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Greed as a Source of Polarization*

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Abstract

The past three decades has witnessed both a growing polarity of political views and a significant growth in campaign contributions. Abstracting from narrow interest groups, these campaign contributions tend to come from lobby groups with extreme positions and to be largest to politicians with extreme policy platforms. Is the rise in campaign contributions the cause of growing polarity of political views? In this paper, we show that if the polarity of campaign contributions is the result of a free-rider problem amongst potential contributors, then under standard assumptions the answer to this question is negative: candidates' policy agendas converge despite the polarity in the preferences of campaign contributors. However, we go on to show that a modest departure from standard assumptions — allowing candidates to directly value campaign contributions (either because it allows them to use less of their own wealth to run the campaign, or because lax auditing allows them to misappropriate some of these funds) — delivers the ability of campaign contributions to cause policy divergence.

Keywords: Polarization; Campaign Contributions; Agendas; Midpoint Agenda; Mean Lobby

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1 Introduction

Expenditures on electoral campaigns have risen dramatically in recent decades, with this increase funded primarily by increased contributions from lobby groups. This increase in spending coincides with an increase in the polarization of US politicians. At a superficial level, these trends appear related, with the largest contributions being made by the most extreme lobby groups to the most extreme candidates. What are the forces that lead to the dominance of extreme lobby groups in campaign contributions? Is the dominance of extreme lobby groups the cause of the rising polarization in US politics?

In this paper, we present a theoretical model of policy formation, lobbying and electoral success in which the polarization of campaign contributions arises out of a natural incentive for moderate interest groups to free ride on the campaign contributions of more extreme interest groups. However, we then show that, under relatively standard assumptions on the objectives of politicians, policy convergence is consistent with the divergence of the interests of major campaign contributors. Under these assumptions, we show that policies converge to a mid-point of the policy preferences of lobby-groups, but that this mid-point will typically be distinct from the median lobby group. In fact, we provide conditions under which it is optimal for politicians to set policy at the level preferred by the average lobby group. We then go on to show that if politicians care about the absolute level of campaign contributions, in addition to their probability of election which is influenced by the relative level of such contributions, then policy divergence can occur with complete polarization obtaining in some special cases. We finally explore the models predictions for the effect of various campaign finance reforms, as well as for the level of polarization of politicians across countries with differing political systems.

These results all derive from the operation of the same force that leads to the extremity of campaign contributions in the first place. The intuition for this is quite straightforward. As more extreme lobby groups care more intensely about policies than do moderate interest groups, they have an greater incentive to make larger contributions. Moreover, their incentive to contribute is increasing in the amount of polarization of policy platforms. If politicians only care about their probability of being elected, and if this probability depends on relative campaign expenditures, then policy convergence results as the gain in the size of the contribution from a more extreme policy is dominated by the increase in ones competitors contributions. However, once politicians begin to care about the absolute size of their contributions

— whether because of intrinsic greed and corruption or because it enables them to use less of their personal funds in a campaign — the incentive to make policy diverge so as to maximize the absolute level of contributions is restored. In the limit, as the private value of contributions dominates the desire for election, complete polarization can result.

This paper is related to a substantial theoretical and empirical literature examining the polarization in politics and the role of lobby groups. In an important early contribution, Austen-Smith (1987) considered competition between two rival lobbying groups and established a convergence result for candidate agendas. In this paper, we generalize the convergence result to a situation in which the identity and number of contributors is endogenous, and where free riding leads to divergence of lobby groups. We also establish the limits of this result once candidates are allowed to value the absolute level of their contributions. Baron (1994) considered the contributions of many lobby groups without emphasizing their public good character and has shown that polarization may result for particularistic but not collective policies. In contrast, we take explicit account the private provision aspect of the contributions, and establish conditions under which polarization may result with collective policies. Herrera, Levine, and Martinelli (2008) explain polarization in a model in that abstracts from the role of lobbyists in campaign financing. By contrast, we focus explicitly on the campaign contribution process.

Our focus on lobbyists support of candidates with a commitment to a fixed collective agenda is motivated by several empirical findings. Most notably consistent with this framework, Langbein (1993) and Poole and Romer (1985) have found that contributors rarely donate to candidates on both sides of an issue[1]. Similarly, many authors have found that contributors support candidates with similar ideological views[2], with this result being strongest for groups like the NRA with strong ideological positions (e.g. Langbein (1993)). Similarly, in a series of papers Snyder (1990), Snyder (1992), Snyder (1993) has argued that ideological PACs do not fit a quid pro quo model of contributions, while Welch (1979) cites evidence that ideological PACs focus on close races as evidence in favor of models of contributions in support of a candidate with given position. Finally, Poole and Romer (1985) provide evidence that contributors provide the largest quantity of support for like-minded candidates.

