AN EXPERIMENTAL STUDY OF ALTERNATIVE CAMPAIGN FINANCE SYSTEMS:
DONATIONS, ELECTIONS AND POLICY CHOICES

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ABSTRACT

We experimentally study the effect of alternative campaign finance systems – as characterized by
different information structure about donors – on donations, election outcomes, political candidates'
policy choices, and welfare. Three alternative campaign finance systems are considered: a full anonymity
(FA) system in which neither the politicians nor the voters are informed about the donors' ideal policies
or levels of donations; a partial anonymity (PA) system in which only the politicians, but not the voters,
are informed about the donors' ideal policies and donations; and finally a no anonymity (NA) system
in which both the politicians and the voters are informed about the donors' ideal policies and donations.

We find that donors contribute less in the FA system than in the PA and NA system, and candidates
are less likely to deviate from their ideal policies under FA than under the PA and NA systems. The
effect of donations on the candidate's policy deviations differs in FA from that in PA and NA. Specifically,
in the FA system larger donations lead to smaller deviations from the candidate's ideal policy; but
in the NA and PA systems, larger donations lead to larger deviations. As a result we observe that the
donations lead to a centrist bias in the candidate's policy choices, i.e., donations are more likely to
make extreme candidate move to the center than to make centrist candidate move to the right. This
centrist bias is present more robustly in FA treatments. Finally, we find that donors greatly benefit
from the possibility of donations regardless of the finance system. Voter welfare remains virtually
unchanged under the PA and NA systems, especially when there is competition among the donors.
Our findings provide the first experimental evidence supportive of Ayres and Ackerman's (2002) campaign
finance reform proposal.

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"Just as troubling to a functioning democracy as classic quid pro quo corruption is the danger that officeholders will decide issues not on the merits or the desires of their constituents, but according to the wishes of those who have made large financial contributions valued by the officeholder."

> — U.S. Supreme Court, McConnell v. FEC [540 U.S. 93 (2003)]

"Sunlight is . . . the best . . . disinfectant."
— Justice Louis Brandeis, *Other People's Money* (National Home Library Foundation, 1933, p. 62), quoted in Buckley v. Valeo [424 U.S. 1, 67, n. 80 (1976)]

"Just as the secret ballot makes it more difficult for candidates to buy votes, a secret donation booth makes it more difficult for candidates to sell access or influence. The voting booth disrupts vote-buying because candidates are uncertain how a citizen actually voted; anonymous donations disrupt influence peddling because candidates are uncertain whether givers actually gave what they say they gave. Just as vote-buying plummeted with the secret ballot, campaign contributions would sink with the secret donation booth."

> —Bruce Ackerman and Ian Ayres, *Voting with Dollars: A New Paradigm for Campaign Finance* (Yale University Press, 2002, p. 6)

1   Introduction

Campaign contributions and spendings have many potential effects. On the positive side, campaign resources allow the candidates to fund the dissemination of useful information to the voters. This may lead the voters to make more informed electoral choices. On the negative side, voters' interests may be harmed if candidates trade policy favors to special interests, or large donors, in exchange for contribution. While the First Amendment of the U.S. Constitution has repeatedly been used by the Courts to strike down efforts to restrict overall campaign spending, the first two quotes above suggest that the Supreme Court nonetheless is concerned about the potential corruptive influence of money in politics.

Throughout history, election procedures have been modified in order to stem the degree of influence in elections and policy choices. Secret ballots, for instance, are often thought of as protection for those who vote against the winning candidate. However, once ballots were made secret, candidates needed an alternative observable measure by which they could reward those who supported them during their campaign. Currently, non-anonymous campaign contributions may fill that role. A candidate cannot tell if an individual votes for him but can see how much money an individual contributes to his campaign. Based on that knowledge, the candidate could choose policies to reward that individual for monetary contributions. Indeed, the importance of money in American electoral campaigns has been steadily increasing over time. In 2008, the elected House of Representatives on average spent $1.3 millions in their campaigns, a 53% increase in real terms over the average expenditure in 1998. Over the same period, the average real cost of a winning Senate campaign increased by 21% to $6.5 million.[1]

Given the suspicion that politicians, once elected, are likely to reciprocate on the desires of those who contributed to their election, as forcefully expressed in the quoted majority opinion of the U.S.

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[1]See http://www.cfinst.org and http://www.opensecrets.org for the historical data on campaign expenditures.

Supreme Court in the *McConnell v. FEC* [540 U.S. 93 (2003)], there have been numerous attempts to control and limit the influence of money in politics. Currently the campaign finance regulations can be characterized by two features, *transparency* and *contribution limits.* On the transparency front, the Federal Election Campaign Act (FECA) of 1972 required candidates to disclose sources of campaign contributions and campaign expenditures. Current campaign finance law at the federal level requires candidate committees, party committees, and political action committees (PACs) to file periodic reports disclosing the money they raise and spend.[2, 3] Additionally, they must disclose expenditures to any individual or vendor.

On the contribution limits front, the 1974 Amendment of FECA introduced statutory limits on contributions and created the Federal Election Commission (FEC) to enforce the limits of individual donations to $1,000 and donations by PACs to $5,000.[4] These specific election donations are known as "hard money." The Bipartisan Campaign Reform Act (BCRA) of 2002, also known as "McCain-Feingold" named after its sponsors, is the most recent major federal law on campaign finance. It revised some of the legal limits on expenditures set in 1974, and prohibited unregulated contributions (commonly referred to as "soft money") to national political parties,[5] but it also doubled the contribution limit of hard money, from $1,000 to $2,000 per election cycle, with a built-in increase for inflation (see Potter (2005), written by a former Commissioner of the Federal Election Commission, for a comprehensive review of the campaign finance disclosure laws in the United States).[6]

A new paradigm for campaign finance reform, proposed by Yale Law School professors Bruce Ackerman and Ian Ayres in their 2004 book *Voting with Dollars: A New Paradigm For Campaign Finance,* however, advocates a drastically different approach to reduce the corruptive influence of money in politics. As highlighted in the third quote above, a key part of Ackerman and Ayres'

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[2]Federal candidate committees must identify, for example, all PACs and party committees that give them contributions, and they must provide the names, occupations, employers, and addresses of all individuals who give them more than $200 in an election cycle. The Federal Election Commission maintains this database and publishes the information about campaigns and donors on its web site.

[3]The *Buckley* Court did indicate a circumstance in which the FECA's disclosure requirements might pose such an undue burden that they would be unconstitutional. The Court opined that disclosure could be unconstitutional if disclosure would expose groups or their contributors to threats, harassment, and reprisals; and the Court suggested a "hardship" exemption from disclosure requirements for groups and inviduals able to demonstrate a reasonable probability that their compliance would result in such adverse consequences.

[4]In its ruling in *Buckley v. Valeo*, 424 U.S. 1 (1976), the Supreme Court upheld contribution limits, but overturned the expenditure limits, stating: "It is clear that a primary effect of these expenditure limitations is to restrict the quantity of campaign speech by individuals, groups and candidates. The restrictions. . . limit political expression at the core of our electoral process and of First Amendment freedoms." Acknowledging that both contribution and spending limits had First Amendment implications, the Court stated that the new law's "expenditure ceiling impose significantly more severe restrictions on protected freedom of political expression and association than do its limitations on financial contributions." The Court implied, however, that the expenditure limits placed on publicly funded candidates were constitutional because Presidential candidates were free to disregard the limits if they chose to reject public financing. The Supreme Court affirmed this ruling in *Republican National Committee v. FEC,* 445 U.S. 955 (1980).

[5]"Soft money" also refers to funds spent by independent organizations that do not specifically advocate the election or defeat of candidates, and funds which are not contributed directly to candidate campaigns.

[6]In early 2010, the U.S. Supreme Court decision, *Citizens United v. Federal Election Commission*, essentially overturned part of the BCRA, by appealing to the First Amendment: Corporations and unions can now use general funds to support or oppose a candidate within 30 days of a presidential primary or 60 days before general elections.

new paradigm instead advocates *full anonymity*, where all contributions will be made secretly and anonymously through the FEC, indicating the campaign to which they want them to go.[7] Private donations would still be allowed but they would be anonymous and the FEC would be the clearinghouse for these now anonymous donations. To prevent the donors from communicating to the politician by donating a specially chosen amount of contributions, the FEC masks the money and distributes it directly to the campaigns in randomized chunks over a number of days.

What paradigm will be more effective in reducing the role of corruptive influence of money in politics, the full transparency system as advocated by FECA (1972), or the full anonymity system as advocated by Ackerman and Ayres? In this paper, we use laboratory experiments to make a first step in addressing this important question.[8] We conduct laboratory experiments to compare the different campaign finance systems – as characterized by different information structure about donors available to the politicians and voters – in terms of donors' contributions, election outcomes and candidates' policy choices.

Specifically, we consider three alternative campaign finance systems as characterized by their information structure.

- **Full Anonymity (FA).** In the FA system, donors' preferences and the exact amount donated by each particular donor is unknown by the candidate and voters. The only information available to the candidate is the total donated amount. We interpret the full anonymity system as corresponding to the system advocated by Ackerman and Ayres (2002).

- **Partial Anonymity (PA).** In the PA system, we assume that donors' preferences and the amount of donations are unknown by voters. The candidate, however, observes the locations and donations of each of the donosr. The partial anonymity system, in our view, corresponds closer to the current campaign finance system in the U.S.

- **No Anonymity (NA).** The NA system can also be referred to as the *Full Transparency* system. Under this system, both the candidates and the voters observe both the donors' locations and their contributions. The NA system will correspond to what happens under a perfectly enforced campaign finance disclosure laws.

Theoretically, the information structures have several effects on the behavior of the candidates, voters, and donors. For example, the candidate's ability to reciprocate the donors in their policy choices depend on whether the donors' ideal policies are observed by the candidate. Anticipating this, the donors will thus have different incentives to donate to the candidates. Finally, the voters will also react to the donations depending on their perception of how likely it is the candidate will move toward the ideal policy of the donors if they win. As we describe in Section 4, in our experiment we focus on the donors and the candidates, and summarize the voters' behavior by electoral rules. In particular, we assume that voters' election behavior under NA differs from that under PA and FA in that the effectiveness of donations under NA depends on the donor's ideal policy location; in particular, we assume that under NA, donations from more extreme donors are less effective.

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[7] Ackerman and Ayres' proposal also includes a Patriot dollar component in which each voter is given a $50 voucher in every election cycle to allocate between Presidential, House and Senate campaigns.

[8] See Morton and Williams (2010) for an excellent introduction of the use of lab experiments in political science.

As we will argue in Section 3, theoretical comparisons between the fully transparent and fully anonymous campaign finance systems are difficult because of the existence of multiple equilibria in infinitely repeated elections. As a result the theoretical literature we review in Section 2 has mostly focused on the effect of contribution limits on election outcomes and welfare in models that feature binding contracts between donors and politicians, which are enforceable only if politicians are aware of donors' identities. In the terminology of our paper, the existing theoretical research assumes that the campaign finance system is either NA or PA, thus it does not allow for the comparison with the fully anonymous system in which donors' identities are not known to the politicians. While there is a large and growing literature using field experiments to study interesting political science issues, we are unaware of any existing study that investigates the effect of different campaign finance systems distinguished by information structures.[9]

In our experiment, there are three types of agents: political candidates, donors, and a continuum of voters whose preferences regarding the subsequently implemented policy are characterized by the interval $[0, 300]$. The voters are not played by human subjects in our study; instead their behavior is summarized and represented by probabilistic voting functions. There are two candidates. One candidate is played by computer and his ideal policy position is fixed at 225. The other candidate is played by a human subject and his preferences may vary from 0 to 150. Without donations, the probability of a human candidate being elected depends on his location in such a way that a more centrist candidate has a higher chance. All information about candidates is common knowledge. Donors can contribute to the human candidate's campaign fund. Donations to the campaign fund do not go directly to the candidate but rather increase his probability of winning the election. Upon observing the amount of donation and other information available in a particular treatment, the human candidates make a decision regarding the implemented policy.[10] The computer, if elected, always chooses the policy 225. Whenever the implemented policy differs from their ideal policy, all agents bear cost equal to a squared distance between the agent's ideal policy and the implemented policy. Because of such a payoff function and the timing of actions, it is a dominant strategy for the candidate to always choose the ideal policy unless interactions are infinitely-repeated. We mimic an infinitely-repeated environment in our setting by randomly determining the last period.

We find that donors contribute less in the FA system than in the PA and NA system, and candidates are less likely to deviate from their ideal policies under FA than under the PA and NA systems. The effect of donations on the candidate's policy deviations differs in FA from that in PA and NA. Specifically, in the FA system larger donations lead to smaller deviations from the candidate's ideal policy; but in the NA and PA systems, larger donations lead to larger deviations. We find that donors greatly benefit from the possibility of donations regardless of the finance system. Voter welfare remains virtually unchanged under the PA and NA systems, especially when there is competition among the donors. Finally, we observe a centrist bias, i.e., donations are more likely to make extreme candidate move to the center than to make centrist candidate move to the right. Our findings provide the first experimental evidence supportive of Ayres and Ackerman's (2002) campaign finance reform proposal.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 presents a theoretical model of the donor-candidate relationship in which donations

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[9] Randomized field experiments are used widely in political science, but mostly in studies on voter behavior, see, e.g., Green and Gerber (2008), for studies on how to get out to vote using field experiments.

[10] For the sake of data completeness candidates were asked to make a decision before observing the election outcome.

increase the probability a candidate is elected. Under the assumption that a candidate does not reward the donor by implementing a policy closer to the donor there is a corner solution where the donor contributes either zero or enough to increase the candidate's probability of winning to 100%. Section 4 describes our experimental design, including some modifications to the theoretical model in order to make it more consistent with the design. Section 5 presents the experimental results. Finally, Section 6 concludes.

2   Related Literature

There is a large theoretical literature in economics and political science that analyzes welfare consequences from campaign contribution limits.[11] It is typically assumed that campaign contributions are used in electoral races to provide information to voters, and the candidates secure contributions by promising favors. The literature emphasizes two different ways that campaign expenditures may provide information to voters. One strand of the literature assumes that campaign advertising is directly informative (e.g., Coate 2004a, 2004b; Ashworth 2006). For example, Coate (2004a) presents a model in which limits to campaign contributions may lead to a Pareto improvement. His main insight is that the effectiveness of campaign contributions in increasing votes may be affected by the presence of contribution limits. When contributions are unrestricted and candidates have a strong desire to hold office, campaign advertising will not be that effective because voters will rationally be cynical about qualified candidates, anticipating that they will implement favors for their contributors if elected. This cynicism will reduce the likelihood of voters switching their votes and, despite the fact that resources are spent on advertising, qualified candidates will not have much of an electoral advantage over unqualified opponents. On the other hand, when campaign contributions are limited, candidates' incentive to offer favors to extract more contributions is dampened. Voters now anticipate that advertised candidates will implement fewer favors than in the unrestricted case and this may increase the likelihood they will vote for them. This increase in the effectiveness of advertising means that limits, despite reducing the level of campaign advertising, need not reduce the likelihood that qualified candidates get elected. Moreover, if elected such candidates will implement fewer favors than in the unrestricted case. Thus, all regular citizens can be better off when contributions are limited.

A second strand of the literature instead assumes that political advertising is only indirectly informative (e.g., Potters, Sloof, and Van Winden, 1997; Sloof 1999; Prat 2002a, 2002b). The core idea in these papers is that candidates have qualities that interest groups can observe more precisely than voters and the amount of campaign contributions a candidate collects signals these qualities to voters, which is the informational benefit of campaign contributions. However, lobbyists make campaign contributions based on promises from candidates that they are prepared to adopt a policy stance that goes toward the lobby's preferred policy and away from the median voter's preferred policy. Prat (2002a), for example, showed that banning contributions can raise voters' aggregate welfare when the losses in terms of information about competence are smaller than the costs of policy distortion. In a similar model, Sloof (1999) showed that a disclosure requirement on the identities of contributors and the amounts involved is beneficial to voters relative to an electoral environment with no disclosure.

