Citizen Candidates in the Lab: Rules, Costs, and Positions*

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Abstract

We report the findings from a study that explores candidate participation in a context where citizens can become candidates under both plurality and run-off voting systems. The study also considers the influence of entry costs and different platforms of potential candidates. While our findings align with the expected outcomes of the citizen-candidate model, there's notable over-participation by candidates from less favorable electoral positions. These entry patterns adjusted well to the QRE. This research adds to the existing body of knowledge about what motivates candidates to enter races under different voting systems and analyzes the behavior of candidates in extreme positions.

Keywords: Citizen Candidates, Electoral Systems, Laboratory Experiment, Quantal Response.

JEL Codes: D72, C92, D70

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1 Introduction

The relationship between electoral systems and electoral outcomes has long been a major object of study by political economists going back to, at least, Duverger (1954).[1] As the choice of electoral system is generally neither frequent nor random, observational studies provide limited scope for testing the theoretical mechanisms proposed to explain this relationship. Many of these limitations can be overcome in a laboratory experiment. In this paper, we provide the results of one such experiment, concentrating on the manner in which electoral systems influence the behavior of the potential candidates in an election. Specifically, we shall compare incentives for running for office implied by two commonly used systems: the simple plurality and the two-round run-off. .

Our theoretical framework for this study is the citizen-candidate model (Besley and Coate, 1997; Osborne and Slivinski, 1996), one of the few established approaches to endogenizing the number and the identity of political candidates and proposals in elections. In this environment, a society of agents with publicly known preferences in some policy space has to decide on a common policy. Crucially, only alternatives explicitly proposed (nominated) by somebody shall be presented to voters. 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 officeholders. Once the set of candidates is fixed, the entire society votes and the elected candidate implements their favorite policy (as the individual preferences are public, candidates cannot commit to implementing any policy at variance with their ideal).

To the best of our knowledge, the has been no experimental study of candidate entry, either in the citizen-candidate or any other framework, comparing the candidate entry incentives under the plurality and the run-off voting systems: particularly surprising, given that the original theoretical exposition of the citizen-candidate model by Osborne and Slivinski, 1996 was centered around this comparison. Our setting was in great part designed to fill this

[1] See, for instance, Bol, Dellis, and Oak (2016) for a recent survey.

gap, and we confirm the main prediction of the Osborne and Slivinski, 1996 model in this respect. The citizen-candidate setting further allows us to concentrate on the binary entry decision as such, avoiding complications having to do with policy choice.

Unfortunately, though it does a good job presenting the incentives faced by potential candidates deciding to run for office, the citizen-candidate model is not easy to test using available electoral data. To begin with, a direct test of the model's prediction for the differential impact of different electoral systems would require observing random variations of the electoral system over "similar" electoral policies. Testing the model mechanisms in detail would also heavily rely on exact public knowledge of the policy preferences of potential candidates, even those who may never choose to run in an actual election. Furthermore, predictions of the model are 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 exogenously vary in natural political systems. The substantial multiplicity of equilibria for many parameter values in the model makes designing a satisfactory empirical test even harder. Many of these problems could be 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. The most complex challenge is presented by the model's inherent equilibrium multiplicity for most parameter values. Still, it is also possible to design environments that minimize this problem in the lab, allowing definitive tests of the model predictions.

The early experimental literature on candidate behavior in elections has concentrated on candidate platform choice[2]. More recently, Tsakas and Xefteris (2021) conducted a laboratory study of the impact on candidate platform choice of the exogenous threat of additional candidate entry (along the lines of Thomas R. Palfrey (1984)). There has been comparatively little experimental work on comparing candidate entry incentives under variable

[2]See, for instance, the early work by Mckelvey and Ordeshook (1982) on two-candidate competition in environments with and without Condorcet winners, or a study by Aragones and Thomas R. Palfrey (2004) on policy platform choice by candidates of different quality.

electoral systems. Indeed, Thomas R. Palfrey (2016), in his survey of the field, noted that as of that moment, he was aware of only two such experimental studies; only a few studies have attempted to narrow this gap in the literature since.

Though an important advance, for being the first to attempt a laboratory testing of incentives for candidate entry, Cadigan (2005) is somewhat limited in scope. It reports the 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. Another experimental test of the citizen-candidate environment we are aware of has been conducted by ourselves (Elbittar and Gomberg, 2009). Unfortunately, the equilibrium multiplicity turned out to be a severe problem in that study, resulting in major coordination problems among the participants. More recently, Kamm (2017) adds theoretical and experimental analysis of a citizen-candidate with proportional representation (confirming the tendency of this electoral system to lead to greater candidate polarization). In a similar spirit Bol, Matakos, Troumpounis, and Xefteris (2019), consider an environment where a policy choice follows a strategic entry decision and compare a plurality and a proportional representation environment in that setting. Grober and Palfrey (2019) report the results of a laboratory study of a version of the citizen-candidate environment with private information about candidate policy preferences. Surprisingly, though the comparison of the entry incentives under the plurality and the run-off electoral system were central (Besley and Coate, 1997; Osborne and Slivinski, 1996), until now, there has been no direct experimental implementation of these. Filling this gap is our study's objective.[3]

Our goal was to design an environment that avoids the problem of coordinating on a

[3] Our analysis may be viewed as complementary to the recent experimental work of Bouton, Gallego, Llorente-Saguer, and Morton (2022), which analyses voter behavior across these two electoral systems; in contrast, we concentrate our attention on the behavior of candidates.

single equilibrium while preserving significant predictions (Osborne and Slivinski, 1996). In particular, that model predicts that under the run-off electoral system, there would be a stronger pull for entry exclusively by politicians closest to the median of the voter ideal point distribution. The high candidate entry cost for both electoral systems implies the same pull to the center. It is these implications of the model that we would like to test.

As it was done in some of the earlier work[4], 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.[5] Only politicians may choose to run for office, while the set of voters (implemented in our experiments by a computer) is larger. In practice, not every voter would have name recognition and/or funding lined up to make him a viable candidate in a given election. Furthermore, only politicians are under sufficient public scrutiny to make empirically plausible the assumption that their political views are known. 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 rest of this paper is organized as follows. Section 2 presents the basic citizen-candidate model along the lines of Osborne and Slivinski (1996), section 3 describes the experimental design we employ, section 4 presents our experimental results, including the quantal response equilibrium analysis, and section 5 concludes.

2 Citizen-Candidate Model

Our model adapts the one originally introduced in Osborne and Slivinski (1996). While Besley and Coate (1997) provides a similar model that allows for a small number of agents

[4]For instance, Cadigan (2005) and Elbittar and Gomberg (2009).

[5]This simplification of the original citizen-candidate model has been previously introduced, for instance, in Dellis and Oak (2016).

(a setting that would seem to be easier to implement in a lab), we follow 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 Osborne and Slivinski (1996), we concentrate on the comparison of candidate entry 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 symmetric single-peaked preferences, with ideal points distributed over the continuum according to some distribution F (for the rest of the paper, it shall be assumed to be uniform). Our main departure from Osborne and Slivinski is in limiting the set of possible candidates to a small finite subset of citizens with corresponding ideal points $Q = \{q_1, ..., q_n\}, q_i \in [0, 100]$.

Potential candidates, or politicians, may choose to nominate or not to nominate themselves for the office. As in Osborne and Slivinski (1996), it is assumed that everyone knows agent preferences and that there is no commitment, so the politicians can only promise that if elected, they would implement their ideal policies. The rest of the voters are assumed to never run for office but to vote for the candidate whose ideal policy is the closest to their own.

Hence, the game has $N = \{1, 2, ...n\}$ politician players. Each player 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. Potential candidates consider the cost of participation c, the possible benefits of being elected or "ego rent" b, and the distance between their ideal policy and the final policy implemented. As in Osborne and Slivinski (1996), we assume that if everybody decides not to enter, the resultant outcome is "catastrophic": a large negative payoff $-D$ for everyone. To summarize, the individual payoff in this game is given by $u_i(x, q_i)$, representing the preferences of citizens:

$$u_i(x, q_i) = \begin{cases} -D, & \text{if } s_i = 0, \forall i \in Q \\ -\alpha||x - q_i|| - cs_i + bw_i(s), & \text{otherwise} \end{cases} \quad (1)$$

where α is a parameter reflecting the relative importance of policy vis-a-vis non-policy payoffs and w_i takes the value of 1 if the agent wins and 0 otherwise. Notice that whether a candidate wins depends on the voting system, voter ideal point distribution, and the profile of individual entry decisions ($s = \{s_1, ..., s_n\}$).

