POLICY PLATFORMS, CAMPAIGN SPENDING AND VOTER PARTICIPATION

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ABSTRACT. We model electoral competition between two parties in a winner-take-all election. Parties choose strategically first their platforms and then their campaign spending under aggregate uncertainty about voters' preferences. We use the model to examine why campaign spending in the United States has increased at the same time that politics has become more polarized. We find that a popular explanation–more accurate targeting of campaign spending–is not consistent. While accurate targeting may lead to greater spending, it also leads to less polarization. We argue that a better explanation is that voters preferences have become more volatile from the point of view of parties at the moment of choosing policy positions. This both raises campaign spending and increases polarization. It is also consistent with the observation that voters have become less committed to the two parties.

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1. Introduction

Three stylized facts about recent electoral politics in the US are (1) an increased polarization of the Democratic and Republican parties, (2) a substantial increase in campaign spending, and (3) a reduction in the voters' commitment to the two parties. Poole and Rosenthal [18] and McCarty, Poole and Rosenthal [14] provide some evidence on polarization, based on the average distance between Democratic and Republican members of Congress on a liberal-conservative scale. They find that polarization has been sharply increasing since around 1980, after a long period of decline starting around 1900. With respect to campaign spending, using data from the Federal Election Commission, Corrado [8] estimates that spending by parties in federal campaigns went from 58 million dollars in 1976 to over 1 billion in 2004 in nominal terms–this is an increase from 0.66 to 3.11 per capita in real terms (2000 dollars). About the campaign effort of political parties and allied interest groups, an interesting indirect source is the percentage of respondents in public opinion studies contacted by political parties in elections. National Election Studies [16] (Tables 6C.1a, 6C.1b and 6C.1c), provides evidence of a sharp increase in the percentage of respondents contacted by either party since 1990. Finally, with respect to the commitment of voters to the two parties, party affiliation has fallen enormously since 1960. According to observers, the fraction of voters who register as neither Democrat nor Republican has gone from 1.6 in 1960 to 21.7 in 2004 (see [7], p. 11). The party identification data from the National Election Studies [16] (Tables 2A.1, 2A.2 and 2A.3) is consistent with this view. The percentage of voters who declare themselves as independent or leaning independent has gone from 25 in 1960 to 37 in 2002.

In this paper, we provide a model in which party platforms, campaign spending and turnout are determined by the decisions of parties in reaction to underlying voters' preferences and the technology employed by parties to bring voters to the booth. Thus, we provide a framework to explain the recent trends in US electoral politics. We model electoral competition as a two-stage game. In the first stage, two parties (with both an ideological and an office motivation) strategically choose their platforms. In the second stage, parties decide how much to spend on the campaign. Turnout for each party is a function of campaign spending as well as voters' bias in favor of one or the other party. We treat party bias as subject to aggregate shocks. Shocks to party bias reflect voters' learning after policy positions are fixed as well as about the candidates' policy intentions with regard to issues on which parties cannot precommit. We consider campaign spending as having an impact on turnout via mobilization of voters. We pay special attention to the effectiveness of campaign targeting. If the targeting ability of parties is low, then campaign spending partially misfires, by mobilizing voters in favor of the other party; if the targeting ability of parties is high, each party's spending mobilizes only voters in favor of that party.

We consider two possible explanations of the aforementioned stylized facts. First, commentators have suggested that the reason for both the increased polarization and campaign spending is that skilled political operatives using sophisticated statistical tools and purchasing advertising in local markets are better able to target particular voters (see for example [21]). However, in our model improved targeting may indeed lead to an increase in campaign spending–but it also leads to a *reduction* in polarization. The reason for the reduction in polarization is that, in deciding their policy platforms in the first stage of the game, parties anticipate an increase in campaign costs in the second stage as a result of more accurate targeting. Polarized platforms become too costly.

The second explanation–and our favored one–is that voters preferences have become more volatile. By increased volatility, we mean larger aggregate shocks to party bias. We show in our model that increase in volatility leads to both an increase in campaign spending and an increase in polarization. The effect of volatility on polarization is very intuitive. Greater volatility means that the results of elections are less certain. Consequently, the parties have less reason to please the centrist voters, and are free to move towards their own extreme preferences. The effect of volatility on campaign spending is less intuitive. We can decompose it in two effects. First, holding fixed the party positions, increasing volatility unambiguously lowers spending. However, increasing volatility also increases polarization in the first stage of the game. That means that in the second stage game, the stakes are higher–it is better to win and worse to lose. That increases the marginal benefit of spending. So there are two offsetting effects, and the comparative static corollary shows that the increased spending dominates if there is not much polarization in the initial situation.

The classical rationale for party loyalty, as spelled out by Downs [9], is that party brands allow voters to save on the cost of acquiring or processing information about the policies actually espoused by the parties on many issues that may be important for voters. From this perspective, an increased access of voters to relevant information about the candidates and their policy intentions will result in a reduction in the value of political brands as an informational short cut and thus in a weakening of the voters' commitment to parties. The increased volatility in voters' preferences may well reflect the flow of information to voters in the course of political campaigns which we see as the result of changes in the media industry well beyond the control of the parties.