Our emphasis on free riding by interest groups is consistent with a substantial em-

[1]Although, see Schlozman and Tierney (1986) for an alternative view.

[2]For example, Chappell (1982), Gopoian (1984), Saltzman (1987), Welch (1980), Welch (1982) and many others.

pirical literature that has found free riding by lobby groups to be important, albeit typically in the context of specific policies. For example, Bloch (1993) finds that the degree of unionization is positively related to support for minimum wage legislation, while Kischgassner and Pommerehne (1988) find that it is positively related to measures of social expenditure. Other authors have found a positive relationship between producer concentration in an industry and political influence[3].

The remainder of the paper is organized as follows. The basic model is presented in Section 2. Section 3 presents the striking convergence result. Section 4 introduces greedy politicians into the basic model and derives the polarization results. Section 5 investigates some implications of the model, and Section 6 concludes.

2 The General Model

In this section, we outline a relatively general model of agenda setting, campaign contributions, and electoral outcomes. In succeeding sections, we specialize this model in various ways in order to focus on specific forces that affect the decision making of both candidates and contributors.

Consider a model with the following elements. There are two political candidates competing for election to one position, indexed by $i = 1, 2$. The game begins with each candidate selecting a policy platform or "agenda", denoted $a_i \in [0, 1]$. That is, we are allowing candidates to commit to an agenda.

There exists a finite (and possibly large) number of lobby groups. Each lobby group is identified with (and indexed by) its preferred agenda $j \in [0, 1]$. A lobby group's preferences over agendas, a, are represented by

$$V_j(a) = -|a - j|^{\alpha}, \tag{2.1}$$

with a common $\alpha > 0$. It is typical to assume that $\alpha \geq 1$, which ensures that V is concave so that the marginal distaste of a lobby group for an agenda is increasing as the agenda deviates further from the lobby's preferred agenda. We also allow for the case of $\alpha \in (0, 1)$ in which the marginal distaste for alternative agendas is initially high and decreases as agendas become further removed from the lobby's ideal point.

In the second stage of the game, after observing the agenda choices of each candidate, each lobby group j may elect to contribute a non-negative amount $c_j(i)$ towards

[3] For example, Esty and Caves (1983), Gardner (1987), Guttman (1980), Kalt and Zupan (1984) and Trefler (1993). For a contrary view, see Becker (1986) and Pincus (1975).

candidate i's campaign at a cost to the lobby group given by

$$\phi(c_j(1) + c_j(2)). \tag{2.2}$$

For now, we assume only that ϕ is convex and increasing in total contributions.

In the third stage of the game, each candidate i chooses how much to spend on their electoral campaign. This choice, S_i, is constrained above by the size of contributions. This choice may also be constrained below. For example, in a country with relatively little corruption and accurate auditing of campaign donations, candidates may have to spend all of their campaign contributions; in a country with a great deal of corruption and little auditing, candidates may be able to appropriate some or all of their campaign contributions for their own personal consumption. For now, we represent these constraints abstractly by choice set B:

$$(S_i, C_i) \equiv \left(S_i, \sum_j c_j(i) \right) \in B. \tag{2.3}$$

The preferences of each candidate are likewise expressed somewhat abstractly as the sum of a term that captures the private benefit of campaign contributions (potentially, net of campaign spending), and a term that reflects the expected benefit from winning the election:

$$U(C_i, S_i) + p\left(S_i, S_{-i}, a_i, a_{-i}\right) W, \tag{2.4}$$

where W represents the value the agent places on winning the election and p is the probability of winning the election, and where the notation "$-i$" has been used to denote the rival candidate. For simplicity, we assume that the candidate has no preference over agendas, except in so far as they affect the size of campaign contributions and the probability of electoral victory.

The probability of winning the election has been conditioned on both the campaign spending of each candidate and their initial agenda choices, in order to encompass a wide array of voting mechanisms. Indeed, for now we simply summarize the outcome of the fourth stage of the game — in which agents vote — simply in terms of the probability that a candidate wins the election as a function of both campaign spending and agenda choices, $p(S_i, S_{-i}, a_i, a_{-i})$. This reduced form (symmetric) specification allows us to capture a number of alternative, and not necessarily exclusive, possible assumptions about the way campaign expenditures and agendas affect election outcomes. We illustrate this with a few examples provided in the Appendix B. In each of these examples, the probability of winning the election is continuously differentiable in the campaign spending levels S_i, but need not be differentiable in the choice of agenda a_i. As a result, we assume only that the p is continuously differentiable in the spending levels.

