking contests (Davis and Reilly 1998; Potters, De Vries and Van Linden 1998; Amegashie, Cadsby and Song 2007; Sheremeta and Zhang 2010). Finally, the finding that theoretically irrelevant information may impact individual behavior in laboratory experiments is an important addition to the experimental political science literature.[18] Besides empirical contributions, this study opens several avenues for future research. First, it is important to further investigate how individual behavior changes when the number of contestants is large, e.g. as in voting experiments of Levine and Palfrey (2007). Second, it would be interesting to conduct a field experiment using campaign professionals instead of undergraduate students. Future research should also consider other realistic extensions to multi-stage contests, including asymmetric contestants, incomplete information, and endogenous formation of political groups.

References

Amaldoss, W., and Rapoport, A. 2009. Excessive expenditure in two-stage contests: Theory and experimental evidence. In F. Columbus (Ed.), Game Theory: Strategies, Equilibria, and Theorems. Hauppauge, NY: Nova Science Publishers.

Amegashie, J. A. 1999. The design of rent-seeking competitions: Committees preliminary and final contests. Public Choice 99: 63–76.

Amegashie, J.A., Cadsby, C.B., and Song, Y. 2007. Competitive burnout: Theory and experimental evidence. Games and Economic Behavior 59: 213-239.

Baik, K. H., and Lee, S. 2000. Two-stage rent-seeking contests with carryovers. Public Choice 103: 285–296.

Battaglini, M., Morton, R., and Palfrey, T.R. 2007. Efficiency, Equity, and Timing in Voting Mechanisms. American Political Science Review 101: 409-424.

Bognanno, M.L. 2001. Corporate Tournaments. Journal of Labor Economics 19: 290-315.

Davis, D., and Reilly, R. 1998. Do many cooks always spoil the stew? An experimental analysis of rent seeking and the role of a strategic buyer. Public Choice 95: 89-115.

Druckman, J.N., Green, D.P., Kuklinski, J.H., and Lupia., A. 2006. The Growth and Development of Experimental Research in Political Science. American Political Science Review 100: 627–35.

Ehrenberg, R.G., and Bognanno, M.L. 1990. Do Tournaments Have Incentive Effects?, Journal of Political Economy 98: 1307-24.

Fischbacher, U. 2007. z-Tree: Zurich Toolbox for Ready-made Economic experiments. Experimental Economics 10: 171-178.

Gerber, A. 1998. Estimating the Effect of Campaign Spending on Senate Election Outcomes Using Instrumental Variables. American Political Science Review 92: 401-11.

Glantz, S.A., Abramowitz, A.I., and Burkart, M.P. 1976. Election Outcomes: Whose Money Matters? Journal of Politics 38: 1033-38.

Gradstein, M. 1998. Optimal contest design: Volume and timing of rent seeking in contests. European Journal of Political Economy 14: 575–585.

Gradstein, M., and Konrad, K.A. 1999. Orchestrating Rent Seeking Contests. Economic Journal 109: 536-45.

Green, D and Gerber, A. 2003. The under-provision of experiments in political science. The Annals of the American Academy 589: 94-111

Holt, C.A., and Laury, S.K. 2002. Risk Aversion and Incentive Effects. American Economic Review 92: 1644-1655.

Kaplan, T.R., and Sela, A. 2008. Effective Political Contests, Centre for Economic Policy Research, Working Paper.

Kinder, D.R., and Palfrey, T. 1993. Experimental Foundations of Political Science. Ann Arbor: University of Michigan Press.

Levine, D., and Palfrey, T.R. 2007. The Paradox of Voter Participation: A Laboratory Study. American Political Science Review 101: 143-58.

Levitt, S. 1994. Using Repeat Challengers to Estimate the Effects of Campaign Spending on Election Outcomes in the U.S. House. Journal of Political Economy 102: 777-798.

Moldovanu, B., and Sela, A. 2006. Contest architecture. Journal of Economic Theory 126: 70-96.