Previous literature since the work of Wittman [22] and Calvert [5] has dealt with role of electoral uncertainty in electoral competition. We innovate with respect to previous literature by considering simultaneously the role of electoral uncertainty and that of campaign spending–in particular targeting accuracy. While the importance of the anticipation of campaign spending on the positions adopted by parties may not be intuitive at first sight, political parties do spend considerable money and effort to encourage people to vote. This includes such things as decreasing the direct cost of voting–for example by providing volunteers who drive voters to the polls; decreasing the cost of acquiring information–for example by publicizing attractive aspects of their platforms and candidates and negative aspects of their rivals; increasing the cost of not voting–for example via social sanctions; and by signaling the closeness and importance of the election race. Campaign spending needs to be financed from contributions of party members and officials and, through fund-raising, of party sympathizers. By the same token, we may expect political parties to take into account the expected cost of bring voters to the booth, including when formulating electoral platforms.

Coate [6] and Schultz [20], among others, have recently approached campaign spending from an informational perspective. Coate considers a model of electoral competition in which parties are ideologically motivated. Parties can choose between adopting a moderate or an extremist policy position. Adopting a moderate position has the advantage of inducing contributions of moderate interest groups, and those contributions allow voters to infer that in fact the candidate is a moderate. In Coate's setup, we would expect a positive relation between policy moderation and campaign spending, while we are trying to explain exactly the opposite relation.[1] Schultz [20] discusses the joint determination of targeting of informative advertising and transfers in a model in which each party has an exogenous advertising budget. In earlier work, Prat [19] considers contributions from a single interest group to office-seeking parties, an environment which is not appropriate to discuss polarization. From a different perspective, Baron [4] considers the

[1] The model of Coate shares some characteristics with the seminal work of Austen-Smith [3].

role of campaign spending in inducing uninformed voters to vote for one or the other party.

Campaign spending has potentially at least three roles: (1) Move party sympathizers to effectively vote; (2) Persuade undecided voters or voters leaning to the other party of the merits of one party's policies; (3) Dissuade sympathizers of the other party to vote. We have focused on the "mobilization" aspect of campaign spending rather than on the "persuasion" or "vote suppression" aspects. In our model parties attempt to internalize the voting costs of their supporters; since their targeting ability is limited they reduce as well the voting cost of some of their opponents' voters. Of course, in reality, parties do also spend resources in trying to suppress the vote for the other party, by attempting to increase the cost of registering for voters leaning to the other party, by damaging the image of the other party's candidate, and so forth, and they also invest resources in trying to persuade voters favoring the other party to lean their way. Our focus on spending in mobilization reflects our belief that quantitatively speaking this is likely to be most important part of the campaign effort. We pay some attention to the persuasion aspect of campaigns in an extension of the basic model.

Among other related work, Meirowitz [15] and Ashworth and Bueno de Mesquita [2] have developed models of electoral contests in which parties increase their probability of winning the election by investing in valence, which increases their attractiveness to supporters of either party. Dekel, Jackson and Wolinsky [10] have devoted some attention to the issue of buying votes using different procedures. In their setup, campaign expenditure is more effective and less is spent if the parties can buy binding commitments to vote ("up front vote buying"). In comparison, in our setup voters cannot make binding commitments with parties, but parties have an (imperfect) ability to target their spending to favorable voters. Aragonès and Neeman [1] consider another two-stage model of electoral competition. In their model, parties choose policies in the first stage, but unlike what happens in our model they choose a level of ambiguity in implementing their policies in the second stage. In their model, as in ours, a two-stage game is a natural assumption since changing ideology is comparably harder than changing other party decisions. In our model, in particular, it is natural to think of parties as choosing their platforms before engaging in a costly effort to gather support for these platforms at the voting booth.

2. The Model

We model a winner-take-all election between two parties, **D** and **R**. The election takes place in two stages. In the first stage, the two parties simultaneously choose binding policy platforms d and $1-r$, which are elements of the policy space $[0,1]$. In the second stage, observing the policy platforms of the other party, they simultaneously choose their campaign efforts D and R, which are elements of the effort space $[0,1]$.

Each party has an "office motivation" for winning the election, which we represent as an amount $G \in [0,1]$ for winning the election. Each party also cares about the policy p implemented by the winning party. In particular, party **D** and party **R** have Euclidean preferences and their ideal points in the policy space are, respectively, 0 and 1.[2] Finally, we identify the campaign effort D, R with the cost of that effort. Overall, party **D** and party **R**'s payoffs are

$$V^{\mathrm{D}} = \begin{cases} G - d - D & \text{if party } \mathbf{D} \text{ wins} \\ -(1-r) - D & \text{if party } \mathbf{R} \text{ wins} \end{cases},$$

and

$$V^{\mathrm{R}} = \begin{cases} G - r - R & \text{if party } \mathbf{R} \text{ wins} \\ -(1-d) - R & \text{if party } \mathbf{D} \text{ wins} \end{cases}.$$

The outcome of the election is determined by the voters, of whom there is a continuum uniformly distributed on the unit interval and indexed by $v \in [0,1]$. Voters' preferences are determined jointly by party positions and by "party identification," as modeled by Lindbeck and Weibull [12, 13] and others. As described below, voters will not necessarily turn out to vote, so the determinant of the election is the fraction that favor either party *and* turn out to vote.