Unlike politicians, who have a strategic role to play, regular voters in our experiment will be computerized robots who will 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 (we chose to use a discrete voter space in order to avoid explaining the notion of a continuous distribution to participants who were mostly not exposed to calculus or probability theory). The robot voters always vote for a nominated candidate whose ideal point is closest to their own (in case $e > 1$ candidates are at the same distance from a given voter, the winner is randomly selected, with every one of the closest candidates having a probability $\frac{1}{e}$ of being chosen). Also, since the implemented strategy x is decided by the winning candidate, if $s_i \neq 0$ for some $i \in Q$, $x = x(s) = \Sigma q_i w_i(s)$. This is true since the winning candidate will choose their ideal point to maximize $u_i(x, q_i)$.

The election's winner is determined by the voting of a larger society. In this paper, we consider two voting rules:

- **Simple Plurality**: The candidate who gets the most votes wins, with ties resolved randomly, with every one of the leading candidates having an equal probability of winning.

- **Runoff**: The two candidates with the highest votes from the first round are presented for the same set of voters to choose from in the second round, in which the winner is determined as in the plurality rule, and ties in both rounds are resolved randomly, with equal probability of being chosen among the tied candidates.

Following the bulk of the earlier literature, we shall concentrate on the pure strategy Nash equilibria. An important role in our setting shall be played by the distance between the politicians' ideal points and the median of the voter distribution m. 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.[6]

Proposition 1 *Equilibrium possibilities*

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

b) In every two-candidate equilibrium under the plurality rule, the candidates are located symmetrically around m. Furthermore, such an equilibrium will exist only if there are symmetric politicians located close enough to m or if the symmetric politicians are the closest ones to m.

3 Experimental Design and Procedures

Our experimental design directly measures the relative performance of the Citizen-Candidate model under different parametrizations and voting rules: simple plurality and runoff. The cost of entry and the ideal points of the candidates are different between the six treatments analyzed. These treatments correspond to different games in the Citizen-Candidate model and can have different NE. Table 1 summarizes the parameters of each treatment. The rest of the section describes the procedure and parameters chosen.

[6]The proof of this proposition can be found in Appendix B. The key difference with respect to Osborne and Slivinski (1996) is that only a subset of citizens can participate instead of any citizen.

3.1 Procedure

Matching procedure and positions. Each election involved 3 participants who were supposed to decide on whether to run or not. The distribution of participants ideal points was defined within the interval 0 to 100. This distribution was either constant across rounds within the same treatment or varied only once during a session for some treatments. Each participants ideal point was randomly chosen for each period, corresponding to an election. In each election, participants, having observed their ideal points, had to decide whether to nominate themselves as possible candidates. All voter decisions were taken by the computer, assuming that voters were distributed uniformly on the $[0, 100]$ interval (this was, of course, announced to the participants at the beginning). After each election, participants got feedback about the ideal points of the entrants and the winner in their election, as well as the vote shares received by every candidate and their monetary payoff.

Practice and real periods. We consecutively ran 30 elections in groups with three potential candidates in each experimental session. At the beginning of each session, participants played three practice trials. They received feedback but were instructed that the results of those trials wouldn't affect their final payoffs.

3.2 Experimental Treatments

Experimental treatments and parameter values. We ran six experimental treatments. All six experimental treatments had three potential candidates with different ideal points within the interval 0 to 100. Each point within the interval represented a sincere voter (the votes were sincerely cast by the computer and aggregated according to the voting rule employed in the treatment).

- **Simple plurality v. Runoff**: The first four treatments have the same ideal positions (Left: 20, Center: 30, Right: 80) while changing the participation cost and the voting rule.

Table 1: Parameters and NE in each game according to the Citizen-Candidate model. The ideal points are classified by their relative position in the game.

			Ideal points:			
Treatment/Game	Voting Rule	c	Left	Center	Right	NE
PL	Plurality Rule	5	20	30	80	(30), (20, 80)
PH	Plurality Rule	20	20	30	80	(30)
RL	Run-Off	5	20	30	80	(30)
RH	Run-Off	20	20	30	80	(30)
PLCS	Plurality Rule	5	30	50	70	(50), (30, 70)
PLCA	Plurality Rule	5	30	50	80	(50)

Note: All games share the parameters: $\alpha = 0.1$, $b = 25$, and $D = 40$

- **Simple plurality symmetric v. Simple plurality asymmetric**: For the remaining two treatments, participants faced the same voting rule for two kinds of ideal position distributions, each for 15 periods. In the first treatment, participants moved from participating in a symmetric structure of position (Left: 30, Center: 50, Right: 70) to an asymmetric structure (Left: 30, Center: 50, Right: 80). In the second treatment, participants moved from the asymmetric structure of position (Left: 30, Center: 50, Right: 80) to the symmetric structure (Left: 30, Center: 50, Right: 70).

3.3 Predictions

In the last column of Table 1, we present the Nash equilibria in pure strategy for the 3-candidate entry games for all six treatments.[7] The only games with a two-candidate equilibrium are PLCS and PL, which are those with low cost under the plurality voting rule. The following are the main models predictions:

Prediction 1: Only the candidates from the central position should enter: i) under

[7] Completely eliminating equilibrium multiplicity from our design would necessarily complicate the design. Within the citizen-candidate model, both under plurality and the run-off rule, the equilibrium with entry from the centrist position alone is remarkably robust. In particular, it cannot be eliminated in an experimental game we propose here with just three players. Given that the citizen-candidate model is generally known for equilibrium multiplicity, we believe that concentrating fully on complex and rather non-generic environments in which equilibria are unique would not add much to what we already established. Our current design is a compromise between the desire to produce sharp predictions and the inherent properties of the model.

the runoff voting rule (RL and RH treatments), ii) under the simple plurality rule with the high-cost entry (PH treatment), or iii) under the simple plurality with an extreme candidate (PLCA treatment).

Prediction 2: Potential candidates at the central position may abstain from entering either i) under the simple plurality rule with the low-cost entry (PL treatment) or ii) under the simple plurality with symmetric candidates around the center candidate (PLCA treatment).

3.4 Sample and Payments

Sample. A total of 294 participants were recruited, and the experiment was implemented in 16 sessions. All participants were drawn from a wide cross-section of students at the Instituto Tecnolgico Autónomo de México (ITAM) in Mexico City. Participants enrolled in only one session. All sessions were computerized and run at ITAM.

Table 2: Summary of the sessions and participants in each treatment.

Treatment	Identification	Sessions	No. Participants	No. Bankruptcy
Simple Plurality / Low Cost	PL	3	19, 18, 20	0, 0, 0
Simple Plurality / High Cost	PH	3	15, 20, 23	9, 13, 16
Runoff / Low Cost	RL	3	26, 16, 27	0, 0, 2
Runoff / High Cost	RH	3	15, 15, 15	4, 5, 6
Simple Plurality Symmetric followed by Asymmetric Ideal Points	PLCS/PLCA	2	18, 15	0, 0
Simple Plurality Asymmetric followed by Symmetric Ideal Points	PLCA/PLCS	2	21, 12	1, 0

Note: The last two columns show quantities per session.

Initial capital and bankruptcy rules. All payments were in Mexican Pesos (MN11 = USD1 at the time).[8] We started each experimental session by allocating every agent MN140 pesos

[8]All the experimental treatments were conducted in 2008; the PLCS and PLCA treatments were part of the project we presented at the June 2008 Workshop on the Political Economy of Democracy, which was published in the accompanying volume (Elbittar and Gomberg 2009). The remaining treatments were conducted later that year, in part in response to the difficulties with experimental implementation of citizen-candidate environments we reported in that study.

Table 3: Average payoffs in each treatment (stage game) by the relative ideal position played.

	Relative Position		
	Left	Center	Right
PL	-5.194	5.735	3.402
PH	-7.266	-0.903	-11.508
RL	-2.878	19.145	-7.144
RH	-6.197	3.974	-10.226
PLCS	5.733	-2.015	3.170
PLCA	7.591	4.239	-6.955

of initial capital, to which the payments corresponding to the model parameter values were added and subtracted. Participants were allowed to continue until they finished a trial with a negative balance. If the number of session participants at that point was not divisible by 3, some of them would skip the round. Therefore, the number of observations we have per participant varies. If a participant went bankrupt, s/he had to wait in the room until the experimental session was finished.

Payoff Parameters. Participants had to pay a cost $c \in \{5, 20\}$ if they chose to run for election (this cost was identical for all participants within a session) and received a benefit of $b = 25$ for winning it, and an additional "ideological" cost equal to the distance between the winning proposal and their ideal point was subtracted. To encourage participation, a charge of $D = 40$ was applied to all participants whenever none of them chose to run for election.[9]

Table 2 shows the number of sessions and participants in each treatment. The number

[9]The high negative payoff in case of non-entry is an intrinsic feature of the Citizen-Candidate model of Osborne and Slivinski (1996). In their model, in case nobody enters, everybody is assumed to get a payoff of minus infinity in order to eliminate the possibility of no-entry equilibria. Since we are testing empirical implications of that model, it seemed important to replicate that feature. In our treatment, this payoff, though substantial, at negative 40 pesos, is still less than a third of the show-up fee. In practice, very few subjects ever faced it: out of the 2578 elections we observed in the lab, there were only 38 (less than 1.5 percent) in which this penalty was imposed. Substantial over-entry was present in treatments where entry from certain positions would nearly always lead to a loss. Thus, in the RH treatment, where the unique equilibrium prediction was the entry by the centrist subject at 30, that subject failed to enter only 13 times in 350 elections. Nevertheless, at least one left- or right-wing subject entered in 137 out of those 350 elections. In 131 of those cases, those subjects lost, each incurring a 20 pesos entry cost (in 27 elections, both the left- and right-wing subjects entered, each paying the high cost).

of participants and how many went bankrupt per session is shown in the last two columns, respectively. Meanwhile, Table 3 summarizes the average payoffs (initial capital not included) for each position and for each treatment.