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[11]See Morton and Cameron (1992) for a comprehensive review of the earlier literature.

While there is a large experimental literature on voting, very little exists on campaign finance.[12] Houser and Stratmann (2008) conduct experiments where candidates can send advertisements to voters in order to influence the elections. Advertisements may or may not be costly (to voters) to send but they contain information about the candidate's quality (high or low). Based on a model where power-hungry candidates are motivated to trade favors for campaign contributions, they found in their experimental data that high-quality candidates are elected more frequently, and the margins of victory for high-quality candidates are also larger, in publicly financed campaigns than in privately financed electoral competitions . They also found that contribution caps can improve voter welfare but do not increase the likelihood that high-quality candidates will be elected.

3 A Theoretical Model

In this section, we provide a simple analytical framework to understand the incentives for donors to contribute to the candidates' campaign. We also use the model as the basis of our experimental design described in Section 4.

3.1 Basic Set Up for a Single Election

Agents. There are three types of agents in the model: political candidates, (potential) donors and voters.[13] There are two political candidates in each election, $J > 0$ donors and a continuum of voters.

Policy Space and the Ideal Policies of the Agents. We assume that the set of policies that can be implemented is characterized by an interval $[0, b]$. Agents have preferences over which particular policy is implemented. Specifically, we assume that each agent has a *most-preferred* policy, sometimes referred to as the *ideal* policy, $x \in [0, b]$ with $b > 0$. If an agent's ideal policy is x, and the implemented policy is y, then the agent's disutility is $-(y - x)^2$.

The ideal policies for the two candidates in our model are denoted respectively as c_1 and c_2. The locations of candidates are assumed to be common knowledge. This would be the case if, for example, during the electoral campaign or during prior political activities the preferences of candidates became known to the public; alternatively, the candidate's ideal policy could reflect the candidate's party position.[14]

The ideal policy for donor $j \in \{1, ..., J\}$ is denoted by $\ell_j \in [0, b]$. Whether ℓ_j is known or not to the voters and the political candidates depends on the campaign finance system we describe below. Finally, voters' ideal policies are located uniformly on the interval $[0, b]$.

Baseline Winning Probabilities. Suppose that the ideal policies of the two candidates be c_1 and c_2, and suppose that $c_1 < c_2$. Then given that voters' ideal policies are uniformly distributed on $[0, b]$, the expected vote share of the candidates will be given by $(c_2 + c_1)/2b$ and $(2b - c_2 - c_1)/2b$

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[12]See Palfrey (2006) for an insightful survey on laboratory experiments related to political economy issues, and see Morton and Williams (2010) for an updated review of experimental methodology and reasoning in political science.

[13]We will from now on drop the adjective "potential" and simply refer to "potential donors" as "donors". Readers should be aware that this refers to the role designated to a particular agent.

[14]However, this assumption does preclude us from exploring the role of campaign expenditures in informing the voters about the candidates' positions.

respectively, under the assumption that a voter will vote for the candidate whose ideal policy is closer to his own. We assume, as is common in probabilistic voting models, (see, e.g., Calvert, 1985 and Banks and Duggan, 2005) that candidate i's probability of being elected, denoted by ρ_i, corresponds to the theoretical vote share, i.e.,

$$\rho_1 = \frac{c_2 + c_1}{2b}, \qquad \rho_2 = 1 - \rho_1 = \frac{2b - c_2 - c_1}{2b}. \tag{1}$$

We refer to these as baseline winning probabilities, and we will describe below how campaign contributions affect these probabilities.

Candidates' Objective Function. We assume that if candidate i wins he enjoys utility v_i from being elected. While a candidate's ideal policy is common knowledge, he is not restricted to choosing his ideal policy if elected.

Denote candidate i's policy choice as y_i, which leads to a loss of $-(y_i - c_i)^2$ if i is elected and y_i gets implemented. Thus, i's objective is to choose y_i to maximize

$$\rho_i \cdot \left[v_i - (y_i - c_i)^2\right] - (1 - \rho_i)\left[y_j - c_i\right]^2, \tag{2}$$

where y_j is the policy choice of candidate $j \neq i$. Note that the second term in (2) does not depend on candidate i's choice y_i.

Donors and Campaign Donations. There are J donors in our model. A donor can contribute to a candidate's campaign fund. Donations to the campaign fund do not go directly to the candidate, but do increase the candidate's probability of winning the election. The donor's benefits from donations are two-fold. First, donations can increase the likelihood that the candidate a donor prefers will win. Second, if interactions are repeated the candidate who received donations might reciprocate and choose a policy which is more beneficial to the donor.

In this paper, we focus on donations to *one* given candidate, say, candidate 1, for simplicity. In other words we assume that if donors decide to donate they can only donate to candidate 1 or donate nothing. This simplifying assumption will help us to concentrate on our main question of interest, which is to what extent big donors can influence the policy choice of a given candidate. In particular, we abstract away from questions of the competition between candidates for donations and from competition between donors contributing to different candidates.

Information and Timing. We consider three alternative campaign finance systems that differ in their information structure. For all three systems candidates' locations are common knowledge and each particular donor always knows his preferences. The first system we consider is called *Full Anonymity (FA)*. Under FA donors' preferences and the exact amount donated by each particular donor is unknown by the candidate and voters. The only information available to the candidate is the total donated amount. The second campaign finance system is called *Partial Anonymity (PA)*. Under PA, the candidate and the donors, but not the voters, know the location and donations of each individual donor. Finally, we also consider a *No Anonymity (NA)* system where both the candidate and voters observe donors' preferences and donated amount. In particular, voters anticipate that the candidate will reciprocate generous donations by choosing a policy which is more favorable to donors.

	Full Anonymity (FA)	Partial Anonymity (PA)	No Anonymity (NA)
Voters	No	No	Yes
Candidate	No	Yes	Yes

Table 1: Voters' and Candidate's Information About Donors Under the Three Campaign Finance Systems.

Table 1 summarizes the differences in the assumed information of the voters and the candidate about the donors' donations and their identities (ideal policies).

The timing in each election is as follows. First, donors learn their locations and the locations of both candidates. Then each donor decides how much to contribute to candidate 1. The election takes place and the winner determines the policy, which is publicly observed.

Payoffs. We assume that candidate 1's actual probability of winning is increased from its baseline winning probability ρ_1 as in (1) depending on the donations he receives from the donors. We assume that donor $j's$ donation d_j increases candidate $1's$ probability of winning at a rate r_j. The impact of donations on candidate 1's winning probability may depend on donor identity under the no-anonymity system, *if* the voters anticipate that donors may differ in how the candidate's policy choice upon winning is affected. Thus, for FA and PA we assume that $r_j = r$ for all j whereas for NA r_j can differ among the donors.

Ignoring the natural constraint that the probability of elections cannot be greater than 1 for notational simplicity, the expected payoff for a donor with ideal location ℓ_j and wealth w who donates d_j to candidate 1, when candidate i chooses policy y_i if elected, is:

$$\left(\rho_1 + \sum_{k=1}^{J} r_k d_k\right)\left[w - d_j - (y_1 - \ell_j)^2\right] + \left[\rho_2 - \sum_{k=1}^{J} r_k d_k\right]\left[w - d_j - (y_2 - \ell_j)^2\right]. \tag{3}$$

We assume that a donor's contribution amount is constrained to be non-negative and no more than an exogenously set maximal donation amount $\bar{w} \leq w$.

Notice that in (3), a donor's realized payoff may be negative if the chosen policy of the winning candidate y_i is too far from the donor's ideal policy. Since participants in an experiment cannot receive negative payoffs we modify (3) as

$$\left(\rho_1 + \sum_{k=1}^{J} r_k d_k\right)\max\left\{\left[w - d_j - (y_1 - \ell_j)^2\right], 0\right\} + \left[\rho_2 - \sum_{k=1}^{J} r_k d_k\right]\max\left\{\left[w - d_j - (y_2 - \ell_j)^2\right], 0\right\}. \tag{4}$$

In what follows we will refer to (3) as "*no limited liability*" case and to (4) as "*limited liability*" case.

3.2   Finite Elections

We first analyze the case of finite elections. With finite elections, backward induction implies that for any campaign finance system there is no scope for the politicians for reciprocating the donors. In this sense all elections are independent from each other and it is sufficient to simply analyze the one-period election. Furthermore, as there is no reciprocating by the politicians, all donors will be contributing *only* to increase the probability of winning for their preferred candidate, and *not* to affect the policy choice of the human candidate.

No limited liability Case. We begin our analysis with the no limited liability case. From the backward induction argument we know that the candidate i will choose policy c_i which is correctly anticipated by donor j who will choose d_j to maximize

$$\left(\rho_1 + \sum_{k=1}^{J} r_k d_k\right) \left[w - d_j - (c_1 - \ell_j)^2\right] + \left[\rho_2 - \sum_{k=1}^{J} r_k d_k\right] \left[w - d_j - (c_2 - \ell_j)^2\right]. \tag{5}$$

This function is linear with respect to d_j and therefore the maximization problem has a corner solution at $d_j^* = 0$ or $d_j^* = \bar{w}$. It is optimal for donor j to donate as much as possible, i.e. $\bar{w}$, to candidate 1 if

$$-1 + r_j[(c_2 - \ell_j)^2 - (c_1 - \ell_j)^2] > 0; \tag{6}$$

and to donate 0 otherwise. Looking at (6) we see that it is optimal to donate nothing when either the impact of donations, r_j, is small or when there is not much difference between candidates' platforms from the donor's point of view.

If the election probability does not reach 1 then nothing more needs to be done and, in particular, notice that the behavior of other donors has no impact on optimal d_j. If, however, the election probability does reach 1 the result is modified as follows. Denote by J_1 the minimum number of donors needed to make the probability of elections equal to 1 for candidate 1. Suppose that there are $J_{\bar{w}}$ donors for whom (6) holds. If $J_{\bar{w}} < J_1$ then all donors with (6) will donate $\bar{w}$ and the rest will donate 0. If $J_{\bar{w}} \geq J_1$ then we will have a multiplicity of equilibria where the sum of donations from donors with (6) is such that $\rho_1 + \sum_k r_k d_k = 1$.

Limited Liability Case. Next consider the case in which players' payoffs are restricted to be non-negative. First, consider the case when $w \leq (c_2 - \ell_j)^2$. When this condition is satisfied, it means that the donor receives zero payoff whenever the second candidate is elected and therefore the donor's objective function is

$$\max_{\{d_j\}} \left[\rho_1 + \sum_{k=1}^{J} r_k d_k\right] \left[w - d_j - (c_1 - \ell_j)^2\right]. \tag{7}$$

Assuming an interior solution, the first order condition implies that the optimal amount of donations is

$$d_j = \frac{w}{2} - \frac{(c_1 - \ell_j)^2}{2} - \frac{\rho_1}{2r_j} - \frac{\sum_{k \neq j} r_k d_k}{2r_j}. \tag{8}$$

As compared to the case of no limited liability, the interior solution is feasible as long as $d_j \in [0, \bar{w}]$. Parameters affect the optimal donation in an intuitive way. Richer donors will donate more and donations are higher if the candidate's ideal policy is closer to the donor's; also donors with larger impacts on elections, i.e., those with higher r_j, donate more. These properties carry through to the equilibrium donation levels given by (9) below. Furthermore, we observe a free-riding effect, that is, if other donors donate more, then donor j will donate less. Suppose that the best-response donation for all donors is as given by (8), then the Nash equilibrium is:

$$d_j^* = \left(1 - \frac{1}{J+1} \sum_{k=1}^{J} \frac{r_k}{r_j}\right) w - \frac{1}{J+1} \frac{\rho_1}{r} - \frac{J}{J+1}(c_1 - \ell_j)^2 + \frac{1}{J+1} \sum_{k \neq j} \frac{r_k}{r_j}(c_1 - \ell_k)^2. \tag{9}$$

When $w > (c_2 - \ell_j)^2$ a donor's utility coincides with the no limited liability case if $d_j < w - (c_2 - \ell_j)^2$ and it becomes (7) otherwise. Depending on parameter values three cases are possible: the optimal donation can be either 0, $w - (c_2 - \ell_j)^2$, or the level determined by (8). Having three cases makes the exact analytical expression for the NE too cumbersome and so for parameter values from our experiment we calculate it numerically.

3.3 Infinitely-Repeated Elections and Campaign Finance Systems

When the candidate-donors interactions are infinitely repeated and when all agents are sufficiently patient, we are in the realm of the folk theorem and the game admits multiple equilibria. In particular, in infinitely-repeated elections, it is possible to sustain an equilibrium in which candidates will reciprocate to donors' contributions in their policy choice, understanding that otherwise donor contributions will no longer be as forthcoming in future elections. Donors contribute to the candidate not only to influence who wins the election, but also to influence the candidate's policy choice upon winning the election. Thus the set of equilibria will depend on the information structure implied by alternative campaign finance systems.[15]

For the purposes of our paper we do not need a complete characterization of the equilibrium set. However, we are interested in how candidate's response to donations affects the optimal donation level as compared to the static case. To fix ideas, let $\mathbf{d} = (d_1, ..., d_J)$ denote the profile of donations by the J donors. Suppose that $y_1^{*S}(\mathbf{d}; c_1)$ is candidate 1's policy choice as a function of $\mathbf{d}$ under campaign finance system $S \in \{\text{FA, PA, NA}\}$.[16] Note that when interactions are infinitely repeated donors can anticipate that the candidate will choose a policy that is different from c_1.[17] For simplicity, consider the limited liability case when $w \leq (c_2 - \ell_j)^2$. In this case, donor $j's$ problem in campaign finance system S is, analogous to (7), given by,

$$\max_{\{d_j\}} \left[\rho_1 + \sum_{k=1}^{J} r_k d_k \right] \left\{ w - d_j - \left[y_1^{*S}(\mathbf{d}; c_1) - \ell_j \right]^2 \right\}. \tag{10}$$

The first order condition with respect to d_j for problem (10) is:

$$r_j w - 2 r_j d_j - \left[y_1^{*S}(\mathbf{d}; c_1) - \ell_j \right]^2 - \rho_1 - \sum_{k \neq j} r_k d_k - \frac{\partial \left[y_1^{*}(\mathbf{d}; c_1) - \ell_j \right]^2}{\partial d_j} = 0. \tag{11}$$

Comparing (8) and (11) we see that donations will be higher than in the static model if and only if

$$\left[(y_1^{*S}(\mathbf{d}; c_1) - l_1)^2 - (c_1 - l_1)^2 \right] + \frac{\partial \left[y_1^{*S}(\mathbf{d}; c_1) - \ell_j \right]^2}{\partial d_j} \leq 0.$$

In other words, if the donor anticipates a more favorable policy (the first term) and expects more favorable response to larger donations (the second term) then the optimal donations will be larger than in the static case. By the same token, if donors anticipate less favorable policy to be implemented then it might be optimal to donate less.

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[15]See Mailath and Samuelson (2006) for a comprehensive review of the research on repeated games, in particular on the differences between repeated games with public monitoring and with private monitoring.

[16]We are restricting ourself to equilibria in which the candidate's policy choice only depends on the donation profile in the current election and ignores the past donation history.

[17]Recall that in finite elections, $y_1^{*}(\mathbf{d}; c_1) = c_1$.

In contrast to the finite election case, a donor's belief about $y_1^{*S}(\mathbf{d};c_1)$ and, therefore, her behavior, depends crucially on the campaign finance system S. For example, in the FA system, one would expect that $y_1^{*\text{FA}}(\mathbf{d};c_1)$ is not as responsive to $\mathbf{d}$ as $y_1^{*\text{PA}}(\mathbf{d};c_1)$ or $y_1^{*\text{NA}}(\mathbf{d};c_1)$. In our analysis of the experimental data in Section 5, we empirically examine the differences in the policy choice function, as well as donor's contribution amounts, across different campaign finance systems.