Policy preferences of voters are Euclidean with their ideal point determined by their index v. In addition to their policy preferences, voters have an idiosyncratic party bias b_v in favor of **D** and an aggregate party bias b, also in favor of **D**. So voter v will favor party **D** if

$$-|v-d| + b_v + b > -|v-(1-r)| \tag{2.1}$$

and will favor party **R** if the inequality is reversed. For simplicity we assume that b is uniformly distributed with support $[-\alpha, \alpha]$ and that b_v is uniformly distributed with support $[-\beta, \beta]$. The realization of b is not known to parties until after they propose their policy position and carry out their campaign spending. Notice that α is a measure of

[2] More generally, we can assume that parties' ideal points are not necessarily at the boundary points of the policy space, but are far enough from each other for the parties' equilibrium platforms (described in Theorem 3.3 below) to be located in between.

the volatility of voter preferences. We let F represent the distribution of the common valence shock b. We assume $\alpha \geq 1$; this means that regardless of the choice of policy platforms it is not possible to predict with probability one which party will win the election. We also assume $\beta \geq 1+\alpha$; this means that regardless of the choice of policy platforms and of the realization of the common shock it is not possible to predict with probability one which party any given voter will support.[3]

Voters do not necessarily show up to vote for the party they favor. Rather, the numbers that show up are determined by the effort made by each party to turn out the vote. A fraction $tD+(1-t)R$ of voters favoring party **D** and a fraction $tR+(1-t)D$ of voters favoring party **R** show up to vote for the parties they favor, while the other voters abstain. The parameter $t \in [1/2, 1]$ represents the accuracy of campaign targeting. If $t = 1$, then D, R represent how many (what fraction) of voters each party chooses to turn out. If $t < 1$, some of the campaign spending of each party misfires, by mobilizing voters in favor of the other party.

Note that the cost of campaign depends upon the fraction of voters attracted to the polls rather than the absolute number; so if a party has very few favorable voters, it is just as costly to turn out half of them as if the party has a lot of favorable voters. We think of campaign effort as informing voters where to vote, urging voters about the importance of the issues at stake in terms of their values or personal beliefs, and similar activities, through the choice of messages to be spread by media channels. An interpretation of the technology for attracting voters to the polls is the following. Let s_D and s_R be the fractions of voters who support party **D** and party **R**, respectively. If party **D** makes a campaign effort D, then $s_D \times D$ voters leaning in favor of party **D** and $s_R \times D$ voters leaning in favor of party **R** are reached by party **D**'s campaign effort. With perfect targeting ($t = 1$), the messages spread by party **D**'s campaign are tailored so carefully that all voters favorable to party **D** that are reached by party **D**'s campaign go to vote, and none of the voters favorable to the other party that are reached by party **D** goes to vote. With no targeting ($t = 1/2$), half of the voters reached by party **D** go to vote, independently of their voting intentions. With imperfect targeting ($t \in (1/2, 1)$) we get a convex combination of the two extreme cases. We consider other targeting technologies without any leakage in favor of the other party in Section 5.

[3]Without idiosyncratic uncertainty, we would have to consider realizations of the common shock such that every voter favors the same party, which is unrealistic and analytically inconvenient.

3. Equilibrium

From the model, we can work out the probability that each party wins, voter turnout and winning margin as a function of the policy platforms and campaign spending.

Theorem 3.1. *The fraction of voters favoring party* ***D*** *is*

$$1/2 + \left(b + d - d^2 - r + r^2\right)/(2\beta).$$

with the remainder favoring party ***R****. If $D + R > 0$, the probability that party* ***D*** *wins is*

$$F\left(d - d^2 - r + r^2 + 2\beta(t - 1/2)(D - R)/(D + R)\right).$$

Aggregate voter turnout is

$$(D + R)/2 + (D - R)(t - 1/2)(b + d - d^2 - r + r^2)/\beta,$$

and the winning margin is

$$|(D + R)(b + d - d^2 - r + r^2)/2\beta + (D - R)(t - 1/2)|.$$

All proofs may be found in the Appendix. In the expression for the probability of **D** winning the election, the term $d - d^2 - r + r^2$ represents the effect of policy platforms, while the term $(D-R)/(D+R)$ represents the effect of campaign spending. If $D = R = 0$, we let $(D - R)/(D + R) = 0$.[4]

Given the probabilities of winning, we can work out the second stage equilibrium campaign spending given policy platforms.

Theorem 3.2. *If $1 - d - r + G \leq 0$, then the unique second stage Nash choice of campaign spending is $D = R = 0$. Otherwise, both parties spend the same amount*

$$E^* = \max\{\beta(t - 1/2)\left(1 - d - r + G\right)/2\alpha, 1\}. \tag{3.1}$$

Both parties spend the same for *any* choice of policy platforms because the utility gain for winning the election is the same for both parties, $1 - d - r + G$, and the density function of the aggregate shock is monotonic, so the first order conditions of the problem of the parties (described in the proof of the theorem) cannot be satisfied for different levels of spending for the two parties.

We can find now the first stage equilibrium, which is unique and symmetric. To avoid dealing with various corner cases, we assume that

$$\beta(t - 1/2) < \alpha < 1 + G + \beta(t - 1/2). \tag{3.2}$$

[4]This is equivalent to assuming that a small fraction of voters votes if there is no campaign spending.

The first inequality in assumption 3.2 guarantees that there is enough electoral uncertainty for parties (i) not to fully converge to the median voter's expected ideal policy, and (ii) not to attract all favorable voters to the voting booth. The second inequality guarantees that there is not enough electoral uncertainty for parties to adopt their favorite policy platforms.