3 Divergent Lobbies and Convergent Agendas

To begin, and to focus attention on the "public good" aspect of campaign contributions, we specialize the above model in a number of ways. First, we assume that the candidates do not value campaign contributions except in so far as these contribution increase the probability of electoral success, and that campaign contributions are the only source of funds for campaign expenditures. The former is a relatively standard assumption in the literature although, as we will see below, it has a significant effect on the results.

Second, we assume that the probability of electoral success does not depend on agendas, and is strictly increasing in a candidates campaign spending. This has the effect of removing an obvious force for the convergence of agendas in equilibrium, and hence strengthens the nature of our convergence result.

Under our assumptions, the third stage of the game described above is degenerate. We solve the game consisting of the first two stages by backward induction.

3.1 Campaign Contributions

We first establish the identity of the contributing lobbies and the size of their contributions in an arbitrary subgame for given policy choices of the candidates, $\{a_i\}$. For tractability, and without loss of generality, we will adopt the convention that candidate 1 is to the left of candidate 2. That is, $a_1 \leqslant a_2$.

Consider the problem of a lobby j, that is considering contributing to candidate 1. Then that lobby solves the following problem, taking as given the opponent's campaign fund $C_2 = \sum_k c_k(2)$ and the total contributions $C_1(-j) = \sum_{k \neq j} c_k(1)$ of other lobbies to candidate 1's campaign:

$$\max_{c \geqslant 0} -p(c+C_1(-j), C_2)|a_1-j|^{\alpha} - (1-p(c+C_1(-j), C_2))|a_2-j|^{\alpha} - \phi(c+c_j(2)), \quad (3.1)$$

which is equivalent to

$$\max_{c \geqslant 0} p(c + C_1(-j), C_2)\Delta_j(a_1, a_2) - \phi(c + c_j(2)), \tag{3.2}$$

where we have defined the added benefit to lobby j of policy a_1 over policy a_2 by

$$\Delta_j(a_1, a_2) = |a_2 - j|^\alpha - |a_1 - j|^\alpha. \tag{3.3}$$

This is a very well behaved convex problem, with the first order condition for an optimum given by

$$\frac{\partial p(C_1, C_2)}{\partial C_1}\Delta_j(a_1, a_2) \leq \phi'(c_j(1) + c_j(2)), \tag{3.4}$$

and symmetrically for contributions to candidate 2

$$\frac{\partial p(C_2, C_1)}{\partial C_2}\Delta_j(a_2, a_1) \leq \phi'(c_j(1) + c_j(2)), \tag{3.5}$$

with each of these conditions holding with equality if the contribution by lobby j to candidate $i = 1, 2$ is positive.

Some results can be established without placing any further restrictions on the cost of funds or the preferences of the lobbies.

Lemma 1 *No lobby ever makes positive contributions to both candidates.*

Proof. This follows from the fact that both p and ϕ are strictly increasing. ■

The properties of the solution depend on the curvature of the lobby's preferences (given by the size of α), the curvature of the probability of electoral success probability p, and the curvature of the cost of funds function ϕ. We get some of out starkest results when we assume that the cost of funds function ϕ is linear in contributions.

Lemma 2 *If $\alpha > 1$ and $\phi(c) = \phi c$, then only the extreme lobbies contribute in any subgame. That is, in every subgame, $C_1 = c_{\underline{j}}$ and $C_2 = c_{\overline{j}}$, where $\underline{j} = \min j$ is the left-most lobby and $\overline{j} = \max j$ is the right-most lobby.*

Proof. Suppose not. Then there exists a j satisfying $\underline{j} < j < \overline{j}$ and such that the first order condition for contributing to one candidate holds with equality. But note that under the assumptions of the lemma, for any $a_1 < a_2$ the term $\Delta_j(a_1, a_2)$ is decreasing in j. But then the first order condition for at least one of the extreme lobbies is violated, a contradiction. Suppose then that $a_1 = a_2$. But then $\Delta_j(a_1, a_2) = 0$ for all j and no lobby contributes. ■

In order to ensure that the extreme lobbies make positive contributions, one could impose Inada condition on p and that $a_1 \neq a_2$ (or a weaker condition that ensures that the marginal product of the first contribution is greater than ϕ).