Analogously, we can also easily delineate the incentives for the candidate's policy choice in the infinitely repeated elections environment. When candidate 1 decides on his policy choice in a given period, he will take into consideration his belief regarding donors' contribution function in the next period $d_j^{*S}(y_1)$. The candidate chooses policy y_1^* this period based on the trade-off of short-term loss (from choosing a policy that differs from c_1) and the benefit from next period's higher contributions (and thus a higher likelihood of winning the election). Again, it is important to note that a different campaign finance system S can lead to different beliefs by the candidate regarding donation functions.

4   Experimental Design and Procedures

Our actual experimental design is closely related to the model described in the previous section. In this section, we present the details of the experimental design as well as the justifications for some of the design choices.[18]

4.1   Players and Basic Environment

Donors, Candidates, and Voters.   All participants were divided into groups and assigned to either the role of *donors* or the role of *candidates*. Within each group, there were exactly two candidates for the election. However, only *one* candidate is a human participant; the other candidate is represented by a *computer* player.[19]   For convenience, we also refer to the human candidate as candidate 1, and refer to the computer candidate as candidate 2. The number of donors in each group varies from one to three.

In each experimental session, we start with the one-donor phase where each donor was paired with a human candidate for 14 rounds, followed by a two-donor phase where two donors were paired with a human candidate for 12 rounds, and, finally, in the three donor phase the three donors were paired with a human candidate for 11 rounds.

Voters are not represented by human subjects in our experiments.[20]   Their role of choosing the winning candidates is summarized by the probability function of the human candidate being elected. In what follows, we explain how the winning probability function depends on a candidate's ideal policy, her donations received, and voters' information (or lack thereof) about the locations of the donors.

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[18]We provide the experimental instructions given to the subjects in an FA treatment in the Appendix.

[19]Having only one human candidate allows us to abstract away from potential strategic interplays between the candidates, and allow us to focus only on the strategic interactions between the human candidate and donors.

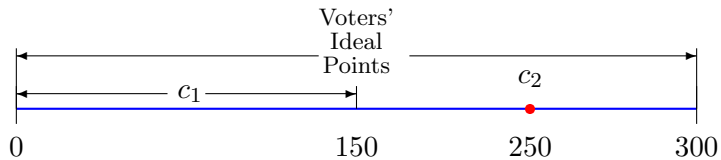[20]See Benoît et. al. (2010) for a laboratory experiment on voting.

Figure 1: The Ideal Policies of Voters, Donors and Candidates

Policy Spectrum and the Ideal Policies. The policy spectrum is given by the interval $[0, 300]$ and we assume that the ideal policy location of voters is uniformly distributed in this interval.[21] The ideal policy location of the computer candidate, c_2, is fixed at 225; the ideal location of the human candidate c_1 is randomly drawn from the range $[0, 150]$.[22] The realization of c_1 and $c_2 = 225$ are known to all donors (and voters). Like human candidates, donors' ideal policies are drawn randomly from the range $[0, 150]$. In treatments with multiple donors, their ideal policies are independent from each other. Figure 1 shows the potential ideal policies of voters, donors, and candidates.

Donations and Policy Choice. Each donor is provided with an endowment $w = 9,000$ ECUs (Experimental Currency Units) at the beginning of each game, of which a pre-specified amount, $\bar{w}$, can be used as contributions to a candidate's campaign where the value of $\bar{w}$ varies among treatments. As in the theoretical model, donations can be made only to the human candidate. Donations are *not* direct transfers to the candidate. Their effect is to increase the probability that the human candidate is elected.

Candidates observe the total donated amount and in PA and NA treatments candidates also observe the individual donations and donors' preferences. Candidates determine the implemented policy which affects the payoff of all participants in a candidate's group. The computer candidate always implements a policy choice of 225 if elected, while the human candidate is free to implement any policy along the $[0, 300]$ spectrum.

4.2 Campaign Finance Systems, Information Structure, and Election Results

The key experimental variation of our study is how alternative campaign finance systems provide different amounts of information to the voters and politicians about the donors' ideal policies and their contributions. In this paper, we study how this information affects donors' incentive to donate and the candidate's incentive to reciprocate in policy choices. The effect of the information on voters, however, is subsumed in our specification regarding how campaign contributions affect election results, which we explain here.

Human Candidate's Baseline Probability of Winning. If the realized ideal location of the human candidate is given by c_1, we assume that her *baseline* probability of winning the election, ρ_0, is specified by (1):

$$\rho_0 = \frac{c_1 + 225}{2 \times 300}, \tag{12}$$

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[21]Because voters are not represented by human subjects, this assumption about the distribution of voters' ideal policies will be reflected in the election probability function described below.

[22]Note that, by limiting c_1 to be randomly drawn from $[0, 150]$, the human candidate's average ideal position is at 75, making it on average symmetric with respect to the computer candidate.

which simply represents that fraction of voters whose ideal points are closer to c_1 than to $c_2 = 225$. For example, a human candidate located at $c_1 = 0$ would have an initial probability of election of 37.5% while a candidate located at $c_1 = 75$ would have an initial probability of 50% and one located at $c_1 = 150$ would have an initial probability of 62.5%.

The Effect of Information Structure on Voter Behavior. The three campaign finance systems described in Section 3 differ in the information available to the candidates and the voters about the donors' ideal locations and their campaign contributions. The main experimental object of interest in this study is on the effects of the alternative campaign finance systems on donors' contribution decisions, the winning candidate's policy choices and welfare. As a result, we assume that the effect of the information structure on voter behavior is captured by the effect of campaign donations on the probability of the human candidate being elected.

   Election Probabilities under FA and PA. Specifically, we assume that in the Full Anonymity and Partial Anonymity systems, campaign donations increase the probability a candidate is elected at the rate of 1% per 100 ECUs of contribution. That is, in both FA and PA systems, if the human candidate's ideal policy position is c_1 and the candidate receives a total donation of $D = \sum_{j=1}^{J} d_j$, then the probability of him being elected is given by:[23]

$$\rho_S(D) = \rho_0 + rD = \frac{c_1 + 225}{2 \times 300} + 0.0001D, \text{ for } S \in \{\text{PA, FA}\} \tag{13}$$

where $r = 0.0001$ reflects the effect of campaign expenditures on election outcomes.[24] The justification for the voters to behave this way is that in both FA and PA, the voters are assumed to be unaware of the donors' identities and contributions to the candidates.

   Election Probability under NA. The voter behavior under the No Anonymity (or the Full Transparency) system is more complex. The key feature of the NA system is that both the voters and candidates are aware of the donors' ideal locations. As a result, it is reasonable to assume that voters will expect the candidate's policy choices to be affected by the donors' ideal locations in a setting of repeated elections, which will affect their voting behavior and thus the election results. Qualitatively, we capture the effect of voter information in the NA system by postulating that the effectiveness of donations in affecting the election results in the NA system depends on the donor's location; in particular, donations from more extreme donors are less effective. Intuitively, if the candidate receives a large contribution from a donor, then voters may view that candidate as being more likely to implement the policy favored by the donor which then will affect the election probability.

   More formally, denote the maximum allowable donation amount by all the donors as $\overline{D}$,[25] and write d_j as the donation of donor j whose ideal location is at ℓ_j. Let $\mathbf{d} = (d_1, ..., d_J)$ and $\mathbf{l} = (\ell_1, ..., \ell_J)$ denote the profile of donations and ideal policy locations for the J donors. We assume that the voters expect that, given $(\mathbf{d}, \mathbf{l})$, the policy implemented by the human candidate

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[23]For studies on the effects of campaign spending to vote shares and probability of winning, see, e.g., Jacobson (1985), Abramowitz (1988), Green and Krasno (1988), Levitt (1994), and Gerber (1998).

[24]Of course, the winning probability is capped by one, so the human candidate wins the election with probability $\min\{\rho_0 + rD, 1\}$. We ignore the boundary of 1 for expositional ease.

[25]The level of $\overline{D}$ is an experimental choice variable that we describe below.

will be:

$$y_1^e(\mathbf{d}, \mathbf{l}) = \sum_{j=1}^{J} \frac{d_j}{\overline{D}} \ell_j + \left(1 - \sum_{j=1}^{J} \frac{d_j}{\overline{D}}\right) c_1. \tag{14}$$

Expression (14) captures our intuition that voters are sophisticated enough to expect politicians to reciprocate large donations and implemented policies favorable to large contributors. For example, if none of the donors donates then $\mathbf{d} = \mathbf{0}$, and thus $y_1^e(\mathbf{0}, \mathbf{l}) = c_1$; if there is only one donor with ideal location ℓ_1 who chooses to donate $d_1 = \overline{D}$, then (14) implies that the voters believe that the human candidate will be fully captured and expects a policy choice of $y_1^e = \ell_1$. In general, if the amount of donations is low relative to $\overline{D}$, then the voters expect the human candidate's policy choice to be close to c_1.[26]

We assume that the aggregate effect of donations on the human candidate's probability of being elected is given by:

$$\rho_{\mathrm{NA}}(\mathbf{d}, \ell) = \frac{y_1^e(\mathbf{d}, \ell) + 225}{2 \cdot 300} + r \sum_{j=1}^{J} d_j, \tag{15}$$

which captures the two effects of donations under the NA system: first, as in the FA and PA system, the term $r \sum_{j=1}^{J} d_j$ captures the direct positive effect of donations and campaign finance expenditures on the probability of winning at rate $r = 0.0001$; second, different from the FA and PA system, voters know the donors' donations and their ideal policies and expect the human candidate to be at least partially captured by them after winning the election, thus the base rate of winning the election by the human candidate changes from ρ_0 to $[y_1^e(\mathbf{d}, \ell) + 225]/(2 \cdot 300)$. Note that since it is implausible that donations of few large donors can guarantee the election with probability one we imposed the restriction that the updated probability of election cannot be greater than 0.8.

4.3 Additional Details about the Experimental Design

Payoffs for Players. The active players in our experiments are the donors and the human candidates. Now we specify their payoffs. If a donor with ideal policy ℓ_j donates d_j to the human candidate, and the policy implemented by the elected candidate (whether it is the human or the computer candidate) is y, then the donor's payoff is given by

$$\Pi_D(y; d_j, \ell_j) = \max\{9,000 - d_j - (\ell_j - y_i)^2, 0\}, \tag{16}$$

where we recall that 9,000 is the amount of ECUs we provide to each donor subject. Also notice that we impose the limited liability case to guarantee that participants of our study will receive non-negative payoffs.

For a human candidate with ideal policy location c_1 who chooses to implement a policy y_1, her payoff is given by:

$$\Pi_C(y_1; c_1) = \begin{cases} 6,000 - (c_1 - y_1)^2 & \text{if she wins,} \\ 0 & \text{if she loses} \end{cases} \tag{17}$$

where 6,000 ECU is the human candidate's value of winning the election.[27]

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[26]This particular functional form was chosen for two reasons. First, the resulting marginal impact of donations does not depend on donated amount. Second, it does not depend on the amount donated by other donors.

[27]Voters' payoff function is not important for our experiment because we do not use experimental subjects for

Other Experimental Variations. Though the main focus of our experiment is on the effect of the variation in campaign finance system, we also vary the number of donors and the maximum donatable amount in a given campaign finance system. Specifically, for each experimental session (defined below), we vary the number of donors from one to three sequentially. Considering a different number of donors enabled us to study the effect of the competition between donors for favors from politicians. As for the maximum donatable amount we considered two cases. In one set of sessions, we allow each donor to contribute 1000 ECUs per round, so that the total amount available for donation is 1000 in the one donor phase, 2000 for two donor phase, and 3000 in the three donor phase; in another set of sessions we keep the aggregate amount of donations set at 3000, so that in the one donor phase each donor can contribute 3000, while in the two and three donor phases each donor can contribute 1500 and 1000 respectively.

Time Line in a Given Round. The timing in each round is as follows. First, donors and the human candidate observe their ideal policy location. Then, donors decide how much to contribute to the human candidate. In making their contribution decisions, the donors are provided with the following information: the candidates' ideal policy locations; the human candidate's baseline probability of winning the election ρ_0 as calculated in (12); their potential payoff losses if either the human candidate or computer candidate is elected and implements their ideal policy; and for the NA and PA treatments, also, the locations of the other donors.

Once all donors make their contribution decision, the candidates and donors view the amount of donations (in aggregate for the FA treatment and by donor in the PA and NA treatments), the updated probability of the human candidate winning the election, and, in the NA and PA treatments, also the ideal locations of all donors. The human candidates then make their policy decisions[28] after which the winning candidate is randomly selected according to the updated probabilities, as given by (13) for the FA and PA treatments and (15) for the NA treatment.[29] Finally, the winning candidate's chosen policy is implemented and a final screen shows each participant his or her own payoff for this round.

4.4 Sessions and Treatments

In total we conducted six sessions defined by the combinations of information structure (either FA or PA or NA) and the maximum donatable amount (either 1000 or 3000 ECUs). Within each session, we kept the information condition and the rule with regard to maximum donatable amount fixed. However, we varied the number of donors during a given session, starting from a one-donor phase where each donor was paired with a human candidate for 14 rounds, followed by a two-donor phase where two donors were paired with a single candidate for 12 rounds, and finally, in the three-donor phase three donors were paired with a single candidate for 11 rounds.

As mentioned in Section 3, the candidates can rationally deviate from their ideal policy if interactions are infinitely repeated. To mimic an infinitely-repeated environment we kept the matching between the donor (or donors) and the human candidate constant within each phase. For

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them. However, when we evaluate the effect of campaign finance systems on welfare in Section 5.4, we assume that voters have similar payoff function as the donors, with the exception that they do not contribute.

[28]We chose to have candidates choose their policy decision prior to the announcement of the election winner so as to have a complete set of policy choices for the candidates.

[29]We use the random number z-Tree's generator. See Fischbacher (2007) for a description of the z-Tree software.

	3000	1000
FA	24	12
PA	24	24
NA	24	12

Table 2: Number of subjects per session

example, in one-donor phase the same candidate was matched with the same donor for the entire 14 periods. Furthermore, to eliminate the last-period effect, the number of rounds per phase was not announced to the subjects and was varied to minimize guessing when the last period per phase would occur.

In order to facilitate the comparison of different treatments, we used the same pre-generated values for candidates' and donors' ideal policy locations. That is, in all one-donor treatments we used the same 14 pairs of candidate-donor locations. In all two-donor treatments we used 12 triplets of candidate-2 donor locations and so on. Given that the same participants would play treatments with 1, 2 and 3 donors, the ideal locations for one-donor treatments differed from the ideal locations for two- and three-donor treatments. Across sessions, however, the draws of the ideal policies were kept identical.[30]

The six conducted sessions are denoted by the abbreviation of the information condition and a number representing the maximum donatable amount rule. For example, in session denoted as FA3000 the donations were fully anonymous and the total donatable amount was 3000. Thus in the one-donor phrase of FA3000 the donor could donate 3000 ECUs at most, in two-donor phase each donor could donate 1500 ECUs at most and so on. In session NA1000 the No Anonymity information structure was used and the maximum donatable amount per donor was equal to 1000 regardless of the number of donors.

Table 2 provides a summary of our experimental design and a number of subjects participating in each session. A total of 120 subjects participated. Sessions were conducted at Florida State University's xs/fs laboratory in September 2010. Payments averaged about $18.25 for the 90 minute sessions.

5 Results

This section presents experimental results. Throughout the section we will use the same notations as in the theoretical part of the paper. Specifically, c_1 will denote the location of a human candidate, ℓ_j the location of donor j, d_j the donation of donor j and finally, the policy chosen by the human candidate will be denoted as y_1. In what follows, we will also refer to policy locations from $[0, 49]$ as *extreme* locations, those from $[50, 100]$ as *moderate* locations, and those from $[101, 150]$ as *centrist* locations. We first present and discuss descriptive statistics in Section 5.1; we then study the determinants of candidate policy choices in Section 5.2 and donor donations in Section 5.3; and finally we investigate the welfare implications of allowing donations and candidates' responses to those donations under the alternative campaign finance systems in Section 5.4.