We have

Theorem 3.3. *If assumption 3.2 holds, there is a unique subgame perfect Nash equilibrium, it is symmetric, and in equilibrium each party chooses the platform*

$$p^* = \frac{1}{2} - \frac{1}{4}\left(\sqrt{G^2 + 4(\alpha - \beta(t-1/2))} - G\right),$$

where $0 < p^* < 1/2$.

Intuitively, p^* is the solution to the first order condition of the problem faced by either party

$$(1 - 2p^* + G)(1 - 2p^*)/(2\alpha) = \frac{1}{2} - \beta(t-1/2)/(2\alpha).$$

The left-hand side in the equation above represents the gain obtained by moderating the party position by choosing a policy platform closer to $1/2$. The gain from a marginal increase in p is equal to the marginal increase in the probability of winning $(1-2p^*)/2\alpha$ multiplied by the prize for winning the election $1 - 2p^* + G$. The right-hand represents the loss for the party due to adopting a less preferred platform. The loss is equal to the equilibrium probability of winning the election $(1/2)$ minus

$$\beta(t-1/2)/2\alpha.$$

From theorem 3.2, the equilibrium cost of campaigning is equal to the expression above multiplied by the prize for winning the election $1 - 2p^* + G$. Thus, the expression above appears in the first order condition because moderating the party position reduces the expected effort in the campaigning stage of the electoral competition. Moderation and campaign spending are substitutes for each party in the sense that each party would like to spend less the more moderate is its own platform, keeping fixed the actions of the other party. Moreover, each party is aware that moderating its own platform it also induces the other party to spend less. The fear of a costly campaign acts in favor of moderation.

4. Comparative Statics

Using Theorems 3.2 and 3.3 we get that, if assumption 3.2 holds,

$$E^* = \beta(t-1/2)(\sqrt{G^2+4(\alpha-\beta(t-1/2))}+G)/4\alpha.$$

The following result is immediate.

Corollary 4.1. *If assumption 3.2 holds, the equilibrium policy position p^* is increasing in t and β and decreasing in α. Moreover, if $G=0$,*

$$\begin{aligned} \frac{\partial E^*}{\partial \alpha} &\gtreqless 0 \iff t-1/2 \gtreqless \frac{\alpha}{2\beta} \quad \textit{and} \\ \frac{\partial E^*}{\partial t} &\gtreqless 0 \iff \frac{\partial E^*}{\partial \beta} \gtreqless 0 \iff t-1/2 \lesseqgtr \frac{2\alpha}{3\beta}. \end{aligned}$$

This result provides unambiguous predictions with respect to the effects of the parameter of the model on polarization $(1/2-p^*)$. An increase in the accuracy of campaign targeting *reduces* polarization, and an increase in electoral uncertainty *increases* polarization. The effect of electoral uncertainty on polarization is quite intuitive and in agreement with previous literature going back to the work of Wittman [22] and Calvert [5]. *Per contra*, our result on the effect of targeting accuracy on polarization is novel. Intuitively, since targeting accuracy increases the effectiveness of campaign spending, it leads parties to anticipate more campaign spending for fixed policy platforms, thus providing a reason for parties to adopt moderate platforms. This reduces the incentive for parties to diverge in the first stage of the model.

The effects of the parameters of the model on campaign spending (and thus on turnout) are not clear cut. This is because parties set their policy choices anticipating the campaign stage of the electoral game. Thus, the direct effect of the underlying parameters on campaign spending may be undone by indirect effects through policy choices. For instance, from Theorem 3.2, we can see that holding policy choices constant, an increase in the accuracy of campaign spending increases spending. However, increased accuracy also reduces polarization, thereby reducing the incentive to invest in campaigning. Similarly, an increase in electoral uncertainty has a negative direct effect on campaign spending but a positive indirect effect.

From Theorem 3.2, we expect indirect effects to be particularly strong if office motivation is relatively small. Corollary 4.1 provides some comparative statics results with respect to campaign spending for the case $G=0$, as illustrated by Figure 4.1. (The upper and lower bound on $t-1/2$ in the figure are given by assumption 3.2, which is necessary for the existence of an interior equilibrium.) Intuitively,

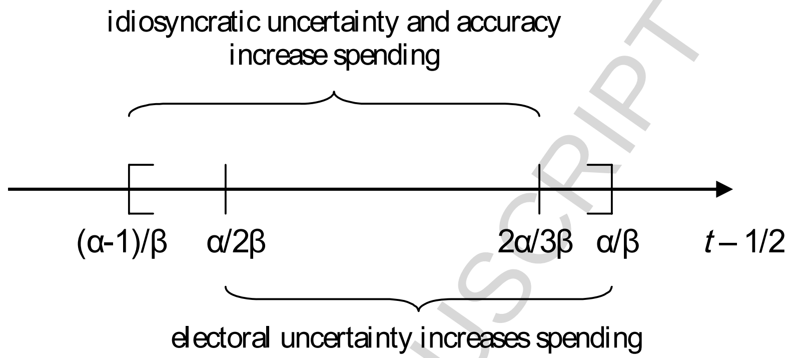

Figure 4.1. Ideological Parties

electoral uncertainty increases spending if the direct negative effect over campaign spending ($-E^*/\alpha$) is overwhelmed by the indirect positive effect through the increase in polarization ($E^*/(2(1-2p^*))^2$). This happens if in the initial situation polarization is small ($1 - 2p^* \leq \sqrt{\alpha/2}$), which the evidence in McCarty et al. [14] suggests was the case in the US before 1980.

