Learning in Campaigns:

A Policy Moderating Model of Individual Contributions

to House Candidates

by

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and

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Abstract

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We propose a policy moderating model of individual campaign contributions to House campaigns. Based on a model that implies moderating behavior by voters, we hypothesize that individuals use expectations about the Presidential election outcome when deciding whether to donate money to a House candidate. Using daily campaign contributions data drawn from the FEC Itemized Contributions files for 1984, we estimate a generalized linear model for count data with serially correlated errors. We expand on previous empirical applications of this type of model by comparing standard errors derived from a sandwich estimator to confidence intervals produced by a nonparametric bootstrap.

Introduction

Rational partisan models of electoral behavior propose that individuals incorporate into their decisions information about the expected outcome of the next election. Individuals use the electoral expectations to determine how to vote, including whether and how to split their tickets between the parties when choosing presidential and Congressional candidates (Alesina and Rosenthal 1995, Mebane 1999*b*). In rational partisan models intended to explain macroeconomic fluctuations, economic investors who try to predict post-election levels of inflation incorporate current electoral expectations into their valuations of inflation-sensitive assets (Cohen 1993, Alesina, Roubini and Cohen 1997). We propose that similar considerations figure in individuals' decisions whether to give money to candidates for U.S. House seats.

During presidential election years, the media coverage of primaries and polls provides significant amounts of information about the prospects and policies of the presidential candidates in both parties. As the primary season passes, one candidate in each party usually acquires sufficient delegates to ensure nomination by his party at the convention. During the primaries, the policy position attributed to each party is a mixture of the positions taken by all the candidates that have a positive chance of winning the nomination. As the primary contest closes, each party's policy position converges to the position of the winning candidate. Based on the function for policy-related losses introduced in Mebane (1999*b*), we derive mechanisms that may cause potential contributors to House campaigns to respond systematically to each party's position, changing their propensity to contribute as the positions change during the primary period. We also derive mechanisms that may tie House contributions to expectations about which party will win the presidential election. In short, we analyze the link between campaign contributions to House candidates and the expected presidential election outcome, and ask whether individual contributions are consistent with policy moderating behavior.

We focus on campaign contributions from individuals. Although contributions by Political Action Committees (PACs) have received the most attention from academics, journalists and politicians, contributions from individuals remain the largest total source of campaign funds for House candidates.[1] The data for the current analysis are the daily counts of contributions to House candidates during 1984.

In addition to distinguishing contributions by party, we also create separate series by type of candidate and by quality of the challenger.[2] We estimate these models separately in part because the mean levels of contributions are extremely heterogeneous—incumbents have traditionally higher fund-raising capacities than challengers, and open seat and high quality challengers fare better than low quality challengers. The separation also enables us to investigate which type of candidate contributions are most strongly affected by policy moderating calculations. In the current analysis we do not examine the dynamic relationships between different types of candidates. For instance, we do not examine relationships between contributions to challengers and contributions to incumbents. Ignoring such relationships is a weakness of the current treatment that we intend to remedy in future work.

At a purely empirical level, this study offers two main innovations over earlier studies. First, the daily frequency of the data enables a detailed analysis of contributions as they evolve within a campaign.[3] Second, we model the dynamics of the probability of a contribution using a generalized linear model for count data with serially correlated errors (Zeger 1988). We expand on previous empirical applications of this type of model by comparing the performance of the commonly used sandwich estimator confidence intervals with those produced by a nonparametric bootstrap.

[1] In the early 1980s, individuals contributed more than twice as much money as PACs. This gap has diminished, with a 5:4 ratio in 1992.

[2] Definition of quality is based solely on whether a challenger has previously held elected office. A challenger who has done so is deemed high quality. The quality dataset was collected by Gary Jacobson. See Jacobson (1990).

[3] One exceptional analysis, Mutz (1995), considers weekly contributions to presidential candidates within the 1988 primary season.

A Policy Moderating Model of Individual Contributions

We propose a policy moderating model of individual campaign contributions to House campaigns. Based on a model that implies moderating voting behavior (Mebane 1999*b*), we hypothesize that individuals use expectations about the Presidential election outcome when deciding whether to donate money to a House candidate. Moderation in the context of voting means an individual chooses a House candidate knowing that the post-election policy will be an intermediate combination of the policy position of the President and the position of the House. Individuals try to minimize the distance between the combined policy position and their own ideal points. For some voters this means voting a split ticket. For contributions, moderation means increasing the probability of donating money to a House candidate who would move the combined policy position closer to the contributor's ideal point. For some centrally located individuals, that means contributing to a candidate who would balance the policy position of the President. In this section, we first briefly discuss how our analysis relates to extant work on campaign contributions, highlighting our general assumptions and limitations. We then develop the theoretical foundation and hypotheses of the policy moderating model of campaign contributions.

We assume that each contribution to a candidate increases that candidate's share of the vote. So a rational contributor expects that a contribution to a Republican will increase the proportion of Republicans in Congress, and expects that a contribution to a Democrat will result in the opposite. This places us within the class of models that Morton and Cameron (1992) describe as position-induced (PI), but our approach provides some notable innovations. PI models generally "assume contributors take the outcome associated with each candidate as fixed while attempting to alter the probability of election of the candidate" (Morton and Cameron 1992, 87). In short, a contributor seeks to obtain policy outputs closer to her desired ideal point by affecting the probability of election of a type of representative, and thereby influencing the composition of the legislature. We add to this formulation the calculation that most policies are a compromise between the legislative and executive branches of government. Therefore, a desire to change the composition of the legislature is conditional upon the expected location and power of the President, in addition to expectations about the composition of the House.

For two key reasons our model of individual contributions does not include the main considerations addressed by the literature on service-induced (SI) contributions; in particular we ignore the idea of contributing in order to alter legislators' behavior and the problematic of enforcing commitments.[4] First, typical individual contributors differ in significant ways from typical PACs. The most obvious differences revolve around resources: individuals are bound by lower spending limits, and in general lack a professionalized staff to dispense and monitor contributions to a large number of candidates. Whatever service-inducing leverage PACs are able to exert, Keim and Zardkoohi (1988) point out that those groups with larger budgets and homogeneous interests (e.g., labor PACs) are able to exert more leverage than smaller, more factionalized interests (e.g., corporate PACs). Their results suggest that the even more numerous individual contributors, who have even more heterogeneous interests than corporate PACs and possess smaller contribution budgets, should have proportionality smaller leverage. Second, the SI literature does not in general consider the effects of contributions on the probability of victory of candidates, and as such is separate from the central concerns of this paper.[5] To the extent that individuals are giving to a clear winner in order to extract some service (Ben-Zion and Eytan 1974, 7(e)), the less they will be responsive to the policy moderating calculations that we will develop.

We also do not address the principal themes of the political behavior literature on the motivations of individual contributions to campaigns, which focuses primarily on the effects of bandwagons and horse-race coverage. For a recent review of the literature and an exemplary analysis of presidential primary contributions see Mutz (1995). The central concern of that

[4]See for example Baron (1989), Snyder (1990), Romer and Snyder (1994), and Austen-Smith (1995).

[5]Exceptions include Baron (1994) and Mebane (1999*a*)

literature is to understand the process in which "potential contributors are making a concerted effort to allocate their money more efficiently, either by not giving money to a primary candidate unless they know he or she has a chance of winning, or by not giving money to a candidate until they know he or she truly needs it to win" (Mutz 1995, 1019). Mutz's analysis considers the decision to contribute to a candidate in the Democratic primary contest as isolated from the outcomes expected in other elections, including House races and the competition in the Republican primaries. In contrast, our analysis is explicitly concerned with the motivation to contribute to House races, conditioned on expectations about both the expected policy position of the future President and the composition of the House as a whole. Our analysis is only marginally concerned with the campaign particulars of the individual candidates. From a practical perspective, there is unfortunately no available source of information which provides time series of poll data for each House campaign.

We begin the development of our model by noting a fundamental assumption of our theory: Democrat and Republican policy positions are separated. Without this assumption, no theory of moderation, whether it be for voting, bond trading, or contributing, makes sense. Empirical evidence does support that individuals at least perceive a separation of the parties (e.g., Poole and Rosenthal (1984)) and that Representatives consistently separate on roll call votes (e.g., Poole and Rosenthal (1997) and Heckman and Snyder (1997)).

Let θ_{Dt} and θ_{Rt} respectively denote the policy positions of the Democratic and Republican parties at time t. Both θ_{Dt} and θ_{Rt} take values on the unit interval: $\theta_{Dt} \in [0,1]$ and $\theta_{Rt} \in [0,1]$. The policy expected to result from each possible election outcome depends on the parties' positions and three other factors: the policy position expected to be supported in the House; the President's strength in comparison to the House; and which party's candidate is elected President. The expected position of the House is represented simply as a weighted average of the parties' positions, with each party's weight being the proportion of the two-party vote that is expected to be cast nationally for the party's House candidates. Using $\bar{H}_t$ to denote the proportion of the national vote expected to be Republican at time t, the position expected for the House at time t is $\bar{H}_t\theta_{Rt}+(1-\bar{H}_t)\theta_{Dt}$. The post-election policy expected given any particular value of $\bar{H}_t$ is then a weighted average of the expected position of the House and the expected position of the President's party. The weight of the President represents the President's strength in comparison to the House. For each value of $\bar{H}_t$ there are two expectations for post-election policy, depending on the President's party:

$$\tilde{\theta}_{Dt} = \alpha\theta_{Dt} + (1-\alpha)[\bar{H}_t\theta_{Rt} + (1-\bar{H}_t)\theta_{Dt}] \,, \qquad 0 \le \alpha \le 1$$
$$\tilde{\theta}_{Rt} = \alpha\theta_{Rt} + (1-\alpha)[\bar{H}_t\theta_{Rt} + (1-\bar{H}_t)\theta_{Dt}] \,, \qquad 0 \le \alpha \le 1 \,.$$

At time t, policy $\tilde{\theta}_{Dt}$ is expected to occur if a Democrat is President and policy $\tilde{\theta}_{Rt}$ is expected to occur if a Republican is President. The weight, α, represents the strength the President is expected to have. The value $\alpha = 1$ means that the President is expected to dictate policy so that the legislature would play no role, while $\alpha = 0$ means that the legislature is expected to determine policy with the President being irrelevant. The functional forms of $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ are essentially the same as the simplest policymaking formalism considered by Alesina and Rosenthal (1995, 47–48).

The preference each potential contributor has for each possible election outcome is measured by the loss the potential contributor expects given that outcome. The loss increases with the absolute discrepancy between the potential contributor's ideal point, denoted $\theta_i \in [0,1]$, and the policy expected given the election outcome. The policy-related losses expected at time t with, respectively, a Democratic and a Republican President are

$$\lambda_{Dit} = |\theta_i - \tilde{\theta}_{Dt}|$$
$$\lambda_{Rit} = |\theta_i - \tilde{\theta}_{Rt}| \,.$$

During the campaign, the potential contributor does not know for sure which party's candidate will be elected President. We assume that the potential contributor computes an expectation for the expected loss, by using the probability that each candidate will win in a standard expected-value formula. Let $\bar{P}_t$ denote the expectation at t for the probability that the Republican wins.