Lemma 3 *If $\alpha < 1$ and $\phi(c) = \phi c$, then only the lobbies most closely aligned with the candidates' platforms contribute in any subgame. More formally, in every subgame, $C_1 = c_{j_1}$ and $C_2 = c_{j_2}$, where $j_i = \arg\min_j \left(|a_i - j|^\alpha - |a_{-i} - j|^\alpha\right)$; unless the* $\arg\min[\cdot]$ *is multi-valued (which never occurs in equilibrium), in which case we may have two lobbies contributing to a candidate.*

Proof. The proof is analogous to that of the previous lemma. ■

Note that the contributing lobby is either the lobby most closely aligned with the candidate ($j_i = \arg\min_j |a_i - j|$) or, if the closest lobby is more centrist than the candidate, possibly the second closest.

When the cost of funds is strictly convex, we obtain less extreme results in which more than one lobby may contribute to each candidate. For the purposes of generalization, let the preferences of a lobby j be now represented by

$$u_j(a) = -|a - j|^\alpha - \phi c^\sigma, \tag{3.6}$$

where $\sigma > 1$. Whereas a single lobby (with the greatest benefit from a particular election outcome) contributed under the earlier specification of preferences (which corresponds to $\sigma = 1$); under the more general preferences, most lobbies will contribute to one candidate or another, since the marginal cost of a contribution is 0 at first. For that reason, the only lobby that may not contribute to any candidate is the one that is indifferent between the candidates. For all other lobbies, the first order condition with respect to contribution holds with equality:

$$\frac{\partial p(C_1, C_2)}{\partial C_1}\Delta_j(a_1, a_2) = \phi\sigma c_j(1)^{\sigma-1} \qquad \text{whenever} \quad \Delta_j(a_1, a_2) > 0 \tag{3.7}$$

and

$$\frac{\partial p(C_2, C_1)}{\partial C_2}\Delta_j(a_2, a_1) = \phi\sigma c_j(2)^{\sigma-1} \qquad \text{whenever} \quad \Delta_j(a_2, a_1) > 0. \tag{3.8}$$

Denoting the marginal productivity of contributions to candidate 1 by $\theta_1 = \frac{\partial p(C_1, C_2)}{\partial C_1}$, and defining θ_2 analogously, we obtain

$$c_j(i) = \left(\frac{\theta_i}{\phi\sigma}\Delta_j(a_i, a_{-i})\right)^{\frac{1}{\sigma-1}} \qquad \text{whenever} \quad \Delta_j(a_i, a_{-i}) > 0. \tag{3.9}$$

To complete the characterization, we simply need to note that[4]

$$C_i = \sum_{\Delta_j(a_i, a_{-i})>0} c_j(i). \tag{3.10}$$

3.2 Political Agendas

Having established the optimal behavior of the lobbies in the second stage of the game, we are now ready to consider the agenda-setting behavior of the candidates. To simplify the presentation, we restrict ourselves to the linear cost of funds case and the simplest symmetric specification of the probability of electoral success. That is, from now on, we assume that $\phi(c) = \phi c$ and $p(S_i, S_{-i}, a_i, a_{-i}) = \frac{S_i}{S_i + S_{-i}}$.

Lemma 4 *No candidate ever chooses a platform that is located further from the center (the other candidate) than the preferred point j of the lobby that contributes to the candidate's campaign in equilibrium.*

Proof. By locating further from the other candidate than the supporting lobby's preferred point, a candidate would both lower her own campaign contributions and increase those of the opponent (from equations (3.4) and (3.5)). ■

Lemma 5 *If $\alpha < 1$, no candidate ever chooses a platform that is not located at a preferred point j of some lobby (which contributes to the candidate's campaign in equilibrium). That is, candidates do not locate (choose platforms) at points where there are no lobbies.*

Proof. Due to concavity of the value function, moving away from the preferred point of a supporting coalition lowers the candidate's contribution more than the opponent's. ■

We now establish the first key result — the convergence of agendas when the candidates' sole objective is winning the election. We begin with the most extreme (and simplest) case in which the cost of funds is linear so that only the most extreme lobbies contribute, before going on to consider the more general convex cost of funds case. We show that, for all specifications, there is convergence in agendas to some

[4] For the presentation purposes, it may be more attractive to have the equation appear as $C_i = \sum_{V_j(a_i,a_{-i})>0} w_j c_j$, where w_j is the "size" of group j. This is perfectly legit if we say that the preferences (3.6) are those of an individual lobby member, and w_j is the measure of the members of lobby j.

"central" agenda. We also show that, in general, the convergence will NOT be to a median agenda.

First, we have to pick a functional form for the probability of winning the election. We choose the simplest symmetric functional form:[5]

$$p(S_i, S_{-i}) = \frac{S_i}{S_i + S_{-i}}. \tag{3.11}$$

Picking up from equations (3.4) and (3.5), we get, plugging in the functional form of p,

$$\frac{C_{-i}}{(c + C_{-i})^2}\Delta_{j_i}(a_i, a_{-i}) = \phi, \tag{3.12}$$

which can be solved for the (subgame) equilibrium contribution c. The values Δ_j are given by equation (3.3).