4 Results and Discussion

This section compares the experimental results of the six treatments presented in light of the comparative statics derived from the citizen-candidate model.

Table 4 shows the number and the proportion of entries in each position (left, center, and right) for treatments under the simple plurality rule with low (PL) and high (PH) entry costs and under the runoff voting rule with low (RL) and high (RH) entry costs. For example, 47% (254/540) is the proportion of potential candidates that decided to participate in the election in the left position under the plurality rule. Table 5 shows the number and the proportion of entries in each position for the last two treatments under the simple plurality rule when the positions of the extreme potential candidates are symmetric (PLCS) and asymmetric (PLSCA) with respect to the central position.

Table 4: Total number of entries by positions for the plurality and runoff voting rules under different entry costs

Position	PL	PH	RL	RH
Left	254	89	254	82
%	47%	23%	39%	91%
Center	468	332	630	337
%	87%	87%	97%	96%
Right	468	218	278	82
%	87%	57%	43%	23%
No. Elections	540	380	648	350

Table 5: Total number of entries by positions in the treatments PLCS and PLCA (the plurality voting rule with low cost under symmetric and asymmetric extreme positions). The table shows the results for the treatments presented in different order.

Ideal positions	PLCA/PLCS		PLCS/PLCA	
	PLCA-1	PLCS-2	PLCS-1	PLCA-2
Left	146	149	147	82
%	88%	90%	89%	23%
Center	137	92	72	337
%	83%	56%	44%	96%
Right	77	147	150	82
%	47%	89%	91%	23%
Total	165	165	165	165

Note: Columns TREATMENT-1 and TREATMENT-2 refer to the treatment presented at first or second respectively.

4.1 Voting rules and entry costs

Our first set of comparisons is between voting rules and entry costs. In general, we would expect the run-off rule to generate entry rates at the centrist position as compared with the plurality rule, while the converse would be expected at the extreme positions. For both voting rules, we would expect higher entry rates at the central position (and, correspondingly, lower entry rates at the extreme positions) when the entry cost is higher.

Table 6 reports pairwise z-tests among the first four treatments. In this table, the proportion of entries at each position for the plurality voting rule with a low entry cost is compared against those for the plurality with a high entry cost and the runoff voting rule (with high and low cost). Thus, for instance, the result in the third row and second column is (-7.294), indicating that the proportion of entry in the left position is significantly higher for the plurality voting rule once the entry cost decreases for a p-value less than 0.1%. A similar result is obtained in the right position. For the central position (result in the third row and third column), the pairwise z-test is not significant for a p-value less or equal to 5%. Hence, we do not observe a significant change in behavior for the central candidates.

When we compare the PL and RL treatments (the simple plurality with the runoff voting rule with a low entry cost), we obtain significant differences in the entry rates for all positions. In particular, for the extreme left and right positions, there is a significantly higher entry rate under the plurality rule than under the runoff voting rule. In contrast, we obtain a higher proportion of entries in the central position under the runoff rule. Similar results to the previous ones are obtained for the runoff rule with higher entry costs: more participation in the center and less participation at the extremes.[10] Figure 1 reports the aggregate proportions of entries (for all positions and entry costs) under the plurality and the runoff voting rules.

Table 6: Pairwise z-tests of significant differences, PL and PH, RL and RH

	PL		
	Left[2]	Center[1]	Right[2]
PH	-7.294***	-0.311	-10.047***
RL	-2.720**	-6.846***	-15.540***
RH	-7.097***	-4.769***	-18.966***

Note: *p<0.05; **p<0.01; ***p<0.001
[1] Null H_0:PL$\geq$ PH,PL$\geq$ RL or PL$\geq$ RH
[2] Null H_0: PH$\geq$ PL, RL$\geq$ PL or RH $\geq$ PL

In order to obtain a clearer understanding of our experimental results while controlling for individual behavior, we consider the following random effect logit model for estimating the likelihood of individual i at time t located at the ideal position *j: left, center, right* to enter conditional on the entry cost level and the prevalent voting rule:

$$Entry_{it}^{j} = 1\{intercept = \delta_1 d_{HighEntryCost} + \delta_2 d_{Runoff} + \delta_3 Period + v_i + \epsilon_{it} \geq 0\}$$

For each entry decision, 1{.} is an indicator function that takes the value of one if the left-hand side of the inequality inside the brackets is greater than or equal to zero; otherwise, it takes the value zero. $d_{HighEntryCost}$ is a dummy variable equal to one when the entry cost

[10] Additionally, when we compare the plurality voting rule with the runoff voting rule (both with high entry costs), we obtain similar results to those reported when the entry cost is low, with the exception of the position of the extreme left, in which we did not find a significant difference for a p-value less or equal to 5%.

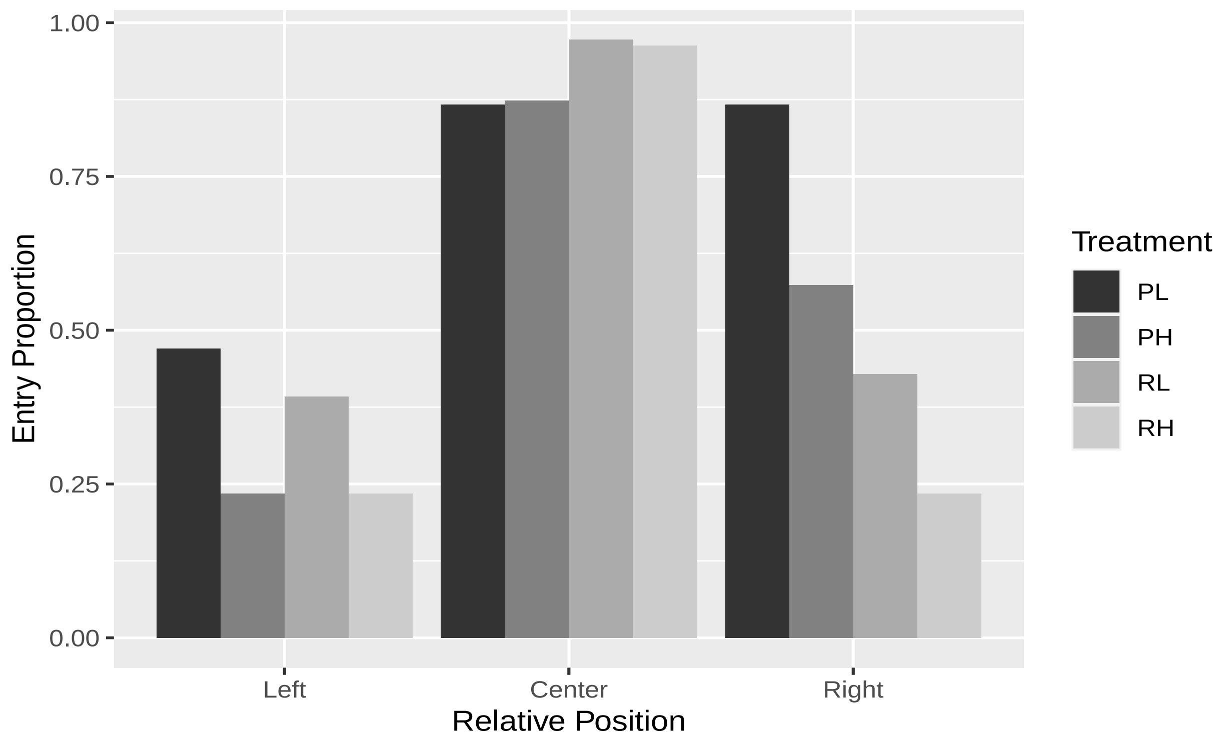


Figure 1: Entry proportion in the runoff rule treatments for each candidate characterized by their relative position among their competitors.

is high; d_{RunOff} is a dummy variable equal to one when runoff is the prevalent voting rule; period represents the period (time trend), treating time as a continuous variable. We use a random-effect logistic model, where ϵ_{it} are i.i.d. logistic distributed with mean zero and variance $\sigma_{\epsilon}^2 = \pi^2/3$, independently of v_i.