The potential contributor's expected loss is

$$\lambda_{it} = (1 - \bar{P}_t)|\theta_i - \tilde{\theta}_{Dt}| + \bar{P}_t|\theta_i - \tilde{\theta}_{Rt}| \ ,$$

Each potential contributor acts to minimize its expected loss. Every potential contributor believes that each contribution to a candidate increases the share of the votes that that candidate will receive, and therefore affects the proportion of the national vote going to Republicans. A contribution to a Republican candidate increases the expected proportion $\bar{H}_t$, while a contribution to a Democratic candidate decreases $\bar{H}_t$. Let $\lambda_{it:H_0}$ denote the value of λ_{it} when $\bar{H}_t = H_0$. Suppose that the effect on $\bar{H}_t$ from a contribution of size $x \geq 0$ to a Republican candidate is $q_R(x)$, with $q_R(0) = 0$, $q'_R(x) > 0$, $q''_R(x) < 0$, and that the effect on $\bar{H}_t$ from a contribution of size $x \geq 0$ to a Democratic candidate is $-q_D(x)$, with $q_D(0) = 0$, $q'_D(x) > 0$, $q''_D(x) < 0$. If the expected Republican share of the vote in the absence of the contribution is H_0, then the effect on i's loss of contributing x to a Republican is

$$w_{Rit}(x) = \lambda_{it:H_0+q_R(x)} - \lambda_{i:H_0}$$

and the effect of contributing x to a Democrat is

$$w_{Dit}(x) = \lambda_{it:H_0-q_D(x)} - \lambda_{i:H_0} \ .$$

The contribution to the Republican reduces i's loss if $w_{Rit}(x) < 0$, and the contribution to the Democrat reduces i's loss if $w_{Dit}(x) < 0$. Making a contribution of size x at time t imposes a direct cost on i of $k_{it}(x)$, with $k'_{it}(x) > 0$, $k''_{it}(x) > 0$. Each individual therefore chooses the contribution amount x that minimizes the total loss, which for a Republican candidate and a Democratic candidate are, respectively

$$C_{Rit}(x) = w_{Rit}(x) + k_{it}(x)$$

$$C_{Dit}(x) = w_{Dit}(x) + k_{it}(x) \ .$$

To find the conditions under which contributions occur, it is convenient to express the effects $w_{Rit}(x)$ and $w_{Dit}(x)$ in a different form. Note that the marginal effect of an increase in $\bar{H}_t$ on the expected loss λ_{it} is $\partial\lambda_{it}/\partial\bar{H}_t = w_{it}$, where

$$w_{it} = b(\theta_{Dt} - \theta_{Rt})[\bar{P}_t \,\mathrm{sgn}(\theta_i - \tilde{\theta}_{Rt}) + (1 - \bar{P}_t)\,\mathrm{sgn}(\theta_i - \tilde{\theta}_{Dt})] \ ,$$

writing $b = 1 - \alpha$ (so $b \geq 0$).[6] Using w_{it}, we may write the effect of contributing to a Republican as

$$\begin{aligned} w_{Rit}(x) &= \int_{H_0}^{H_0 + q_R(x)} w_{it} d\bar{H}_t \\ &= b(\theta_{Dt} - \theta_{Rt}) \int_{H_0}^{H_0 + q_R(x)} [\bar{P}_t \,\mathrm{sgn}(\theta_i - \tilde{\theta}_{Rt}) + (1 - \bar{P}_t)\,\mathrm{sgn}(\theta_i - \tilde{\theta}_{Dt})] d\bar{H}_t \end{aligned}$$

and the effect of contributing to a Democrat as

$$\begin{aligned} w_{Dit}(x) &= -\int_{H_0 - q_D(x)}^{H_0} w_{it} d\bar{H}_t \\ &= b(\theta_{Rt} - \theta_{Dt}) \int_{H_0 - q_D(x)}^{H_0} [\bar{P}_t \,\mathrm{sgn}(\theta_i - \tilde{\theta}_{Rt}) + (1 - \bar{P}_t)\,\mathrm{sgn}(\theta_i - \tilde{\theta}_{Dt})] d\bar{H}_t \ . \end{aligned}$$

We examine the case where $\theta_{Rt} > \theta_{Dt}$. In that case there are six types of potential contributors to a candidate of each party. Each individual's type depends on the individual's ideal point and the expected policies $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$. Each individual's type also depends on the magnitude x of the contemplated contribution, because the contribution affects $\bar{H}_t$ and therefore $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$. Using H_0 to denote the expected Republican share of the vote in the absence of the contribution, the conditions that define an individual's type in relation to a contribution to a Republican, denoted $T_{Rit}(x)$, are given in Table 1. Figure 1 depicts an example of the regions of the unit interval that correspond to the $T_{Rit}(x)$ types for particular values of θ_{Dt}, θ_{Rt} and $q_R(x)$. In Figure 1, $\tilde{\theta}_{Dt:H_0}$ denotes the value of $\tilde{\theta}_{Dt}$ when $\bar{H}_t = H_0$; $\tilde{\theta}_{Rt:H_0}$ is defined likewise. The conditions that define the individual's type in relation to a contribution to a Democrat, denoted $T_{Dit}(x)$, are given in Table 2. Figure 2 depicts the regions of the unit interval that correspond to the $T_{Dit}(x)$ types, for the same values of θ_{Dt}, θ_{Rt} and $q_D(x) = q_R(x)$ that were used in Figure 1.

[6] $\mathrm{sgn}(x) = -1$ if $x < 0$, $\mathrm{sgn}(x) = 0$ if $x = 0$, and $\mathrm{sgn}(x) = 1$ if $x > 0$.

Table 1: Individual Types for a Contribution to a Republican House Candidate

$$
T_{Rit}(x) = \begin{cases}
\text{leftist,} & \text{if } \theta_i < \tilde{\theta}_{Dt}, \theta_i < \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 \leq \bar{H}_t \leq H_0 + q_R(x) \\
\text{center-to-leftist,} & \text{if there exists } q_i^*,\ 0 \leq q_i^* \leq q_R(x) \text{, such that} \\
 & \theta_i > \tilde{\theta}_{Dt} \text{ for } H_0 \leq \bar{H}_t < H_0 + q_i^* \text{ and} \\
 & \theta_i < \tilde{\theta}_{Dt} \text{ for } H_0 + q_i^* < \bar{H}_t \leq H_0 + q_R(x), \\
 & \text{and } \theta_i < \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 \leq \bar{H}_t \leq H_0 + q_R(x) \\
\text{centrist,} & \text{if } \tilde{\theta}_{Dt} < \theta_i < \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 \leq \bar{H}_t \leq H_0 + q_R(x) \\
\text{right-to-centrist,} & \text{if there exists } q_i^*,\ 0 \leq q_i^* \leq q_R(x) \text{, such that} \\
 & \theta_i > \tilde{\theta}_{Rt} \text{ for } H_0 \leq \bar{H}_t < H_0 + q_i^* \text{ and} \\
 & \theta_i < \tilde{\theta}_{Rt} \text{ for } H_0 + q_i^* < \bar{H}_t \leq H_0 + q_R(x), \\
 & \text{and } \theta_i > \tilde{\theta}_{Dt} \text{ for all } \bar{H}_t,\ H_0 \leq \bar{H}_t \leq H_0 + q_R(x) \\
\text{rightist,} & \text{if } \theta_i > \tilde{\theta}_{Dt}, \theta_i > \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 \leq \bar{H}_t \leq H_0 + q_R(x) \\
\text{right-to-leftist,} & \text{if there exist } q_{Di}^* \text{ and } q_{Ri}^*,\ 0 \leq q_{Ri}^* < q_{Di}^* \leq q_R(x) \text{, such that} \\
 & \theta_i > \tilde{\theta}_{Dt} \text{ for } H_0 \leq \bar{H}_t < H_0 + q_{Di}^* \text{ and} \\
 & \theta_i < \tilde{\theta}_{Dt} \text{ for } H_0 + q_{Di}^* < \bar{H}_t \leq H_0 + q_R(x) \text{, and} \\
 & \theta_i > \tilde{\theta}_{Rt} \text{ for } H_0 \leq \bar{H}_t < H_0 + q_{Ri}^* \text{ and} \\
 & \theta_i < \tilde{\theta}_{Rt} \text{ for } H_0 + q_{Ri}^* < \bar{H}_t \leq H_0 + q_R(x)\ .
\end{cases}
$$

Table 2: Individual Types for a Contribution to a Democrat House Candidate

$$
T_{Dit}(x) = \begin{cases}
\text{leftist,} & \text{if } \theta_i < \tilde{\theta}_{Dt}, \theta_i < \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 - q_D(x) \leq \bar{H}_t \leq H_0 \\
\text{left-to-centrist,} & \text{if there exists } q_i^*,\ 0 \leq q_i^* \leq q_D(x), \text{ such that} \\
 & \theta_i < \tilde{\theta}_{Dt} \text{ for } H_0 - q_i^* < \bar{H}_t \leq H_0 \text{ and} \\
 & \theta_i > \tilde{\theta}_{Dt} \text{ for } H_0 - q_D(x) \leq \bar{H}_t < H_0 - q_i^*, \\
 & \text{and } \theta_i < \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 - q_D(x) \leq \bar{H}_t \leq H_0 \\
\text{centrist,} & \text{if } \tilde{\theta}_{Dt} < \theta_i < \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 - q_D(x) \leq \bar{H}_t \leq H_0 \\
\text{center-to-rightist,} & \text{if there exists } q_i^*,\ 0 \leq q_i^* \leq q_D(x), \text{ such that} \\
 & \theta_i < \tilde{\theta}_{Rt} \text{ for } H_0 - q_i^* < \bar{H}_t \leq H_0 \text{ and} \\
 & \theta_i > \tilde{\theta}_{Rt} \text{ for } H_0 - q_D(x) \leq \bar{H}_t < H_0 - q_i^*, \\
 & \text{and } \theta_i > \tilde{\theta}_{Dt} \text{ for all } \bar{H}_t,\ H_0 - q_D(x) \leq \bar{H}_t \leq H_0 \\
\text{rightist,} & \text{if } \theta_i > \tilde{\theta}_{Dt}, \theta_i > \tilde{\theta}_{Rt} \text{ for all } \bar{H}_t,\ H_0 - q_D(x) \leq \bar{H}_t \leq H_0 \\
\text{left-to-rightist,} & \text{if there exist } q_{Di}^* \text{ and } q_{Ri}^*,\ 0 \leq q_{Di}^* < q_{Ri}^* \leq q_D(x), \text{ such that} \\
 & \theta_i < \tilde{\theta}_{Dt} \text{ for } H_0 - q_{Di}^* < \bar{H}_t \leq H_0 \text{ and} \\
 & \theta_i > \tilde{\theta}_{Dt} \text{ for } H_0 - q_D(x) \leq \bar{H}_t < H_0 - q_{Di}^*, \text{ and} \\
 & \theta_i < \tilde{\theta}_{Rt} \text{ for } H_0 - q_{Ri}^* < \bar{H}_t \leq H_0 \text{ and} \\
 & \theta_i > \tilde{\theta}_{Rt} \text{ for } H_0 - q_D(x) \leq \bar{H}_t < H_0 - q_{Ri}^* .
\end{cases}
$$

Figure 1: Example of Types for a Contribution to a Republican House Candidate

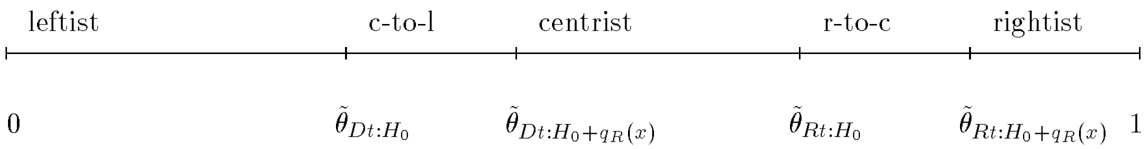
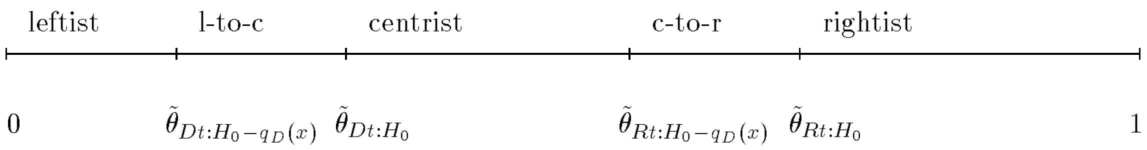


Figure 2: Example of Types for a Contribution to a Democrat House Candidate



The cases of a right-to-leftist or of a left-to-rightist occur only when the distance between $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ is very small or the effects $q_R(x)$ and $q_D(x)$ of a contribution on $\bar{H}_t$ are very large. As those conditions occur rarely, if at all (certainly not in the data analyzed in this paper), we henceforth ignore the right-to-leftist and left-to-rightist cases.