Solving the equations (3.12) for the contributions as a function of platform choices, we get

$$C_i = \Delta_i \frac{\Delta_i \Delta_{-i}}{\phi\,(\Delta_i + \Delta_{-i})^2}, \tag{3.13}$$

where the values Δ are given by equation (3.3). It is important to note that $\frac{C_1}{C_2} = \frac{\Delta_1}{\Delta_2}$.

In a symmetric equilibrium (when $\Delta_{j_i} = \Delta_{j_{-i}} = \Delta$), we get $C_i = \frac{\Delta}{4\phi}$ for both candidates.

We are now ready to characterize the equilibria.

Theorem 1 *If $\alpha > 1$ and the candidates' sole objective is winning the election, the unique equilibrium has both candidates locating (choosing platforms) in the mid-point between the two extreme lobbies, at $j_m = \frac{\bar{j}+\underline{j}}{2}$. Contributions are zero in equilibrium.*

Proof. This is an equilibrium because moving away from the midpoint increases opponent's contributions more than your own.

A candidate i, whose only objective is to win the election, will (strategically) maximize $\frac{C_i}{C_{-i}} = \frac{\Delta_i}{\Delta_{-i}}$. That is, the candidate will take into account the effect of her choice of platform a_i on the contributions to her opponent. So, the problem of the (left) candidate 1 is:

$$\max_{a_1 \leqslant a_2} \frac{(a_2 - \underline{j})^\alpha - (a_1 - \underline{j})^\alpha}{(\bar{j} - a_1)^\alpha - (\bar{j} - a_2)^\alpha} \tag{3.14}$$

[5] Our results are robust to a more general symmetric specification $p(S_i, S_{-i}) = \frac{S_i^\rho}{S_i^\rho + S_{-i}^\rho}$.

If $a_{-i} < \frac{\underline{j}+\bar{j}}{2}$, then candidate i will choose to locate to the right of a_{-i} ($a_i > a_{-i}$). To see this, simply observe that $\Delta_{\underline{j}}(a, a_{-i}) < \Delta_{\bar{j}}(a_{-i}, a)$ for $a < a_{-i}$ and $\Delta_{\bar{j}}(a, a_{-i}) > \Delta_{\underline{j}}(a_{-i}, a)$ for $a_{-i} < a \leqslant j_m$. Similarly, if $a_{-i} > \frac{\underline{j}+\bar{j}}{2}$, then candidate i will choose to locate to the left of a_{-i} ($a_i < a_{-i}$). Either way, candidate i can guarantee herself more than 50% chance of winning the election. Thus, choosing any platform other than j_m cannot be part of a pure strategy equilibrium. In fact, since choosing j_m guarantees at least 50% chance of winning the election (regardless of what the opponent's platform is), the only equilibrium has both candidates choosing j_m. ■

It is important to note that the above result is not a median voter result. The midpoint to which the platforms converge need not be the preferred point of a median voter (or a median lobby for that matter).

Theorem 2 *If $\alpha < 1$ and the candidates' sole objective is winning the election and the number of lobbies is N, then there are N^2 distinct equilibria. The two candidates choose some lobbies' (not necessarily distinct) preferred points as their platforms. The contributions are $C_1 = C_2 = \frac{\Delta}{4\phi}$, where Δ is given by equation (3.3).*

Proof. The proof follows from Lemma 5. ■

It is worth noting that if there are any informed voters (who vote sincerely and are not affected by campaigns), and there is a lobby that has the same preferred point as the median voter, then we get the median voter result when $\alpha < 1$: The platforms converge to the median voter's preferred point.

Lastly, if $\alpha = 1$, we have a continuum of equilibria with platforms locating anywhere on $[\underline{j}, \bar{j}]$ and the identity (and number) of contributing lobbies being indeterminant in general. Again, introducing infinitesimal number of informed voters is enough to get a unique equilibrium with both platforms at the median voter's preferred point and no contribution in equilibrium.[6]

With a more general convex cost of funds, we also get agenda convergence. To illustrate, consider the case of $\sigma = 2$ and $\alpha = 1$. The former implies that

$$C_i = \frac{\theta_i}{\phi\sigma} \sum_j \max\{\Delta_j(a_i, a_{-i}), 0\},$$

and the latter implies that the values Δ simply compare the linear distance from the lobby to the two candidates. As a result, if the candidates' sole objective is to win