Taking the plurality rule with low entry cost (PL) treatment as a baseline, we could expect δ_1 to be negative when a potential candidate's position is extreme (either left or right) and positive when their position is central.

If we observe δ_2 to be positive for a central position and a negative sign for the extreme positions, it will support the conclusion that the runoff voting rule has a positive effect on promoting the entrance of the central candidate while dissuading the entry of the extreme positions (our theoretical prediction in this case).

The results of our estimations are presented in Table 7. Notably, agents with ideal points at the extreme right are less willing to participate in an election under the run-off rule (we do not, however, obtain a significant result for the potential candidates on the left). Agents with centrist ideal points are more likely to participate in the runoff system. Agents at both extremes are also less likely to enter when the cost of entry is high. However, centrists do not enter at a significantly higher rate under high costs. Finally, we observe that over time, entry rates decrease at the extremes and increase at the center. To sum up, we obtain the following:

Result 1 (Voting rules and entry cost) The runoff voting rule tends to promote, on average, less competition from extreme candidates than the simple plurality rule. On the other hand, higher entry costs induce less entry by the extreme candidates.

Table 7: Likelihood of potential candidates deciding to participate in the election controlling for entry cost and voting rule

	Dependent variable:		
	Entry Decision		
	Left	Center	Right
	(1)	(2)	(3)
HighCost	-1.221^{***}	0.072	-1.875^{***}
	(0.277)	(0.321)	(0.284)
RunOff	-0.199	1.896^{***}	-2.862^{***}
	(0.269)	(0.348)	(0.293)
Round period	-0.984^{***}	1.118^{***}	-1.922^{***}
	(0.133)	(0.221)	(0.154)
Constant	0.237	2.043^{***}	3.695^{***}
	(0.236)	(0.277)	(0.294)
Observations	1,918	1,918	1,918

Null $H_0 : \delta = 0$
Standard errors are clustered at individual level.
Note: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Table 8: Pairwise z-tests of significant differences PLCS and PLCA

	PLCS		
	Left[2]	Center[1]	Right[2]
PLCA	0.392	-8.063***	-11.281***

[1] Null $H_0 : PLCS \geq PLCA$
[2] Null $H_0 : PLCA \geq PLCS$
Note: *p<0.05; **p<0.01; ***p<0.001

4.2 Role of asymmetry in ideal points

The last two treatments were designed to explore the incentives provided by variable ideologies of potential candidates. The logic of the citizen-candidate model suggests higher entry rates when the potential extreme candidates are located symmetrically in the ideological space, as compared with the environment in which their ideal points are asymmetric. Table 8 reports pairwise z-tests between these two treatments.[11]

Considering pairwise z-tests between treatments for each position, we observe that participants under the asymmetric treatment entered more frequently in the central position and less frequently in the extreme right (with no significant difference at the extreme left). Figure 2 reports the aggregate proportions of entry (for all positions) for the plurality rule under the symmetric and asymmetric treatments.

We also present the results of estimating the following random effect logit model:

$$Entry_{it}^{j} = 1\{Intercept + \delta_1 d_{Asym} + \delta_2 d_{Order} + v_i + \epsilon_{it} \geq 0\}$$

As in the other regression, for each entry decision, $1\{.\}$ is an indicator function that takes the value of one if the left-hand side of the inequality inside the brackets is greater than or equal to zero; otherwise, it takes the value zero. d_{Asym} is a dummy variable equal to one when the asymmetric treatment is implemented; d_{Order} is a dummy variable equal to one

[11]The PLCS and PLCA treatments were run in the same sessions so that the same participants faced both treatments, with the order of the treatments variable across sessions; as we did not observe any difference in behavior based on this variation, we present here the results by treatment, pooling the data from various sessions together

Table 9: Likelihood of potential candidates deciding to participate in the election controlling for asymmetry of extreme positions

	Dependent variable:		
	Entry Decision		
	Left	Center	Right
	(1)	(2)	(3)
Asymmetric treatment	0.079	2.048^{***}	-2.444^{***}
	(0.304)	(0.238)	(0.239)
Treatment order	0.765	-0.488	0.385
	(0.589)	(0.448)	(0.315)
Constant	2.732^{***}	0.177	2.325^{***}
	(0.441)	(0.328)	(0.279)
Observations	660	660	660

Null $H_0 : \delta = 0$
Standard errors are clustered at individual level.
Note: *p<0.05; **p<0.01; ***p<0.001

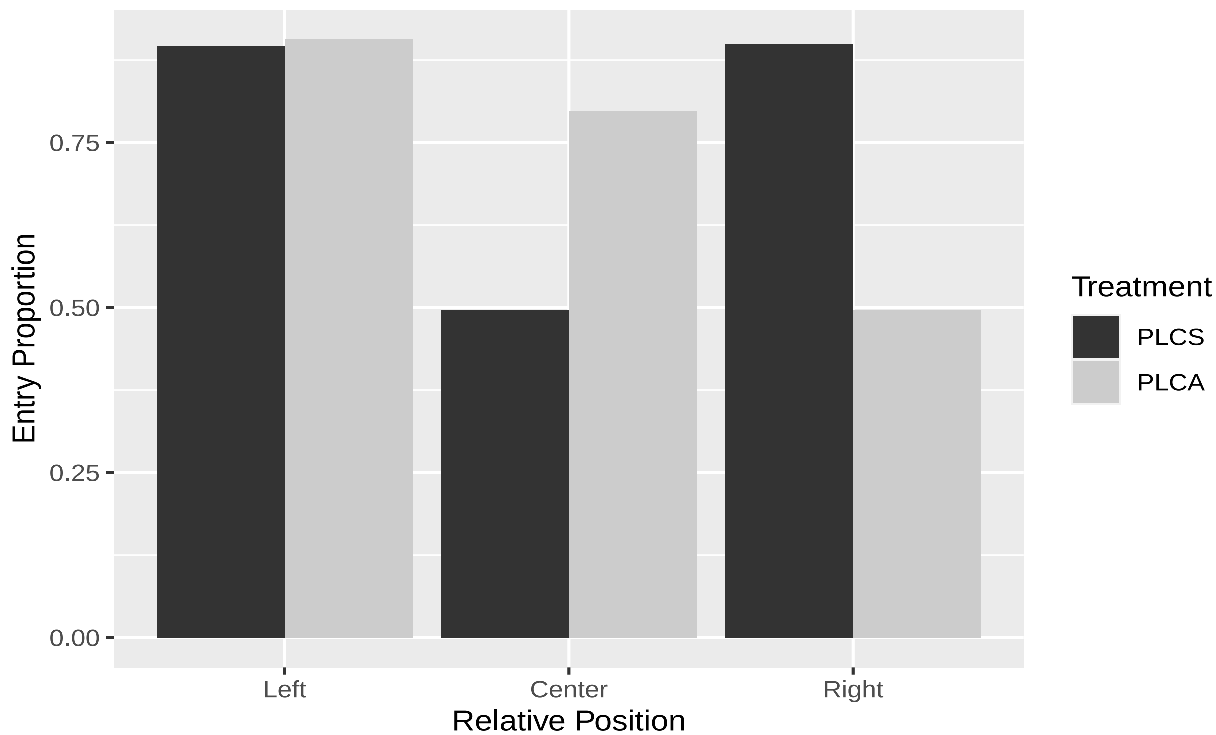


Figure 2: Entry proportion in the runoff rule treatments for each candidate is characterized by their relative position among their competitors.

when the symmetric treatment is implemented before the asymmetric treatment. We again use a random-effect logistic model, where ϵ_{it} are i.i.d. logistic distributed with mean zero and variance $\sigma_{\epsilon}^2 = \pi_2/3$, independently of v_i.

In Table 9, the results of this regression are presented. We observe low entry rates from the right and correspondingly higher entry rates at the center in the asymmetric treatment. However, we do not find a significant difference between the treatments for the entry from the leftist ideological position.

Result 2 (Asymmetry of ideal points) Asymmetry in ideal points of the potential candidates results in less entry from the extremes and more entry at the center.