Broken down by type, the effect on i's loss of a contribution of size $x \geq 0$ to a Republican is

$$w_{Rit}(x) = \begin{cases} b(\theta_{Rt} - \theta_{Dt})q_R(x), & \text{(leftist)} \\ b(\theta_{Rt} - \theta_{Dt})[q_R(x) - 2(1 - \bar{P}_t)q_i^*], & \text{(center-to-leftist)} \\ b(\theta_{Dt} - \theta_{Rt})(1 - 2\bar{P}_t)q_R(x), & \text{(centrist)} \\ b(\theta_{Dt} - \theta_{Rt})[(1 - 2\bar{P}_t)q_R(x) + 2\bar{P}_t q_i^*], & \text{(right-to-centrist)} \\ b(\theta_{Dt} - \theta_{Rt})q_R(x), & \text{(rightist)}\ . \end{cases}$$

The effect of a contribution to a Democrat is

$$w_{Dit}(x) = \begin{cases} b(\theta_{Dt} - \theta_{Rt})q_D(x), & \text{(leftist)} \\ b(\theta_{Dt} - \theta_{Rt})[(2\bar{P}_t - 1)q_D(x) + 2(1 - \bar{P}_t)q_i^*], & \text{(left-to-centrist)} \\ b(\theta_{Dt} - \theta_{Rt})(2\bar{P}_t - 1)q_D(x), & \text{(centrist)} \\ b(\theta_{Rt} - \theta_{Dt})[q_D(x) - 2\bar{P}_t q_i^*], & \text{(center-to-rightist)} \\ b(\theta_{Rt} - \theta_{Dt})q_D(x), & \text{(rightist)} . \end{cases}$$

The contribution to a Republican that minimizes individual i's loss is the value $x = x^* \geq 0$ that solves the first-order condition $C'_{Rit}(x) = 0$, where

$$C'_{Rit}(x) = \begin{cases} b(\theta_{Rt} - \theta_{Dt})q'_R(x) + k'_{it}(x), & \text{(leftist)} \\ b(\theta_{Rt} - \theta_{Dt})q'_R(x) + k'_{it}(x), & \text{(center-to-leftist)} \\ b(\theta_{Dt} - \theta_{Rt})(1 - 2\bar{P}_t)q'_R(x) + k'_{it}(x), & \text{(centrist)} \\ b(\theta_{Dt} - \theta_{Rt})(1 - 2\bar{P}_t)q'_R(x) + k'_{it}(x), & \text{(right-to-centrist)} \\ b(\theta_{Dt} - \theta_{Rt})q'_R(x) + k'_{it}(x), & \text{(rightist)} . \end{cases}$$

For a rightist, $C'_{Rit}(x) = 0$ has a positive solution x^* if $b(\theta_{Dt} - \theta_{Rt})q'_R(0) + k'_{it}(0) < 0$. If such a solution exists it is a minimum, since $b(\theta_{Dt} - \theta_{Rt})q''_R(x) + k''_{it}(x) > 0$. If $\bar{P}_t < \frac{1}{2}$, a minimizing, positive solution may exist for a centrist or a right-to-centrist. Unless $\bar{P}_t = 0$, a positive contribution from a centrist or right-to-centrist is always smaller than the contribution from a rightist who has the same marginal cost function $k'_{it}(x)$. If $\bar{P}_t > \frac{1}{2}$, neither a centrist nor a right-to-centrist contributes because then $b(\theta_{Dt} - \theta_{Rt})(1 - 2\bar{P}_t)q'_R(x) + k'_{it}(x) > 0$ so that $C'_{Rit}(x) = 0$ has no solution. Neither a leftist nor a center-to-leftist ever contributes to a Republican, because $b(\theta_{Rt} - \theta_{Dt})q'_R(x) + k'_{it}(x) > 0$ so that $C'_{Rit}(x) = 0$ has no solution.

The contribution to a Democrat that minimizes individual i's loss is the value $x = x^* \geq 0$

that solves $C'_{Dit}(x) = 0$, where

$$C'_{Dit}(x) = \begin{cases} b(\theta_{Dt} - \theta_{Rt})q'_D(x) + k'_{it}(x), & \text{(leftist)} \\ b(\theta_{Dt} - \theta_{Rt})(2\bar{P}_t - 1)q'_D(x) + k'_{it}(x), & \text{(left-to-centrist)} \\ b(\theta_{Dt} - \theta_{Rt})(2\bar{P}_t - 1)q'_D(x) + k'_{it}(x), & \text{(centrist)} \\ b(\theta_{Rt} - \theta_{Dt})q'_D(x) + k'_{it}(x), & \text{(center-to-rightist)} \\ b(\theta_{Rt} - \theta_{Dt})q'_D(x) + k'_{it}(x), & \text{(rightist)} . \end{cases}$$

There is a minimizing, positive solution for a leftist if $b(\theta_{Dt} - \theta_{Rt})q'_D(0) + k'_{it}(0) < 0$. Such a solution may exist for a centrist or a left-to-centrist if $\bar{P}_t > \frac{1}{2}$. Neither a rightist nor a center-to-rightist ever contributes to a Democrat, because $b(\theta_{Rt} - \theta_{Dt})q'_D(x) + k'_{it}(x) > 0$.

Changes in $(\theta_{Dt} - \theta_{Rt})$ may affect the number of contributions candidates receive. If $q'_R(x)$ and $k'_{it}(x)$ remain unchanged, then an increase in $(\theta_{Dt} - \theta_{Rt})$—due to either an increase in θ_{Dt} or a decrease in θ_{Rt}—directly reduces the size of each contribution x^*, whether to a Republican or to a Democrat. An increase in $(\theta_{Dt} - \theta_{Rt})$ may also directly reduce the number of contributions by eliminating for some individuals the existence of positive solutions to the first-order conditions.

A change in $(\theta_{Dt} - \theta_{Rt})$ may also be associated with a change in the number of contributions, not because of the difference $(\theta_{Dt} - \theta_{Rt})$ per se, but because of the separate consequences of changes in θ_{Dt} or θ_{Rt}. The mechanism is that changes in θ_{Dt} or θ_{Rt} may change some potential contributors' types. Suppose either θ_{Dt} or θ_{Rt} increases while individuals' ideal points remain fixed. Then both $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ increase, so that some centrists become leftists and some rightists become centrists. If $\bar{P}_t < \frac{1}{2}$, the increase in the number of leftists increases the number of contributions to Democrats: if $\bar{P}_t < \frac{1}{2}$ then necessarily $b(\theta_{Dt} - \theta_{Rt})(2\bar{P}_t - 1)q'_D(x) + k'_{it}(x) > 0$, but for the same values of b, θ_{Dt}, θ_{Rt}, $q'_D(x)$ and $k'_{it}(x)$ it may be that $b(\theta_{Dt} - \theta_{Rt})q'_D(x) + k'_{it}(x) \leq 0$. If $\bar{P}_t < \frac{1}{2}$, the increase in the number of leftists reduces the number of contributions to Republicans; the reduction in contributions depends on the value of $\bar{P}_t$, being greatest when a Democrat is certain to be elected President, i.e., when $\bar{P}_t = 0$. If $\bar{P}_t < \frac{1}{2}$, the conversion of

Table 3: Changes in Types and Contributions Due to Changes in Expected Policies

Condition	How Types Change	$\bar{P}_t$	Change in Number of Contributions Democratic	Republican
$\tilde{\theta}_{Dt}$ increases	more leftists, fewer centrists	$\bar{P}_t < \frac{1}{2}$	more	fewer (fewest if $\bar{P}_t = 0$)
		$\bar{P}_t > \frac{1}{2}$	more (no change if $\bar{P}_t = 1$)	no change
$\tilde{\theta}_{Rt}$ increases	fewer rightists, more centrists	$\bar{P}_t < \frac{1}{2}$	no change	fewer (no change if $\bar{P}_t = 0$)
		$\bar{P}_t > \frac{1}{2}$	more (most if $\bar{P}_t = 1$)	fewer

some rightists to centrists does not change the number of contributions to Democrats: rightists never contribute to Democrats, but with $b(\theta_{Dt} - \theta_{Rt})(2\bar{P}_t - 1)q'_D(x) + k'_{it}(x) > 0$ neither do centrists. If $\bar{P}_t < \frac{1}{2}$, the conversion of rightists to centrists reduces somewhat the number of contributions to Republicans, with the magnitude of the reduction depending on the value of $\bar{P}_t$; the reduction is smallest—no reduction at all—when a Democrat is certain to be elected President, i.e., when $\bar{P}_t = 0$. Table 3 summarizes the preceding pattern of changes in the numbers of contributors when $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ increase with $\bar{P}_t < \frac{1}{2}$. Table 3 also summarizes the pattern of changes, derived analogously, when $\bar{P} > \frac{1}{2}$. The changes go in the opposite directions when $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ decrease, which occurs whenever either θ_{Dt} or θ_{Rt} decreases with individuals' ideal points remaining fixed.

Changes in $\bar{P}_t$ may also affect the number of contributions. If $\bar{P}_t$ increases from $\bar{P}_t < \frac{1}{2}$ to $\bar{P}_t > \frac{1}{2}$, centrists cease contributing to Republicans and begin contributing to Democrats. A change in $\bar{P}_t$ may also affect the number of contributions by altering some potential contributors' marginal costs. For instance, if the Republican presidential candidate is very likely to win—if $\bar{P}_t$ is much greater than $\frac{1}{2}$—then for rightists $k'_{it}(x)$ may be smaller than in situations where the presidential race is close. $k'_{it}(x)$ would be smaller if rightists think that, with $\bar{P}_t$ being large, there is less need to contribute to the presidential election effort (perhaps via "soft money" contributions to national or state party committees), and so reallocate their personal political budgets to allow themselves to give more to congressional candidates. Or, to the extent that rightists strongly identify with the Republican party, a high value of $\bar{P}_t$ may make them more susceptible to partisan appeals to give the President a Congress that will pass the Republican party program—or the frequency and strength of such appeals may increase as $\bar{P}_t$ gets large. Analogous considerations may apply to leftists and contributions to Democrats when the Democratic presidential candidate is very likely to win.

A change in $\bar{P}_t$ that directly increases contributions to one party then indirectly increases contributions to the other party. Suppose $\bar{P}_t$ increases in a way that causes contributions to Republican candidates to increase. The contributions increase the candidates' vote shares: $\bar{H}_t$ increases. This is a kind of presidential coattail effect. When $\bar{H}_t$ increases, both $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ increase, assuming that θ_{Dt} and θ_{Rt} remain unchanged. The increase in $\tilde{\theta}_{Dt}$ changes some centrists into leftists, while the increase in $\tilde{\theta}_{Rt}$ changes some rightists into centrists. The increase in the number of leftists and centrists produces an increase in contributions to Democrats. $\bar{H}_t$ consequently decreases, but meanwhile the increase in $\bar{P}_t$, having first boosted contributions to Republicans, has also boosted contributions to Democrats.

Such a mechanism of reactivity operates generally. Anything that increases contributions to candidates of one party causes the share of the votes for those candidates to increase, thus causing $\bar{H}_t$ to change in the direction favorable to that party. But the change in $\bar{H}_t$ causes $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ to change such that some individuals change from types that may contribute to candidates of the party that originally gained, into types that contribute only to candidates of the other party. Any factor that increases contributions to one party therefore ends up increasing contributions to both parties.

The reactivity mechanism means that contributions from individuals have a dynamic structure. The dynamic does not, strictly speaking, have contributions to one party's candidates varying directly in response to contributions to the other party's candidates. Rather, contributions to either party vary in response to the expected policies $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$. The expected policies change as the expected vote share $\bar{H}_t$ changes, and $\bar{H}_t$ varies with contributions. To trace the partial effects of an exogenous shock accurately through the implied system of relationships would require not only a correct specification for the system but probably data disaggregated to the level of individual candidates. If the dynamics are not correctly specified, effects estimated in a system will be net of all the reactive oscillations, and probably there will be spurious serial dependence. Including the initial shock variable in the specification may eliminate the evidence of serial dependence.

Statistical Model

In the present analysis we focus on the probability of individuals to contribute to House election campaigns, and therefore study the dynamics of the counts of contributions. Zeger (1988) proposed a model for time series of counts, applying the generalized linear model (GLM) idea of basing specifications on the first two moments of the data (McCullagh and Nelder 1989). We refer to this model as the GLM/AR (Generalized Linear Model with Autoregressive Residuals) model. While the standard Poisson GLM assumes independent observations, Zeger's parameter-driven method allows observations to be correlated by a latent process.[7]

In the case of campaign contributions, one contribution does not in general directly cause another. Contributions are autocorrelated because there are unobserved events that are serially correlated. Examples include the varieties of candidate momentum (Bartels 1988) and the cumulative effect of advertising campaigns. As we noted above, spurious serial correlation may also be the product of misspecifying the reactive dynamics of contributions. As Campbell (1994) argues tautologically, "if we could measure these [explanatory] factors precisely, and put them in the model, there should be no residual autocorrelation and we would have fewer problems of inference." (193)

To model serial correlation, Zeger proposes a covariance stationary latent process, $\epsilon =$

[7] Alternatively, Zeger and Qaquish (1988) offer a observation-driven autoregressive generalized linear model.