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[30]Table 4 records the actual draws of the human candidate's ideal policy location c_1 and the donor(s)' ideal policy locations, l_1, l_2 and l_3, depending on the number of donors in the treatment.

5.1 Descriptive Statistics

Table 3 reports the basic descriptive statistics of the experimental results on donors' donations and human candidates' policy choices by session and number of donors. Panel A of the table shows average actual (left column) and the average theoretical (right column) donations, where the theoretical predictions were calculated using derivations from Section 3 and under the assumption that donors expect the candidate to implement c_1. Panel B shows the average deviations and the average absolute deviations of the human candidates' policy choices from their ideal policy locations. Average absolute deviation measures candidate's responsiveness to donations and average deviation measures whether donations tend to distort candidate's choice towards the centrist or extreme policies.

	Panel A: Donations					
	Actual			Theoretical		
	1	2	3	1	2	3
FA1000	549	975	1346	627	984	1225
PA1000	610	1133	1543	627	984	1225
NA1000	569	1165	1725	500	1032	1345
FA3000	1397	1599	1645	962	1268	1225
PA3000	1735	2209	1666	962	1268	1225
NA3000	1522	1939	2392	944	1250	1345
	Panel B: Policy Choices					
	Deviation			|Deviation|		
	1	2	3	1	2	3
FA1000	6.82	10.00	11.73	19.82	18.58	11.73
PA1000	8.57	-0.75	19.52	16.30	6.15	23.97
NA1000	4.25	4.56	3.82	8.77	8.60	3.82
FA3000	4.74	13.90	2.33	9.65	21.73	7.21
PA3000	1.25	-1.13	14.55	10.39	12.06	19.18
NA3000	2.86	2.59	24.30	23.95	13.78	27.70

Table 3: Actual and Equilibrium Donations by Treatment. Candidates Deviations and Absolute Deviations by Treatment.
NOTES: The top panel shows actual donations observed in each treatment as well as equilibrium predictions. The equilibrium is calculated under the assumption that donors expect the candidate to implement his MPP. The bottom panel shows the average deviations of the candidate from his MPP as well as the average absolute deviation.

Donations. Panel A shows that donors' average actual donations in the FA treatments are lower than in the PA treatments. This holds for any number of donors and for both the 1000 and 3000 maximum donatable amount conditions. In the PA treatments, it is not unreasonable for donors to expect candidate's reciprocation in the policy choices which justifies more generous donations. This effect is quite strong: with the exception of 3-donor 3000-treatments, the donations in PA are considerably larger than donations in FA.

Panel A also shows that donors' average actual donations in the FA treatments are lower than

in the NA treatments. This also holds for any number of donors and for both the 1000 and 3000 maximum donatable amount conditions. This finding provides support for Ackerman and Ayres' (2002) proposal for campaign finance reform, at least in reducing the level of donation money in politics.[31] The FA treatment, relative to the NA and PA treatments, at least weakens the policy reciprocity motive for the donors to contribute to the candidate, while leaving intact the donation motive for increasing the winning probability of the candidate whose ideal policy is closer to the donors.[32]

The ranking of the average donations between the NA and the PA treatments is more complicated both for the theoretical and the actual data. Panel A shows that, for 1-donor treatments donations in the NA treatment are less than those in the PA treatments, while for 3-donor treatments donations in NA are greater than those in PA. For 2-donor treatments NA donations are slightly greater under the 1000 maximum donatable amount treatment but less when the maximum donatable amount is 3000. Intuitively, in the NA treatments the campaign donations vary in the rate with which they impact the election probability. In particular, extreme donors whose donations are less effective in NA may have two possible responses: either to reduce donation because it is less effective to begin with or to donate more to compensate for the reduced effectiveness of donation in the NA setting. Both approaches can be rational depending upon donors' beliefs. Similarly centrist donors can donate more or less than in the PA treatments. As we see from Panel A both scenarios are possible.

Policy Choices by the Human Candidate.   Panel B of Table 3 shows that, with the exception of the PA1000 and PA3000 treatments, the candidate's average deviations tend to be positive. Recall from Section 4 that the ideal location of the human candidate c_1 was randomly drawn from the range $[0, 150]$, while the voters' ideal policies were uniformly drawn from the range $[0, 300]$. Thus, c_1 tends to be to the *left* of the median voter and so a positive distortion of the human candidate in his policy choice is in fact a *centrist bias*. In section 5.2, we show that one reason for the centrist bias is that candidates with a higher initial probability of election – i.e. those with more central locations – are less responsive to donations. Assuming that centrist policies are more socially desirable than extreme policies, contributions to a candidate's campaign should have a welfare improving effect. This claim is investigated in detail in section 5.4.

There are two exceptions, however. In the 2-donor PA1000 and PA3000 treatments the candidate's average deviation was slightly (less than two units) negative. This is due to the fact extreme donors exert the most influence in the PA treatments as compared to the FA treatments (where their location is unknown to the candidate) and NA treatments (where their donations have a smaller effect than donations from more centrist donors). Thus, extreme donor influence can be strong enough to outweigh the centrist bias and move the candidate towards more extreme policies. We will see the confirmation of this finding in Results 2 and 4 in Section 5.2.

Finally, the average absolute deviation varied from 3.82 in NA1000 to 27.70 in NA3000, with the former corresponding to a loss of 15 ECUs (out of the 6000 ECUs obtained from winning the election) and the latter to a loss of 767 ECUs due to not choosing y_1 to be equal to c_1. The average

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[31]The level of money in politics is only one aspect of the effects of campaign finance reforms. Below we will also consider the policy choices by the candidates and the effect on voter welfare under different campaign finance regimes.

[32]As we show below, the candidates still modify their policy choice away from their ideal policy even in FA treatments, though to a lesser degree than in PA and NA treatments.

absolute deviation across all treatments was 15 and therefore the candidates on average would sacrifice 3.75% of their election benefits.

5.2 Policy Choice

5.2.1 Deviations in Candidates' Policy Choice

Figure 2 shows locations of donors and the human candidates, as well as the average policies chosen by the human candidates, for each period. The top panel shows the data for 1-donor treatments, the middle panel for 2-donor treatments and the bottom panel for 3-donor treatments. In all six charts, circles correspond to candidates' locations; crosses, triangles and diamonds correspond to donors locations. The blue line are candidates decisions in FA, green line in NA and red line in PA.

As it can be immediately seen from Figure 2, deviations from candidates' ideal policies are very common. Indeed, the average chosen policy differed from the ideal policy in almost every round of every treatment. Interestingly, deviations also occur frequently in the FA setting even though donors' locations are unknown to candidates. However, centrist and moderate candidates were less likely to deviate in the FA treatments which is particularly noticeable in 3 donor treatments. In NA and PA treatments, where donors' locations were observed, we see that with few exceptions candidates would choose a policy that is more favorable to donors. Specifically in treatments with one donors and in treatments with multiple donors where all donors' ideal policies are located on the same side of the candidate, the candidate would typically move towards the donor(s).

To formally test whether and when the deviations are statistically significant and whether these deviations differ with the campaign finance systems, we conduct t-tests comparing the candidate's ideal policy with the chosen policy. To explain how we do this, we shall recall from Section 4.4 that, for each period t we have fixed the values of candidate and donors' ideal locations across the six sessions (as defined by the combinations of information structure and the maximum donatable amounts) and also within the same session across groups. For example, in period 1 of all 1-donor treatments (whether the information structure is FA, NA or PA, and whether the maximum donatable amount is 1000ECU or 3000ECU), the candidate's location was 63 and the donor's location was 12. Thus, we will observe the policy choices from 18 human candidates for FA and NA information structure and from 24 candidates for PA information structure.[33] Using the 18 (24 respectively) observed policy choices for FA and NA (PA respectively), we can test whether the policy choice of the human candidate (denoted by $PolC$) differs significantly from their ideal policies c_1. Table 4 reports the results from the t-tests for whether the policy chosen by the candidate deviates substantially from his ideal location. The results are presented for each candidate's location and each treatment and are ordered with respect to c_1. In Table 4, we use the indicator '1' to denote the case where the hypothesis $PolC = C$ is rejected in favor of $PolC > C$ at the 5% level, '-1' to denote the case where the hypothesis $PolC = C$ is rejected in favor of $PolC < C$ at the 5% level, and '0' to denote the case where the hypothesis $PolC = C$ can not be rejected at the 5% level.

The deviation pattern shown in Table 4 is overall fairly systematic. First and foremost, there

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[33]As described in Table 2, 36 subjects participated in FA and NA sessions and 48 subjects participated in the PA sessions. In 1-donor treatments, two subjects are paired in a group. Thus, we have 18 human candidates in FA and NA sessions and 24 in PA sessions. One can analogously determine the number of human candidate choices for 2-donor and 3-donor treatments.
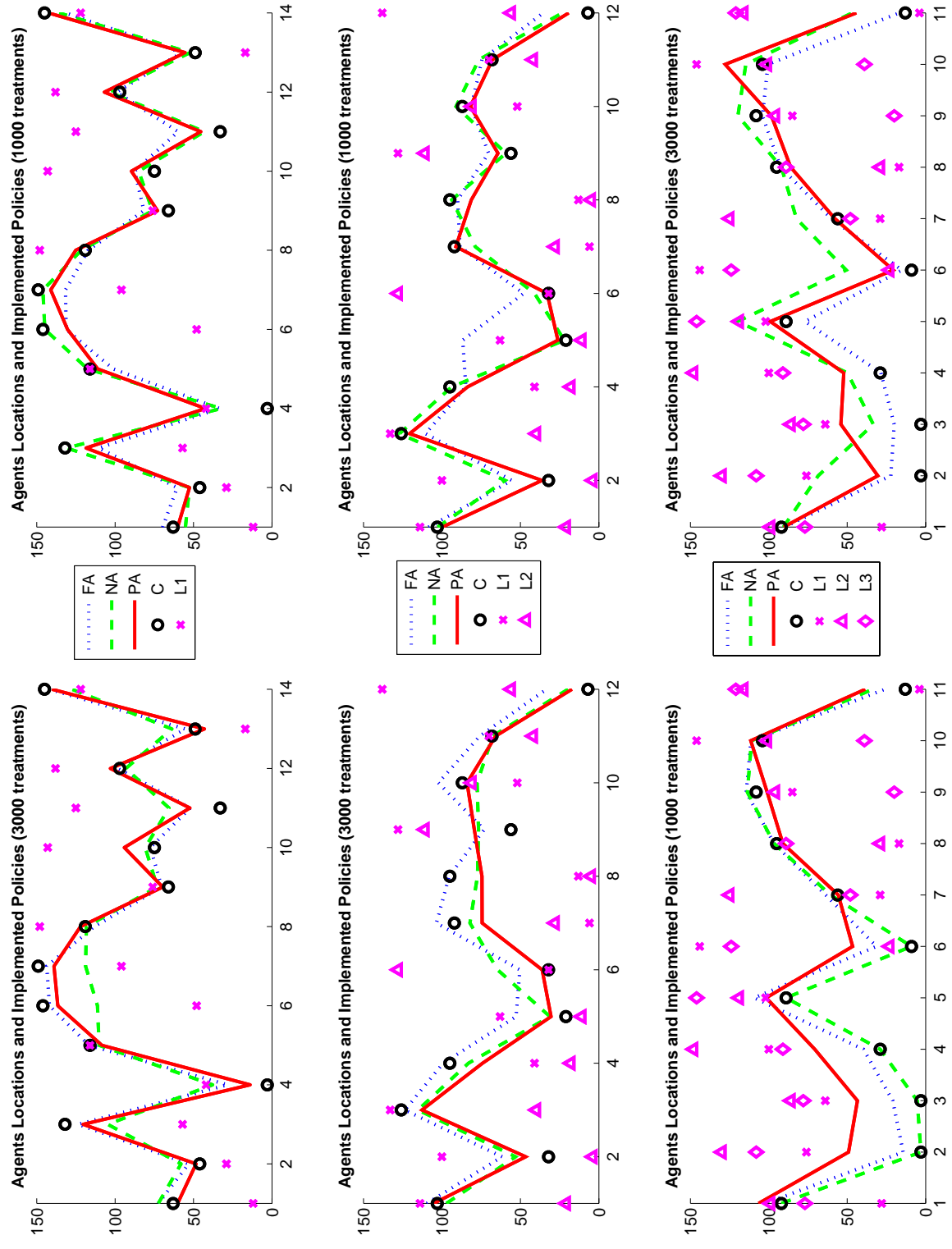
Figure 2: Locations of Donors and Candidates, and the Average Policies Chosen by the Candidate for Each Period.

20

c_1	FA	NA	PA	l_1	l_2	l_3	Period
3	1	1	1	42			4
33	1	1	1	125			11
46	1	1	0	29			2
49	0	0	0	17			13
63	1	0	0	12			1
66	1	1	1	76			9
75	0	0	1	143			10
97	0	0	1	138			12
116	0	0	-1	116			5
119	0	0	1	148			8
132	0	-1	-1	57			3
145	0	-1	-1	122			14
146	0	-1	0	48			6
149	0	-1	-1	96			7
7	1	1	1	138	56		12
21	1	1	1	63	11		5
32	1	1	1	100	4		2
32	0	1	0	32	128		6
56	0	1	1	128	111		9
68	0	0	0	70	42		11
87	0	0	-1	52	81		10
92	0	-1	0	6	28		7
95	0	-1	-1	41	18		4
95	0	-1	-1	13	5		8
103	0	0	0	114	21		1
126	0	-1	-1	133	40		3
3	0	1	1	76	130	108	2
3	0	1	1	64	86	78	3
9	0	1	1	144	23	124	6
13	0	1	1	4	116	121	11
29	0	1	1	100	148	91	4
56	0	0	0	29	125	48	7
89	0	0	1	102	119	146	5
92	0	0	0	28	99	77	1
95	0	0	-1	17	29	89	8
104	0	0	0	146	101	39	10
108	0	0	-1	85	96	20	9

Table 4: Comparing the Chosen Policy with the Ideal Candidate's Policy.

NOTES: The results of t-test $PolC = C$ for each particular candidate's location. An entry of '1' denotes the case where the hypothesis $PolC = C$ is rejected in favor of $PolC > C$ at the 5% level; an entry of '-1' denotes the case where the hypothesis $PolC = C$ is rejected in favor of $PolC < C$ at the 5% level, and an entry of '0' denotes the case where the hypothesis $PolC = C$ can not be rejected at the 5% level.

tend to be fewer significant policy deviations under FA than under NA and PA. This simply follows from the observation that there are much less frequent non-zero entries in FA than in NA and PA. Moreover, the deviations under FA, when they do, occur only when the candidate's ideal location is extreme; in contrast, the deviations under NA and PA occur more generally across the spectrum of candidate's locations.

Second, Table 4 also shows that, if the candidate's location is extreme, the deviations tend to be significant and are towards the center of the policy spectrum. Such a systematic deviation in all three information structures is not particularly surprising since for extreme candidates donors are most likely to be to the right of the spectrum. In particular, the candidate does not have to observe their locations to correctly anticipate this.

Third, when the candidate's ideal policy is close to the center but donors' locations are more extreme, we observe that under the NA and PA systems it is possible for donors to induce the candidate to choose a policy away from the center of the spectrum to the left. This effect is not significantly present under the FA system. However, it should be noted that the NA treatment does filter out some of the extreme donors' influences; in particular, in the 3-donor case the deviations to the left are significant only for PA and are not significant for the NA system.

Finally, as we already saw from Figure 2, when candidates respond to donations they move towards the donor. While there are exceptions to that rule, such as period 2 of 1-donor NA treatment, most of the time the chosen policy was more favorable to donors than the politician's ideal policy.[34]

We should emphasize that the pattern whereby extreme candidates move to the right and centrist candidates move to the left is not due to mechanical restrictions imposed on the candidate's policy space and donors' locations. The key determinant for candidate's choice especially in PA and NA treatments is donors' locations. For example, in our experimental data we do observe a centrist candidate deviating to a more centrist policy as in period 8 of 1-donor PA treatment where $c_1 = 119$ and $l_1 = 148$. At the same time, in 2-donor NA and PA treatments moderate candidates located at 87, 92 and 95 would move left towards more extreme donors.