The model predicts that if campaign spending goes up, so does voter turnout; from Theorem 3.1 equilibrium voter turnout is equal to E^*. It also predicts that the expected winning margin (i.e. the advantage of the election winner over the loser as a percentage of turnout) goes up if electoral uncertainty goes up; from Theorem 3.1 the equilibrium expected winning margin is equal to $\alpha/2\beta$. Both these predictions follow from the assumption that campaign spending simply mobilizes voters to the voting booth. If the "persuasion" and "vote suppression" aspects of electoral campaigns are taken into account, the relationship between campaign spending, turnout and winning margin can become more complex without undermining the comparative statics results in corollary 4.1, as discussed in Section 5.3.[5]

[5]With respect to individual voting intentions, note that larger *electoral* (as opposed to idiosyncratic) uncertainty does not necessarily imply that *individual* voting intentions fluctuate more often – since parties platforms become more polarized, it takes a larger (individual plus aggregate) shock to alter one voter's voting intentions. In spite of the increasing polarization, Wlezien and Erikson [23] find that 1980 and 1992 exhibit the largest fluctuations in voting intentions during the course of presidential campaigns since 1944. We take this as evidence of larger aggregate shocks to voters' preferences.

5. Robustness

5.1. **Partisan voters.** We consider here a version of the model with partisan voters. In particular, we assume that there is a fraction $\rho < 1/2$ of voters who always support party **D** and a fraction of the same size who always support party **R**, with the remainder of the voters being uniformly distributed on the unit interval and with preferences as described in the model above. As in the model above, the fraction of voters favoring party **D** who turn out to vote for this party (regardless of whether they are partisans or not) is equal to $Dt + (1-t)R$, and similarly for party **R**. Defining $\tilde{\beta} = \beta(1+\rho)/(1-\rho)$, the probability that party **D** wins in the model with partisan voters is

$$F(d - d^2 + r - r^2 + 2\tilde{\beta}(t - 1/2)(D - R)/(D + R)),$$

and in the unique subgame perfect Nash equilibrium, under the appropriate version of assumption 3.2, we get that each party chooses the platform

$$p^* = \frac{1}{2} - \frac{1}{4}\left(\sqrt{G^2 + 4(\alpha - \tilde{\beta}(t - 1/2))} - G\right).$$

As in the original model, polarization is increasing in α and decreasing in t. Moreover, if $G = 0$,

$$\frac{\partial E^*}{\partial \alpha} \gtreqless 0 \iff t - 1/2 \gtreqless \frac{\alpha}{2\tilde{\beta}}.$$

Surprisingly, an increase in the fraction of partisans induces parties to adopt more moderate platforms. Intuitively, an increase in partisanship leads parties to anticipate a more fierce campaign stage, and the fear of a costly campaign induces moderation during the policy stage. Moreover, if $G = 0$,

$$\frac{\partial E^*}{\partial \rho} \gtreqless 0 \iff t - 1/2 \lesseqgtr \frac{2\alpha}{3\tilde{\beta}}.$$

That is, the effects of partisanship on moderation and campaign spending are similar to those of targeting accuracy. Equilibrium turnout $((1+\rho)E^*)$ is increasing in the fraction of partisans, while expected winning margin $(\alpha/2\tilde{\beta})$ is decreasing in partisanship.

5.2. **Targeting partisans.** We have modeled an increase in the accuracy of targeting as a reduction in the leakage of resources toward mobilizing voters favorable to the other party. There are other useful ways to model accuracy. Consider, for instance, the model with partisan voters described previously and ignore for simplicity the possibility of leakage. Let the fraction of favorable partisan voters that a party is able to attract to the polls be equal to atE_i and the fraction of favorable independent voters that a party is able to attract to the polls be equal to aE_i, where $t \geq 1$ and $at < 1$. An increase in t represents now an increased ability in attracting partisans to the voting booth. The probability that party **D** wins in the model with partisan voters is now

$$F(d - d^2 - r + r^2 + 2\beta((t - 1/2)\rho + 1/2)(D - R)/(D + R)),$$

and in the unique subgame perfect Nash equilibrium, under the appropriate version of assumption 3.2, we get that each party chooses the platform

$$p^* = \frac{1}{2} - \frac{1}{4}\left(\sqrt{G^2 + 4(\alpha - \beta((t - 1/2)\rho + 1/2)} - G\right).$$

Again, we get similar comparative statics to the original model. Polarization is increasing in α and decreasing in t. Moreover, if $G = 0$,

$$\frac{\partial E^*}{\partial \alpha} \gtreqless 0 \iff (t - 1/2)\rho + 1/2 \gtreqless \frac{\alpha}{2\beta}.$$

Note that we keep the fraction of partisan voters constant and introduce electoral uncertainty through a common valence shock, in the tradition of probabilistic voting models. Thus, the probability of winning the election, given a pair of policies (d, r), is the same regardless of targeting accuracy, as long as both parties spend the same. Since in equilibrium both parties adopt the same level of spending, the only channel through which targeting accuracy affects the choice of policy platforms is the anticipation of more costly spending. This implies that targeting accuracy favors the adoption of moderate platforms.