$(\epsilon_1, \ldots, \epsilon_T)^\top$,

$$\begin{aligned} E(\epsilon_t) &= 1 \\ \operatorname{cov}(\epsilon_t, \epsilon_{t+\tau}) &= \sigma^2 \rho_\epsilon(\tau) \end{aligned} \tag{1}$$

Conditional on this process, $y = (y_1, \ldots, y_T)$ is a sequence of independent counts with moments,

$$\begin{aligned} u_t &= E(y_t \mid \epsilon_t) = \exp(\eta_t)\epsilon_t \\ w_t &= \operatorname{var}(y_t \mid \epsilon_t) = u_t \end{aligned} \tag{2}$$

where η_t is the intensity parameter. In our empirical analysis we will allow the intensity to be a function of explanatory variables, $\eta_t = x_t^\top \beta$. The marginal moments of y_t are by iterated expectations,

$$\begin{aligned} \mu_t &= E(y_t) = \exp(\eta_t) \\ v_t &= \operatorname{var}(y_t) = \mu_t + \sigma^2 \mu_t^2 \\ \rho_y(t, \tau) = \operatorname{corr}(y_t, y_{t+\tau}) &= \frac{\rho_\epsilon(\tau)}{[\{1 + (\sigma^2 \mu_t)^{-1}\}\{1 + (\sigma^2 \mu_{t+\tau})^{-1}\}]^{\frac{1}{2}}} \end{aligned} \tag{3}$$

In contrast to the independent Poisson GLM, the off-diagonal elements of the covariance matrix are no longer necessarily zero.

The parameter estimates, $\hat{\beta}_R$, are defined as the solution to the estimating equation,

$$\frac{\partial \mu^\top}{\partial \beta} V^{-1}(y - \mu) = 0 \tag{4}$$

where $V = \operatorname{var}(y)$. Since y is a non-stationary series, we approximate V with a "working" covariance matrix, $\hat{V}_R \approx D^{1/2} R(\alpha) D^{1/2}$, where $R(\alpha)$ is the autocorrelation matrix for a stationary autoregressive process (Zeger 1988, 624). We estimate this matrix using the autocorrelation parameters $\hat{\rho}$ for an AR(p) process, estimated for pre-specified order p from the series, $(y-\mu)v^{-1/2}$, which is stationary. Taking the inverse we obtain $\hat{V}_R^{-1} = D^{-1/2} L^\top L D^{-1/2}$, where $D = \operatorname{diag}(v)$ and $L^\top L$ is the inverse of the correlation matrix of the AR(p) process, employing the Prais-Winsten transformation (Prais and Winsten 1954) to gain an unconditional estimate of the working covariance matrix. L is thus the filter that removes the serial correlation between observations, assuming there is an AR(p) process.

We compute $\hat{\beta}_R$ iteratively, using least squares at each iteration. Let $\hat{\beta}_R^{(j)}$ denote the estimate from iteration j. Using $\hat{\beta}_R^{(j)}$ to compute $\hat{\mu}$, $\hat{\sigma}^2$, $\hat{\rho}$ and hence $\hat{D} = \mathrm{diag}(\hat{v})$ and $\hat{L}$, compute $A = \mathrm{diag}(\hat{\mu})$, $C = \hat{L}\hat{D}^{-1/2}AX$, $Z = \left(\partial\hat{\mu}^\top \middle/ \partial\hat{\beta}_R^{(j)}\right)\hat{\beta}_R^{(j)} + y - \hat{\mu}$ and then

$$\hat{\beta}_R^{(j+1)} = \left(C^\top C\right)^{-1} C^\top \left(\hat{L}\hat{D}^{-1/2}Z\right) . \tag{5}$$

A variety of Monte Carlo studies have been performed on the GLM/AR estimator, in particular Zeger (1988) and Barron (1992). Zeger finds that there are efficiency gains from using GLM/AR over a Quasi-GLM with a quadratic negative-binomial dispersion, under the hypothesis of serially correlated latent errors. Barron performs a broader analysis, considering a variety of data generating processes. With independent Poisson data, GLM/AR (he calls it GQL) performs almost identically to both the Quasi-GLM model and the maximum-likelihood negative binomial model. Using the GLM/AR model there is some loss in efficiency in estimating the dispersion parameter σ^2. Under the assumption of serially correlated errors in the Poisson process, slope estimates $\hat{\beta}$ have much lower variance in GLM/AR, although dispersion parameter again has higher variance. In sum, there seems not to be any particular penalty to using GLM/AR in the absence of serial correlation in the errors, and there can be very large gains if such a process is present.

Zeger suggests the use of a sandwich estimator for the covariance matrix of $\hat{\beta}_R$, since one uses a "working" covariance matrix in the estimation procedure instead of the true covariance matrix. In addition we consider a bootstrap method for estimating confidence intervals. For GLM/AR, we adapt a nonparametric bootstrap method commonly used with serially correlated data (Efron and Tibshirani 1993, 94–102). Using the converged $\hat{\beta}_R$ parameter estimates, we calculate the Pearson residuals, $\hat{r} = (y - \hat{\mu})\hat{D}^{-1/2}$, then filter them using $\hat{L}$ to produce independent and identically distributed innovations. We then resample with replacement from these innovations 1000 times. For each resample of innovations, we reconstruct the AR(p) process, add back in the variance v, recombine with the μ so as to create a new count series, and finally reestimate the parameters. We then use the percentile method to calculate 95% confidence intervals for each parameter.[8]

Data and Detailed Model Specification

The campaign contributions data are drawn from the Federal Election Commission (FEC) Itemized Contributions files for 1984.[9] Our present analysis focuses on the counts of contributions rather than the amounts contributed. Figures 3, 4 and 5 plot the values of the counts of daily contributions, with day 1 being January 11th and day 300 being the day prior to the general election, which was held on November 5th.

—Figures 3, 4 and 5 about here—

We use counts instead of amounts for both substantive and technical reasons. Substantively, we are interested in estimating the probability of a contribution—any contribution, which exceeds the minimum reporting requirement—as a measure of mobilization within the context of a theory of rational partisan contributing. Making a financial contribution has been shown to be the form of political participation most affected by level of individual wealth, (Verba, Schlozman and Brady 1995) and to use dollar amounts in this case would further overemphasize the impact of higher income contributors—those who are able to contribute the maximum amounts to a campaign. Technically, using dollar amounts leads to a variety of additional estimation problems. Relying on a measure which is related to the ability to contribute large amounts of money is not only substantively less interesting, but adds further heterogeneity and thus unaccounted for overdispersion to our measures of interest. Moreover, employing amounts as

[8]Code written in Splus for performing the estimation of the GLM/AR model and bootstraps is available from the authors.

[9]We obtained the raw data files from the FEC by anonymous ftp from ftp.fec.gov:/FEC/. In combination with the Committee Master files and Candidate Master files, we extracted for each election cycle all new individual contributions for candidates competing in the upcoming election. This includes any candidate in current cycle who has raised or spent $5,000 toward the current election and any individual who appears on a ballot or who has registered with the FEC but has not yet raised $5,000.

our dependent variable would add censoring problems, since FEC rules impose a maximum amount of \$1,000 on individual contributions per campaign cycle.[10] We are thus able to obtain a clearer picture of contribution dynamics using counts instead of amounts.

In terms of our empirical results, however, none depend on our use of counts. The same overall patterns of contributions are clearly represented in both counts and amounts; for example see Figure 6, which compares the counts and amounts series for high quality Democratic challengers.[11]

—Figure 6 about here—

We define separate series for each party, and then for five types of candidates: candidates running in districts with an open seat; high quality challengers; low quality challengers; incumbents running against high quality challengers; and incumbents running against low quality challengers. Because Jacobson's data indicate the quality value only of the general election challenger, our classification of some challengers as high quality is actually an approximation. Some challengers who did not survive to the general election may have been high quality candidates according to the criterion of having held elected office previously. If any challenger in a district is designated a high quality challenger in Jacobson's data, we treat the contributions to all the challengers in that district as contributions to high quality challengers. If no challenger in the district is high quality, then all contributions to challengers there are treated as contributions to low quality challengers.

The linear function was constructed for each series as follows,

$$\eta_t = \beta_0 + \beta_1 \,\mathrm{Saturday}_t + \beta_2 \,\mathrm{Sunday}_t + \beta_3 \,\mathrm{Primaries}_t + \beta_4(\theta_{Dt} - \theta_{Rt}) + \beta_5 \bar{P}_t \ . \tag{6}$$

[10]There are two campaign cycles, primary and general election, for a maximum combined contribution of \$2,000 for individuals.

[11]Estimating the GLM/AR model using amounts rather than counts produces results differing only trivially from those reported in Tables 3 and 4. Estimates for σ^2 are larger (typically 50 percent larger) and estimates for β_0 are much more positive (the difference between β_0 for amounts and β_0 for counts averages about 5).

Saturday_t and Sunday_t are dummy variables included to take into account the low frequency of contributions being reported as received on weekend days. The pattern of low counts on Saturday and Sunday is visually obvious in Figures 3, 4 and 5. We assume that the reduction of contribution counts on weekends reflect weekend reductions in mail delivery and campaign office staffing that have nothing to do with potential contributors' interests in policy positions and expected election outcomes. Omitting the Saturday_t and Sunday_t variables would, however, introduce a substantial component of serial dependence in the disturbance.[12]

Primaries_t is the number of congressional seats that had a contested primary within the past week. The variable counts only primaries that had candidates of each type running against one or more opponents.[13] This variable captures the impact of resolving uncertainty over which candidate will compete in the general election for each party. Once a candidate has won the primary, individuals may be more likely to contribute to her campaign. In terms of the policy-moderating model, we might say that $q'(x)$ increases for that candidate. Plots of the values of Primaries_t for candidates in open seat districts and for high quality challengers are in Figures 7 and 8. Of particular note is the activity around day 150 of the high quality Democratic challenger series—the series hits a high four times the magnitude of the next largest value. Such a relative extreme is unique to this series, and possibly accounts for the uniquely strong effect Primaries_t has in this particular series.

—Figures 7 and 8 about here—

$(\theta_{Dt} - \theta_{Rt})$ is the difference in the expected policy location of the two major parties. Each policy location is mapped onto the $[0, 1]$ interval, with 0 being most liberal position and 1 being the most conservative. θ_{Dt} is the weighted sum of the locations of each of the Democratic party

[12]Including dummy variables for the other days of the week shows no statistically significant differences among them.

[13]We collated the dates of all contested House primaries during 1984 from Scammon and McGillivray (1985). We joined that data set with Jacobson's challenger quality data to construct separate Primaries_t series for each type of candidate.

primary candidates, the weights being each candidate's expected probability of nomination. Both the candidate positions and the candidates's probabilities of winning are derived from data taken from the American National Election Study (ANES) 1984 Continuous Monitoring Study (Miller and the National Election Studies 1985). The Continuous Monitoring Study performed daily interviews of random cross-sections of individuals from 11 January 1984, through 31 December 1984. θ_{Rt} is the policy location of President Ronald Reagan, the de facto Republican candidate throughout the 1984 primary season; we treat θ_{Rt} as constant throughout the entire year. We measure $\bar{P}_t$ as the average subjective probability of Reagan winning the general election ($\bar{P}_t$). The policy position and expected probability of winning data for Reagan are also derived from the Continuous Monitoring Study. Plots of our measures of $(\theta_{Dt} - \theta_{Rt})$ and of $\bar{P}_t$ are shown in Figure 9. Details regarding their construction are described in the Appendix.

The key predictions from the policy moderating model concern the effects of $(\theta_{Dt} - \theta_{Rt})$ and $\bar{P}_t$. The predictions are not unambiguous, because they depend on the distributions of ideal points among those who have marginal cost function values $k'_{it}(x)$ sufficiently small that their contribution behavior is sensitive to variations in $C'_{Rit}(x)$ and $C'_{Dit}(x)$. To obtain relatively clear predictions, we assume that for most individual contributors the decision to contribute is not a close call—for rightists who contribute, for instance, $b(\theta_{Dt} - \theta_{Rt})q'_R(0) + k'_{it}(0)$ is much less than zero—so that the decision whether to contribute is primarily determined by the contributor's type. Such an assumption seems plausible in light of the high percentage of contributions—about 40 percent—that equal the maximum amount allowed by law.

If the principal cause of changes in decisions whether to contribute is changes in potential contributor's types, then the policy moderating model predicts that during 1984 the effect of $(\theta_{Dt} - \theta_{Rt})$ on the number of contributions should be positive: the model predicts $\beta_4 > 0$. Consider first that because θ_{Rt} is constant, any change in $(\theta_{Dt} - \theta_{Rt})$ is entirely due to change in θ_{Dt}. So if $(\theta_{Dt} - \theta_{Rt})$ increases, both $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ are increasing. Next observe that throughout the period covered by our data, $\bar{P}_t > \frac{1}{2}$ (see Figure 9). Table 3 shows that if $\bar{P}_t > \frac{1}{2}$, the number of contributions to Democrats should increase as $\tilde{\theta}_{Dt}$ and $\tilde{\theta}_{Rt}$ increase, while the number of contributions to Republicans should decrease. There is reason to believe that the effect on contributions to Democrats should be by far the larger effect. The bulk of individual contributions to Democrats may be expected not to come from those furthest on the left, if only because those furthest on the left tend to be among the poorest Americans, and so cannot afford to contribute (Verba, Schlozman and Brady 1995). In terms of the policy moderating model, such people have high marginal cost function values. Movements from centrist to leftist or from rightist to centrist may therefore affect a high proportion of potentially Democratic contributions. A high proportion of rightists, on the other hand, are wealthy enough to make contributions, and have ideal point values high enough that the increases in $\tilde{\theta}_{Rt}$ that occurred during 1984 were not sufficient to turn them into centrists. For those rightists whose contributing behavior is affected by changes in $\tilde{\theta}_{Rt}$, the consequences of the reactivity mechanism may outweigh the direct effect of a change in $(\theta_{Dt} - \theta_{Rt})$.