[6] In this case, we do not even need a lobby to live at the median voter's point.

the elections, the unique equilibrium is policy convergence to the "mean lobby" (the "probability" weighted average of all lobbies), as opposed to the midpoint agenda obtained under the constant marginal cost of funds.[7]

4 Greedy Candidates and Divergent Agendas

In the previous section we have established a result that, at first glance, seems surprising: Even though the private provision of publicly valuable contributions leads to extreme lobbies being the largest (and in some cases, the only) contributors, *and* even though the contributions to a candidate are increasing with polarization, the agenda's of competing candidates converge in equilibrium. Upon reflection, the result is quite intuitive: although polarization increases the absolute level of a candidates contributions, they increase the level of the candidates opponent's contributions even more, so that relative contributions decline. Under our (standard) assumption that it is relative contributions that matter for electoral success, we obtain policy convergence.

This logic also suggests that polarization should result in any model in which candidates value the absolute level of their contributions in addition to (or possibly instead of) their relative contributions. There are a large number of more or less compelling reasons why this might be the case. For example, candidates may derive some pure utility from receiving a large quantity of contributions. Alternatively, if contributions to a campaign need not be spent on the campaign, and may instead be used to finance candidate consumption, then candidates will also value a large absolute level of contributions. Finally, to the extent that a candidate may use their own funds to support their campaign, the larger are the absolute level of contributions the less of a candidates own money will be spent on the campaign, leading candidates to value the absolute level of contributions.

In this section, we establish our agenda polarization result through a series of simple examples.

4.1 Illustrative simple extension

Consider first an extremely simplified extension: Allow the candidates to consume fraction $1-\gamma$ of the contributions they collect, and make their preferences increasing

[7] This is the point where having w_j could come in handy - it makes it very clear that the lobbies are "probability-weighted".

in consumption and independent of winning the election.

Now, the candidates will choose their platforms with the sole goal of maximizing their own contributions. The candidates are no longer concerned with the opponent's contributions since they do not care about winning the elections. We immediately obtain the desired result:

Theorem 3 *The unique equilibrium (for any $\alpha > 0$) has two candidates tailoring to the extreme lobbies. That is, $a_1 = \underline{j}$ and $a_2 = \overline{j}$.*

It is worth noting that allowing the candidates to consume a fixed portion of endowments does not affect the (subgame) equilibrium contributions as a function of the platforms. That is, equation (3.13) still holds and does not include γ. The basic intuition for this (somewhat surprising) result comes from the fact that the marginal productivity of the contributions (in affecting the probability of election victory) remains unchanged. While left candidate's consumption lowers the productivity of the left lobby's contributions, the right candidate's consumption of her (right lobby's) contributions raises the productivity right back up. This observation will be important in allowing us to characterize the equilibria in a richer model of the next subsection (see the derivation (4.6)).

4.2 Richer Model

Again, the only aspect of the model we will alter is the preferences of the candidates. They will now care about *both* personal consumption (out of the campaign contributions) *and* winning the elections. The candidates will get to decide how much to consume out of their campaign fund:

$$\max_{S_i \in [0,C]} v(C - S_i) + p(S_i, S_{-i})W \tag{4.1}$$

where S_i is the amount the candidate i actually spends on campaign, C is the amount contributed to the candidate by the lobbies, S_{-i} is campaign spending (net of consumption) of the opponent, and W is the value of winning the election. Of course, this is the problem of a candidate in the third stage of the game. In the first stage, the candidates still get to choose their platforms. We will not allow the candidates in stage 1 to commit to restricting their consumption at the later stage.[8]

[8]However, the model may be well-suited to study some campaign finance regulation that does restrict such consumption.

The first order condition of the candidate's (ex-post) problem (4.1) is

$$v'(C - S_i) = W\frac{\partial p(S_i, S_{-i})}{\partial S_i} = \frac{WS_{-i}}{(S_i + S_{-i})^2}. \tag{4.2}$$

In order to get a closed form solution, we will consider a particular functional form of the candidates' utility function:

$$v(h) = \ln h.$$

This assumption dramatically simplifies the analysis, as it implies that, from the perspective of the contributors, the candidates' behavior resembles that in the illustrative example above, and the equilibrium in the second stage is still characterized by equation (3.13).