If there were uncertainty about the fraction of partisan voters favoring one party rather than the other, an improvement in the ability to target partisans could in equilibrium lead to more polarization.[6] The reason is that the probability of winning the election by offering an extreme platform, while the other party offers a moderate platform, would increase with targeting accuracy. In effect, targeting accuracy would directly increase electoral uncertainty, favoring polarization.

5.3. **Impressionable voters.** We consider here a version of the model in which "persuasion" has a role. In particular, we assume there is a fraction γ of impressionable voters, of which a fraction $D/(D + R)$ support party **D** and a fraction $R/(D + R)$ support party **R**, with the remainder of the voters being uniformly distributed on the unit interval

[6] We thank a referee for pointing out this possibility.

and with preferences as described in the model above. The probability that party **D** wins in the model with impressionable voters is

$$F(d - d^2 + r - r^2 + 2\beta(t/(1-\gamma) - 1/2)(D - R)/(D + R)),$$

and in the unique subgame perfect Nash equilibrium, under the appropriate version of assumption 3.2, we get that each party chooses the platform

$$p^* = \frac{1}{2} - \frac{1}{4}\left(\sqrt{G^2 + 4(\alpha - \beta(t/(1-\gamma) - 1/2))} - G\right).$$

Equilibrium expected turnout is equal to either party's spending

$$E^* = \beta(t/(1-\gamma) - 1/2)(\sqrt{G^2 + 4(\alpha - \beta(t/(1-\gamma) - 1/2))} + G)/4\alpha,$$

and the expected winning margin is $(1-\gamma)\alpha/2\beta$. If α and γ go up, we can have simultaneously an increase in polarization, campaign spending and turnout and a reduction in expected winning margins.[7]

5.4. **Simultaneous versus sequential moves.** Our result that targeting accuracy reduces polarization depends critically on the assumption that policy platforms are set before parties engage in costly campaigns. To see this, suppose that parties choose simultaneously their policy platforms and their level of campaign spending. The objective function of party **D** can be written as

$$F\left(d - d^2 - r + r^2 + 2\beta(t - 1/2)\frac{D - R}{D + R}\right)(1 - d - r + G) - 1 + r - D.$$

The first order conditions of the problem of party **D** with respect to d and D are, respectively,

$$(1 - 2d)(1 - d - r + G)/2\alpha = F\left(d - d^2 - r + r^2 + 2\beta(t - 1/2)\frac{D - R}{D + R}\right)$$

and

$$2(1 - d - r + G)(\beta/\alpha)(t - 1/2)R/(D + R)^2 - 1 = 0.$$

From these and the first order conditions of party **R** we get that, in a symmetric equilibrium,

$$d = r = \frac{1}{2} - \frac{1}{4}\left(\sqrt{G^2 + 4\alpha} - G\right)$$

and

$$D = R = \beta(t - 1/2)(4\alpha)^{-1}\sqrt{G^2 + 4\alpha}.$$

[7] The condition for this is that the change in α relative to γ is larger than $\beta t/(1-\gamma)^2$ and smaller than $\alpha/(1-\gamma)$. This condition is undoubtedly special, but we want to point out that an increase in electoral uncertainty is not inconsistent with tighter elections.

Thus, an increase in accuracy leads both parties to spend more in the campaign but has no effect on polarization.

5.5. **Campaign spending limits.** In the context of the model, an immediate effect of binding campaign spending limits would be a reduction in voter turnout. With respect to policy platforms, the first order conditions of the problem of the parties under campaign spending limits are similar to those with simultaneous choice of platforms and spending. We obtain

$$d = r = \frac{1}{2} - \frac{1}{4}\left(\sqrt{G^2 + 4\alpha} - G\right).$$

Interestingly, binding campaign spending limits would *increase* polarization by eliminating one of the incentives for moderation at the margin, namely the fear of a costly campaign.

6. Conclusion

Our goal has been to understand why campaign spending has increased at the same time that politics has become more polarized in the US. To do so, we have developed a model of political competition incorporating policy platforms, campaign spending and voter turnout. Our model shows that an improvement in targeting alone is not enough to explain both trends in US politics. Improving targeting may lead to an increase in campaign spending but it also leads to a *reduction* in polarization. That is, with better targeting parties compete more both by spending more and increasing attention given to the median voter, that is by being less polarizing, at least as long as the median voter is unlikely to be a partisan voter.

On the other hand, an increase in the volatility of voter preferences does lead both to an increase in campaign spending and also to an increase in polarization. As we noted, it is also potentially an explanation for the increasing lack of party affiliation. We treat office motivation G as exogenous; but it may very well be that as fewer voters have a party affiliation, parties fall into the hands of extremists, which are more motivated by policy considerations than by holding office–this reinforces the effect that is in the model. Note also that a reduction in partisanship leads to more polarized party platforms in our model with partisan voters.

Changes in voter uncertainty and targeting accuracy which we have treated as exogenous in this paper may well reflect underlying changes in the media industry, particularly in the way in which news are produced and distributed to the public and contribute to forming public opinion. Understanding how targeting accuracy and volatility of preferences are related to an evolving media environment seems to be a key issue in explaining the recent trends in US electoral politics. If in fact polarization and increased spending are not transient phenomena but reflect ultimately technological changes, modelling political competition will have to pay more attention to voter mobilization issues than in the past.