4.3 Quantal Response Analysis

A major theoretical challenge in this paper is the need to explain entry from hopeless positions. Consider, for instance, the unique equilibrium in the PH or either of the Run-off treatments. As long as the centrist candidate enters, the lack of profitable unilateral deviations is based on the fact that anybody trying to enter from an extreme position is guaranteed to lose. This conclusion is not going to be affected by things like introducing risk aversion: the payoff from deviation is actually non-stochastic. To justify such entry, we would, therefore, need to introduce a tremble into the entry decision of the centrist candidate: there has to be a positive probability of her not entering and then consider the response of other potential candidates to such a tremble. One framework that allows us to do exactly that is the Quantal Response Equilibrium (QRE) of McKelvey and Thomas R Palfrey, 1995. [12]

We calculated the QRE for each game to capture the excessive entry observed in the experiment with respect to the NE (McKelvey and Thomas R Palfrey, 1995; Goeree, Holt, and Thomas R. Palfrey, 2016). We considered the logit quantal response function to describe the participant's strategy for a given λ. This is the functional specification more commonly used:

$$\sigma_{ij} = \frac{e^{(\pi_j(\sigma_{-i}))\lambda}}{e^{(\pi_j(\sigma_{-i}))\lambda} + e^{(\pi_{i\neq j}(\sigma_{-i}))\lambda}} = \frac{1}{1 + e^{(\pi_{i\neq j}(\sigma_{-i}) - \pi_j(\sigma_{-i}))\lambda}} \tag{2}$$

Where σ_{ij} is the probability player i chooses option $j \in \{Enter,\ \ Not\ Enter\}$. Notice that the expected payoff of each action π_j is a function of the probability of entry from other players σ_{-i} and the parameters in each game. Then, we can define the function $\sigma(\sigma, \lambda)$ as

[12]One could further incorporate other theories into the QRE framework to help explain the observed entry from losing positions, but few theories would be able to generate over-entry in this setting on their own without something like the QRE model to account for the possibility of non-entry from the centrist position. QRE provides us with a framework to think of deviations from optimal entry behavior by others: for the purposes of this paper, it should almost be thought of as a parametrization rather than a behavioral explanation. Alternatively, we could consider expressive behavior, where candidates enter to manifest support for their ideals rather than to influence the election outcome; candidates might also run for office to express their beliefs or build a reputation. Candidates might also view participation in elections as a learning process or an opportunity to build a reputation for future decision endeavors. Running for office can increase a candidate's visibility, establish their identity, and lay the groundwork for subsequent contests. Even if the current chances of winning are low, the long-term benefits of increased recognition might justify entering the race. Psychological literature suggests that individuals often exhibit overconfidence in their abilities and chances of success (Camerer and Lovallo, 1999; Danz, 2020). Candidates might overestimate their likelihood of winning or their ability to influence the election outcome. This cognitive bias could lead to more candidates choosing to run than what would be expected under rational expectations, contributing to the observed over-participation.

the vector of probabilities each player chooses to enter for a given λ and the vector of beliefs about others' mixed strategies σ. Thus, a QRE is a fixed point of $\sigma(\sigma, \lambda)$ for a fixed value of λ: $\sigma^* = \sigma(\sigma^*, \lambda)$. A detailed description of QRE and its estimation can be found in Goeree, Holt, and Thomas R. Palfrey (2016).

An important feature of the model is that as λ increases, the probability of choosing the option with the highest expected value approaches 1, and when $\lambda = 0$, the response is completely random. All the Nash Equilibria (described in Table 1) are approachable: there is a sequence of QRE that converges to them as $\lambda \to \infty$. Then, we can interpret λ as a measure of the degree of optimization in participants' strategy. In PL and PLCS games, for large enough values of λ, there is a QRE that converges to the Equilibrium with the extreme candidates entering the election.

4.3.1 Maximum Likelihood Estimation of λ

The maximum likelihood estimator for λ was calculated using the equilibrium correspondence approach: a QRE was calculated in every iteration when optimizing for λ. This required solving a system of non-linear equations to find a fixed point of $\sigma(\sigma, \lambda)$. We used the R packages *optim* (R Core Team, 2017) and *nleqslv* (Hasselman, 2017) to do all the estimations.

We optimized over the next log Likelihood function:

$$logL(\lambda) = \Sigma_{i=1}^{n=3} \Sigma_{j=1}^{J_i=2} f_{i,j} log(\sigma_{ij}^*(\lambda)) \tag{3}$$

where $f_{i,j}$ are the times each $i - th$ candidate chooses their $j - th$ option. This likelihood was constructed under the assumptions of independence of decisions and equal λ for all candidates.

The parameter λ was estimated assuming it was equal across games: global estimate and separately for each game. These estimates and their standard deviations are reported in Table 10.

The predicted equilibrium as a function of λ: $\sigma^*(\lambda)$ is displayed in the figure 3 for

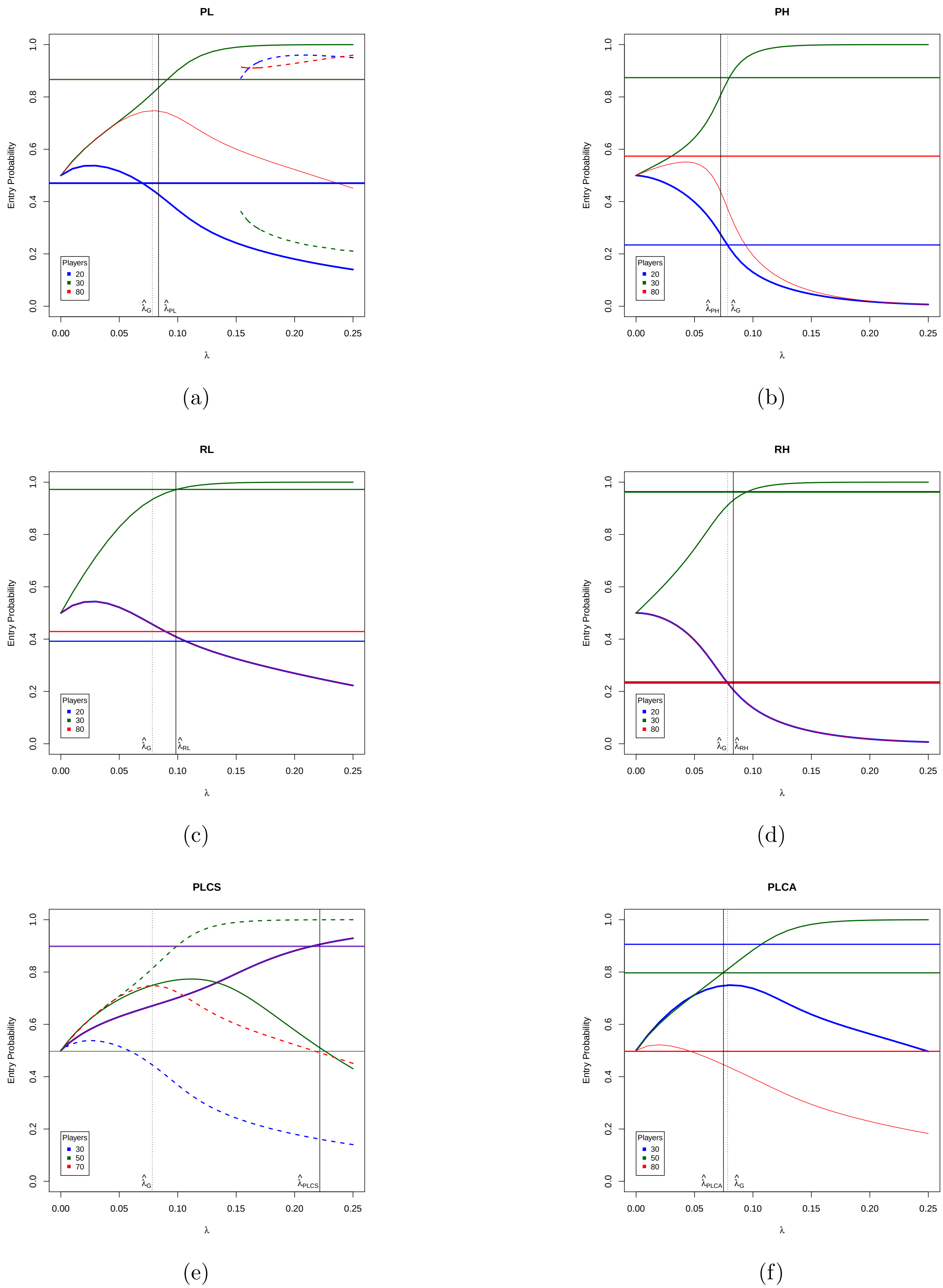


Figure 3: QRE paths for each treatment. Each colored line represents the candidate's entry probability for different levels of λ. The horizontal lines show the entry proportions observed in the experiment. The dotted lines represent the QRE closer to the proportions observed in the data.

Table 10: MLE estimators of λ in each game. The global estimator considers the same parameter across games.

	PL	PH	RL	RH	PLCS	PLCA	Global
$\hat{\lambda}$	0.0836	0.0723	0.0984	0.0832	0.2216	0.0748	0.0783
SD	0.0028	0.0014	0.0040	0.0024	0.0072	0.0044	0.0010

each game, with λ in the horizontal axis and each line indicating the proportion of entry predicted for each position; the green, blue, and red lines for the centrist, left, and right relative positions, respectively (QRE paths). Games PH, RL, RL, and PLCA have only one equilibrium; therefore, they have only one QRE for every λ. Games PL and PLCS have two equilibria. The solid lines represent the QRE convergent to the NE closer to the proportion observed, and the dotted lines show the second QRE convergent towards the NE further from the data. The proportions observed are included in the graphs as solid horizontal lines with colors indicating different relative positions. The figreffig:QRE also shows the global estimate λ_G with a dotted vertical line and the estimated λ_g within each game with a solid vertical line. We can observe the prediction of each estimation as the place where the QRE paths and the vertical lines cross. It is apparent that the difference between the prediction and the actual proportion of entries is close when considering λ_g.