The first order conditions (4.2) for the campaign spending become:

$$\frac{1}{C_1 - S_1} = \frac{WS_2}{(S_1 + S_2)^2},$$
$$\frac{1}{C_2 - S_2} = \frac{WS_1}{(S_1 + S_2)^2}.$$

It follows that

$$\frac{S_1}{C_1 - S_1} = \frac{S_2}{C_2 - S_2} = \frac{WS_1S_2}{(S_1 + S_2)^2}. \tag{4.3}$$

That is, the candidates spend the same fraction γ of their contributions on their campaigns (and consume the rest)! The fraction γ spent on the campaigns solves

$$\frac{1}{\gamma} = \frac{(C_1 + C_2)^2}{WC_1C_2} + 1. \tag{4.4}$$

Now, the problem in stage 2 of the (extreme) contributor to candidate i is the familiar

$$\max_{c_i} p(S_i(c_i, C_{-i}), S_{-i}(c_i, C_{-i}))\Delta_i - \phi c_i \tag{4.5}$$

and the intuition developed in Section 4.1 applies. It is worth noting that the level of contributions does affect the fraction γ spent on the campaign. While the contributors do recognize this fact, their behavior is still captured by the familiar equation (3.13), since their are not concerned with the campaign spending per se, but only with the *relative* campaign spending of their preferred candidate (relative to the opponent's).[9]

[9]The key is the fact that the candidates spend the *same* fraction γ of their contributions on campaigning, which was established by equation (4.3). We can thus use the expression $S_j = \gamma(c_i, C_{-i})C_j$.

More formally, the marginal effect of the contributions on the probability of winning the election (taking the effect on candidates' behavior into account) is

$$\begin{aligned}\frac{\partial p(S_i(c_i, C_{-i}), S_{-i}(c_i, C_{-i}))}{\partial c_i} &= \frac{\partial p(S_i, S_{-i})}{\partial S_i}\frac{\partial S_i}{\partial c_i} + \frac{\partial p(S_i, S_{-i})}{\partial S_{-i}}\frac{\partial S_{-i}}{\partial c_i} \\ &= \frac{S_{-i}}{(S_i + S_{-i})^2}\left(\gamma + \frac{\partial \gamma}{\partial c_i}c_i\right) - \frac{S_i}{(S_i + S_{-i})^2}\frac{\partial \gamma}{\partial c_i}C_{-i} \\ &= \gamma\frac{S_{-i}}{(S_i + S_{-i})^2} + \frac{\partial \gamma}{\partial c_i}\left(\frac{\gamma C_{-i}c_i}{(S_i + S_{-i})^2} - \frac{\gamma c_i C_{-i}}{(S_i + S_{-i})^2}\right) \\ &= \frac{\gamma^2 C_{-i}}{\gamma^2(c_i + C_{-i})^2} = \frac{C_{-i}}{(c_i + C_{-i})^2}, \qquad (4.6)\end{aligned}$$

which is exactly what we had in section 3.2. This allows us to arrive at the following:

Theorem 4 *If $\alpha > 1$, the degree of polarization $|a_1 - a_2|$ is decreasing in the value W of winning the election. If $\alpha \leqslant 1$, the equilibrium features complete polarization, regardless of the value of W.*

Proof. See Appendix A.1. ■

4.3 Generalizations

While the nice closed form results of the last section were derived under a specific functional form assumptions, they do carry over to more general environments.

Consider an environment with the general specification of the candidates' preferences given by equation (2.4). To keep the analysis tractable, we will not let the candidates choose how much to consume — the fraction of contributions spent on campaigning, γ, is given exogenously, as in section 4.1. This is still a meaningful model, since the sophisticated preferences of the candidates affect their platform choices.

Conjecture 1 *If $\alpha > 1$, we obtain partial polarization in equilibrium. The extent of polarization is decreasing in the value of winning the elections, W.*

In contrast,

Theorem 5 *If $\alpha \leqslant 1$ and candidates put any weight on their private consumption, we obtain complete polarization in equilibrium.*

Proof. Recall from the analysis in section 3 that candidate's choice of platform affects the willingness to contribute of her own and opponent's lobbies symmetrically. Thus, there is no cost to polarization, while there is still the benefit of raising the amount contributed (both to ownself a to the opponent). ■

This result is especially striking, since the basic mechanism determining the contributions is exactly that of Baron (1994).

5 Implications

Corruption need not lead to polarization. If corruption makes the value of being in office higher, it lower the relative weight candidates put on consuming the contributions, and limits the extent of polarization.

6 Conclusion

First, we have established a result that, at first glance, seems surprising: Even though the private provision of publicly valuable contributions leads to extreme lobbies being the largest (and in some cases, the only) contributors, *and* even though the contributions to a candidate are increasing with polarization, the agendas of competing candidates converge in equilibrium, when the candidates only care about winning the election. Upon reflection, the result is quite intuitive: although polarization increases the absolute level of a candidate's contributions, they increase the level of the candidate's opponent's contributions even more, so that the relative contributions decline.