7. Appendix

Proof of Theorem 3.1. Using equation 2.1, if $d \leq 1 - r$,

$$\Pr\{\text{voter } v \text{ favors party } \mathbf{D}\} = \begin{cases} \frac{1}{2} + \frac{1-r-d+b}{2\beta} & \text{if} \quad 0 \leq v \leq d \\ \frac{1}{2} + \frac{1-r+d+b-2v}{2\beta} & \text{if} \quad d \leq v \leq 1-r \\ \frac{1}{2} + \frac{r-1+d+b}{2\beta} & \text{if} \quad 1-r \leq v \leq 1 \end{cases}.$$

Integrating this over voters v we get the overall fraction favoring party **D**

$$\begin{aligned} & d\left(\frac{1}{2} + \frac{1-r-d+b}{2\beta}\right) + (1-r-d)\left(\frac{1}{2} + \frac{1-r+d+b}{2\beta}\right) \\ & +r\left(\frac{1}{2} + \frac{r-1+d+b}{2\beta}\right) + \int_{v=d}^{v=1-r} \frac{-2v}{2\beta}\, dv \\ & \qquad = \frac{1}{2} + \frac{(b+d-d^2-r+r^2)}{2\beta}. \end{aligned}$$

Similar calculations show the same result in case $d > 1 - r$. Thus, the probability that party **D** wins is equal to the probability that

$$\begin{aligned} (tD + (1-t)R)\left(\frac{1}{2} + \frac{b+d-d^2-r+r^2}{2\beta}\right) & \\ > (tR + (1-t)D)\left(\frac{1}{2} - \frac{b+d-d^2-r+r^2}{2\beta}\right), & \end{aligned} \tag{7.1}$$

or

$$b > -(d - d^2 - r + r^2) - 2\beta(t - 1/2)(D - R)/(D + R).$$

Using the symmetry around zero of the distribution of b, this implies the overall probability that **D** wins is the expression above.

Aggregate voter turnout is obtained by adding the two sides of 7.1, and the winning margin is obtained by taking the absolute value of the difference between the two sides of 7.1. $\square$

Proof of Theorem 3.2. Suppose that parties have chosen their policy platforms in the first stage of the game and consider their choice of campaign spending in the second stage. Let the parties be $i = \mathbf{D},\mathbf{R}$, and let $p_i = d, r$ and $E_i = D, R$. Let F_i denote F if $i = \mathbf{D}$ and $1 - F$ if $i = \mathbf{R}$. The objective function of party i is

$$F_i\left(d - d^2 - r + r^2 + 2\beta(t-1/2)\frac{D-R}{D+R}\right)(-p_i + G)$$
$$+\left(1 - F_i\left(d - d^2 - r + r^2 + 2\beta(t-1/2)\frac{D-R}{D+R}\right)\right)(-1+p_{-i}) - E_i,$$

or equivalently,

$$F_i\left(d - d^2 - r + r^2 + 2\beta(t-1/2)\frac{D-R}{D+R}\right)(1 - d - r + G)$$
$$- 1 + p_{-i} - E_i.$$

If $1-d-r+G \leq 0$, then the unique Nash choice of campaign spending is $D = R = 0$, as each party is either indifferent or prefers the other one to win. Now consider the case in which $1 - d - r + G > 0$ (as will hold in the subgame perfect equilibrium analyzed in the next section). It is easy to show that there is no Nash equilibrium in which either one or the two parties do not spend any positive amount. The following first order condition must hold for $i = \mathbf{D},\mathbf{R}$ in any Nash equilibrium if both parties spend positive amounts:

$$1 \ \leq \ f\left(d - d^2 - r + r^2 + 2\beta(t-1/2)\frac{D-R}{D+R}\right)$$
$$\times (1 - d - r + G)\, 2\beta(t-1/2)(2E_{-i})(D+R)^{-2}$$

with strict equality if $E_i < 1$. Thus, we must have for $i = \mathbf{D},\mathbf{R}$

$$1 \ \leq \ (1 - d - r + G)\, 2\beta(t-1/2)(2E_{-i})(D+R)^{-2}/2\alpha$$

with strict equality if $E_i < 1$. The unique solution to this system is

$$D = R = \max\{\beta(t-1/2)\,(1-d-r+G)\,/2\alpha, 1\}$$

as stated by the theorem. Since the second derivative of the objective function of either party is nonpositive, in fact we have found the (unique) Nash equilibrium choice of campaign spending for any given pair d, r. □

We now prove a series of Lemmas leading up to the proof of Theorem 3.3.

Lemma 7.1. *Given any p_{-i}, party i's best response policy choice is such that* $1 - d - r + G \geq 0$.