In general, the estimated value of λ is similar between games, as we can observe when comparing the difference between $\hat{\lambda}_G$ and $\hat{\lambda}_g$. Also, the general entry pattern for different positions is preserved between these two estimates. However, the only estimates not statistically different from $\hat{\lambda}_G$ are $\hat{\lambda}_{PL}$ and $\hat{\lambda}_{PLCA}$. The most striking difference is in the PLCS game, where the estimate is 2.8 times larger than $\hat{\lambda}_G$. Also, the predicted equilibrium with $\hat{\lambda}_{PLCS}$ is very close to the proportion observed, contrary to what happens with $\hat{\lambda}_G$. In this game, candidates in the extreme positions entered with higher proportions than the centrist, contrary to other games where the centrist candidate entered frequently. The worst prediction is in the PLCA game, where the proportion of entry of the extreme position (q_{30}) is higher than the centrist (q_{50}), a phenomenon that QRE cannot explain.

5 Conclusion

The objective of our study has been to study the impact of differential candidate-entry incentives under two standard electoral systems: plurality and two-round run-off. For this purpose, we designed an experimental environment based on the citizen-candidate model (Besley and Coate, 1997; Osborne and Slivinski, 1996), but limiting equilibrium multiplicity that has complicated the model's previous empirical testing.

Our empirical findings largely confirm the theoretical predictions of the model. In particular, compared with the plurality vote, we observe that the two-round run-off electoral system strongly encourages entry by the center of the ideological spectrum and discourages entry by extremists. We also demonstrate a similar effect of the elevated entry costs. Finally, we confirm the crucial role in encouraging extremist entry played by the symmetry of the ideal point distribution. Deviations from the Nash Equilibrium predictions are largely driven by over-entry from "hopeless" ideological positions and match quite well with the predictions of the Quantal Response Equilibrium (QRE).

The main empirical puzzle that we identify concerns the issue of equilibrium selection. In the treatments PL and PLCS, there are multiple equilibria: one in which only the centrist candidate enters and another in which both of the potential extreme candidates enter, keeping the centrist out of the election. The former equilibrium seems to consistently emerge in PL, while the latter best describes the results in PLCS. The reason for this difference remains to be understood, but the relative position of the centrist candidate might be the main driver of this result. The equilibrium with two candidates entering seems to prevail when the centrist candidate is at the median point. The PL treatment has a centrist position that is biased to the left with respect to the median point, which makes the payoffs between alternative candidates asymmetric. PL and PLCS treatments also differ in the positions of the extreme candidates; the positions are more extreme in the PL game. However, the asymmetric position of the centrist player seems to be the more plausible cause behind the effect of the centrist position on the final equilibrium chosen by the participants. The centrist winning equilibrium is costlier in the PL treatment with more extreme positions than in the PLCS treatment with less extreme positions.

This experiment checks the theoretical predictions of electoral settings that can not be exogenously changed in the field: voting rules, cost of entry, and relative political position. It also informs on the predictions where theory gives no unique answer; it sheds light on the effect of payoff symmetries in the emergence of equilibrium with two extreme candidates.

References

Aragones, Enriqueta and Thomas R. Palfrey (2004). "The Effect of Candidate Quality on Electoral Equilibrium: An Experimental Study". In: *The American Political Science Review* 98 (1), pp. 77–90. ISSN: 15375943. DOI: 10.1017/S0003055404001017.

Besley, Timothy and Stephen Coate (1997). "An Economic Model of Representative Democracy". In: *The Quarterly Journal of Economics* 112 (1), pp. 85–114.

Bol, Damien, Arnaud Dellis, and Mandar Oak (2016). "Comparison of voting procedures using models of electoral competition with endogenous candidacy". English. In: *The Political Economy of Social Choices*. Springer, pp. 21–54. ISBN: 9783319401164. DOI: 10.1007/978-3-319-40118-8_2.

Bol, Damien, Konstantinos Matakos, Orestis Troumpounis, and Dimitrios Xefteris (2019). "Electoral rules, strategic entry and polarization". In: *Journal of Public Economics* 178. ISSN: 00472727. DOI: 10.1016/j.jpubeco.2019.104065.

Bouton, Laurent, Jorge Gallego, Aniol Llorente-Saguer, and Rebecca Morton (2022). "Run-off Elections in the Laboratory". In: *The Economic Journal* 132 (641), pp. 106–146. ISSN: 0013-0133. DOI: 10.1093/ej/ueab051.

Cadigan, John (2005). "The citizen candidate model: An experimental analysis". In: *Public Choice* 123 (1-2), pp. 197–216. ISSN: 00485829. DOI: 10.1007/s11127-005-0262-4.

Camerer, Colin and Dan Lovallo (1999). “Overconfidence and Excess Entry: An Experimental Approach”. In: *American Economic Review* 89 (1), pp. 306–318. ISSN: 0002-8282. DOI: 10.1257/AER.89.1.306.

Danz, David (2020). “Never underestimate your opponent: Hindsight bias causes overplacement and overentry into competition”. In: *Games and Economic Behavior* 124, pp. 588–603. ISSN: 0899-8256. DOI: https://doi.org/10.1016/j.geb.2020.10.001. URL: https://www.sciencedirect.com/science/article/pii/S0899825620301421.

Duverger, Maurice (1954). *Political Parties Their Organization and Activity in the Modern State*. 2nd. Routledge Kegan Paul. ISBN: 0416683207. URL: http://www.amazon.com/Political-Parties-Organization-Activity-Modern/dp/B001UIDFQ2/ref=sr_1_1?s=books&ie=UTF8&qid=1458593986&sr=1-1&keywords=maurice+duverger%20http://www.amazon.com/dp/0416683207.

Elbittar, Alexander and Andrei Gomberg (2009). “An Experimental Study of the Citizen-Candidate”. In: *The political Economy of Democracy*, pp. 35–50.

Goeree, Jacob K., Charles A. Holt, and Thomas R. Palfrey (2016). *Quantal Response Equilibrium: A Stochastic Theory of Games*. Princeton University Press, p. 328. ISBN: 9780691124230.

Hasselman, Berend (2017). “nleqslv: Solve Systems of Nonlinear Equations”. In: URL: https://cran.r-project.org/package=nleqslv.

Kamm, Aaron (2017). “Plurality Voting Versus Proportional Representation in the Citizen-Candidate Model”. In: URL: https://www.dropbox.com/s/ca0abjmg3a6pktg/Citizen%5C%20Candidate%5C%20Experiment.pdf?dl=0.

Mckelvey, Richard D and Peter C Ordeshook (1982). “Two-Candidate Elections without Majority Rule Equilibria: An Experimental Study”. In: *Simulation Games* 13 (3), pp. 311–335. URL: https://doi.org/10.1177/0037550082133004.

McKelvey, Richard D and Thomas R Palfrey (1995). “Quantal Response Equilibria for Normal Form Games”. In: *Games and Economic Behavior* 10 (1), pp. 6–38. ISSN: 08998256. DOI: 10.1006/game.1995.1023. URL: http://dx.doi.org/10.1006/game.1995.1023.

Osborne, M. J. and A. Slivinski (1996). “A Model of Political Competition with Citizen-Candidates”. In: *The Quarterly Journal of Economics* 111 (1), pp. 65–96. ISSN: 0033-5533. DOI: 10.2307/2946658.

Palfrey, Thomas R. (1984). “Spatial Equilibrium with Entry”. In: *The Review of Economic Studies* 51.1, pp. 139–156. ISSN: 0034-6527. DOI: 10.2307/2297710. eprint: https://academic.oup.com/restud/article-pdf/51/1/139/4476582/51-1-139.pdf. URL: https://doi.org/10.2307/2297710.

— (2016). “Experiments in Political Economy”. In: *The Handbook of Experimental Economics, Volume Two*. Ed. by John H. Kagel and Alvin E. Roth. Princeton University Press, pp. 347–434. DOI: 10.1515/9781400883172-007/HTML.

R Core Team (2017). *R: A Language and Environment for Statistical Computing*. URL: http://www.r-project.org/.

Tsakas, Nikolas and Dimitrios Xefteris (2021). “Stress-testing the runoff rule in the laboratory”. In: *Games and Economic Behavior* 128, pp. 18–38. ISSN: 10902473. DOI: 10.1016/J.GEB.2021.03.008.

Appendix A.