One way to obtain policy divergence then is to make the candidates care about their own contributions directly. We do so by allowing the candidates to consume a portion of contributions to their campaigns. Interestingly, under the standard assumption regarding the preferences of the lobbies (convex loss function), we find that only the extreme lobbies ever contribute, but that the polarization in equilibrium is only partial. However, if the loss function of the lobbies is concave, we find that the contributing lobbies in any subgame are the ones most closely aligned with the candidates' declared agendas, and yet even the slightest amount of "greed" delivers complete polarization in equilibrium.

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A Proofs

A.1 Proof of Theorem 4

To establish that polarization increases with greed (decreases with W) when $\alpha > 1$, take (interior) equilibrium (a_1^*, a_2^*) which occurs when $W = W^*$. Now consider $W' > W^*$. Or rather, consider $W_1' > W_1^*$ ...

The complete polarization result when $\alpha \leqslant 1$ follows directly from the Theorem 2.
■

B Mapping Existing Frameworks into Our Model

Example 1. Perfectly Informed Voters. Suppose that there is a unit measure of voters distributed uniformly over the unit interval and indexed by $i \in [0, 1]$ with preferences over agendas given by

$$u_i(a) = -|a - i|^\alpha,$$

so that the added benefit to voter i of policy a_1 over policy a_2 is given by

$$\Delta_i(a_1, a_2) = |a_2 - i|^\alpha - |a_1 - i|^\alpha. \tag{B.1}$$

These voters are perfectly informed and are unaffected by campaigns. In this model, voter $i = \frac{1}{2}$ is the median voter. Hence, the probability that candidate 1 wins the elections is given by:

$$p^{MV}(S_1, S_2, a_1, a_2) = \begin{cases} 0 & \text{if } \Delta_{\frac{1}{2}}(a_1, a_2) > 0 \\ \frac{1}{2} & \text{if } \Delta_{\frac{1}{2}}(a_1, a_2) = 0 \\ 1 & \text{if } \Delta_{\frac{1}{2}}(a_1, a_2) < 0 \end{cases}. \tag{B.2}$$

Example 2. Informed and Uninformed Voters. The closest to our model is that of Baron (1994). However, we are only interested in collective policies (those that affect everyone), and choose to drop the particularistic policy considerations. The mapping from Baron (1994) into our framework is then quite simple: Normalize the total number of voters to one and assume that they are divided into separate groups of informed and uninformed voters with the measure of uninformed voters given by θ. The probability that candidate 1 wins the election, given spending levels and agenda's, is then given by

$$p^{UV}(S_1, S_2, a_1, a_2) = \theta \frac{S_1}{S_1 + S_2} + (1 - \theta) \frac{a_1 + a_2}{2}. \tag{B.3}$$

It may be worth noting that, as the measure of uninformed voters θ approaches zero, the model does not collapse to Example 1 - it retains continuity in a's. However, we are more interested in the limit of this model as the measure of uninformed voters θ approaches one, when the election outcome depends only on campaign spending and not directly on the candidates' agenda choices.

Example 3. Spending to "Get Out the Vote." Another model that fits neatly into our general framework is a slight modification of Herrera, Levine, and Martinelli (2008), in which campaign spending increases the proportion of potential voters who turn up to vote.[10] There are two office-motivated candidates, who first simultaneously choose their agendas, and then their spending. The voters have both idiosyncratic and aggregate (unknown) candidate bias. The voters also care about the policy choices - they have Euclidean preferences with their ideal points distributed uniformly on $[0, 1]$. Campaign spending by the candidates is necessary to motivate the electorate to vote. However, the spending is not perfectly targeted, and brings some of the opponent's supporters to the polling stations. The fraction of candidate i's supporters who turn out to vote is then $(tS_i + (1 - t)S_{-i})$, where $t \in (\frac{1}{2}, 1]$ is the accuracy of campaign targeting. As Herrera, Levine, and Martinelli (2008) show, the probability of the (left) candidate 1 winning the election is

$$p^{GV}(S_1, S_2, a_1, a_2) = F\left(a_1 - a_1^2 - a_2 + a_2^2 + 2\beta \left(t - \frac{1}{2}\right) \frac{S_1 - S_2}{S_1 + S_2}\right), \tag{B.4}$$

where F is the c.d.f. of the distribution of the aggregate bias for candidate 1, and β is measure of the dispersion of the idiosyncratic bias (which is distributed uniformly on $[-\beta, \beta]$).

[10]We omit the policy preferences of the candidates (parties) which are present in Herrera, Levine, and Martinelli (2008).