We summarize the above results as follows:

Result 1: *Candidates are less likely to deviate from their ideal policy under FA than under PA and NA systems.*

Result 2: *Under all three information structures, extreme candidates tend to deviate from their ideal policy to the right. Under PA and NA, but not under FA, centrist candidates are also likely to deviate to the left under the influence of extreme donors, though the effect is somewhat weaker for NA especially in 3-donor treatments.*

5.2.2 Determinants of Policy Deviations

Having established the general presence and direction of deviations from the candidate's ideal policy under the three campaign finance systems, we now explore in more detail the factors that affect the candidate's decision to deviate and the deviation size. Table 5 reports the Panel-Tobit

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[34]In 1-donor treatments it is clear which policy is more favorable to the donor. In treatments with multiple donors discussion about a more favorable policy makes sense when all donors are on one side of the candidate. As we can see in these cases statistically significant deviation was always towards the donors.

regression results for each of the information structures and each number of donors. The dependent variable we use in these regressions is the absolute value of the candidate's deviation, i.e., $|y_1 - c_1|$.[35]

Due to natural differences between treatments with different numbers of donors the choice of independent variables depends on J. In all regressions, we include as explanatory variables the ideal policy location of the (human) candidate, donation amount(s), and the squared distance(s) between the donors' and the candidate's ideal policies.[36] For treatments with $J > 1$ we anticipate that the impact of the donor who is closest to the candidate should differ from the donor who is the furthest from the candidate. The variables related to the former are indexed by the word *close* and the variables related to the latter are indexed by the word *far*.

In addition to the above variables, we also added several dummy variables. For all treatments we used dummy variables "DidCMove$_{t-1}$" for whether the candidate deviated last period, "DidCWin$_{t-1}$" for whether the candidate won election last period, and "Is1000" for whether it was 1000 or 3000 treatments. We also added several variables to see whether relative locations of the candidate and donors matter. For the 1-donor treatments we used a dummy variable $(c_1 > l_1)_t$ which takes value 1 if the candidate is more centrist than the donor. For the multiple-donor treatments we used a variable $(c_1 < l_{min})_t$ equal to 1 if the candidate is on the left of donors and variable $(c_1 > l_{max})$ equal to 1 if the candidate is on the right of donors. To quantitatively capture the relative location of the candidate and donors we also used variable $(c_1 - l_{far})(c_1 - l_{close})$. It is negative when the candidate is between the donors and takes its minimum if the candidate location is the average of l_{far} and l_{close}. The further the candidate is from the donors the larger is the value of $(c_1 - l_{far})(c_1 - l_{close})$.

1-Donor Treatments. Panel A of Table 5 presents the results when there is only 1 donor for the FA, PA, and NA treatments separately. First, note that the donation amount d_1 had a significant effect on the deviation size in all three treatments; but interestingly, the sign of the effect differs depending on whether the donor locations were observed by the candidate as in PA and NA treatments, or not as in the FA treatment. Coefficient estimates in Panel A indicate that in the PA and NA treatments larger donations lead to larger deviations. This is quite intuitive and is evidence that candidates reciprocate donors' contributions. However, in the FA treatment we found that larger donations lead to lower deviations. The intuition for this result is very different from that for the PA and NA treatments. Because candidates do not observe the ideal policy location of the donor, they are likely to interpret larger donations as an indication that the donor's ideal policy is close and as a result would reciprocate by not deviating.

The second variable of interest $(l_1 - c_1)^2$, i.e., the distance between the donor and the candidate,

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[35]The reason that we use the absolute deviation and not the level of the deviation is that the interpretation of coefficients is more interesting. For example, a positive sign of a particular variable, say donated amount, means that larger donations led to larger deviations. With the level of the deviation as a dependent variable, the interpretation would be that larger donations lead to more centrist policy which we believe is not as informative. We also believe that we are less likely to find an effect of a variable if we use the level of deviation as the dependent variable because the effects of a particular variable could get canceled since extreme candidates were more likely to move to the right and centrist candidates to the left.

[36]In multiple-donor treatments using variables d_i and l_i where $i = 1, 2$ or 3 would not be informative since the locations of donors were determined independently of their index numbers. Instead we classified donors by being the closest or the furthest from the candidate as one would expect candidates to respond differently to donations from the two.

	FA		PA		NA	
	Coef	p-value	Coef	p-value	Coef	p-value
Panel A: 1 Donors						
d_1	-0.00911	0.007	0.005333	0.036	0.00869	0.001
$(l_1-c_1)^2$	0.000837	0.271	0.001783	0.001	0.001962	0.002
c_1	-0.23703	0.000	-0.10338	0.008	-0.11274	0.014
DidCMove_{t-1}	0.254894	0.004	0.116949	0.095	0.087947	0.196
$(c_1 > l_1)_t$	6.089334	0.234	0.927546	0.799	10.88372	0.012
Is1000	20.89867	0.224	6.244735	0.425	-6.49519	0.513
DidCWin_{t-1}	-11.4843	0.020	-6.6401	0.062	-2.20467	0.593
Constant	9.042807	0.464	-3.50501	0.693	-1.00813	0.911
Panel B: 2 Donors						
d_{far}	-0.01738	0.025	0.008401	0.090	0.005874	0.261
d_{close}	-0.01133	0.128	-0.0027	0.586	-0.01043	0.064
$(l_{\text{far}}-c_1)^2$	-1.36E-03	0.180	0.000104	0.872	0.001544	0.039
$(l_{\text{close}}-c_1)^2$	9.28E-04	0.746	0.004319	0.018	-0.00129	0.553
$(c_1-l_{\text{far}})(c_1-l_{\text{close}})$	0.001632	0.422	0.000954	0.456	-0.00292	0.050
$c_1 < l_{min}$	-8.75953	0.477	-0.02135	0.998	0.598424	0.951
$c_1 > l_{max}$	-3.60347	0.738	-6.95017	0.310	-1.63034	0.853
c_1	-0.35939	0.009	4.93E-02	0.545	8.43E-02	0.420
DidCMove_{t-1}	-0.02118	0.876	2.65E-01	0.039	-1.01E-01	0.513
Is1000	-6.64433	0.834	-8.04145	0.564	-14.8472	0.177
DidCWin_{t-1}	-0.24208	0.973	-0.22501	0.958	-16.0198	0.001
Constant	51.26612	0.033	-20.7085	0.186	14.35641	0.270
Panel C: 3 Donors						
d_{far}	-0.00514	0.501	-0.00932	0.391	-0.00473	0.698
d_{close}	-0.00459	0.553	-0.00197	0.842	0.017474	0.217
$(l_{\text{far}}-c_1)^2$	-0.00107	0.154	-0.00053	0.653	-4.22E-06	0.997
$(l_{\text{close}}-c_1)^2$	-0.00444	0.219	0.000659	0.903	-0.00654	0.213
$(c_1-l_{\text{far}})(c_1-l_{\text{close}})$	0.002979	0.151	0.002096	0.514	0.005056	0.099
$c_1 < l_{min}$	15.21684	0.037	0.823533	0.943	-6.52213	0.569
$c_1 > l_{max}$	-0.04742	0.996	3.857151	0.782	2.066532	0.880
c_1	-0.24849	0.095	-0.32149	0.136	-0.42915	0.058
DidCMove_{t-1}	-0.06557	0.682	-0.0833	0.546	0.033493	0.822
Is1000	17.68183	0.565	-5.13633	0.824	-63.1022	0.001
DidCWin_{t-1}	-0.64694	0.921	-12.4864	0.145	-10.328	0.277
Constant	-6.38454	0.792	37.11373	0.155	42.72141	0.132

Table 5: The Panel Tobit Regression Analysis of the Candidate Behavior.

NOTES: The dependent variable is $|c_1 - y_1|$. The variable d_i with subscript i denotes donations from donor i and l_i denotes location donor i. For multiple-donors panels, variables with subscript "far" refer to the furthest donor from the candidate, and those with subscript "close" refer to the closest donor to the candidate. The variable $(l_i - c_1)^2$ is the squared distance between donor i and the human candidate. The variable "$DidCMove_{t-1}$" is the dummy variable that takes value 1 if the candidate deviated in the last round; the variable $(c_1 > l_1)_t$ is the dummy which takes value 1 if the candidate is more centrist than a donor; "Is1000" is equal to 1 if maximum amount to donate is 1000; "$DidCWin_{t-1}$" is 1 if the candidate won in the last period. Finally, $c_1 < l_{min}$ is equal to 1 if the candidate is to the left of donors and variable $c_1 > l_{max}$ is equal to 1 if the candidate is to the right of donors.

also had an expected impact. In the FA treatment where the distance was unobserved, the impact of this variable was insignificant. But in NA and PA treatments the impact was positive and highly significant. That is, in the NA and PA regimes when the candidate observes the donor's preference, the further away the donor is from the candidate, the more likely the candidate will deviate from his ideal policy and the larger the size of the deviation.

The estimated coefficients on the candidate's ideal location c_1 are negative and significant in all three treatments. Recall that a larger c_1 means that the human candidate has a larger initial probability of being elected. Thus this result means that, holding the donation amount and other factors constant, candidates who are more likely to be elected to start with are less likely to deviate from their preferred policy. Furthermore, it means that extreme candidates' deviations are larger than those of centrist candidates. This together with our observation from Table 4 implies that donations are more likely to make extreme candidate more moderate and less likely to make centrist candidate less centrist. The intuition behind the result is straightforward. When the candidate has a relatively high chance to win elections without the donations (in our model it's centrist candidates) then they value donations less and are less inclined to reciprocate. On the other hand, candidates with a lower election chance may desire campaign contributions more and may be more willing to reward donors. The coefficient estimates indicate that the effect of this centrist bias varies across treatments: it is strongest under FA and is approximately the same in NA and PA with PA being the weakest. This finding that candidate's policy deviations, when influenced by donations, are biased towards the center is beneficial for voters' welfare, an issue discussed more in Section 5.4.

Looking at other variables we see that the candidates' policy response did not differ between the treatments with 1000 and 3000 maximum donatable amounts. The relative position of the candidate and the donor, $(c_1 > l_1)_t$ is insignificant in the FA and PA treatments but it is significant in the NA treatment. Insignificance in FA and PA is not surprising since in the former case donors' locations was unobserved and in both cases the donors' impact on the election probability was the same regardless of whether they are more or less extreme than the candidates. Similarly, significance of $(c_1 > l_1)_t$ in the NA is not surprising because the donations' impact on the election outcomes differs depending on who was more extreme. However, it is somewhat surprising that in the NA treatment candidates' deviation was larger when donors were more extreme (i.e., when $c_1 > l_1$ is true). This is surprising because the election probability formula in expression (15) implies that donations from extreme donors have a lower impact. The willingness of the candidates to respond more aggressively to more extreme donors under the NA regime, despite the voters' backlash, points toward a potential weakness of the NA system.

Finally, the coefficient estimates for the dummy DidCWin$_{t-1}$ are significantly negative in the FA and PA treatments, but negative and insignificant in NA. This is evidence that candidates who lost elections in $t-1$ would deviate more in period t. As for the coefficient estimates for DidCMove$_{t-1}$, they are positive in all three treatments and significant at 10% level in FA and PA. This suggests that candidates who deviated last period were more likely to deviate in the current period as well.

2-Donor Treatments. Panel B of Table 5 presents the results when there are two donors for the FA, PA, and NA treatments separately. The donations by the two donors, now labeled by d_{far} and d_{close} separately, have a negative effect on the candidate's policy deviation in the FA

treatments. But interestingly, only the coefficient estimate of the furthest donor's donation d_{far} is significant.[37] The reason that only d_{far} is significant is as follows. In the FA treatments, recall that the candidate is only able to observe the total donation amount, i.e., $d_{\text{far}} + d_{\text{close}}$, and not d_{far} and d_{close} separately. However, when we regress the total donations on $(c_1 - \ell_{\text{far}})^2$ and $(c_1 - \ell_{\text{close}})^2$, it turns out that only the coefficient for $(c_1 - \ell_{\text{far}})^2$ is significant and it is negative.[38] That is, the furthest donors' donations would drop with the distance between the candidate's and the donor's ideal policy locations. Thus, from the candidate's point of view, receiving a particularly large total donation is a clear indication that both donors have ideal policies close to his; therefore, there is no reason for the politician to move. Moreover, since the indication itself is due to large donations from the relatively furthest donor (whose ℓ_{far} is nonetheless close to c_1), we have that d_{far} is negative and significant.

The effects of the donations differ in the NA and PA treatments from those in the FA treatments described above. In the NA and PA treatments, we find that donations from the furthest donor have a positive effect and donations from the closest donor have a negative effect on the candidate's policy deviations. This is intuitive, since reciprocation to donations from the closer donor requires that the candidate deviate less, whereas reciprocation to donations from a further donor requires that he deviate more. However, only d_{far} is significant in the PA system, while only d_{close} is significant in the NA system. The significance of d_{close} in NA is due to the fact that donations from closer donors have higher impact on election probabilities (see expression 15).

We found that, in the FA treatments, as in the 1-donor case, the squared distance between the candidate and the donors' ideal policies, $(c_1 - \ell_{\text{far}})^2$ and $(c_1 - \ell_{\text{close}})^2$, are both insignificant which is intuitive since they are not observed by the candidate. In the PA system, we found that the distance to the closest donor has a positive and significant impact on the deviation, so that as the distance to the closest donor gets larger, it means both donors are further away and so reciprocation would require larger deviation. In contrast, in the NA system, it is the distance to the furthest donor that has a positive and significant effect. Despite the difference between the PA and NA systems in which of the two variables is significant, the main message is similar to what we observed in 1-donor treatments: when donors' ideal policies are farther away from the candidate's, reciprocating candidates are willing to deviate further away from their ideal policy in the NA and PA treatments.

Also, with two donors, the variable c_1 has a negative and significant effect in the FA system, but it is insignificant in both the PA and NA system. This implies that, with two donors, the centrist bias we discussed previously still applies under the FA system, but we no longer observe this bias in the case of PA and NA. We already saw evidence of that from Table 3, where the only treatments that led to more extreme chosen policies were 2-donor PA treatments. The variable "Is1000" is insignificant in all three treatments which is not surprising since for 2 donors the difference between 3000 and 1000 treatments is less substantial. Finally, as in the 1-donor case, the variable "DidCWin$_{t-1}$" is negative in all three treatments; however, this time it is significant only in the NA treatment.

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[37]However, the null hypothesis that coefficients for d_{far} and d_{close} are equal cannot be rejected (with a p-value of 0.51).

[38]Regression results are available from the authors upon request.

3-donor Treatments   Panel C of Table 5 presents the results when there are 3 donor for the FA, PA and NA treatments separately. The 3-donor case is different from 1- and 2-donor cases in that variables related to donors' locations and donation amounts turn out to be insignificant. This result is quite robust and holds for all three treatments and many alternative regression specifications. The reason is that with three donors the role of one particular donor becomes less important. Candidate's location has a negative and significant effect on his policy deviations, as it was in 1-donor treatments. Thus with three donors we again have a centrist bias, namely, extreme candidates are more likely and centrist candidates are less likely to deviate.[39]

We summarize our main findings in this section as follows:

Result 3: *The effect of donations on the candidate's policy deviations differ in FA treatments (in which the candidate does not observe the donors' ideal policies) from that in PA and NA treatments (in which the candidate observes the donors' policies. Specifically, in the FA system larger donations lead to smaller deviations from the candidate's ideal policy; but in the NA and PA systems, larger donations lead to larger deviations.*

Result 4: *The donations lead to a socially desirable centrist bias in the candidate's policy choices, i.e., donations are more likely to make an extreme candidate move to the center than to make a centrist candidate move to the right. This centrist bias is present robustly for all FA treatments, but for the PA and NA treatments it is present only with 1 donor and 3-donors.*

5.3   Donations

We now investigate the donor's contribution decisions. In order to understand the determinants of donor's donation decisions, we first use as the benchmark the static Nash predictions for the equilibrium donation level as characterized in Section 3 under the assumption that donors expect the candidate to implement his ideal policy, and they face limited liability. We then use the donors' best response to the estimated policy response function we estimated in Table 5 as the benchmark.[40] Finally, we present regression results on the factors that impact the donations.