Instructions

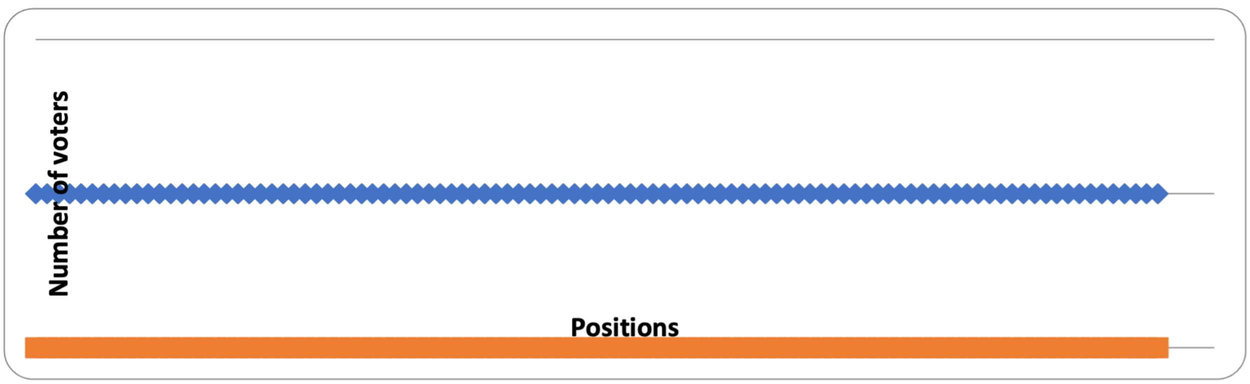
This is an experiment about decision making in elections. CONACYT has provided funds for this research. The instructions are simple and if you follow them carefully and make good decisions, you will be able to earn a CONSIDERABLE AMOUNT OF MONEY, which will be PAID TO YOU IN CASH privately at the end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

After we read the instructions, you will have a chance to make your decisions.

- General procedure

In this experiment you will have to decide whether or not to compete as a candidate in each of the 30 elections that we will carry out at the end of the instructions.

In each of the elections, one of 3 possible alternatives will be chosen the winner by a population of voters (simulated by the computer), according to the voting procedure that we will see later. The 3 alternatives are represented by positions 20, 30 and 80 located on the following line from 0 to 100:



- Group Formation

In each election, you will be part of a group of 3 participants. The composition of each group of participants will change randomly, so that the same group will be made up of different participants in each election. You will never know the identity of who you are participating with.

- Allocation of Alternatives

In each election, one of the mentioned alternatives will be assigned to you as your ideal position. Each participant in your group will be assigned a different position. Thus, a participant will be assigned position 20; to another, position 30; and to another, position 80. The allocation of alternatives for each election will be determined randomly.

- Candidate Application Procedure

To be considered an eligible candidate by the voters, you must decide whether or not to run for your ideal position in each of the elections. That is, you must decide whether or not to compete to be chosen by the voters in each of the elections.

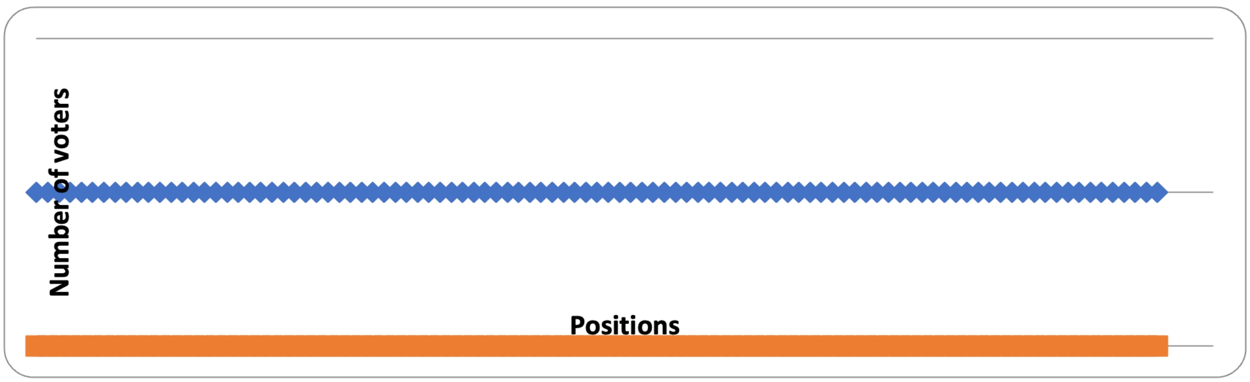
You can only apply for your ideal position and you will not be able to apply for any other position.

Once all participants have made their decisions on whether or not to run for their positions, the winning candidate in each election will be determined according to the voting process described below.

Runoff Treatment

- Election Procedure for the Winning Candidate

For each election, we have a population of 101 voting citizens. Voters are distributed along the line from 0 to 100 as follows: One voter for each whole number represented on the line.



The 101 voting citizens (simulated by the computer) will choose the winning candidate, according to the following voting procedure:

1. In a first round of voting, each citizen will vote for the candidate closest to their position. When there is more than one candidate with the same closeness, the citizen's vote will be randomly assigned among the closest candidates.

2. After the first round of voting, the two candidates who have accumulated the highest number of votes will be chosen to participate in a second round of voting.

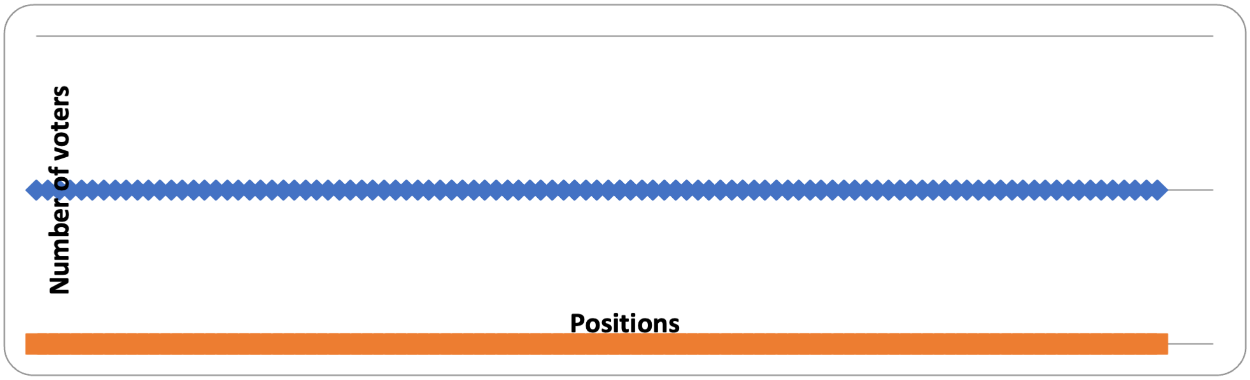
3. In this second round of voting, each citizen will vote for the candidate closest to his position. In the event of a tie, the winner will be determined randomly from the tied candidates. Therefore, there will always be only one winner if there are applicants.

4. In the event that less than three candidates have been nominated, only the first round of voting will be held, choosing the candidate who has obtained the highest number of votes.

Plurality Treatment

- Election Procedure for the Winning Candidate

For each election, we have a population of 101 voting citizens. Voters are distributed along the line from 0 to 100 as follows: One voter for each whole number represented on the line.



The 101 voting citizens (simulated by the computer) will choose the winning candidate, according to the following voting procedure:

1. Each citizen will vote for the candidate closest to his position. When there is more than one candidate with the same closeness, the citizen's vote will be randomly assigned among the closest candidates.

2. The winning candidate will be the one who accumulates the highest number of votes. In the event of a tie, the winner will be determined randomly from the candidates tied for first place. Therefore, there will always be only one winner if there are applicants.

- Initial Balance, Earnings and Payments

Each participant will start with an initial balance of 140 pesos. At each election, the opening balance will be updated as follows:

In the event that at least one alternative has been postulated:

1. The amount in pesos equal to the Alpha parameter (= 0.1) multiplied by the absolute distance between their ideal position and the position of the winning candidate will be subtracted from each participant. That is, the amount of:

$$0.1x|\text{ Your Ideal Position } - \text{ Winning Candidate Position }|$$

2. The amount of 5 pesos will be subtracted from each participant who has decided to postulate their ideal position.

3. The winning candidate will be added the amount of 25 pesos.

In the event that no alternative has been postulated, the only amount of 40 pesos will be subtracted from each participant.

- Accumulated Balance and Payment Procedure

The accumulated balance at the end of each election will be the sum of your starting balance plus the payments and winnings you have obtained in each previous election. The accumulated balance at the end of the 30 periods will be paid to you in a sealed envelope. In case of obtaining a negative balance, you will not get any payment.

Summary of Instructions

In every election,

1. You will be part of a new group of 3 participants.

2. Each group member will be assigned one of the following 3 positions on the line from 0 to 100: 20, 30 and 80.

3. Each participant must decide whether or not to run as a candidate for the election.

4. The 101 voting citizens (simulated by the computer) will determine the winning candidate, voting in two rounds for the one closest to their location.

to. In a first round, the two candidates with the highest number of votes are chosen.

b. In a second round, the winning candidate is chosen from the two candidates with the highest number of votes.

c. A first round of voting will only be carried out in the event that the number of nominated candidates is less than three.