Morton, R. 1993. Incomplete information and ideological explanations of platform divergence. American Political Science Review 87: 382–392.

Morton, R.B., and Williams, K.C. 2008. Experimentation in Political Science. In Jan Box-Steffensmeier, Henry Brady, and David Colier, (Eds.), The Oxford Handbook of Political Methodology. Oxford: Oxford University Press, pp. 339-356.

Parco J., Rapoport A., and Amaldoss W. 2005. Two-stage Contests with Budget Constraints: An Experimental Study. Journal of Mathematical Psychology 49: 320-338.

Potters, J.C., De Vries, C.G., and Van Linden, F. 1998. An experimental examination of rational rent seeking. European Journal of Political Economy 14: 783-800.

Rosen, S. 1986. Prizes and incentives in elimination tournaments. American Economic Review 76: 701-715.

Roth, A.E. 1987. Bargaining Phenomena and Bargaining Theory. In Roth, A. E., (ed.), Laboratory Experimentation in Economics. Cambridge, U.K.: Cambridge University Press, pp. 14-41.

Schmitt, P., Shupp, R., Swope, K., and Cadigan, J. 2004. Multi-period rent-seeking contests with carryover: Theory and experimental evidence. Economics of Governance 5: 187-211.

Sheremeta, R.M. 2010a. Contest Design: An Experimental Investigation. Economic Inquiry, forthcoming.

Sheremeta, R.M. 2010b. Experimental Comparison of Multi-stage and One-stage Contests. Games and Economic Behavior, forthcoming.

Sheremeta, R.M., and Zhang, J. 2010. Can Groups Solve the Problem of Over-Bidding in Contests? Social Choice and Welfare, forthcoming.

Smith, V.L. 1991. Papers in Experimental Economics. New York: Cambridge University Press.

Stein, W.E., and Rapoport, A. 2005. Symmetric multi-stage contests with budget constraints. Public Choice 124: 309-328.

Tullock, G. 1980. Efficient Rent Seeking. In James M. Buchanan, Robert D. Tollison, Gordon Tullock, (Eds.), Toward a theory of the rent-seeking society. College Station, TX: Texas A&M University Press, pp. 97-112.

Notes

[1] Other theoretical studies of multi-stage elimination contests have been conducted by Rosen (1986), Gradstein (1998), and Amegashie (1999). All these studies investigate different aspects of multi-stage contests such as elimination procedures, interdependency between the stages, and asymmetry between contestants.

[2] Other experimental studies of multi-stage contests are done by Schmitt, Shupp, Swope and Cadigan (2004), Amegashie, Cadsby and Song (2007), and Sheremeta (2010b).

[3] Other comparative statics reveal that, as the number of players N in each group increases, the expenditures in the first stage decrease and the expenditures in the second stage increase ($\frac{\partial e_1^*}{\partial N} \leq 0$ and $\frac{\partial e_2^*}{\partial N} \geq 0$). Also, as the number of groups K increases, the expenditures in the first stage e_1^* decrease ($\frac{\partial e_1^*}{\partial K} \leq 0$). The expenditures in the second stage can either increase or decrease in K, depending on N and α. However, when $\alpha = 0$, the second stage expenditures unambiguously decrease in the number of groups K.

[4] Subjects were asked to state whether they preferred safe option A or risky option B. Option A yielded $1 payoff with certainty, while option B yielded a payoff of either $3 or $0. The probability of receiving $3 or $0 varied across all 15 lotteries. The first lottery offered a 5% chance of winning $3 and a 95% chance of winning $0, while the last lottery offered a 70% chance of winning $3 and a 30% chance of winning $0.

[5] Treatments P-FI (F-FI) and P-NI (F-NI) were ran during eight sessions using switching order design, i.e. AB and BA. Treatments N-FI, N-FI23 and N-FI32 were ran separately during the three other sessions.

[6] The endowment of 120 francs was chosen for several reasons. First, the endowment was chosen to be equal to the prize value. Second, the endowment was also chosen to be substantially higher than the Nash equilibrium predictions in order to make sure that in the second stage subjects are not budget constrained.

[7] The procedure for the final part of the experiment closely followed Sheremeta (2010b). At the end of the experiment, 1 out of 15 decisions subjects made in part one was randomly selected for payment. Subjects were also paid for 5 out of 30 periods in each treatment. The earnings were converted into US dollars at the rate of 60 francs to $1. On average, subjects earned $25 each which was paid in cash. Each experimental session lasted about 90 minutes.

[8] To support this conclusion we estimated a simple panel regression for each treatment, where the dependent variable is expenditures and independent variable is constant. The model included a random effects error structure, with the individual subject as the random effect, to account for the multiple decisions made by individual subjects. The model also used clustered standard errors at the session level to account for session effects. Based on a standard Wald test, conducted on estimates of a model, we found that for all treatments the constant coefficients are significantly higher than the predicted theoretical values in Table 4.1 (p-value < 0.05).

[9] We estimated a random effects model where the dependent variable is the expenditures and the independent variables are a period trend, treatment and session dummy-variables, and non-monetary expenditures. The results of the estimation indicate a very significant and positive correlation between the expenditures in contests with prize and the expenditures in a contest with no prize.

[10] The number of correct quiz answers is a good control variable for confusion. Indeed, we find that subjects who understand the instructions better (higher number of correct quiz answers) make lower expenditures in contests with (and without) a prize. Nevertheless, even if we control for this confusion, we still find positive and very significant correlation between expenditures for no prize and expenditures in contests with a prize. This finding suggests that winning is a component in a subject's utility and that higher non-monetary utility of winning causes higher over-expenditures in contests.

[11] The conjecture that subjects have non-monetary value of winning has been used by many studies to explain over-expenditures in contests, including Schmitt, Shupp, Swope and Cadigan (2004), Parco, Rapoport and Amaldoss (2005), Amaldoss and Rapoport (2009). In contrast, the current study presents direct evidence that subjects are willing to pay money just to be winners.

[12] We estimate several random effects models where the dependent variable is the expenditures and the independent variables are the measurements of risk-aversion, session, and treatment dummy-variables. All specifications indicate that risk attitudes elicited from lotteries have significant influence on the expenditures.

[13] A standard F-test for the equality of variances cannot reject the hypothesis that expenditures have the same variance in the first 15 periods as in the last 15 periods of the experiment (p-value > 0.1).

[14] We estimated random effect models separately for each information condition (FI and NI), with expenditures as the dependent variable and treatment dummy as the independent variable. In both conditions the dummy-variable is

significant (p-value < 0.05). When clustering standard errors at the session level, the difference is significant only for the last 15 periods of the experiment (p-value < 0.05).

[15] The differences are statistically significant based on the estimation of random effect models (p-value < 0.05). When clustering standard errors at the session level, the difference is significant only for the last 15 periods of the experiment (p-value < 0.05).

[16] Because of high variance in individual expenditures, the differences are not significant.

[17] The first stage expenditures (22.0 and 33.4) under the *no information* treatments P-FI and F-FI are higher than the expenditures (18.2 and 21.0) under the *full information* treatments P-NI and F-NI. The difference is statistically significant only when comparing F-FI and F-NI treatments. Similarly, the second stage expenditures (32.6 and 18.9) under the *no information* treatments are lower than the expenditures (37.7 and 34.3) under the *full information* treatments.

[18] It has been long recognized in economics literature that theoretically irrelevant information may have impact on individual behavior in the laboratory experiments. Smith (1991) found that in continuous double auction under private information convergence to the Nash equilibrium is faster than under complete information. The argument that private information can yield more equilibrium-consistent results has also been established in the Nash bargaining games (Roth 1987).

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