5.3.1   Using the Static Nash Predictions as the Benchmark

Figure 3 shows the static Nash and the average actual donations in 3000 ECU treatments with 1 donor. The NA treatment data is plotted separately because the impact of donations on election probabilities under NA differ from those under FA and PA, and therefore equilibrium predictions are different. To ease the comparison with the theoretical predictions the x-axis is ordered by distance between the candidate's and the donor's optimal policies.

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[39]Note that we observe non-monotonicity of c_1 for NA and PA treatments. It is significant in 1 and 3-donor treatments and insignificant in the 2-donor treatment. We conjecture that this is due to the following. Having several extreme donors and no centrist donors, a reciprocating centrist politician is more likely to choose a more extreme policy as compared to the case of only one extreme donor and the case of having extreme and centrist donors. The former can explain why there is a centrist bias in the 1-donor treatment but not in the 2-donor treatment. The latter can explain why there is a centrist bias in the 3-donor treatment. Indeed, with three donors it is less likely to have all three of them extreme.

[40]To save space, we only present results for the treatments in which the maximum donatable amount is 3000 ECUs. The results for the treatments with 1000 ECU maximum donatable amount are similar and available from the authors upon request.
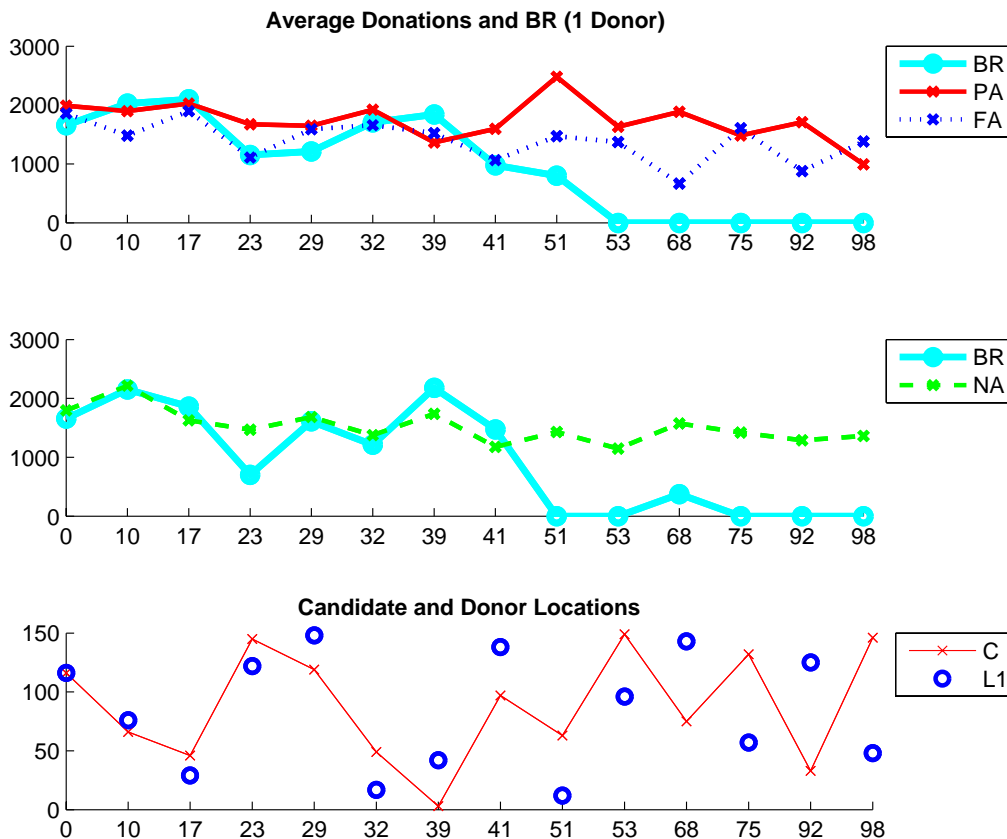
Figure 3: Static Nash (BR) and Actual Donations in Treatments with 1 Donor Ordered by Distance Between the Candidate and the Donor.

Figure 3 shows that, in all three treatments, the observed donation is very close to the theoretical static Nash predictions until the distance between the candidate's and the donor's ideal policies is 51 or more. For each period and each treatment we conduct a t-test to see whether and when the difference was statistically significant. When the distance is less than 51 the t-test shows that, with only two exceptions, there is no significant difference between the theoretical and observed contributions.[41] When the distance is 51 or greater the observed donations were higher than the theoretical ones. The reason is obvious, with larger distances it is likely that donors expected chosen policy to be more favorable thereby justifying higher levels of donations. Comparing donations between FA and PA treatments we see that donations in PA were higher than in FA. Again, given that in the PA treatment donors are likely to have more favorable expectations about candidate's response so it is optimal to donate more.

Figure 4 shows the theoretical and average donations for 2-donor 3000 ECU treatments. In the top row are donations of the donor who was closest to the candidate and the middle row shows donations of the furthest donor. Figures in the left column are for the FA and PA treatments, while those in the right column are for the NA treatments. Again we observe that the average actual donations tend to be higher under the PA treatments than those under the FA treatments. The furthest donors tend to over-contribute compared to equilibrium predictions. As for the closest

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[41]The two exceptions are NA treatment with distance 23 and PA treatment with distance 41.
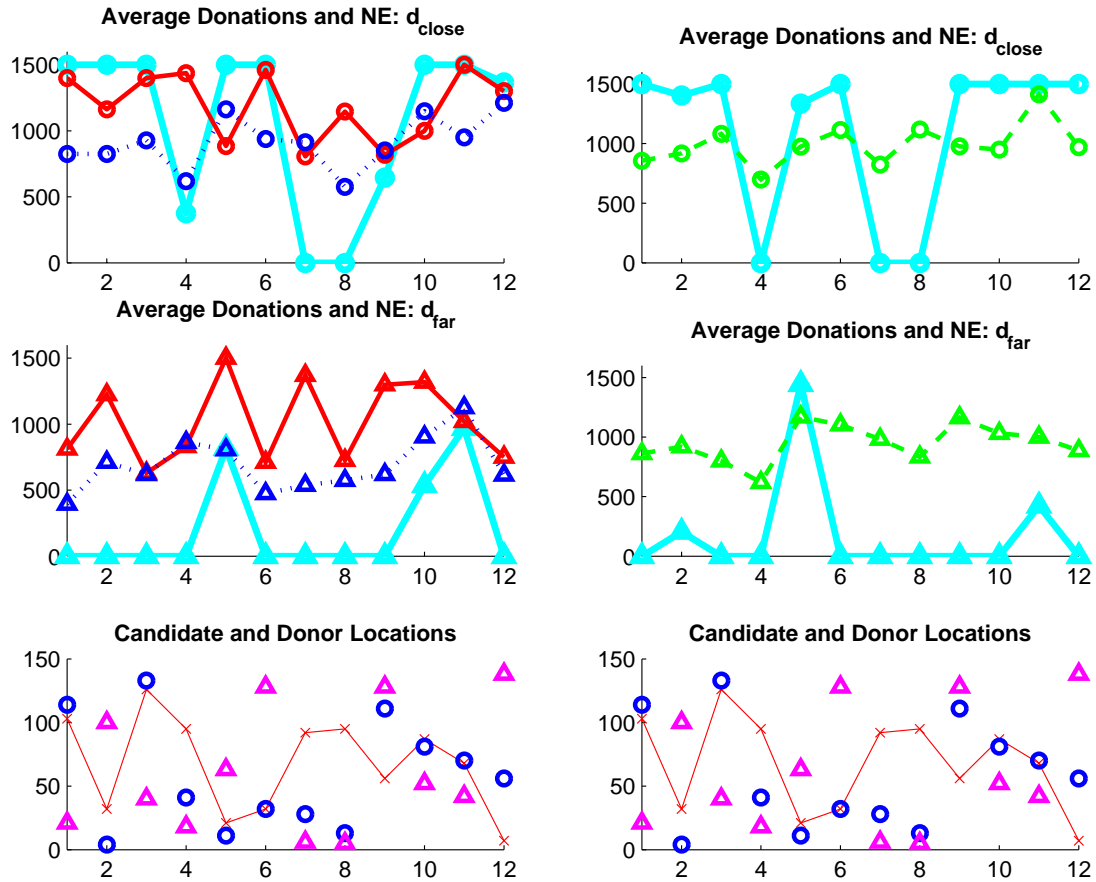
Figure 4: Static Nash and Actual Donations In 2-Donor Treatments.

Notes: (1). Figures in the left column are for FA and PA treatments where the thick cyan line depicts the static Nash prediction; the blue line depicts the actual average donations in FA, and the red line depicts the actrual average donations in PA. Figures in the right column are for the PA treatments where the thick cyan line depicts the static Nash prediction and the green line depicts the actual average donations in PA.

(2). The top charts show actual and predicted behavior of the closest donor. The middle charts show actual and predicted behavior of the furthest donor. The bottom charts are locations of the candidate and donors where the circles correspond to the closest donor, triangles to the furthest one and the line connects the candidates' locations.
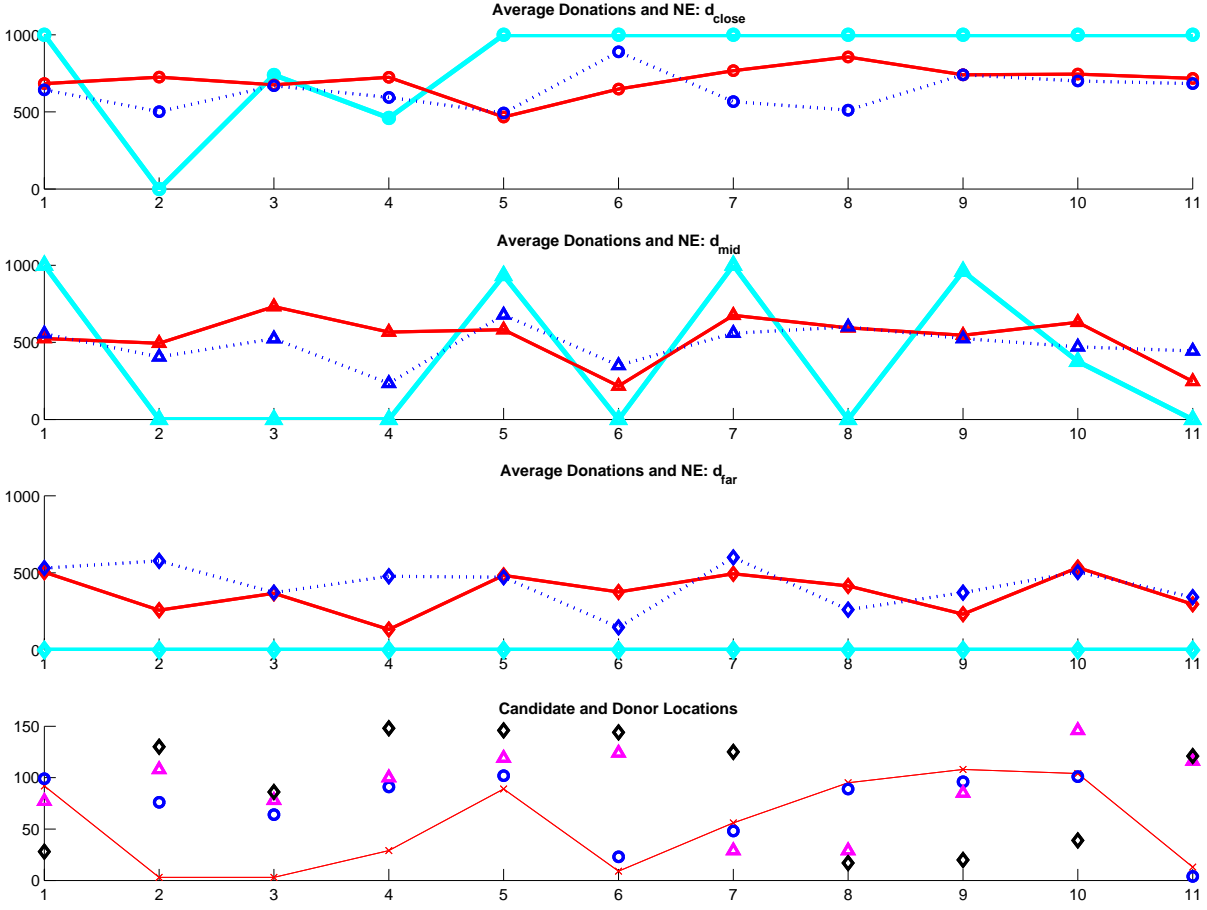
Figure 5: Static Nash and Actual Donations in 3-donor FA and PA Treatments.

Notes: The thick cyan line is equilibrium prediction. The blue line is donations in FA and the red line is for PA. The top chart corresponds to the closest donor, the next chart corresponds to the second closest donor, the third chart corresponds to the furthest donor. In the bottom chart, circles denote locations of the closest donor, triangles denote locations of the middle donor, diamonds locations of the furthest donor and the line connects the candidates' locations.

donors we observe both over- and under-contributions. Whether the closest donor contributed more or less than predicted is largely determined by whether the candidate is expected to implement a less or more favorable policy. In periods 4, 7, 8, 9 and 12, both donors were located on the same side of the candidate, so it is likely that the candidate's response will be a more favorable policy for the closest donor, and except for period 12 we observe overcontribution. In the remaining periods the candidate was located between the donors and was more likely to move towards the furthest donor thereby hurting the closest one. Not surprisingly whenever this happens we observe under-contribution.

Figure 5 shows individual donations in 3-donor treatments. For the sake of space we present only figures for the FA and PA conditions. We observe that the furthest donor was consistently over-contributing and the closest donor was consistently under-contributing. The difference between the FA and PA conditions is now less pronounced and we see several instances where the FA contribution was higher than the PA contribution. Some instances can be explained by the difference

in expectation. For example, in period 6 the closest donor could have more favorable expectations in the FA treatment than in PA. Indeed, in the FA treatment locations of the other two donors were not observed and it was unlikely that the candidate picks the policy that could hurt the closest donor. In the PA treatment on the other hand the politician (and the closest donor) could see that the other two donors are very centrist and potentially could choose a policy which would be too centrist from the closest donor's point of view. Other instances, such as the difference in contributions of the furthest donors in periods 2 and 4, are unlikely to be caused by differences in expectations. In general, as compared to 1- and 2-donor treatments potential difference in donors' expectation is less successful in explaining over- and under-contribution. While overcontribution by the middle donor in periods 2, 3, 4, 6, 8 and 11 as well under-contribution in period 7 could be explained by expectations of more (or less for period 7) favorable policy. However, under-contributions in periods 1, 5 and 9 are less likely to be caused by expectations of less favorable policy. A potential alternative explanation could be that donations are strategic substitutes, so that given overcontribution of the furthest donors it is optimal for other donors to contribute less.

5.3.2 Using the Best Response to the Observed Candidate's Policy Choice Function as the Benchmark

While we showed above that the static Nash predictions for the donors' contributions seem to be matched quite well in some situations, overall we believe that the assumption that donors expect that the human candidate will implement his ideal policy once elected is not realistic. Indeed our analysis in Section 5.2 demonstrates that the candidates systematically respond to the donations, though in different ways depending on the campaign finance system. Here we examine the donors' donations using the donors' best response to their perceived policy response function from the candidates, $y_1^{*S}(\mathbf{d};c_1)$ in the notation of Section 3.3, as the benchmark. We assume rational expectations and approximate the perceived policy choice function by the actual policy choice functions we estimated in Table 5. Using these estimated policy response functions $\widehat{y}_1^{*S}(\mathbf{d};c_1)$, we numerically calculate the equilibrium donation level in each treatment for each number of donors. We then compare these predictions with the amount that was actually donated. The results for 1-donor 3000 ECU maximum donatable amount treatments are presented in Figure 6.

We see that with this new assumption the fit is somewhat improved especially when the distance between the candidate and the donors takes intermediate values. Recall that under the assumption of non-deviating politicians it was optimal to donate 0 when the distance was 53 or larger. Now, in NA it is always optimal to donate a positive amount and in PA it is optimal until the distance becomes 75. To save space we do not show pictures for 2 and 3 donors.[42] In general, the difference in predicted amount of donations is less substantial in cases with multiple donors because the corner solution frequently ends up to be optimal regardless of whether the candidate is expected to move or not.

5.3.3 Regression Analysis

Finally, we focus on which variables impact the size of the donor's donation. The results of fixed-effect panel estimations are shown in Table 6. To make donations comparable across the 1000

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[42]The results for other treatments and multiple-donor cases are available upon request. The fits between this benchmark and the actual donations improved to some degree in all cases.
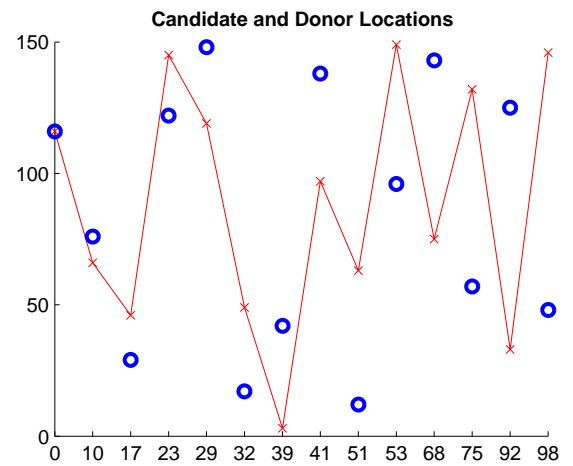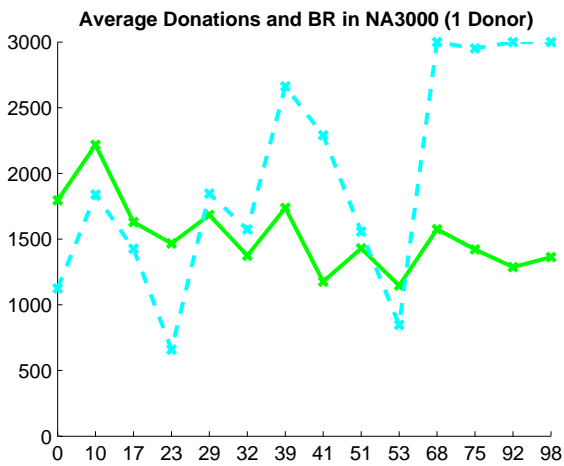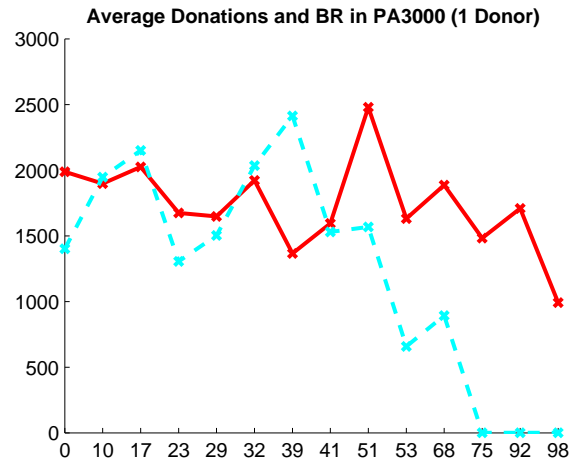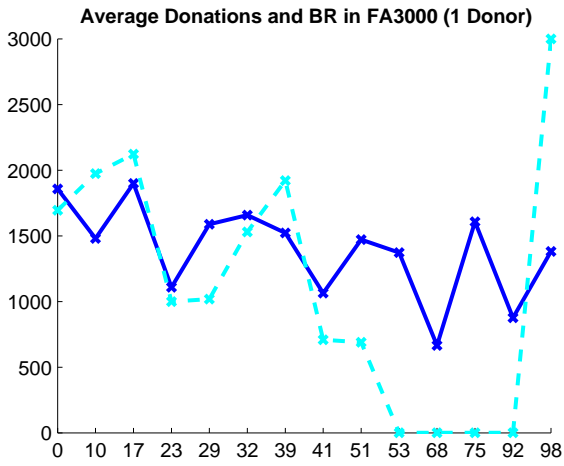
Figure 6: Optimal And Actual Donations Level When It Is Assumed That Politician's Response Is Given By Our Estimates From Table 5.

	FA		NA		PA	
	Coef	p-value	Coef	p-value	Coef	p-value
			Panel A: 1 Donor			
Distance	-0.253072	0.000	-0.33532	0.000	-0.30445	0.000
ρ_1	2.508924	0.931	-36.26717	0.260	-76.0356	0.003
$(c > l)_t$	9.362286	0.042	-0.97448	0.876	-1.05999	0.792
DidCWin_{t-1}	0.118714	0.980	-1.38048	0.761	-12.4846	0.002
r			51207.01	0.381		
Constant	54.29005	0.000	83.55501	0.000	120.7649	0.000
			Panel B: 2 Donors			
Distance	-0.187688	0.000	-0.15409	0.001	-0.18571	0.000
DistOpp	-0.006516	0.389	-0.06303	0.206	-0.0128	0.751
ρ_1	-26.1783	0.209	4.121696	0.917	-66.6349	0.020
$(c > l)_t$	2.26154	0.671	-9.34966	0.155	4.366631	0.240
DidCWin_{t-1}	1.059075	0.672	-0.029	0.993	-6.05022	0.049
r			-37173.8	0.682		
Constant	55.68616	0.000	59.42018	0.031	90.8746	0.000
			Panel C: 3 Donors			
DistMine	-0.136348	0.000	-0.31278	0.000	-0.28133	0.000
DistOpp	0.009176	0.688	0.02225	0.566	0.02321	0.403
DistOpp1	-0.037279	0.069	1.71E-02	0.672	0.016459	0.507
ρ_1	-34.951	0.145	-44.6837	0.422	-15.7999	0.592
$(c > l)_t$	-0.242409	0.942	-2.96024	0.652	6.041486	0.136
DidCWin_{t-1}	-2.446461	0.291	-1.21024	0.724	-10.1538	0.001
r			-92289.1	0.609		
DistC	0.025497	0.647	0.119897	0.125	0.190643	0.006
Constant	52.30902	0.000	85.74142	0.068	58.95858	0.000

Table 6: Donations.

NOTES: The fixed-effect panel estimation of donors' behavior. The dependent variable is donations made by a particular donor as a percentage of total donatable endowment. $DistOpp$ and $DistOpp1$ are the square distances between the donor's opponent(s) and the candidate; $DistC$ is the distance between the closest donor and the candidate; ρ_1 is the initial election probability. In FA and PA $r_j = 0.0001$ for all donors and in NA it differs across donors; $IsCgtD$ is the dummy variable that is equal to 1 if $C > D$. Finally, $WinnerL$ is equal to 1 if the candidate won the election last period.

and 3000 treatments the dependent variable is defined as the percentage of maximum donatable amount. Independent variables include: the donor's distance from the candidate's ideal policy; distances of other donors, "DistOpp" and "DistOpp1"; the distance of the closest donor to the candidate, "DistC" ; the initial probability of election; a dummy variable equal to one if the candidate's location is greater than the donor's location; a dummy variable equal to one if the candidate won the election last period; and, in the NA treatments, the impact of donations r.

Table 6 shows that the major determinant of donations was the distance between the candidate and the donor. It is significant in all 9 treatments and the sign is negative, that is donors donate more to the candidate who is closer. The locations of other donors had no significant impact.

Other notable effects are as follows. First, comparing the constant between treatments we see that for 1 and 2 donor cases the PA has the largest constant then followed by NA and the smallest one is for FA. In the 3-donor case the constants for NA is the highest and the constant for FA

and PA are approximately the same. In other words in 1 and 2-donor sessions, the PA donors are the most generous and the FA donors are the least generous. The same relationship is observed if we simply look at the averages. For example, the average donations in 1-donor FA3000 session was 1397 versus 1522 in NA3000 and 1735 in PA3000. The variable DidCWin_{t-1} is negative and significant in all PA treatments and is insignificant in all other treatments. When DidCWin_{t-1} is significant it means that the candidates who lost in the previous period receive larger donations this period. As we already established candidates are the most responsive in the PA treatment and, therefore, donors might be particularly sensitive if the elections are lost and donate more next round. The increase varies from 6% to 12% of the donatable endowment. Finally, the variable DistC is positive and significant in the PA treatment with 3 donors. This means that when the closest donor gets further away from the candidate donations increase. This is most likely due to the fact that having one donor close to the candidate other donors might expect that the candidate is more likely to ignore the others.

We summarize the main results in this section as follows:

Result 5: *Average donations are the lowest in FA treatments and the highest in PA treatments.*

Result 6: *Donors' actual donations seem to match the theoretical predictions well based on the donors' best response to the candidates' observed policy choice function.*

Result 7: *In all treatments donors donate less to candidates located further away.*

5.4   Welfare

While mitigating the influence of money in politics is the goal of many of the campaign finance reform proposals, we should recognize, as much of the theoretical research reviewed in Section 2 emphasize, campaign contributions can play potentially important roles in improving the electoral outcomes and increase social welfare. Thus in this section, we investigate the effect of campaign finance systems on the voters' and donors' welfare.

5.4.1   Voters' Welfare

To study the impact of different treatments on voter welfare, we calculate and compare the expected voter welfare under the alternative campaign finance systems, using as the benchmark the voter welfare when donations are prohibited. In calculating voter welfare, we assume that voters' preferences are similar to those assumed for the donors, as specified by (16), with the exception that voters do not make donations. We also assume limited liability for the donors. More specifically, suppose that the candidate, if elected, implements policy y_1 and his probability of election is $\hat{\rho}_1$, then the expected utility of a voter with an ideal policy location of μ_i is:

$$\hat{\rho}_1 \cdot \min\left\{9000 - (y_1 - \mu_i)^2, 0\right\} + (1 - \hat{\rho}_1) \cdot \min\left\{9000 - (225 - \mu_i)^2, 0\right\}. \tag{18}$$

In the benchmark when donations are prohibited, $\hat{\rho}_1 = \rho_1$ as determined by (12), and we assume that $y_1 = c_1$, that is the candidate will implement his optimal policy. When calculating the expected voter welfare under alternative campaign finance systems, we use the actual policy proposed by the human candidate and the relevant election probabilities: (13) for the FA and PA
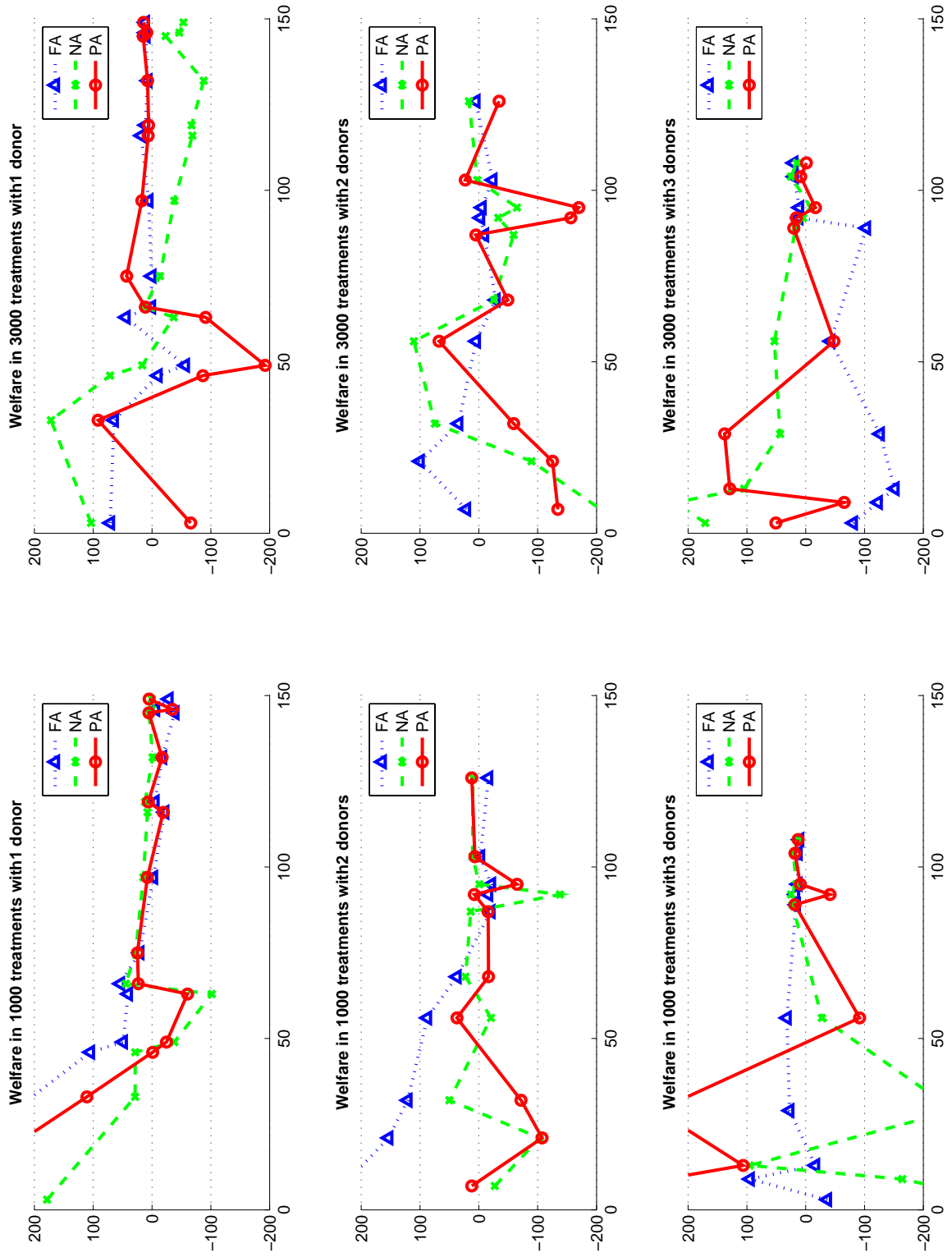
34

Figure 7: Average Voter Welfare Relative to the "No-Donation" under Alternative Campaign Finance Systems and Different Treatments. Notes: (1). The horizon axis denotes the human candidates' ideal policy location; (2). In these calculations, the donors' ideal locations are at their realized values; (3). Positive values of these curves indicate voter welfare gain and negative values indicate voter welfare loss, relative to the no-donation benchmark.

systems, and (15) for the NA system. Finally, we use the assumption that voters' ideal policy locations are uniformly distributed $[0, 300]$ for the aggregation of individual voters' utilities.

Intuitively, the introduction of donations may have two, possibly opposing, effects. One is that the probability of election is altered and the other is that the candidate may respond to these donations by implementing a policy other than his ideal policy. The effect of donations, without the candidate's deviation from his ideal policy in his policy choice, is straightforward. Donations to candidates located between $[0, 75]$ will cause a decrease in social welfare as they increase the probability that extreme candidates are elected; donations to candidates located between $[75, 150]$ cause an increase in social welfare as more centrist candidates now have a higher probability of being elected.[43] However, since candidates are free to choose a policy other than their ideal policy, donations to extreme candidate could be beneficial if they lead to more moderate policies.

In Figure 7 we present the difference between the average voter welfare under alternative campaign finance systems and the "no-donation" benchmark for each candidate position by treatment. For each period, voter welfare for each subject grouping (human candidate and donor(s)) is calculated and then averaged across the groupings in the same treatment. The benchmark welfare then is subtracted from these empirical averages.[44] Since the data series are constructed as the difference of empirical and theoretical welfare, observations above zero show that the particular empirical welfare measure is higher than the no-donation benchmark, while those below zero show that welfare is lower than the benchmark. The data points are ordered by candidate's location.

Overall, we find that when the candidate's position is extreme (i.e., farther away from the center of 150 in our experiment), voter welfare tends to be higher under the campaign finance systems in treatments with 1 and 2 donors. In these treatments, we see that PA tends to perform the worse, while FA tends to perform the best, with few exceptions. In the exceptional cases where voters' welfare under the campaign finance system is lower than the benchmark, we also find that the decrease is fairly low under the FA treatments. The FA system is particularly beneficial to the voters when donors are extreme. The results are noisier and more mixed in the 3-donor treatments. This is in part because there are fewer groupings of candidate and donors in 3-donor treatments. Another finding is that limiting the donatable amount at a lower level reduces the potentially harmful effect of donations. This is particularly noticeable if we compare one- and two- donor treatments with 3000 and 1000 donatable amounts. Finally, while NA treatments do filter out some of the influence of extreme donors there are many instances where the NA treatments lead to the lowest possible welfare.

Table 7 shows average voter welfare by treatment and number of donors.[45] We boldface the number that is larger than its counterpart in each treatment. In the 1-donor treatments, we find that the interaction between the candidate and donors improves voter welfare in all 1000 ECU treatments, and FA seems to perform better than NA and PA. In 3000 treatments, however, voter welfare is improved only under FA. In 2-donor treatments, voter welfare is only improved under FA; and in 3-donor treatments welfare is improved in four of the six treatments. One reason why the 2-donor setting is particularly detrimental for the welfare is that with two donors, it is fairly

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[43]This result is directly tied to the fact that the computer candidate's location is fixed at 225.

[44]Note that the scale of the figures omits some data points (this is particularly true in the NA treatments with three donors) so that changes in aggregate welfare for centrist positions can be more easily discerned.

[45]Relative to what were depicted in Figure 7, we averaged the voter welfare over the realization of the candidates' ideal locations in calculating the numbers reported in Table 7.

likely to have both donors being more extreme than the candidate thereby influencing more extreme policy. Adding the third donor, however, makes such realization of locations considerably less likely which improves the welfare.

	1 donor		2 donors		3 donors	
	Observed	Benchmark	Observed	Benchmark	Observed	Benchmark
FA1000	**3643**	3594	**3591**	3536	**3444**	3432
NA1000	**3608**	3594	3525	**3536**	3350	**3432**
PA1000	**3622**	3594	3507	**3536**	**3522**	3432
FA3000	**3607**	3594	**3547**	3536	3373	**3432**
NA3000	3590	**3594**	3514	**3536**	**3506**	3432
PA3000	3578	**3594**	3464	**3536**	**3457**	3432

Table 7: Average Voter Welfare and the No Donation Benchmark by Treatment.

To determine whether or not there is a statistical difference, total empirical welfare for each group in each treatment is calculated and compared to the benchmark welfare. For example, in the 1-donor FA3000 treatment there are twelve groups and fourteen elections. Each group's total welfare is summed over the fourteen elections and considered an observation. One-tailed Wilcoxon signed-ranks tests are then conducted for each of the fifteen treatments.[46] The 1-donor FA1000 and PA1000 treatments are the only ones where the empirical welfare is significantly greater than the benchmark. The Wilcoxon statistics are 0 and 12 respectively for these treatments, and both are significant at the 2.5% level. The 1-donor and 2-donor PA3000 treatments are the only ones where the benchmark welfare was significantly greater than the observed welfare. The Wilcoxon statistics are 13 and 1 respectively, and are significant at the 2.5% and 1% level. This suggests that voters are primarily harmed in those treatments in which (1) donations have the same impact across donors, (2) the identities of the donors are known, and (3) the number of donors is small enough that the candidate can respond favorably to large donations without (potentially) alienating the other donor.

5.4.2 Donors' welfare

Donor welfare can be calculated in a similar manner to voter welfare, only that the empirical measures of donor welfare must take into account the donations made. Thus, when calculating expected payoffs for donors, each donor's donation is subtracted from his endowment.

Table 8 shows average donor welfare by treatment. The table shows that donors benefit greatly from this campaign finance system, and the only instance in which the no-donation benchmark exceeds the observed donor welfare measure is in the 1-donor FA3000 treatment.

As with the analysis of voter welfare, each series of elections for each group within each treatment is considered a single observation. Total donor observed welfare is calculated and compared to the benchmark donor welfare. Results of the Wilcoxon signed-ranks test overwhelmingly favor the

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[46]Holding the information condition (FA, PA, and NA) constant, the 3-donor 1000 and 3000 treatments are the same as each donor can donate up to 1000. The observations from those treatments are combined so that there are fifteen, instead of eighteen, treatments.

	1 donor		2 donors		3 donors	
	Observed	Benchmark	Observed	Benchmark	Observed	Benchmark
FA1000	**3478**	3439	**3099**	2648	**3191**	2608
NA1000	**3598**	3439	**3010**	2648	**3124**	2608
PA1000	**3592**	3439	**3205**	2648	**3617**	2608
FA3000	3339	**3439**	2889	2648	**3120**	2608
NA3000	**3442**	3439	**3529**	2648	**3775**	2608
PA3000	**3526**	3439	**3550**	2648	**3372**	2608

Table 8: Average Donor Welfare and the No Donation Benchmark by Treatment.

observed welfare. [47]

Result 8: *Voters do not lose much or at all from the presence of campaign donations. They particularly benefit from campaign donations when the candidate is extreme. The worst setting for voter welfare is the PA treatment with 2 donors. Overall, the FA system seems to perform marginally better than the other systems, though the difference is not pronounced in our experiment. Donors generally are better off from the donations, but less so in FA than in NA and PA systems.*

6   Conclusion

Campaign finance reform is one of the most important domestic policy issues, yet important reform proposals are rarely studied empirically. In this paper, we compare alternative campaign finance systems in a laboratory setting and focus particularly on their effects on donations, election outcomes, political candidates' policy choices, and welfare. In our experiment, we consider three alternative campaign finance systems as characterized by different information structure about donors. The first is a full anonymity (FA) system in which neither the politicians nor the voters are informed about the donors' ideal policies or levels of donations, which we think corresponds in essence to the reform advocated by Ayres and Ackerman (2002). The second is a partial anonymity (PA) system in which only the politicians, but not the voters, are informed about the donors' ideal policies and donations, which we think corresponds closer to the current campaign finance system in the U.S. And the third is a no anonymity (NA) system in which both the politicians and the voters are informed about the donors' ideal policies and donations, which will correspond to what happens under a set of perfectly enforced campaign finance disclosure laws. In our experiments there are two politicians with one being computerized, and between one to three large donors, while the voters' choices are summarized by election probabilities that depend on the specifics of the campaign finance systems. Donors choose donations to the human candidate that may increase his chances of being elected.

We find that donors contribute less in the FA system than in the PA and NA systems, and candidates are less likely to deviate from their ideal policies under FA than under PA and NA

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[47]There are too few observations (four each) in the 2-donor FA1000 and NA1000 treatments to calculate statistical significance, but all groups in both treatments had higher observed welfare than benchmark welfare.

systems. We also find that the effect of donations on the candidate's policy deviations differ in FA from that of PA and NA; specifically, in the FA system larger donations lead to smaller deviations from the candidate's ideal policy, but in the NA and PA systems, larger donations lead to larger deviations. As a result the donations lead to a socially desirable centrist bias in the candidate's policy choices, i.e., donations are more likely to make extreme candidate move to the center than to make centrist candidate move to the right. This centrist bias is present more robustly in FA treatments. We also find that voters benefit from the donor's contributions overall when the candidates are extreme, though the effect is small.

These results provide supportive evidence for Ayres and Ackerman's (2002) campaign finance reform proposal. A fully anonymous campaign finance system seems to have the potential to reduce the influence of money in politics more effectively than the current partial anonymity system or the no anonymity system. It more robustly leads to the socially beneficial centrist bias from the candidates.

We should of course bear in mind that our findings are obtained in a laboratory setting, not from the field. Many important issues related to campaign finance and political competition are abstracted away in our study. For example, in our experiment we assumed that candidate's ideal policies are common knowledge to all donors and voters. This suppresses one of the roles of campaign expenditures, namely to inform voters about the candidate's policy platform. We also abstracted away from the critical voter turnout issue as we do not consider at all how voter turnout may be affected by whether or not donations are anonymous. Moreover, we fixed the policy position of the computer candidate and only included one human candidate in our experiment. Thus we are unable to study how political competition might affect the performance of different campaign finance systems. It is interesting and important to study how the alternative campaign finance systems will perform when more of these issues are incorporated and when these systems are possibly implemented in the field rather in the laboratory.

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A   Appendix: Experiment Instructions

What follows are instructions for the FA3000 treatment. Screenshots included at the end are in the order of donor's donation screen, pre-election screen where all donors and candidates see the donations and updated probability of winning (the example is a donor version of the screen), the candidate's policy choice screen, and the payoff screen (the example is the candidate version of the screen).

Welcome to a decision-making study!
Introduction

Thank you for participating in today's study in economic decision-making. These instructions describe the procedures of the study, so please read them carefully. If you have any questions while reading these instructions or at any time during the study, please raise your hand. *At this time I ask that you refrain from talking to any of the other participants.*

General Description

In this study all participants are assigned to one of two roles:

- a *candidate* who would like to be elected;

- a *donor* who may or may not provide financial support for the candidate's campaign.

A candidate, if elected, determines the policy. The policy is described by a number between 0 and 300. A policy of 0 corresponds to one side of the political spectrum and a policy of 300 corresponds to the other extreme of the spectrum. Candidates and donors have a most preferred policy that characterizes your preferences with regards to the implemented policy. The closer the implemented policy is to your most preferred policy the better off you are.

Donor Stage

At this moment I ask you to turn your attention to the monitor. During the study all of you will be assigned the role of either a candidate or a donor. If you are assigned a donor role you will see the screen similar to what you see now. You can see that there are two candidates — $C1$ and $C2$ — and that their most preferred policies are located at 75 and 225 respectively. You are a donor and your most preferred policy is located at 100. The candidate at 225, $C2$, will be played by a computer. This candidate always chooses policy 225 if elected. The other candidate, $C1$, will be played by a human.

Donors have funds, denominated in Experimental Currency Units (or ECUs), available for contribution. On the computer screen you see that you have 9000 ECUs, 3000 of which you can donate. Donations can be made only to the human candidate, $C1$. Donors need to decide how much money they want to contribute to $C1$'s campaign fund. Contributions to the candidate change the probability a candidate is elected as will be explained below.

Without any contributions the initial chance of election is determined by the human candidate's most preferred policy. Having a more extreme policy means a lower chance whereas having a more centrist policy means a higher chance. The initial chance of election will be calculated and displayed on the screen for you every period. You see on the screen that when $C1$ is at 75 his chance of being elected is exactly 50%. When $C1$'s more preferred policy is to the left of 75, his chance of being elected will be less than 50% and when it is to right of 75 it will be larger than 50%.

If the human candidate receives contributions from donors then her chance of being elected changes from the initial chance of election. Contributions increase the chance of election at the rate of 100 to 1. That is a contribution of 100 ECUs increases the chance of election by 1%, a contribution of 200 ECUs by 2%, and so on. The chance of election cannot be made higher than 80%. At this time I ask you to enter a donation

of 3000 and press the "*Donate*" button. You now see a new screen that shows the size of your donation and the new probability for $C1$. Because of your donations the new probability is higher and is equal to 80%. Press the "*Continue*" button.

Candidate Stage

After donors make their donations it is the candidate's turn to implement a decision. For technical reasons we ask candidates to decide on the policy before the actual outcome of elections. If you are assigned the role of candidate you will see the following screen. The screen shows your chance of election as well as the locations of donors and their contributions. You can enter any number between 0 and 300 as your implemented policy. Please submit number 75. This policy will determine everyone's payoff. Notice that the policy you implement has no impact on your chance of election. Your chance of election is only determined by the donations and the initial chance of election. In our example, the chance of election is 80% regardless of the implemented policy.

Profit Stage

The next four screens will show you the profit for $D1$ and $C1$ when $C1$ wins and when $C1$ does not win. In the actual study you will only see one screen that corresponds to your role and the election outcome. The current screen shows the donor's profit if $C1$ is elected. The profit is determined as follows. We take your initial endowment which is 9000, subtract the size of your donation, 3000 in our example, and subtract the loss from the chosen policy. The loss is just the square of the difference between the implemented policy and donor's most preferred policy. In our example it is equal to $(100 - 75)^2 = 625$. Clearly, the further the implemented policy is from a donor's most preferred policy the larger is the loss.

Formally, a donor's profit is calculated as

$$9000 - Donation - (ImplementedPolicy - DonorPreferredPolicy)^2.$$

Please press the "*Continue*" button. This screen shows the donor's profit if $C2$ is elected. The profit is calculated according to the same formula. Since the implemented policy of 225 is too far from 100 the profit is negative. Whenever profit is negative it will be counted as 0. Please press the "*Continue*" button.

The next screen shows $C1$'s profit is $C1$ is elected. Whenever $C1$ is elected he receives 6000. If the implemented policy differs from $C1$'s most preferred policy then $C1$ incurs a loss which is also a square of the difference. In our example $C1$ chose 75 and so the loss is 0. So the total profit is 6000. On the next screen we show $C1$'s payoff if he loses the election. $C1$'s profit is 0 in that case. Thus, the candidate's profit is 0 when not elected and

$$6000 - (ImplementedPolicy - CandidatePreferredPolicy)^2,$$

if elected. Press "*Continue*"

Two donors

Within the study a number of donors will be varied depending upon the phase. The second example depicts the case of two donors: $D1$ and $D2$. In this example you are $D1$. You see the location of the most preferred policies for $C1$ and $C2$ which are 60 and 225. You also see the most preferred policies of both donors. Yours is 100 and $D2$'s is 50. You see that the initial election chance is less than 50% because C1 is to the left of 75. You also see that when there are two donors you can donate only 1500 of your endowment. Please enter 1500 and the computer is programmed so that $D2$'s donations are 0. At the candidate's screen please enter policy 75. When $C1$ wins $D1$'s payoff is 6875. If $C1$ loses then $D1$'s payoff is negative and will be counted as zero. When $C1$ wins now $C1$'s payoff is not 6000 but $6000 - (75 - 60)^2 = 5775$ because his implemented policy differs from his preferred policy. Again, when $C1$ loses his payoff is zero. This completes our example. Notice that during the study you will either see the donor's screens (if you are a donor) or the candidate's screens but not both.

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Phase Description

The study consists of three phases, time permitted. In each phase participants will be divided into groups. In the first phase of the study there will be two people in each group: one candidate and one donor. In the second phase of the study there will be three participants in each group: two donors and one candidate. In the third phase of the study there will be four participants in each group: 3 donors and 1 candidate. *Within a phase your group assignment will not change. Groups are re-assigned in the beginning of every phase.* This means that you will have the same groupmate(s) during each phase of the study but your groupmates in different phases may be different.

Example: In the first phase person A is a candidate and is matched with person B who is a donor. During the entire first phase for person A there will be only one potential donor which is person B and person B can only contribute to candidate A. Furthermore, it is the policy implemented by candidate A, if elected, that will determine B's payoff. In the second phase the group assignment will be randomly re-done. For example, person A can become a donor and will be matched with person C who is the second donor and person D who is a candidate. The assignment will be re-done for the third phase as well.

Cash Payoffs

Your cash payoff will be determined as follows. At the end of the experiment we will randomly draw one of the three phases. Your cash earnings will be equal to the total profit that you earned during that phase with 6000 points being equal to 1 dollar. This is in addition to the $5 that you receive as a show-up fee. For example, if the phase with 2 donors is chosen and you earned 60000 points at that phase then your cash payoff will be: $60000/6000 + 5 = \$15$.