5. Updating of balances will be done as follows after each election:

a. In the event that at least one alternative has been postulated:

i. The amount in pesos equal to 0.1 x will be subtracted from each participant — Your Ideal Position - Position of the Winning Candidate —

ii. The amount of 5 pesos will be subtracted from each participant who has decided to postulate their ideal position.

iii. The winning candidate will be added the amount of 25 pesos.

b. In the event that no alternative has been postulated, the only amount of 40 pesos will be subtracted from each participant.

6. The accumulated balance at the end of each election will be the sum of your initial balance plus the payments and winnings that you have obtained in each previous election.

- Factors that influence your earnings in each election

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

1. The distance between your chosen winning position and your ideal position.

2. Your decision and that of the other participants to apply.

3. Be chosen the winner by the voters.

Next Steps (Read by researcher after reading instructions)

Next we will show you the software that we have designed for you to make your decisions. Therefore, put the instructions on the side of the computer and take the IDENTIFICATION RECORDS sheet found next to your computer.

Server connection

Each participant must initiate their connection with the server using the following procedure: Enter the numbers written at the top of their IDENTIFICATION RECORDS in the Username and Password box. Then hit the submit box.

Completed registrations, press end of registration.

Screen Reading

Next we will review the information that for now appears on your screen. In the upper left part we will find a column where your USER NUMBER, the GROUP SIZE, the ROUND NUMBER, the ROUND TYPE (which in our case we are in the test rounds), and the ACCUMULATED BALANCE (which in our case is the initial balance of 140 pesos). In the second column on the right side, the value of the ALPHA parameter is indicated, the COST

TO APPLY, the PAYMENT AWARDED FOR WINNING, the COST IN THE EVENT THAT NO CANDIDATE IS PRESENT, and finally the NUMBER OF VOTERS.

Practice Rounds

We will now carry out 3 rounds of practice. The main objective of these rounds of practices is that you become familiar with the software that we have designed to make your decisions, and therefore they will not count towards your payments. If you have any questions during practice, please raise your hand and I will try to answer them.

Once everyone has entered their decisions, they must wait until all participants have made their decisions and the computer returns the results of the election.

In case your computer has not activated the decision box, it is because we do not have a number divisible by three, so you will have to wait until the next rounds for your screen to activate.

At the end of the practice periods, your initial balance will return to the initial amount of 140 pesos.

Generate Period 2Let's now proceed to the 2nd practice period. (Press: Start Period) Proceed to make your decisions.

Do you have questions?

Generate Period 3

Let's now proceed to the 3rd. practice period. (Press: Start Period) Proceed to make your decisions.

Do you have questions?

Actual or Played Periods for Money

Now we will proceed to carry out the 30 periods to be played for money. Your initial balance will return to the initial amount of 140 pesos.

Review all screens.

After the experiment begins, you are not allowed to speak or communicate with other participants. Otherwise, we will be forced to exclude it from the experiment. Please focus on your computer screen. If you have any questions, please raise your hand and one of us will come up to you and try to answer it.

Generate Period 1-30 (Press: Period Start) Proceed to make your decisions.

Final payment

Your payment for this second part is the one that appears in the balance on your screen.

Please stay at your posts. One of us will pass on to deliver a final questionnaire and your payment receipt to be filled out by you. Please add the balances obtained in both parts of the session.

They will then be called to come out to receive their payment. Please stop by to drop off all the material that was given to you.

Thank you very much for your participation!

Appendix B.

Proof of Proposition 1

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

The intuition of this proposition is that if the candidate closest to the center enters the political competition alone, other candidates have no incentives to compete against them unilaterally. Also, this candidate will prefer to enter given the strong cost D if no candidate participates in the election.

Let's start with the plurality rule voting system:

The proof is direct by assuming there is a candidate $q_m \in Q$ closest to the median of the voters' ideal points $m = median(U) = 50$. In this proof, we used the uniform distribution of voters $v \sim U[0, 100]$. In the experiment, we use the discrete version with 101 voters distributed uniformly on every integer from 0 to 100; however the proof holds for the discrete case as well.

We have to prove that the strategy profile $s^m = \{s_i s_m = 1, s_i = 0, \forall i \neq m\}$ is indeed an equilibrium. Then, we have to show that no candidate besides q_m has incentives to participate. First, consider another candidate and notice that he cannot be closer to the median by hypothesis: $q_j \neq q_m \iff |q_m - m| < |q_j - m|$. Second, let's start with the case $q_m < q_j$; the other case is completely analogous. Therefore,

$$m - q_m < q_j - m \tag{4}$$

Let's denote the share of votes by $V_i(s)$, and the strategy profile with only q_m and q_j entering as $s' = \{s_i : s_m = 1, s_j = 1, s_i = 0, \forall i \neq m, j\}$. Then,

$$V_m(s') = q_m + \frac{q_j - q_m}{2}$$
$$V_j(s') = 100 - q_j + \frac{q_j - q_m}{2}$$

We need to show that $V_m(s') > V_j(s')$ to prove that s^m is a NE since whoever gets a larger voter share wins the election. If there is no chance to win, candidate j will be better off not competing.

$$V_m(s') > V_j(s')$$
$$\iff$$
$$q_m + q_j > 100$$

Finally, notice that this last condition is guaranteed by equation 4. Therefore, s^m is an equilibrium when $q_m < q_j$. The case $q_m > q_j$ can be proven analogously.

Since the run-off and plurality coincide in the case of two candidates, the same argument applies for run-off as well.

Therefore, s^m is an equilibrium in PR and RO if q_m is the unique closest position to m.

b) In every two-candidate equilibrium under the plurality rule, the candidates are located symmetrically around m. Furthermore, such an equilibrium will exist only if there are symmetric politicians located close enough to m or if the symmetric politicians are the closest ones to m.

Let's start considering two candidates, q_1 and q_2 symmetric with respect to m. Then, $|q_1 - m| = |q_3 - m|$. We have to review the conditions for only these two candidates entering ($s^{sym} = \{s_i : s_1 = 1, s_2 = 1, s_i = 0, \forall i \neq 1, 2\}$) being an equilibrium. To do this, we will show that a potential candidate $j \neq 1, 2$ has no incentives to participate and generate the strategy profile $s' = \{s_i : s_1 = 1, s_2 = 1, s_j = 1, s_i = 0, \forall i \neq 1, 2, j\}$.

Assume with lost of generality that $q_1 < q_2$, and notice that $V_1(s^{sym}) = V_2(s^{sym})$. If $q_j < q_1 \leq m$ or $m \geq q_2 > q_j$, q_j has no chance of winning. This corresponds to the case where q_1 and q_2 are the only closest ones to m. Taking $q_j < q_1 \leq m$, it is clear that candidate j will "steal" voters from candidate 1: $V_1(s') < V_1(s^{sym})$, while candidate 2 has the same share of voter and will win the election $V_1(s') < V_2(s') = V_2(s^{sym})$. Also, notice that this generates even more utility loss to candidate j since q_2 is further away from their ideal point q_j. The same argument follows for the case $m \geq q_2 > q_j$, q_j.

Now we analyze the case $q_1 < q_j < q_2$. The candidate j has a share of voters $V_j(s') = \frac{q_j - q_1}{2} + \frac{q_2 - q_j}{2} = \frac{q_2 - q_1}{2}$. This candidate will enter whenever $V_j(s') > max\{V_1(s'), V_2(s')\}$. When $q_j < m$, the previous conditions turns into $V_j(s') > V_2(s')$. Then we need the following conditions for j to win:

$$
\begin{aligned}
V_2(s') = 100 - \frac{q_j + q_2}{2} \\
\Rightarrow V_j(s') > V_2(s') \\
\iff \quad \frac{q_j - q_1}{2} > 100 - \frac{q_j + q_2}{2} \\
\text{Since } (100 - q_2) = q_3 \\
q_j > 3q_1
\end{aligned}
$$

Analogously, when $q_j < m$, the condition will be $q_j < 1 - 3q_1$. Therefore, whenever $q_j \in (3q_1, 1 - 3q_1)$ j will win the election if participating. However, even if winning, it might not be convenient to participate. Player j needs $b - c > -\alpha|q_j - m|$ to make participating convenient.

Therefore, we need the candidates 1 and 2 to be close: $q_2 - q_1 < (2/3)100$ to assure that there is no possible q_j who can find convenient to participate, or that the cost of entry is too high: $b/2 - c \leq -\alpha|q_j - m|$. A less restrictive condition would be that $q_j \notin [3q_1, 1 - 3q_1]$ which holds when $q_2 - q_1 \leq (2/3)(100 + |q_j - m|)$. Notice that the first condition holds when $q_j = m = 50$.