With $\bar{P}_t > \frac{1}{2}$ throughout the time period of our data, the possible effects of $\bar{P}_t$ on $k'_{it}(x)$ that we discussed previously lead us to predict that the effect of $\bar{P}_t$ on the number of contributions should be positive: the model predicts $\beta_5 > 0$. The prediction follows immediately for contributions to Republicans, and indirectly through the reactivity mechanism for Democrats.[14]

Estimation and Results

We report estimates of the GLM/AR model assuming a residual first-order autoregressive (AR(1)) process. Tables 4 and 5 present the estimates for eight of the series of counts (estimates for low quality challengers are omitted). Columns labeled $\hat{\beta}$ and SE report the point estimates and standard errors from the GLM/AR model. The columns labeled CI present the upper and lower limits of the percentile-method bootstrap 95% confidence intervals. Comparing the bootstrap confidence intervals and the normal theory equivalent based on the sandwich

[14] It is also possible that some leftists, giving up on the Democratic presidential campaign with $\bar{P}_t$ being so high, reallocate their budget for political contributions to House candidates. Such behavior would give an immediate prediction of $\beta_5 > 0$ for Democrats.

estimator standard errors ($\hat{\beta} \pm 2$ SE), we note that the bootstrap intervals are generally bigger than sandwich-based intervals; i.e., the sandwich estimator understates the width of the confidence interval.[15] In this particular sample the sandwich intervals and bootstrap intervals agree with respect to inference based on tests of $\hat{\beta}_j = 0$.[16]

—Tables 4 and 5 about here—

The parameter estimates match the predictions derived from the policy moderating model, for all but one of the eight types of candidates. The effect of the difference in party policy positions ($\theta_{Dt} - \theta_{Rt}$) is positive for all types except Democrats running for an open seat; for that series (see Table 4(D)), the point estimate β_4 is positive but not statistically distinguishable from zero. The effect of the probability that the Republican candidate wins the presidential election ($\bar{P}_t$) is positive for all eight types of candidates.

From the perspective of possible reactivity and spurious serial correlation, it is noteworthy that the residual autoregression parameter estimate (ρ_ϵ in Tables 4 and 5) is zero for three of the four Republican types but is zero for only one of the four Democratic types. This may suggest that the primary source of reactivity is a dynamic initiated on the Republican side by changes in $\bar{P}_t$. Further there may be a special kind of reactivity that affects candidates in open seat races: among Republican candidates, ρ_ϵ is positive only for open seat races; and among Democrats, the effect of ($\theta_{Dt} - \theta_{Rt}$) is not statistically significant only for open seat races. The extra reactivity in open seat races, which the current GLM/AR specification ignores, seems to be inducing spurious serial correlation in the estimates for Republicans and attenuating the estimated effect of policy differences between the parties for Democrats.

Of only incidental interest are the other parameter results. Not surprisingly, the weekend dummies indicate significantly lower contributions dated on Saturdays and Sundays. The number of recently concluded contested House primaries (Primaries$_t$) does not in general have a

[15] For one series, high quality Democrat challengers, the bootstrap CIs are narrower.

[16] The one exception is β_4 (difference in locations) in the Open seat Democrat series, where the bootstrap CI is sufficiently wide to include 0.

significant impact on the level of House contributions, except for a positive effect on high quality Democratic challengers and a negative effect on their incumbent Republican opponents.

In Table 6, we present results from an alternative estimation technique, a Negative Binomial Generalized Linear Model (GLM/NB). The GLM/NB assumes independent observations but allows for over-dispersion using the same quadratic dispersion term, $\text{var}(y_t) = \mu_t + \mu_t^2\sigma_p^2$, that is derived by Zeger from serially correlated errors. Thus, the GLM/NB is essentially the same model as GLM/AR, but with $\rho_\epsilon = 0$ and therefore all zero off-diagonals in the covariance matrix, V_R. The columns $\hat{\beta}$ and SE report the point estimates and standard errors.[17] The CI columns present intervals based on the normal theory, ($\hat{\beta} \pm 2\times$SE).

—Table 6 about here—

Comparisons of confidence interval widths between GLM/AR bootstrap and GLM/NB are mixed. Table 6 illustrates a variety of comparisons. The bootstrap CI are larger than the GLM/NB estimates for Democratic incumbents facing a high quality challenger (A), and smaller for Republicans incumbents facing high quality challengers (B). In one case, Republican incumbents facing low quality challenges (C), inferences drawn from the two models differ: β_5 is not significant in the GLM/NB model while $\bar{P}_t$ is significant according to GLM/AR. There does not appear to be any particular pattern to the differences between GLM/AR and GLM/NB.

This study highlights an aspect of statistical inference—confidence interval estimation—heretofore underemphasized in studies of the various estimators for count data. In their comparisons between GLM/AR and GLM/NB, both Zeger and Barron focused on the performance of point estimates. While the current results do not reveal dramatic differences between the sandwich-based and bootstrap CI estimates, it remains to compare the techniques and explore their small sample behavior systematically. The consequences of using a model such as GLM/NB that ignores serial correlation also call for further systematic study.

[17] We employ the Splus library 'negbin' to estimate the GLM/NB. To be most comparable with the estimation technique used in GLM/AR, we use the method of moments estimator, theta.mm, to calculate our dispersion parameter $\sigma^2 = 1/\theta$. Negbin was written by Bill Venables and is available via Statlib.

Remarks

Our analysis suggests that the financial fortunes of House candidates are significantly linked to the contest for the Presidency. More detailed and disaggregated analysis will be necessary to confirm what appears to be evidence of contributions—and reactive contributions—changing as predicted by the policy moderating theory.

To this end, although it is useful to understand the aggregate dynamics of different types of candidates, we have available individual candidate data. Considerable information about the characteristics of the races were omitted from the current study. Future research will focus on a longitudinal model of individual districts (Liang and Zeger 1986).

Appendix. Candidate Probabilities and Policy Locations

We use the 1984 National Election Study Continuous Monitoring Sample (ANES/CMS) liberal-conservative placement questions to measure to the relative spatial locations of the candidates, Reagan, Glenn, Mondale, Jackson and Hart.[18] The seven-point scale for each question was rescaled onto the [0,1] interval using an approximation based on the empirical cumulative distribution of survey responses. For the present analysis, we do not allow the locations of the candidates to vary with time, and therefore use averages over the entire survey period. The average locations for each of the candidates thus calculated were: Reagan 0.63, Glenn 0.50, Mondale 0.36, Jackson 0.24, Kennedy 0.24, Hart 0.41.

We measure the daily probabilities using data again from the ANES/CMS. For the democratic candidates, we use questions regarding the probability of receiving the party nomination[19] and for Reagan we use the general election probability question.[20] We rescale the measures

[18](V6017, V6021, V0625, V0629, V0633) Kennedy was not measured. We assume that he is approximately the same location as Jackson.

[19](V0311, V0312, V0313, V0314, V0315, V0316) "Now let's talk about who is likely to win the DEMOCRATIC NOMINATION FOR PRESIDENT. We will be using a scale which runs from 0 to 100, where 0 represents NO chance for the nomination, 50 represents AN EVEN CHANCE, and 100 represents CERTAIN victory."

[20](V1001) Two versions were used by the ANES. Up until the Republican convention when Reagan was

onto a [0,1] interval, and smooth the weighted daily responses using a local regression (loess) method, with the number of parameters selected by ANOVA tests.[21] Finally, for the Democrat nomination probabilities, we normalize each candidate's measure such that the sum of all of their probabilities is one. Note that once the Democratic nominating convention occurs, the ANES/CMS no longer asks about the probability of victory of individual Democratic primary candidates, for obvious reasons. Therefore after July 19, the probability of Mondale being nominated is set to one.

What does it mean to use a loess curve to estimate daily probabilities? In particular, how should one think about their forward-looking character? The expected value of a point at time t from the local regression is estimated based on information before and after t—so Reagan's probability, for example, actually includes information about the future values of the Reagan support. We argue that the prospective aspect of the probability measure is appropriate for our use.

Any version of a two-step flow kind of argument leads to the idea that the beliefs about "chances" that members of the general public have in mind lag the beliefs that likely contributors have. That would imply that future values of Reagan's chances include information that contributors have today. This is plausible since contributors tend to be more engaged in politics and better informed by newsletters and polls.

formally nominated, they asked: "Now we'd like you to tell us about some of the candidates' chances of winning the PRESIDENCY in 1984. As before, we will use a scale that goes from 0 to 100 where 0 represents NO chance of winning the Presidency 50 represents an even chance, and 100 represents certain victory. First, what if Ronald Reagan is nominated by the Republicans? What chance does he have of winning the 1984 Presidential election?" and subsequently "As you know, Ronald Reagan has been nominated by the Republican party. What chance do you think he has of winning the 1984 Presidential election?"

[21]Test results for the selection of smoothing parameterization can be obtained from the authors.

References

Alesina, Alberto and Howard Rosenthal. 1995. *Partisan Politics, Divided Government, and the Economy.* Cambridge: Cambridge University Press.

Alesina, Alberto, Nouriel Roubini and Gerald D. Cohen. 1997. *Political Cycles and the Macroeconomy.* Cambridge: MIT Press.

Austen-Smith, David. 1995. "Campaign Contributions and Access." *American Political Science Review* 89(3):566–81.

Baron, David P. 1989. "Service-Induced Campaign Contributions and the Electoral Equilibrium." *Quarterly Journal of Economics* 104:45–72.

Baron, David P. 1994. "Electoral Competition with Informed and Uninformed Voters." *American Political Science Review* 88(1):33.

Barron, David N. 1992. "The Analysis of Count Data: Overdispersion and Autocorrelation." *Sociological Methodology* 22:179–220.

Bartels, Larry M. 1988. *Presidential Primaries and the Dynamics of Public Choice.* Princeton: Princeton University Press.

Ben-Zion, Uri and Zeev Eytan. 1974. "On Money, Votes, and Policy in A Democratic Society." *Public Choice* XVII:1–10.

Campbell, M. J. 1994. "Time Series Regression for Counts: An Investigation Into the Relationship Between Sudden Infant Death Syndrome and Environmental Temperature." *Journal of the Royal Statistical Society, A* 157:191–208.

Cohen, Gerald D. 1993. Pre- and Post-electoral Macroeconomic Fluctuations. PhD thesis Harvard University.

Efron, Bradley and Robert J. Tibshirani. 1993. *An Introduction to the Bootstrap.* New York: Chapman Hall.

Heckman, James J. and James M. Snyder. 1997. "Linear Probability Models of the Demand for Attributes with an Empirical Application to Estimating the Preferences of Legislators." *RAND Journal of Economics* 28:S142–89.

Jacobson, Garcy C. 1990. *The Electoral Origins of Divided Government: Competition in the U.S. House Elections 1946–1988.* Boulder, Co.: Westview Press.

Keim, Gerald and Asghar Zardkoohi. 1988. "Looking for Leverage in PAC Markets: Corporate and Labor Contributions Considered." *Public Choice* 58:21–34.

Liang, Kung-Yee and Scott L. Zeger. 1986. "Longitudinal Data Analysis Using Generalized Linear Models." *Biometrika* 73:13–22.

McCullagh, Peter and John A. Nelder. 1989. *Generalized Linear Models.* Second ed. London: Chapman Hall.

Mebane, Walter R. Jr. 1999*a*. Congressional Campaign Contributions, District Service and Electoral Outcomes in the United States: Statistical Tests of a Formal Game Model with Nonlinear Dynamics. In *Political Complexity: Nonlinear Models of Politics*, ed. Diana Richards. Ann Arbor: University of Michigan Press.

Mebane, Walter R. Jr. 1999*b*. "Coordination, Moderation and Institutional Balancing in American Presidential and House Elections: Presidential Election Years." (manuscript, Cornell University).

Miller, Warren E. and the National Election Study. 1985. "American National Election Study, 1984: Continuous Monitoring Survey." [computer file] Ann Arbor, MI: Center for Political Studies, University of Michigan [original producer]. ICPSR ed. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [producer and distributor].

Morton, Rebecca and Charles Cameron. 1992. "Elections and the Theory of Campaign Contributions: A Survey and Critical Analysis." *Economics and Politics* 4(1):79–108.

Mutz, Diana C. 1995. "Effect of Horse-Race Coverage on Campaign Coffers: Strategic Contributing in Presidential Primaries." *Journal of Politics* 57(4):1015–42.

Poole, Keith and Howard Rosenthal. 1997. *Congress: A Political-Economic History of Roll Call Voting.* New York: Oxford University Press.

Poole, Keith T. and Howard Rosenthal. 1984. "U.S. Presidential Elections 1968–1980: A Spatial Analysis." *American Journal of Political Science* 28(2):282–312.

Prais, S. J. and C. B. Winsten. 1954. "Trend Estimators and Serial Correlation." Cowles Commission Discussion Paper No. 373.

Romer, Thomas and James M. Snyder. 1994. "An Emprical Investigation of the Dynamics of PAC Contributions." *American Journal of Political Science* 38(3):745–69.

Scammon, Richard M. and Alice V. McGillivray, eds. 1985. *America Votes 16: A Handbook of Contemporary American Election Statistics, 1984.* Washington, D.C.: Congressional Quarterly.

Snyder, James M. 1990. "Campaign Contributions as Investments: The U.S. House of Representatives, 1980–1986." *Journal of Political Economy* 98(6):1195–1227.

Verba, Sidney, Kay Lehman Schlozman and Henry E. Brady. 1995. *Voice and Equality: Civic Voluntarism in American Politics.* Cambridge: Harvard University Press.

Zeger, Scott L. 1988. "A Regression-Model For Time-Series Of Counts." *Biometrika* 74(4):621–29.

Zeger, Scott L. and B. Qaquish. 1988. "Markov Regression Models for Time Series; A Quasi-likelihood Approach." *Biometrics* 44:1019–31.

Table 4: Democrat GLM/AR Estimates and Bootstrap Confidence Intervals

	$\hat{\beta}$	SE	CI
A. High Quality Challengers:			
β_0: Constant	-1.667	2.876	(-7.706, 3.533)
β_1: Saturday	-1.862	0.241	(-2.357, -1.450)
β_2: Sunday	-2.386	0.268	(-2.974, -1.939)
β_3: Primaries	0.127	0.059	(0.003, 0.228)
β_4: $\theta_D - \theta_R$	11.553	5.756	(0.562, 22.004)
β_5: $\bar{P}$	8.996	3.022	(3.204, 14.893)
σ^2	1.337		(0.633, 1.738)
ρ_ϵ	0.100		(0.000, 0.205)
B. Incumbents facing High Quality Republican Challenge:			
β_0: Constant	2.742	1.776	(-1.877, 7.525)
β_1: Saturday	-1.242	0.125	(-1.567, -0.966)
β_2: Sunday	-1.838	0.146	(-2.224, -1.542)
β_3: Primaries	-0.034	0.040	(-0.154, 0.054)
β_4: $\theta_D - \theta_R$	22.537	3.620	(13.081, 32.789)
β_5: $\bar{P}$	8.028	1.868	(3.158, 12.757)
σ^2	0.321		(0.328, 0.844)
ρ_ϵ	0.325		(0.211, 0.419)
C. Incumbents facing Low Quality Republican Challenge:			
β_0: Constant	1.351	1.187	(-1.511, 4.429)
β_1: Saturday	-1.321	0.104	(-1.576, -1.091)
β_2: Sunday	-2.416	0.129	(-2.727, -2.121)
β_3: Primaries	-0.011	0.007	(-0.027, 0.006)
β_4: $\theta_D - \theta_R$	15.177	2.403	(9.047, 20.981)
β_5: $\bar{P}$	8.300	1.250	(5.214, 11.320)
σ^2	0.270		(0.272, 0.654)
ρ_ϵ	0.000		(-0.122, 0.102)
D. Open Seat Candidates:			
β_0: Constant	0.384	1.306	(-2.719, 3.612)
β_1: Saturday	-1.246	0.111	(-1.518, -0.984)
β_2: Sunday	-1.860	0.129	(-2.204, -1.562)
β_3: Primaries	-0.029	0.034	(-0.119, 0.056)
β_4: $\theta_D - \theta_R$	6.419	2.657	(-0.155, 13.125)
β_5: $\bar{P}$	5.473	1.371	(1.972, 9.010)
σ^2	0.245		(0.229, 0.663)
ρ_ϵ	0.116		(0.000, 0.214)

Table 5: Republican GLM/AR Estimates and Bootstrap Confidence Intervals

	$\hat{\beta}$	SE	CI
A. High Quality Challengers:			
β_0: Constant	-1.395	1.463	(-4.761, 2.004)
β_1: Saturday	-1.780	0.147	(-2.144, -1.469)
β_2: Sunday	-2.580	0.189	(-3.107, -2.155)
β_3: Primaries	-0.075	0.045	(-0.190, 0.029)
β_4: $\theta_D - \theta_R$	20.686	2.928	(13.776, 27.416)
β_5: $\bar{P}$	12.691	1.527	(9.194, 16.160)
σ^2	0.317		(0.271, 0.780)
ρ_ϵ	0.000		(-0.125, 0.109)
B. Incumbents facing High Quality Democratic Challenge:			
β_0: Constant	2.812	1.829	(-1.508, 7.186)
β_1: Saturday	-2.656	0.245	(-3.356, -2.166)
β_2: Sunday	-3.528	0.349	(-4.782, -2.923)
β_3: Primaries	-0.405	0.190	(-0.862, -0.001)
β_4: $\theta_D - \theta_R$	16.016	3.771	(7.631, 24.548)
β_5: $\bar{P}$	4.937	1.916	(0.237, 9.534)
σ^2	0.506		(0.454, 1.221)
ρ_ϵ	0.000		(-0.106, 0.108)
C. Incumbents facing Low Quality Democratic Challenge:			
β_0: Constant	5.048	1.197	(2.247, 7.962)
β_1: Saturday	-1.395	0.109	(-1.671, -1.148)
β_2: Sunday	-2.273	0.134	(-2.603, -1.980)
β_3: Primaries	-0.014	0.007	(-0.031, 0.001)
β_4: $\theta_D - \theta_R$	16.684	2.452	(10.587, 22.938)
β_5: $\bar{P}$	3.733	1.264	(0.638, 6.758)
σ^2	0.268		(0.292, 0.547)
ρ_ϵ	0.000		(-0.122, 0.103)
D. Open Seat Candidates:			
β_0: Constant	2.950	1.165	(0.177, 5.626)
β_1: Saturday	-1.460	0.107	(-1.700, -1.233)
β_2: Sunday	-2.025	0.127	(-2.363, -1.760)
β_3: Primaries	-0.035	0.036	(-0.124, 0.045)
β_4: $\theta_D - \theta_R$	17.041	2.403	(11.797, 22.781)
β_5: $\bar{P}$	6.137	1.204	(3.399, 8.940)
σ^2	0.178		(0.174, 0.346)
ρ_ϵ	0.110		(0.000, 0.203)

Table 6: Negative Binomial Estimates and Normal Theory Confidence Intervals

A. Democrat Incumbents facing High Quality Democratic Challenges:

	$\hat{\beta}$	SE	CI
β_0: Constant	2.548	1.789	(−1.031, 6.126)
β_1: Saturday	−1.166	0.155	(−1.476, −0.857)
β_2: Sunday	−1.734	0.167	(−2.067, −1.400)
β_3: Primaries	−0.053	0.056	(−0.165, 0.059)
β_4: $\theta_D - \theta_R$	21.574	3.623	(14.329, 28.820)
β_5: $\bar{P}$	7.902	1.899	(4.104, 11.700)
σ^2	1.160		

B. Republican Incumbents facing High Quality Republican Challenge:

β_0: Constant	1.329	2.843	(−4.357, 7.015)
β_1: Saturday	−2.717	0.272	(−3.260, −2.173)
β_2: Sunday	−3.736	0.352	(−4.440, −3.033)
β_3: Primaries	−0.041	0.063	(−0.167, 0.085)
β_4: $\theta_D - \theta_R$	18.245	5.735	(6.775, 29.715)
β_5: $\bar{P}$	7.694	2.995	(1.704, 13.683)
σ^2	0.385		

C. Republican Incumbents facing Low Quality Republican Challenge:

β_0: Constant	5.504	1.528	(2.448, 8.559)
β_1: Saturday	−1.386	0.133	(−1.652, −1.120)
β_2: Sunday	−2.265	0.149	(−2.563, −1.966)
β_3: Primaries	−0.014	0.014	(−0.041, 0.013)
β_4: $\theta_D - \theta_R$	16.425	3.135	(10.156, 22.694)
β_5: $\bar{P}$	3.038	1.613	(−0.188, 6.264)
σ^2	1.541		

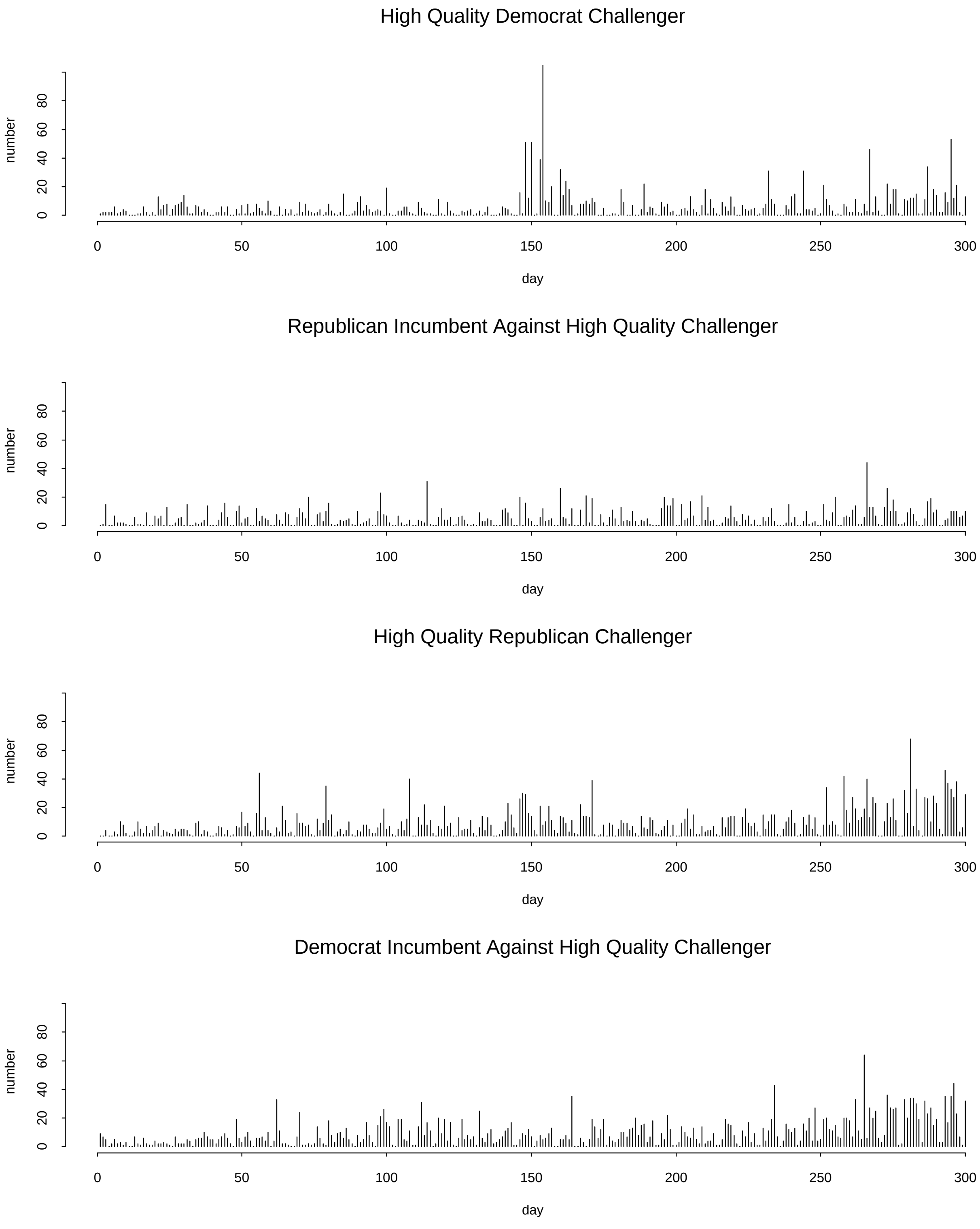


Figure 3: Daily Total Counts of Contributions to House Candidates by Type

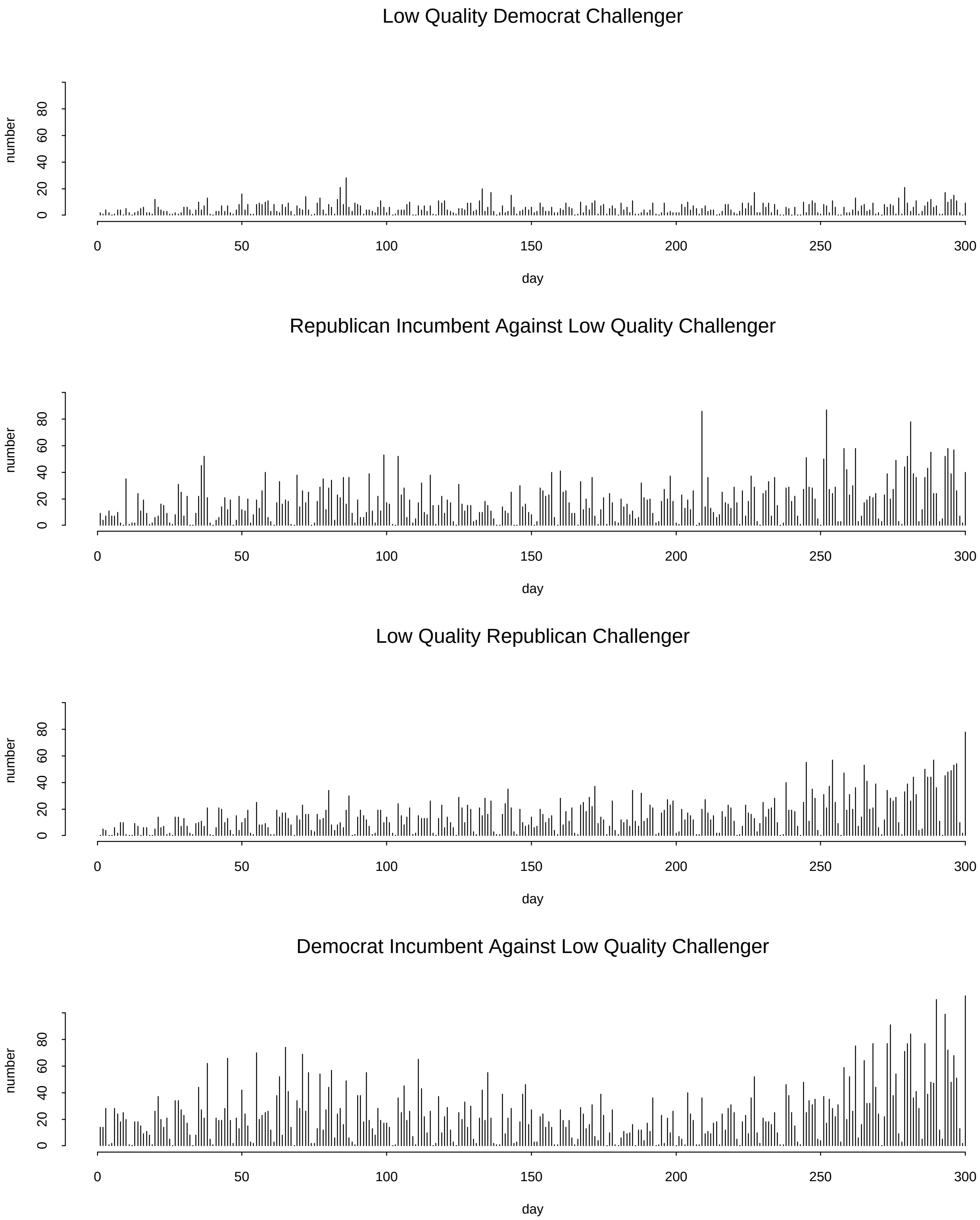


Figure 4: Daily Total Counts of Contributions to House Candidates by Type

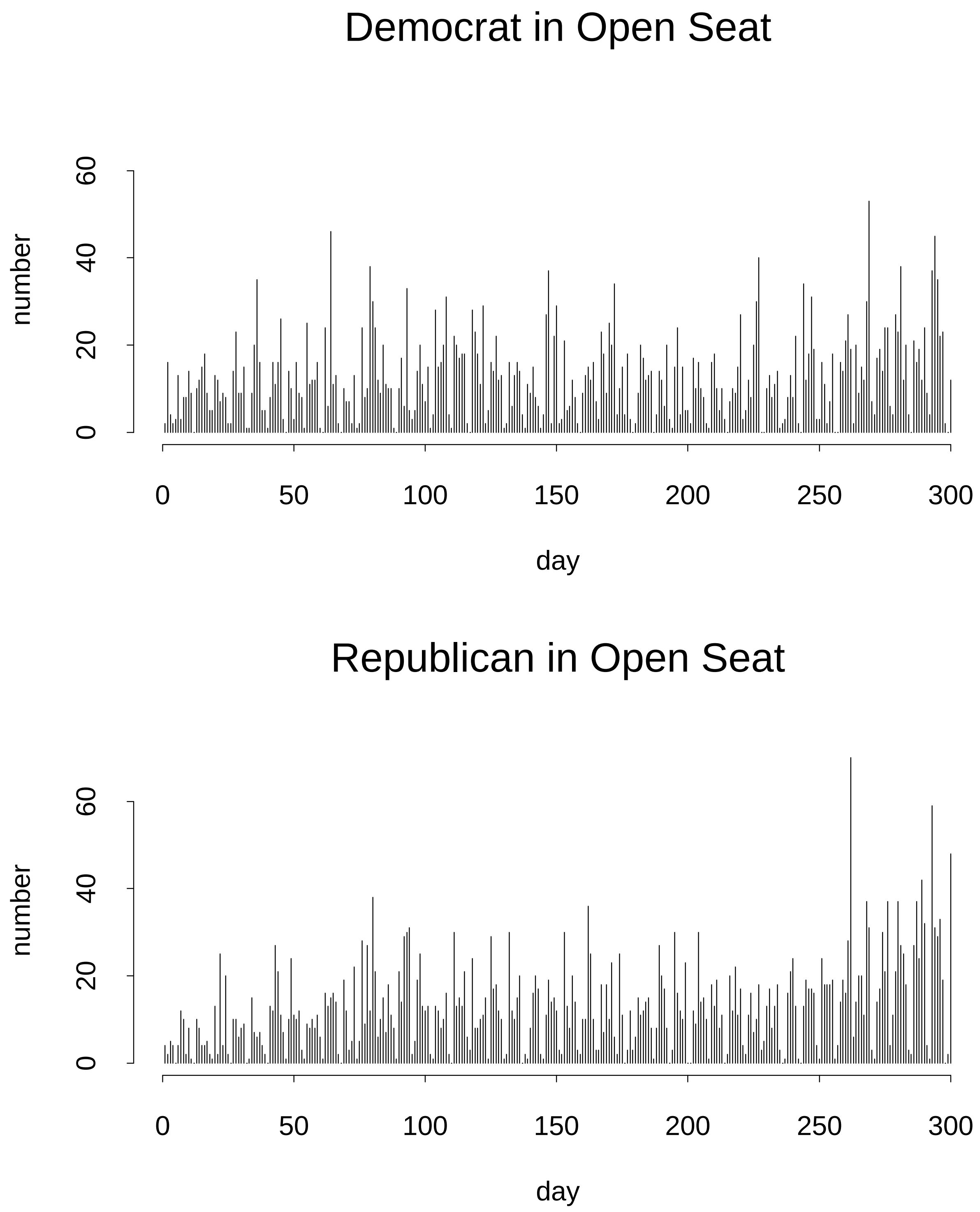
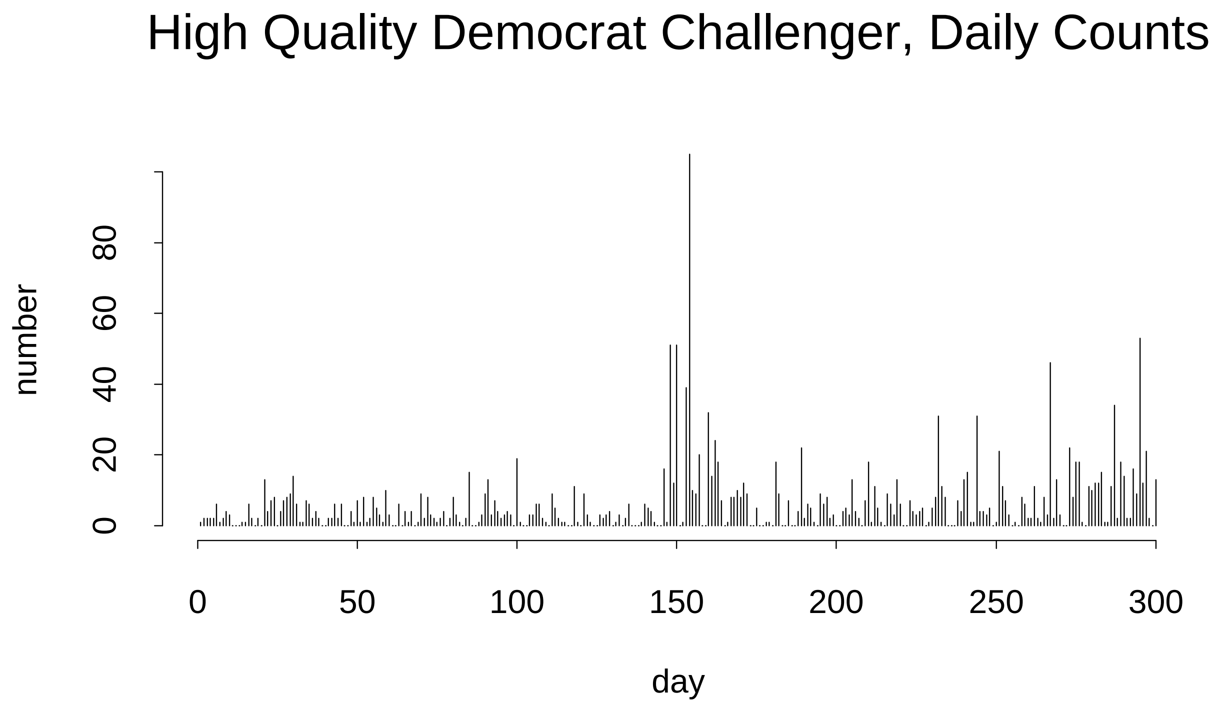


Figure 5: Daily Total Counts of Contributions to House Candidates by Type



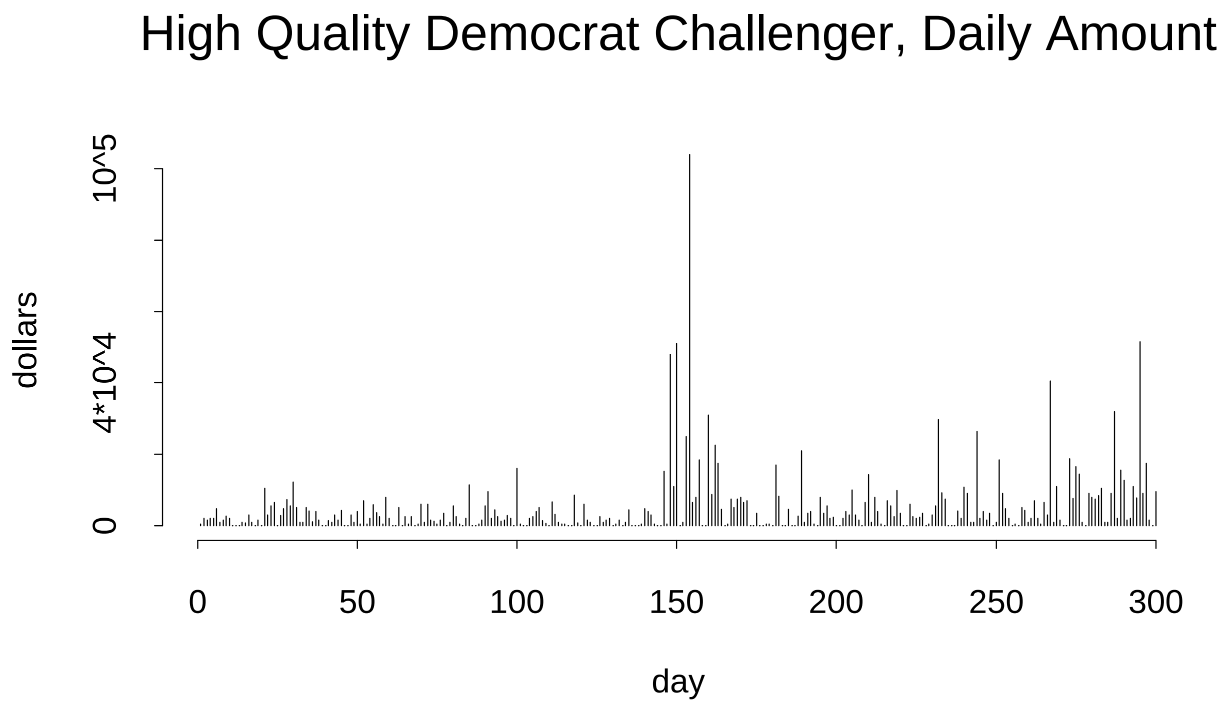


Figure 6: Daily Total Counts vs. Amounts for High Quality Democratic Challegers

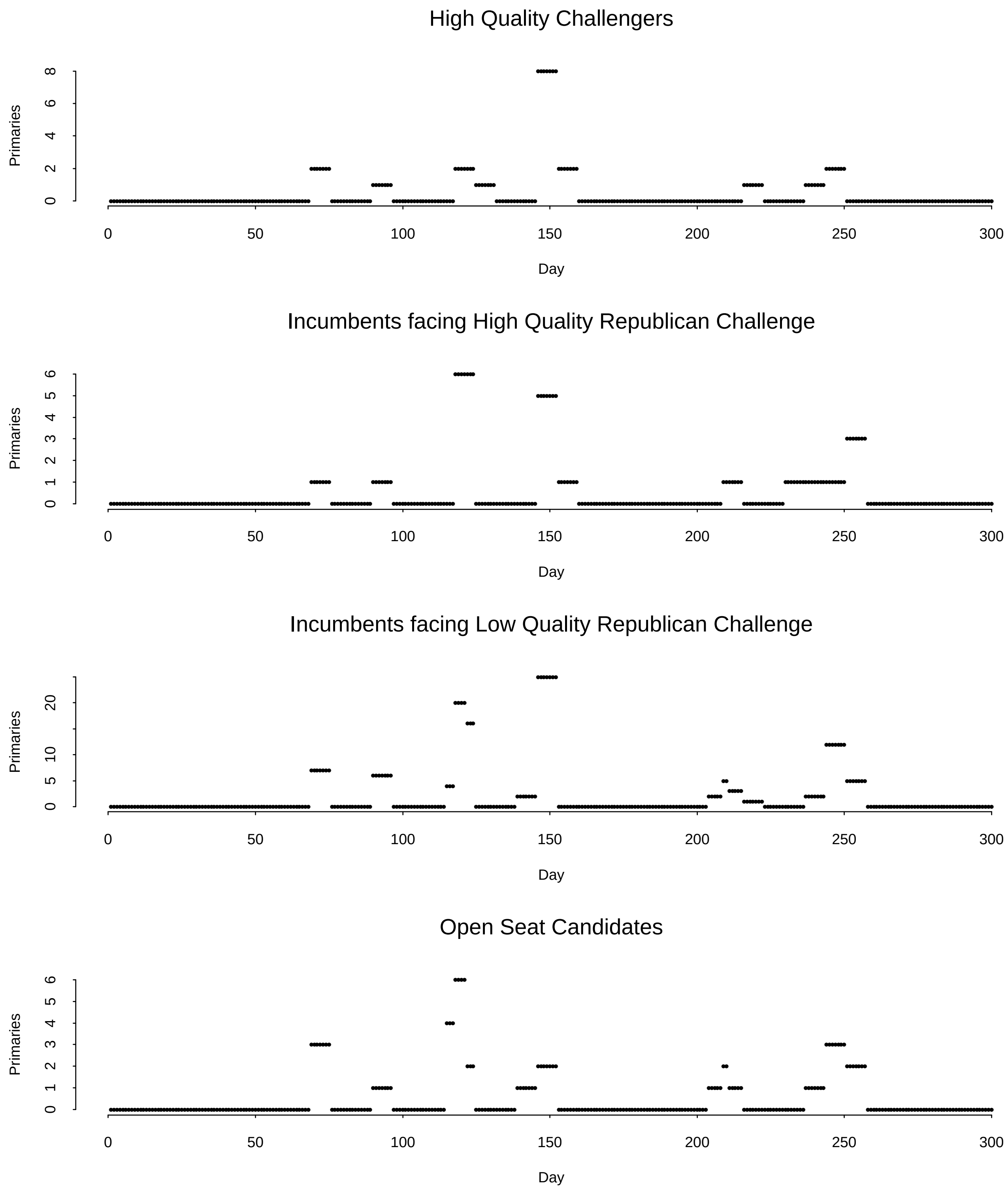


Figure 7: Number of Contested House Primaries Within the Past Week: Democrat

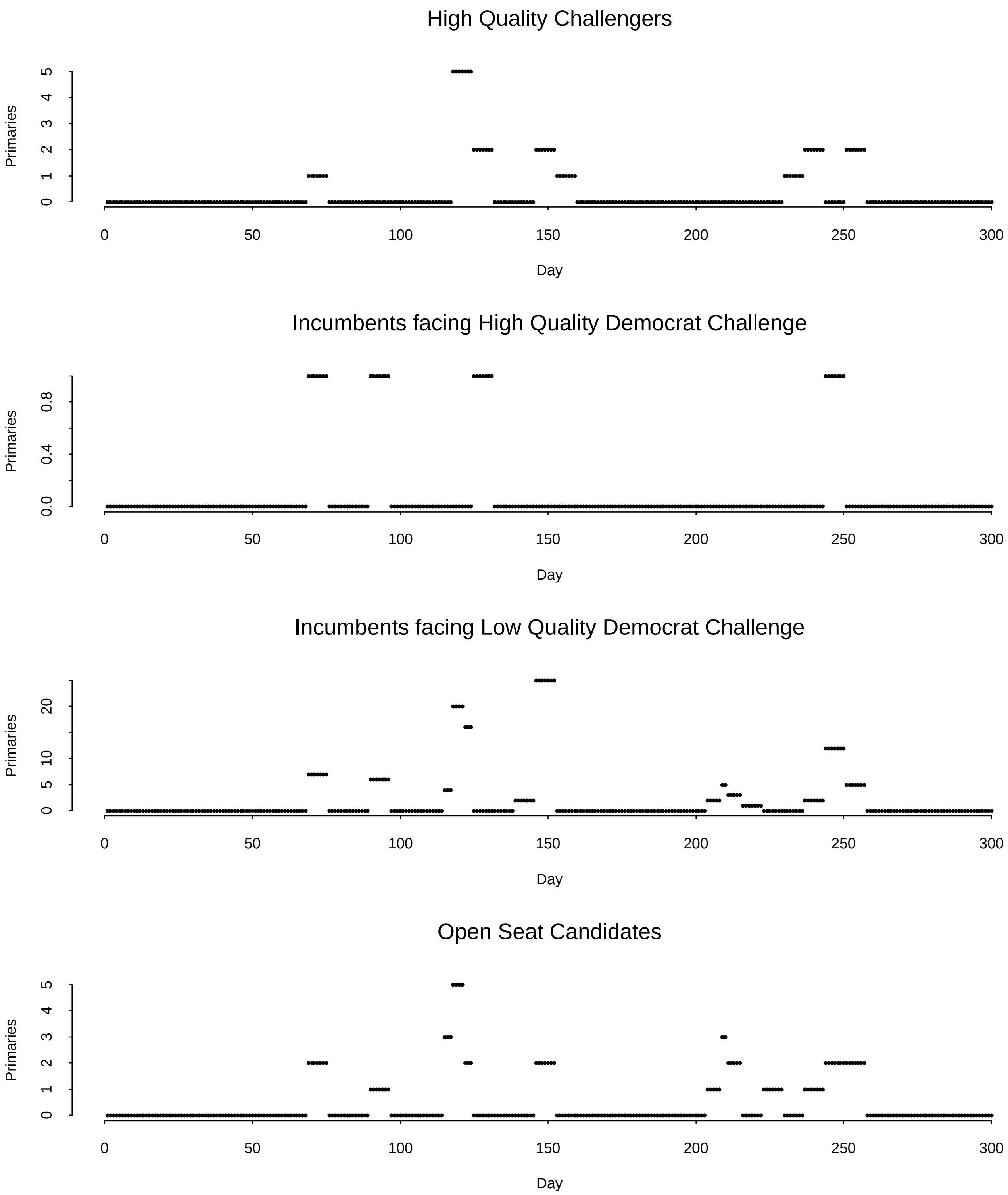


Figure 8: Number of Contested House Primaries Within the Past Week: Republican

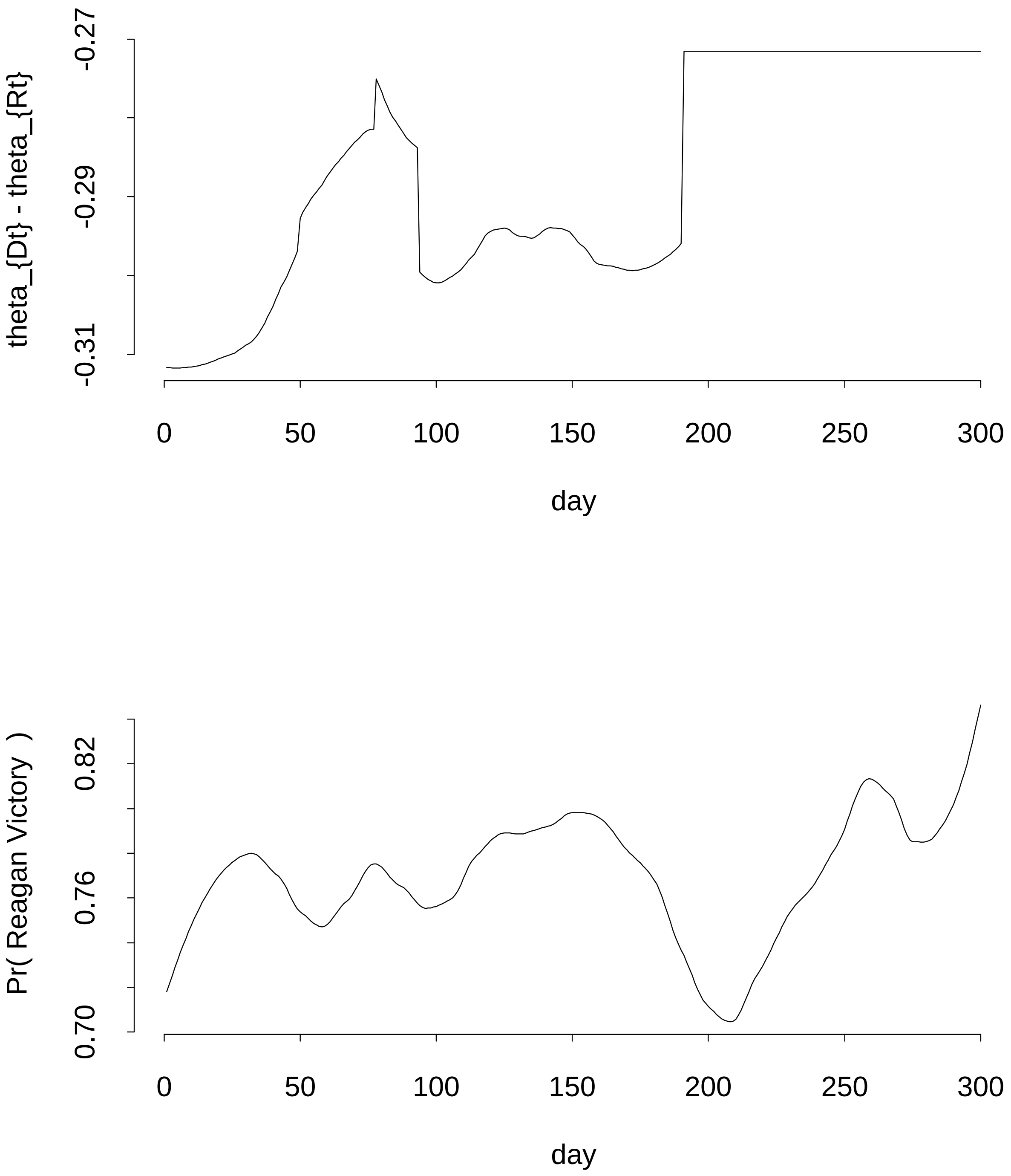


Figure 9: Policy Differences and Probability of Reagan Victory Series