Proof. We focus on the problem solved by party **D**. The problem solved by party **R** is entirely symmetric. Recall that, from 3.2, if $1-d-r+G \leq 0$ then the unique second stage Nash choice of campaign spending is $D = R = 0$. Thus, the objective function of party **D** can be written as

$$F(d-d^2-r+r^2)(1-d-r+G)-1+r$$

over the interval $\{d : d \geq 1-r+G\}$. The derivative of the objective function with respect to d is

$$-F(d-d^2-r+r^2)+\frac{1-2d}{2\alpha}(1-d-r+G)$$

or equivalently

$$-(1/2+(d-d^2-r+r^2)/(2\alpha))+\frac{1-2d}{2\alpha}(1-d-r+G).$$

This expression is strictly negative if $1-d-r+G < 0$ for any $d < 1/2$. If $d \geq 1/2$, this expression is strictly negative if

$$-4d+3d^2-r^2+1+2dr < 2\alpha-1+(2d-1)G$$

or equivalently if

$$-4d+4d^2-(d-r)^2 < 2\alpha-1+(2d-1)G,$$

which is verified since $d \leq 1$ and $\alpha \geq 1$. □

Lemma 7.2. *Given any $p_{-i} \leq 1/2$, party i's best response policy choice is such that $p_i < 1/2$.*

Proof. We focus on the problem solved by party **D**. The problem solved by party **R** is entirely symmetric. Using the previous lemma, we have that, given any policy choice r by party **R**, the best response d^* by party **D** is such that $1-d-r+G \geq 0$. Using Theorem 3.2, assumption 3.2, and $G \leq 1$, if $1-d-r+G \geq 0$ then the unique second stage Nash choice of campaign spending is given by

$$D = R = \beta(t-1/2)\,(1-d-r+G)\,/2\alpha.$$

Thus, the objective function of party **D** in the first stage of the game, anticipating correctly the campaign spending choices of both parties, is

$$F(d-d^2-r+r^2)(1-d-r+G)-1+r \\ -\beta(t-1/2)\,(1-d-r+G)\,/2\alpha. \tag{7.2}$$

The derivative of this objective function with respect to d is

$$-F(d-d^2-r+r^2)+\frac{1-2d}{2\alpha}(1-d-r+G)+\beta(t-1/2)/2\alpha. \tag{7.3}$$

Now, suppose that, given some policy choice $r \leq 1/2$ by party **R**, the best response d^* by party **D** is such that $d^* > 1/2$. Using equation 7.3, the derivative of the objective function at d^* is nonnegative only if

$$F(d^* - (d^*)^2 - r + r^2) - \beta(t - 1/2)/2\alpha < 0.$$

Using equation 7.2, the objective function of party **D** evaluated at d^* is

$$\left(F(d^* - (d^*)^2 - r + r^2) - \beta(t - 1/2)/2\alpha\right)(1 - d^* - r + G) - 1 + r.$$

The first term in this expression is not positive, since $1 - d^* - r + G$ and $F(d^* - (d^*)^2 - r + r^2) - \beta(t - 1/2)/2\alpha < 0$. Thus, Party **D** is better off deviating to $d = r$, because $1 - 2r + G > 0$ and $1/2 - \beta(t - 1/2)/2\alpha > 0$ (using assumption 3.2). □

Lemma 7.3. *Given any $p_{-i} \leq 1/2$, party i's payoff is strictly concave in its own policy choice in the interval* $[0, 1/2]$.

Proof. We focus on the problem solved by party **D**. The problem solved by party **R** is entirely symmetric. Suppose that $r \in [0, 1/2]$, and consider the problem of party **D**. For $d \leq 1/2$, we have $1 - d - r + G \geq 0$. Thus, for $d \leq 1/2$, the second derivative of the objective function, as given by 7.2, is

$$-(1 - 2d)/\alpha - (1 - d - r + G)/\alpha < 0.$$

□

Lemma 7.4. *In equilibrium, $d = r < 1/2$.*

Proof. Using Lemma 7.2, we have that in equilibrium $d \neq 1/2$ and $r \neq 1/2$. Now suppose $d = r > 1/2$. Using assumption 3.2 and Lemma 7.1, we can see that the derivative of the objective function of either party as given by equation 7.3 is negative, a contradiction.

Suppose $d > r > 1/2$ (the case $r > d > 1/2$ is similar). Using the first order condition for either party, we obtain

$$1 - d - r + G = \frac{F_i(d - d^2 - r + r^2) + \beta(t - 1/2)/2\alpha}{(1 - 2p_i)/2\alpha}$$

for $i =$**D**,**R**. Note that the left-hand side is independent of i. Thus,

$$\frac{F(d - d^2 - r + r^2) + \beta(t - 1/2)/2\alpha}{1 - F(d - d^2 - r + r^2) + \beta(t - 1/2)/2\alpha} = \frac{d - 1/2}{r - 1/2}. \tag{7.4}$$

Since $d > r$ and $d + r > 1$, we have $d - d^2 - r + r^2 < 0$, which implies $F(d - d^2 - r + r^2) < 1/2$. Thus, the left-hand side is smaller than one. However, $d > r$ implies that the right-hand side is larger than one, a contradiction.

Suppose $d < r < 1/2$ (the case $r < d < 1/2$ is similar). Then $d - d^2 - r + r^2 < 0$, which implies $F(d - d^2 - r + r^2) < 1/2$. Thus, the left-hand side of equation 7.4 is smaller than one. However, if $d < r$, then the right-hand side $((1/2 - d)/(1/2 - r))$ is larger than one, a contradiction. $\square$

Proof of Theorem 3.3. Lemmas 7.1 to 7.4 imply that in equilibrium $d = r = p^* < 1/2$, where (using equation 7.3) p^* satisfies the first order condition

$$-1/2 + (1 - 2p^*)(1 - 2p^* + G)/2\alpha + \beta(t - 1/2)/2\alpha = 0.$$

Solving this quadratic equation we obtain the desired result. $\square$

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