

# Going Negative in Comparative Perspective: Electoral Rules and Campaign Strategies

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## Abstract

“Going negative” has practical and normative implications for electoral outcomes in all democracies. But most research on campaign strategy is limited to the two-candidate, plurality context provided by many elected offices in the United States. How do campaign strategies change as a function of electoral rules? In this paper, I offer a game theoretic model of campaign strategy that can be applied to any electoral system with any number of candidates. I apply the model to five widely-used electoral systems: single-member district plurality, single-member district run-off, single non-transferable vote, open-list proportional representation, and closed-list proportional representation. I show that campaign strategy is a function of the interaction of electoral rules, system consolidation, and competitiveness. Empirical tests using a new dataset of campaign messages from Brazil, El Salvador, and Mexico provide support for my hypotheses.

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## Introduction

Why do some political systems have highly confrontational and negative political campaigns, while other systems enjoy exclusively positive and very civil campaigns?<sup>1</sup> While many features of US political campaigns have spread across the globe, including highly professionalized media management, negative or attack advertising has a less consistent record. Recent campaigns in some countries have been highly confrontational and negative (Mexico, Brazil, El Salvador) while in others (Chile, Colombia), candidates focus on their own qualifications, experience, and policy proposals.

Understanding the diversity of campaign styles is important because of the potential impact that negative campaigning may have on political life. Scholarship remains divided on whether negativity is good or bad for democracy - or both - but there is agreement that campaign tone matters. On one side, scholars have found that negative campaign messages alienate voters, reduce turnout, and increase cynicism about politics. On the other side, scholars have argued almost the opposite, finding that voters pay more attention to, and acquire more useful information from negative messages, that voters are mobilized by attack advertisements, and that negative advertising is an important part of accountability. Recent work suggests some resolution: below-the-belt negative campaigns are demobilizing, while policy-oriented negative campaigns are mobilizing.

Resolving these issues is especially important in the many new democracies. Campaigns' impact on voters is often greater in emerging than in consolidated democracies, due to weaker partisanship, issue ownership, and weaker ideological cleavages. (Dominguez and Lawson, 2004; McCann and Lawson, 2003; Lawson and McCann, 2005) While students of US campaigns find no or modest campaign effects on voting behavior (Markus, 1988; Bartels, 1992, 1993; Bartels and Zaller, 2001; Geer, 1988; