

An experimental study of the citizen-candidate model: effects of electoral rules and symmetry*

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Abstract

This paper reports preliminary results of a laboratory study of the citizen-candidate model. We observe a certain degree of excess entry even from the "hopeless" positions. Conditional on that deviation from equilibrium, at least, in the simpler treatments, the subjects come close to best responding to the empirical distribution of entrants. We also observe candidate entry decisions to respond to changes in pre-candidate ideal point distribution and to the choice of the voting rule.

1 Introduction

The citizen-candidate model of elections (Osborne and Slivinski 1996, Besley and Coate 1997) is commonly used to endogenize the number and the identity of political candidates and proposals. The model considers a society of agents with publicly known preferences in some policy space who vote to decide on a common policy. Crucially, only alternatives explicitly proposed (nominated) by somebody can be considered for voting and the nomination decision is strategic: citizens choose to nominate themselves, based on their predicted impact on the policy outcome, the cost of running for office and benefits accruing to office-holders. Once the set of candidates is fixed, the entire society votes and the elected candidate implements his/her favorite policy (as the individual preferences are public, candidates cannot commit to implementing any policy at variance with their ideal).

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Unfortunately, the citizen-candidate model is not easy to test, as it heavily relies on exact public knowledge of the distribution of policy preferences in the society, including the policy preferences of potential candidates, even before the nomination and the campaign. Thus, in order to test it fully, we need to know not only preferences of actual candidates in the election, but also of those who chose not to get nominated. The predictions of the model are, furthermore, dependent on parameters (such as the cost of running for office and the benefits of holding it) that might be difficult to measure empirically and even harder to vary in real political systems. A direct test of the model's prediction for the differential impact of different electoral systems is complicated by the relative rarity of electoral system changes. The substantial multiplicity of equilibria for many parameter values in the model makes designing a satisfactory empirical test even harder.

Many of the problems with testing the citizen-candidate model in the field can be easily overcome in an experimental lab. Thus, an experimentalist would have no difficulty varying office-holder benefits or nomination costs, changing the distribution of citizens in the policy space or even the electoral system. In the lab it is also possible to design environments that minimize the problems with equilibrium multiplicity, allowing explicit tests of the model predictions.

Surprisingly, in the dozen years since the publication of the original theoretical papers there has been little work on trying to test the model experimentally. The experimental literature on candidate behavior in elections has concentrated on candidate location decisions.¹ However there has been comparatively little research on candidate entry. In fact, Palfrey (2005) in his recent survey of the field, noted that "to date there have been no experiments" on entry by policy-motivated candidates. That same year Cadigan (2005) published the only previous experimental study of the model that we are aware of. Though an important advance, for being the first to attempt a laboratory testing of the model, Cadigan's work is somewhat limited in scope. It reports results of 2 treatments of an adaptation of the citizen-candidate model that are distinguished by the value of the cost of nomination parameter. In the high-cost treatment the unique predicted equilibrium involves a single candidate entering at the median of the voter distribution, while the low-cost treatment has, in addition to the median-candidate equilibrium, a two-candidate equilibrium with distinct policy proposals.

We propose an experimental design which varies both cost parameters and electoral systems. In particular, in addition to the simple plurality elections, we consider the two-round runoffs.² At least in some environments, Osborne and Slivinski (1996) results may be interpreted as implying stronger pull for entry

¹See, for instance, the early work by McKelvey and Ordeshook (1982) on two-candidate competition in environments with and without Condorcet winners, or the recent study by Aragonès and Palfrey (2004) on policy platform choice by candidates of different quality. For a recent survey of the literature see Palfrey (2005).

²In the future we also intend to test the empirical implications of introducing the proportional representation into the citizen-candidate framework, derived by Hamlin and Hjortlund (2000).

by politicians at the median of the voter ideal point distributions. It is this implication that we would like to test.

Like Cadigan (2005), we impose sincere voting, in order to concentrate on individual entry decisions by potential candidates. At the same time, we want to stay close to the large-electorate spatial model of Osborne and Slivinski (1996). To do this, while keeping the number of participants in an experimental game small, we decouple the potential candidates (whom we shall call "politicians") from the entire society of citizens. Only politicians may choose to run for office, while the set of voters (implemented in our experiments by a computer) is larger. The restriction is not wholly unrealistic, as, in practice, not every voter would have name recognition and/or funding lined up to make him a viable candidate in a given election and only politicians are under a sufficient public scrutiny to make the assumption that their political views are known empirically plausible. In most elections, at least some of the potential "pre-candidates", though credible enough to be considered, choose not to enter the campaign. It is this entry decision that we study. The distribution of politicians' policy preferences is the third variable, crucial to the predictions of the model, that we choose to vary in the lab.

Cadigan's results, which serve as our benchmark, are twofold. Firstly, he observes that the low-cost treatment results in relatively high entry by symmetric off-median subjects, compared with the high-cost treatment. In addition, he claims to confirm observations of over-participation in some of the earlier studies on market entry (such as Camerer and Lovo (1999) and Fischbacher and Thöni (2008)). It should be noted, though, that since Kahneman (1988), fast convergence to theoretically predicted entry rates of entry has been commonly observed (for a recent survey, see, for instance, Camerer 2003). Given the asymmetry of players in the citizen-candidate model (due to the difference in their ideal points), a more relevant observation in this context may be that of Rapoport *et al.* (2002), who, in a market-entry game with asymmetric entry costs find that subjects tend to over-enter, when the pure-strategy equilibrium implies they should be staying out, and under-enter, when the equilibrium implies they should enter.³ Of course, the present model is substantially more complex than the market-entry games, as the candidates' payoffs depend not only on the number of entrants, but also on their location, so a direct analogy may not be appropriate.

Our preliminary conclusions may be summarized as follows. Firstly, we do observe subjects reacting to treatment variable changes. In particular, both the asymmetry of politician ideal point distribution and the run-off electoral system are conducive to greater entry frequencies at the median of the voter ideal points. Secondly, we seem to confirm Cadigan's observation of comparatively high entry in situations, when equilibrium predicts no entry. In fact, entry rates remain non-negligible even from, essentially, hopeless positions. Other than that, the subjects' entry decisions seem to be reasonably close to best responding to the

³This does, in fact, seem to hint at a better interpretation of Cadigan's result, since he observes substantial deviation from certain entry predicted by equilibrium for some ideal points.

empirically observed entry frequencies.

The rest of this paper is organized as follows. Section 2 develops the benchmark model and the experimental treatments, section 3 presents the experimental design, section 4 discusses the results, section 5 concludes.

2 The Experimental Model

Our model is an adaptation of the one introduced in Osborne and Slivinski (1996). Though Besley and Coate (1997) provide a similar model which allows for a small number of agents, which would seem to be easier to implement in a laboratory experiment, we concentrate on the Osborne and Slivinski approach, as we are interested in large elections, where voting may be assumed to be non-strategic (allowing for strategic voting would introduce additional equilibrium multiplicity which we are trying to avoid). In addition, like in Osborne and Slivinski (1996), an important concern for us is the performance of the model under distinct voting rules.

We consider a society that has to implement a single policy x on a unidimensional $[0, 100]$ continuum. Heterogenous voters have single-peaked preferences, with ideal points distributed over the continuum according to some distribution F . As noted in the introduction, our main departure from Osborne and Slivinski is in limiting the set of possible candidates to a small finite subset of citizens (we consider treatments with 3 and 5 potential candidates).

The potential candidates (henceforth, politicians, or agents) may choose to nominate or not to nominate themselves for the office. The rest of the voters are assumed to never run for the office, but simply to vote for the candidate whose ideal policy is the closest to their own (in experimental treatments the role of these non-politician voters is performed by a computer). Following the classic citizen-candidate models it is assumed that agent preferences are known by everyone and that there is no commitment, so that the politicians can only promise that if elected they would implement their ideal policies.

Thus, in the experimental game there are $N = \{1, 2, \dots, n\}$ agents. Each agent i has a 2-point strategy space $S_i = \{0, 1\}$, where $s_i = 1$ means the agent nominates him/herself, and $s_i = 0$ means the agent stays out of the election. Each agent has single-peaked preferences over the policy space, with an integer ideal point $0 \leq q_i \leq 100$ (here and elsewhere we choose to consider only integer points for the purposes of experimental implementation)

Unlike the potential candidates, the voters in our experimental are computerized robots, who always vote sincerely. We assume there are 101 such voters, with a single voter having an ideal point at every integer between 0 and 100 (the discretization of the voter space is done here in order to avoid explaining the notion of a continuous distribution to largely pre-calculus experimental subjects). The robot voters always vote for a nominated candidate whose ideal point is closest to their own (in case $m > 1$ candidates are at the same distance from a given voter, s/he shall randomly select a candidate, with every one of the closest candidates having a probability $\frac{1}{m}$ of being chosen).

The winner of the election is determined by the voting of a larger society. In this paper we consider two voting rules: simple plurality and the two-round runoff. In the former the candidate with the largest number of votes wins outright (ties are resolved randomly, with every one of the top candidates having equal probability of winning). In the latter system, all candidates but the top two get eliminated in the first round, so that the second round is a simple majority vote among the top two contenders (in both rounds, once again, ties are randomly resolved). In this way for any election we have a (stochastic) winner function w_i , which equals to 1 if the agent wins the election, and equals to 0 if he doesn't (whether he does not win due to losing the vote or due to not entering). In all cases, there is a unique winner in the election, and the implemented social outcome is his/her favorite policy: $x = q_i$ whenever $w_i = 1$.

The agents have standard Euclidean preferences over a single-dimensional policy space, they have to pay a cost $c > 0$ to nominate themselves as candidates and they receive a benefit $b > 0$ if elected. Formally, an agent i with an ideal point $q_i \in [0, 100]$ in a society that implements a policy $x \in [0, 100]$ receives the payoff

$$u_i(x; q_i) = -\alpha \|x - q_i\| - cs_i + bw_i$$

(where $\alpha > 0$ is a scale parameter, that in the theoretical model may be normalized to 1).

Finally, if no candidate chooses to enter an election, following Osborne and Slivinski we assume every agent receives a large negative shock (this can be viewed as a major disruption of the political system). Formally, if no candidate is nominated the implemented policy is assumed to be $x = d$, which is equally disliked by all participants:

$$u_i(d; q_i) = -D$$

where $D > 0$ is large.

In general, the citizen-candidate model leads to multiple equilibria. The exact structure of the equilibrium set may be rather complicated, with existing characterizations focusing on the number of agents entering in an election. The key determinants in this respect are the parameters of cost of running for an election c and the benefit from holding office b , as well as the specific of the voting rule chosen. In our case, where the set of potential candidates is restricted, the availability of candidates at certain points of the political spectrum is also crucial. In particular, there are important implications of having candidates at the median m of the voter ideal point distribution (which in the case of the uniform voter distribution is 50). Following the bulk of the earlier literature, we shall concentrate on the pure strategy Nash equilibrium. The following proposition, which follows from the results of Osborne and Slivinski (1996), describes some of the equilibrium possibilities in our setting. It is these implications of the model that we shall try to test in the lab.

Proposition 1 *a) If there is a unique politician closest to m , then for both voting rules there exists an equilibrium in which he is the only candidate.*

b) If there exist two or more politicians closest to m , then the single-candidate equilibrium exists under either voting rule if and only if $b \leq 2c$. In such an equilibrium, one of the politicians closest to the median is the only entrant.

c) In every two-candidate equilibrium under the plurality rule the candidates are located symmetrically around the median of the voter distribution. Furthermore, such an equilibrium will exist only if there are symmetric politicians located between $100/6$ and $500/6$, or if the symmetric politicians are the closest ones to the median.

d) If there are exactly two potential candidates closest to m , then under the run-off system there exists an equilibrium in which they are the only entrants if only if $2c \leq b$.

e) If there is more than one politician at each occupied position to one side of the median and $b > 4c$, then under the run-off in every two-candidate equilibrium only the politicians closest to the median would be candidates.

It should be noted that, except at high values of the cost parameter c compared to the benefit parameter b and when there is only one candidate at the median of the voter ideal point distribution, it is hard to achieve equilibrium uniqueness in the citizen-candidate model. In choosing the parameters of the model to be tested on, we attempt to, at least, ensure uniqueness of pure-strategy equilibrium candidate profiles.

3 Experimental Design

All experimental sessions were conducted at the Instituto Tecnológico Autónomo de México (ITAM) in Mexico City and the subjects were undergraduates recruited in introductory economics courses. The experiments were computer-administered (sample computer screens are presented in the appendix 2). A total of 10 experimental sessions were conducted and each session had between 12 and 30 participants.

In each experimental session we consecutively ran 30 elections in groups with 3 or 5 candidates, with both group membership and subject ideal points randomly changed before each election. If the total number of subjects in the room was not divisible by 3 (respectively, 5), in each round some subjects would be randomly selected to sit it out. Therefore, up until the last round the termination time effectively remained random.

The distribution of subjects' ideal points was either constant, or varied only once during a session, but each subject's location was randomly chosen for each period, which corresponded to an election. In each election subjects, having observed their positions, had to decide whether to nominate themselves as possible candidates. All voter decisions were taken by the computer. After each election subjects got the feedback about the ideal points of the entrants and the winner in their election, as well as the vote shares and received by every candidate and their own monetary payoff.

All payments were in Mexican Pesos ($MN\$11 = USD\1). We started each experimental session by allocating every agent MN140 pesos of initial capital, to

which the payments corresponding to the model parameter values were added and subtracted. In all treatments we take $D = -MN\$40$, $b = MN\$25$ and $\alpha = MN\$0.1$. There are both high-cost (HC) and low-cost (LC) treatments: in the former we set $c = MN\$20$ or $MN\$18^4$ and in the latter $c = MN\$5$. If subjects balance was reduced to below 0 pesos, they were excluded from further election rounds (in practice this only occurred in high-cost treatments).

We have conducted treatments with 3- and 5-subject groups. For the three-subject groups, we considered two configurations of the politician ideal points: 30, 50, 70 and 30, 50, 80. For the plurality rule, in the former treatment at low cost there are two pure-strategy Nash Equilibria: in one only agent at 50 enters, whereas in the other s/he stays out and agents at 30 and 70 enter the election. At high cost, in both configurations only the agent at 50 may enter in equilibrium (at this point we have only run the low-cost treatments). In order to analyze the impact of prior learning we have run the two ideal point configurations sequentially with the same agents, varying the order: in one treatment the 30, 50, 70 configuration was run before 30, 50, 80, and in the other treatment the ordering was reversed (a two session of each order treatment has been run).

Unfortunately, in the three-person treatments with distinct ideal points of candidates it is impossible to eliminate the equilibrium in which the only entrant is the candidate closest to the median of the voter distribution (indeed, conditional on such candidate being the lone entrant, nobody else would be better off by entering either under the plurality rule, or under the run-off rule). This motivated our decision to consider treatments with 5 agents, some of which coincide in their ideal positions.

For the five-subject groups, we kept the distribution of candidate ideal points fixed at 25, 25, 50, 50, 75. In this treatment for the plurality rule at low cost there is only one pure-strategy equilibrium candidate configurations possible, with the agent at 75 entering together with one of the two agents at 50. In contrast, under the run-off system there is a unique equilibrium in which both agents at 50 enter (and nobody else does). At high cost in any pure-strategy equilibrium under both voting rules *only one* agent can enter at 50. At this point we ran two sessions of each low-cost treatment and two sessions of the high-cost plurality rule treatment. It should be noted, that even though equilibrium entry predictions are unique, only the low-cost run-off treatment has a unique equilibrium. The other treatments, therefore, may present substantial coordination problems. The summary of the equilibrium predictions for the 5-subject treatments is given in table 1:

⁴We reduced the cost to \$17 pesos in a later session in an attempt of reducing subject bankruptcy rates.

Table 1: Equilibrium Entry Positions for 5-subject treatments

	plurality rule	run-off
high cost	50	50 (<i>to be run</i>)
low cost	25,75	50,50

4 Results

Our results can be summarized as follows. In every treatment there is a substantial "floor" on entry probability from every position. In fact, almost always we observe candidates from each position entering with, at least, a 25% probability. Except for this, agents come close to best-responding to the empirically observed entry distributions. The degree of excess entry in the largely "hopeless" positions was sufficiently high to force us to modify the original experimental design: since the first high-cost session (with entry cost $c = 20$ pesos) had to be terminated early due to the "bankruptcy" of the majority of subjects, in the subsequent session we lowered the entry cost parameter to $c = 17$ (lowering it further would have come close to changing the equilibrium predictions). Unfortunately, this session, likewise, ended early due to a mass bankruptcy.

Figure 1 presents the entry probabilities by the ideal point in the three-person treatments. In total, we have an observation of 330 "symmetric" elections (with subjects' ideal points at 30,50 and 70) and an equal number of "asymmetric" elections (with candidates at 30,50, and 80).

It can be observed that when the distribution of ideal points is symmetric the "extremist" subjects enter with probabilities close to 90%. Since whenever both extreme subjects enter, the centrist subject loses the election, whereas he wins whenever no more than one opponent competes, the empirical distribution implies that such a candidate, if nominated, has just about a 20% probability of winning, with the extremist candidates winning about 40% of the time each. Notably, the empirical entry distribution is not too far from the best response for all candidates: given the value of the parameters, the centrist subjects come close to being indifferent between entering and not entering, while both extremist candidates should enter.

The asymmetric case entry pattern is very distinct. The striking feature is the high entry rate of the nearly hopeless candidates at 80. The "far rightists" have negligible winning probabilities, as they can only win if nobody else enters (in fact, their wins are almost never observed in the data). Nevertheless, they enter half the time. This high entry rate by the ultra-right frequently ensures the victory of the left: whenever the subject at 80 enters, the candidate at 30 is guaranteed a win. This does seem to induce extremely high entry rates on the left. The centrists, however, win whenever the right does not enter, which likewise serves to elevate their entry probabilities.

In order to study the differential effects of treatments on the entry probabilities we ran a random effect logit regressions for entry probability. Table 2 presents results of these for each entry position. In each regression the *asym*

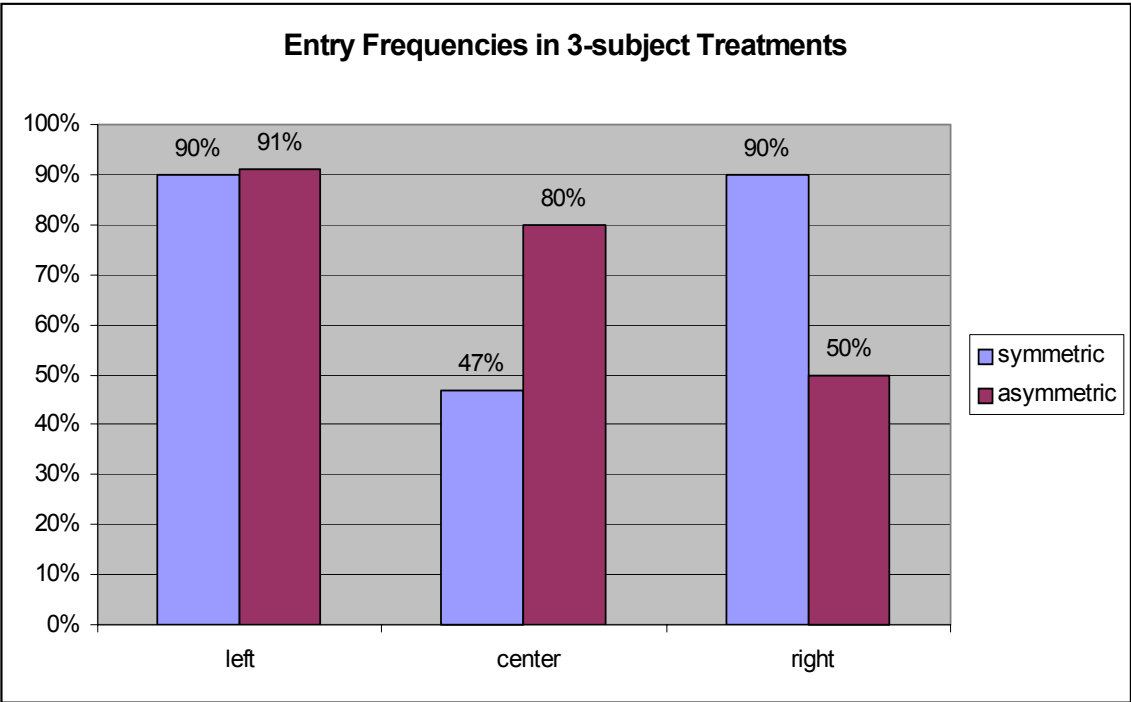


Figure 1:

Table 2: Random effect logit regressions for the entry probabilities in three-person treatments

	left	center	right
<i>constant</i>	3.336**	0.083	2.863**
<i>std.error</i>	(0.625)	(0.430)	(0.479)
<i>asym</i>	-0.401	0.526	-2.245**
<i>std.error</i>	(0.630)	(0.449)	(0.494)
<i>order</i>	-0.721	0.511	-0.394
<i>std.error</i>	(0.565)	(0.459)	(0.322)
<i>period</i>	0.009	0.050	-0.017
<i>std.error</i>	(0.049)	(0.033)	(0.045)
<i>period_asym</i>	0.064	0.201**	0.025
<i>std.error</i>	(0.073)	(0.052)	(0.053)
**-p<0.01			

coefficients refer to changes in entry probabilities between the symmetric and the asymmetric treatments. We also introduced two distinct period variables, to account for the possibility of different learning patterns for the symmetric and asymmetric elections.⁵

The regressions show that there is little dynamics going on during the sessions, except that whenever in the asymmetric elections the centrist candidates quickly increase their entry probabilities (no observable dynamics occurs in other positions and in symmetric elections). This may suggest a learning argument (as, given the empirical entry frequency by the ultra-rightists at 80, the entry by the leftists is still, in expectation, profitable, no learning occurs in this position). The position asymmetry has a further large effect on the rightist entrants, who sharply decrease their entry probabilities when moved further to the right (this entry rate, however, remains rather high, with no observable dynamics during the session). There are no obvious order effects due to symmetric or asymmetric elections being run first.

Figure 2 presents entry probabilities for the low-cost 5-person treatments.

In the plurality rule elections subjects nearly always enter at 75 (as is predicted by the equilibrium), and enter with a probability of 63% at 25. Adjusting for the obvious coordination difficulties between the subjects at 25, these results seem to be very close to the predicted equilibrium. Indeed, the implied probability that there is nobody entering at either 25 or 75 is under 15%. Thus, the

⁵we also considered introducing the separate period variables to account for the order of conducting the symmetric and asymmetric elections, but the corresponding coefficients were never statistically significant.

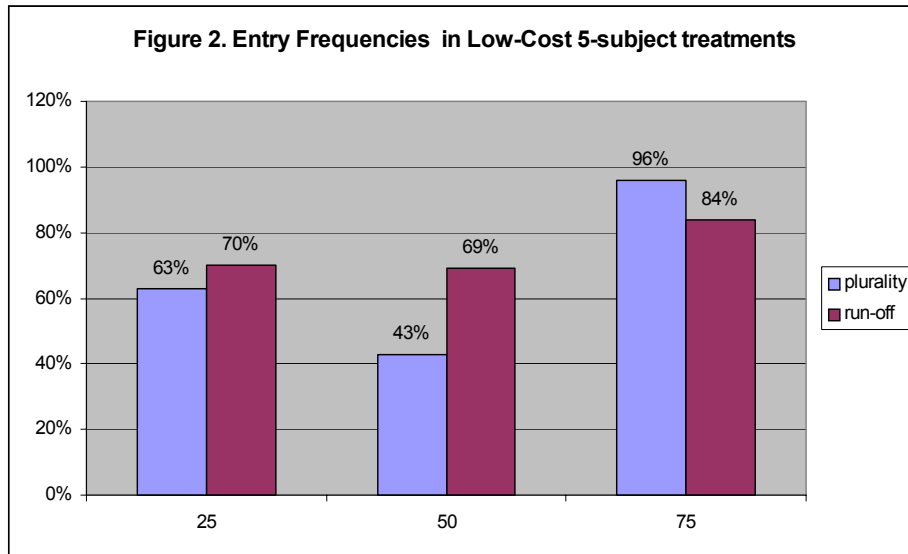


Figure 2:

entrance at 50 does not present many chances of winning (to win the centrist candidate has to be alone at his position, with at least one of the remaining positions being unoccupied). Strikingly, 43% of the time the subjects choose to enter here, which implies that an agent considering entry at this position would be expecting to lose with a probability of over 90%, which cannot justify incurring the entry cost. The most notable difference across treatments is a substantial increase in entry at the center in the run-off treatment compared with the simple plurality treatment. A smaller decrease in entry at 75 is likewise notable, as it comes in comparison with nearly certain entry under the plurality rule.

Table 3 presents the results of the random-effect logit regressions for entry probabilities for the run-off and plurality elections.

The results seem to indicate significant increase over time of entry probabilities both at 25 and at 50 during the runoff sessions, and a smaller significant decrease in entry probabilities in the center during the plurality rule sessions. Furthermore, even ignoring the dynamics, the run-off may result in a somewhat higher entry probability in the center (the corresponding coefficient is significant at a 10% level). At this point, the decrease in entry at 75 in the run-off has not been shown to be statistically significant.

As a total of 49 and 35 distinct subjects participated, respectively, in the plurality and run-off rule treatments we may try to look for individual entry

Table 3: Random effect logit regressions for the entry probabilities in three-person treatments

	left	center	right
<i>constant</i>	1.019**	0.012	3.854**
<i>std.error</i>	(0.282)	(0.334)	(0.838)
<i>runoff</i>	-0.444	0.879	-1.389
<i>std.error</i>	(0.428)	(0.513)	(0.941)
<i>period</i>	-0.019	-0.026*	-0.036
<i>std.error</i>	(0.012)	(0.013)	(0.041)
<i>period/runoff</i>	0.054**	0.043*	-0.028
<i>std.error</i>	(0.019)	(0.020)	(0.049)
** - p<0.01	* - p<0.05		

patterns. Figures 3 and 4 present the distribution of agents by average entry frequency.

It can be immediately seen that in both plurality and run-off elections from every position at least some subjects enter always or nearly always (in fact, we did observe certain subjects entering always, irrespective their position). This accounts for a substantial chunk of overall over-entry in losing positions. It should be also noted that whereas nearly all subjects always enter at 75 under the plurality rule, the distribution is more diffuse under the run-off rule. Furthermore, whereas many subjects almost never enter at 50 under the plurality rule (or do so only rarely), almost every subject enters with, at least, a 40% probability of under the run-off rule.

The results from the high-cost treatment, at this point, can, at best, be considered tentative. The main reason for this is that neither experimental session for this treatment was properly concluded due to a massive subject bankruptcy (in fact, in an unsuccessful attempt to reduce bankruptcy we reduced in the later session the entry cost from MN\$20 to MN\$17 pesos). The following table presents the results of the first 19 rounds of all plurality rule 5-subject treatments.

It is striking, that varying entry cost has no effect on subjects located alone at 75. In contrast, the subjects both 50 and 25 decrease their entry rates when costs are high. Still, these rates remain high, considering that both the leftists and the centrists are losing with probabilities far above $\frac{1}{2}$, repeatedly incurring the huge entry cost. The equilibrium prediction (entry only at 50) does not come close to being observed. To make any definitive conclusions here, though, we would need to properly implement the high-cost treatment.

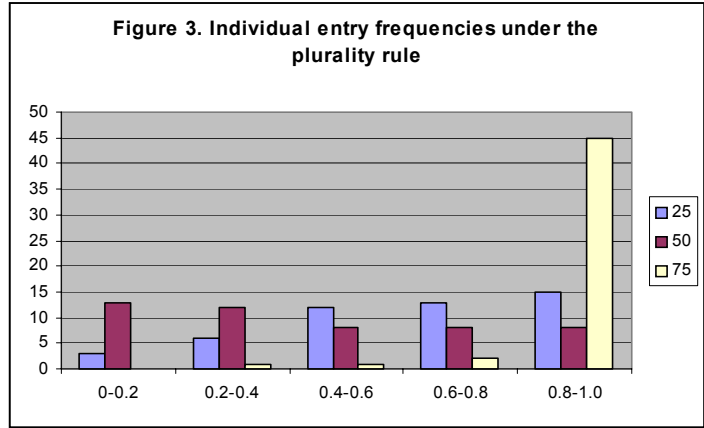


Figure 3:

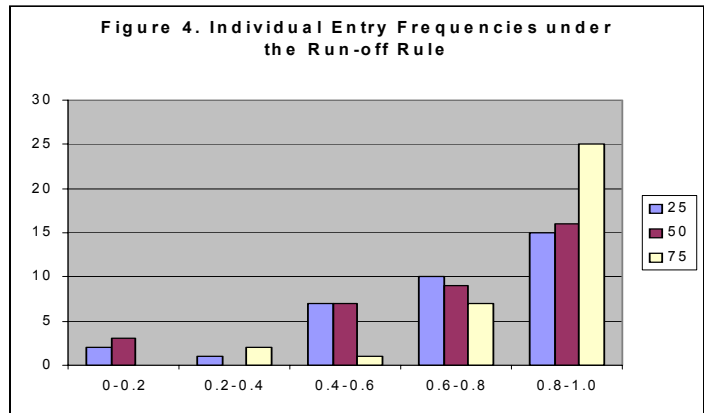


Figure 4:

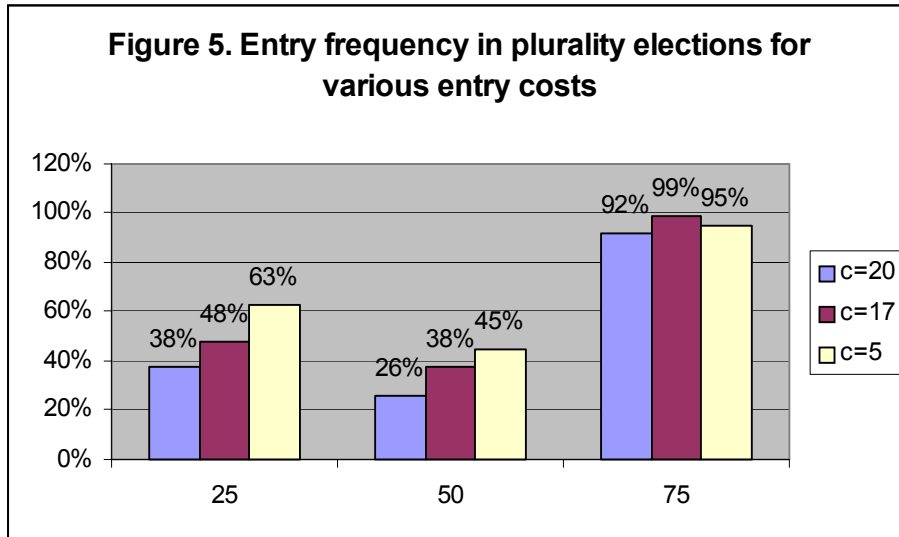


Figure 5:

5 Conclusions and Future Research

This paper presents the preliminary results of a series of experiments on the candidate entry in the citizen-candidate framework. Overall, we believe the theory does a reasonable job in predicting the consequences in changes of the control variables. The three-person treatments seem to both provide evidence for the theoretically predicted divergent equilibria and suggest a pattern of possible learning behavior. The comparative plurality rule and run-off rule treatments with five subjects provide evidence for the predicted strengthening of the candidates near the median in the latter electoral system. On the other hand, our results provide strong evidence for consistent excess entry by subjects in "hopeless" or "nearly hopeless" positions (an occasional failure to enter by subjects even in the most advantageous positions may be noted as well). Furthermore, the multiplicity of equilibria leads to important coordination problems that require further study. Finally, the definitive conclusions about the high-cost treatments would have to be postponed, until these are run properly, in order to avoid mass subject bankruptcy.

The more detailed analysis of the data remains to be done. Firstly, the non-negligible entry frequencies by nearly inevitably losing candidates, combined with what informally appears to be close to the best response behavior by subjects otherwise, leads us to believe that a model of quantal response equilibria of McKelvey and Palfrey (1995) might be useful in explaining our observations. In addition, the tentative evidence for the importance of learning that comes out of the three-subject treatments (and recalls some of the observations of

Rapoport et al. 2002) suggests another avenue for further research. Finally, as the multiplicity of equilibria is nearly inevitable in the citizen-candidate model (unless the only equilibrium involves entry by only Condorcet winners), the resultant coordination problems would have to be studied.

References

- [1] Aragonès, E, and T. Palfrey (2004), The Effect of Candidate Quality on Electoral Equilibrium: An experimental Study, *American Political Science Review* **98**, pp. 77-90
- [2] Besley, T., and S. Coate (1997), An Economic Model of Representative Democracy, *Quarterly Journal of Economics* **112**, pp. 85-114.
- [3] Cadigan, J. (2005), The Citizen-candidate Model - an Experimental Analysis, *Public Choice* **123**, pp. 197-213.
- [4] Camerer, C. (2003), *Behavioral Game Theory*. New York: Russel Sage Foundation.
- [5] Camerer, C., and D. Lovo (1999), Overconfidence and Excess Entry: An Experimental Approach, *American Economic Review* **89**, pp. 306-318.
- [6] Fischbacher, U, and C. Thöni (2008), Inefficient Excess Entry in an Experimental Winner-Take-All Market, *forthcoming in Journal of Economic Behavior and Organization*.
- [7] Hamlin, A., and M. Hjortlund (2000), Proportional Representation with Citizen Candidates, *Public Choice* **103**, pp. 205-230.
- [8] Kahneman, D. (1988), Experimental Economics: a psychological perspective. In R. Tietz, *et al.* (editors), *Boundedly Rational Behavior in Experimental Games and Markets*. New York: Springer Verlag, pp.11-18.
- [9] McKelvey, R., and P. Ordeshook (1982), Two-candidate Elections Without Majority Rule Equilibri, *Simulation and Games* **13**, pp. 311-335.
- [10] McKelvey, R.D. and Palfrey, T.R. (1995). "Quantal Response Equilibria in Normal Form Games." *Games and Economic Behavior*. **10**, 6-38.
- [11] Osborne, M. and A. Slivinski (1996), A model of Political Competition with Citizen Candidates, *Quarterly Journal of Economics* **111**, pp. 65-96.
- [12] Palfrey, T. (2005), Laboratory Experiments in Political Economy, CEPS Working Paper No. 111, Princeton University
- [13] Rapoport, A., D. Seale and E. Winter (2002), Coordination and Learning Behavior in Large Groups with Asymmetric Players, *Games and Economic Behavior* **39**, 111 - 136.

6 Appendix 1: Experimental Instructions

An English translation of the original Spanish-language experimental instructions for one of the three-person treatments follows (the rest of the instructions were analogous):

Instructions

This is an experiment about decision-making. CONACYT has provided funds for this research. The instructions are simple, and if you follow them carefully and take good decisions you can earn a CONSIDERABLE AMOUNT OF MONEY, which shall be PAID TO YOU IN CASH privately at the end of the session.

After we read the instructions, you will have an opportunity to make your decisions.

- General Proceedings

In this experiment you have to decide whether to compete as a candidate in each of the 30 elections that we shall run at the end of these instructions. We shall first run the experiment with 15 elections under one parameter configuration and 15 elections under another configuration.

In the first 5 elections, one of 3 possible alternatives shall be elected as a winner by a population of voters (simulated by the computer) in accordance with the voting procedures that we shall see later. The three alternatives are represented by the positions 30, 50 and 70 in the following line from 0 to 100. Wrong line – remove the numbers.

- Group formation

In each election you will form a part of a group of three participants. The composition of each group shall change randomly, so that the same group shall consist of different participants in each election. You shall never know with whom you are participating.

- Alternative Assignment

In each election one of the mentioned alternatives shall be assigned as your ideal position. Every participant of a group shall be assigned a different position. So, one participant shall be assigned position 30, the second shall be assigned position 50, and the third shall be assigned position 70. The position assignment shall be determined randomly.

- Candidate Nomination Procedure

To be considered as a candidate, eligible for the voters (not clear) you shall have to decide whether to propose your ideal position in each of the elections. That is, you have to decide whether to compete or not in order to be elected by the voters in each election.

You only can propose your ideal position and you can't propose any other position.

Once every participant takes his/her decision to nominate or not their positions, the winning candidate in each election shall be determined according to the voting procedure described below.

- Procedure for Electing the Winning Candidate

For every election we shall have a population of 101 citizen voters. The voters are distributed along a line from 0 to 100 as follows: each voter at each integer number on the line.

The 101 citizen voters (simulated by the computer) shall elect the winning candidate in accordance with the following voting procedure.

1. Each citizen shall vote for the candidate that is the closest to its location. Do you need both position and localization? When more than one candidate is equally close, the citizen's vote will be randomly assigned to one of the closest candidates.

2. The winning candidate shall be the one that gets the largest number of votes. In case of a draw, the winners shall be determined randomly among the candidates tied for the first place.

- Initial balance, Earnings and Payments

Each participant shall start with an initial balance of 120 pesos. In each election the initial balance shall be adjusted as follows:

In case at least one alternative is proposed:

1. Each participant shall be subtracted the amount in pesos equal to the parameter Alpha ($=0.1$) multiplied by the absolute distance between his/her ideal position and the position of the winning candidate. That is, the subtracted amount is equal to:

$0.1 \times |\text{your ideal position} - \text{position of the winning candidate}|$

2. From each participant who decides to nominate his/her candidacy an amount of 5 pesos shall be.

3. The winning candidate shall have 25 pesos added.

In case no alternative is nominated, every participant shall be subtracted the same amount of 40 pesos.

- Accumulated Balance

The balance accumulated at the end of each election shall be the sum of the initial balance plus the payments and earnings obtained in each previous election

- Payment proceedings

The total that you accumulate during the total you accumulate over 30 rounds shall be paid to you at the end of the experiment

- Summary of the instructions

In every election,

1. You shall form a part of a new group of 3 participants.
2. Every member of a group shall be assigned one of the following 3 positions on the line from 0 to 100: 30, 50, 70.

3. Every participant will have to decide whether to nominate him/herself as a candidate in an election.

4. The 101 citizen voters (simulated by the computer) shall determine the winning candidate, voting for the one closest to their location.

5. The updating of the balance shall be done in the following manner after each election:

- a. In case at least one alternative has been proposed:

i. Every participant shall be subtracted the amount in pesos equal to $0.1 \times$ |his ideal position – the position of the winning candidate|

ii. From every participant who decides to nominate himself an amount of 5 pesos shall be subtracted.

iii. The winning candidate shall earn 25 pesos.

b. In case no alternative is nominated, the same amount of 40 pesos shall be subtracted from all participants. En el caso de que ninguna alternativa se haya postulado, se le sustraerá a cada participante el único monto de 40 pesos.

6. The balance accumulated at the end of each election shall be the sum of your initial balance plus the payments and earnings obtained in every previous election.

- Factors that influence the gains and losses in every election

As you can see, your earnings shall be influenced by three factors:

1. The distance between the position elected the winner and your ideal

2. The decision by yourself and other participants whether to

3. whether you are elected the winner by the voters)

Later steps (read out by the researcher after reading the instructions)

We shall now demonstrate you the software that we have designed for your decision-making. Therefore, please leave your instructions next to your computer, and take the IDENTIFICATION REGISTER page, which you can find next to the computer.

Connecting to the server

Every participant must initiate the connection with the server, using the following procedure. Enter into the boxes User and Password the numbers written at the top of your IDENTIFICATION REGISTER. Now press the Send button.

The screen.

We shall now study the information that appears on your screen. At the top let us find a column which says USER NUMBER, GROUP SIZE, PERIOD NUMBER, PERIOD TYPE (in our case we are in the practice rounds) and ACCUMULATED BALLANCE.(which in our case is the initial ballance of 140 pesos). In the second column, on the right, you see the value of the ALPHA parameter, the NOMINATION COST, the PAYMENT FOR WINNING, and the COST IN CASE THERE IS NO CANDIDATE NOMINATED, and, finally, the NUMBER OF VOTERS.

We shall now see the graph, which indicates the number of voters in each point on the line between 0 and 100, as well as the distinct alternatives. At the same level to the right there buttons which you should touch with your MOUSE to take your decision to nominate yourself, or not to nominate yourself.

Practice rounds

We shall now have 3 practice rounds. The primary objective of these practice rounds is for you to familiarize yourselves with the software we have designed for your decision-making, so these rounds won't count for your payment. If you have any questions during the practice rounds, please raise your hand, and I shall try to respond to them..

Once you enter your decision, you have to wait for everyone to take their decision and for the computer to calculate the election result.

If your computer does not have the decision-making box activated, this is because the number of you in the room is not divisible by 3. In this case you have to wait for the following rounds for your box to be activated.

Generate Period 1

We now start the first practice round. (Press: Iniciar Período)

(After the computer generates the results)

In the Results Table on the right you see a graph, which indicates the number of votes that was obtained by each nominated candidate. On the left, you find your initial balance, the payment for winning, which is bigger than zero if you won the election, the nomination cost, which is bigger than zero if you nominated yourself, the cost due to distance from the winner, the cost due to lack of candidates, which is bigger than zero if nobody in your group decided to nominate themselves, and, finally, the accumulated balance, which is your initial balance, plus gains, minus costs.

Any questions?

Results list: If you would like to maintain a register of your accumulated balance, please use the back of the information register page. In any case, the computer records your decisions and accumulated payments.

Generate Period 2

We now proceed to the second practice period (Press: Iniciar Período) Proceed to taking your decisions

Any questions?

Generate Period 3

We now proceed to the third practice period. (Press: Iniciar Período) Proceed to taking your decisions.

Any questions?

Real periods played for money

We shall now start the first 15 periods of play for money.

- Check the screens

Once the experiment starts, you are not permitted to talk or to communicate with other participants. Otherwise, we shall be forced to exclude you from the experiment. Please concentrate on your computer screen. If anyone gets a question, please raise your hand and one of us shall approach you and try to respond.

Generate Period 1 (Press: Inicio de Período)

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Generar Período 15 (Press: Inicio de Período)

Proceed to taking decisions.

We shall now start the second part of the experiments, with a different set of positions.

The positions for the next 15 rounds have changed. Now the positions will be 30,50 and 85, the rest of the parameters remain as before.

Any questions?

Generate Period 16 (Press: Inicio de Período)

...

Last period

Generate Periodo 30 (Press: Inicio de Período)

Procedan a tomar sus decisiones.

Final payment

Your final payment is the balance that appears on your screen.

Please remain seated. One of us shall pass around to hand out the final questionnaire and your payment receipt that you should fill out.

After this you will be called to get your payment. Please, return all the materials that we gave you.

Thanks a lot for participation!

7 Appendix 2. Sample Screen



Figure 6: The subjects' computer screen before (top) and after (bottom) the election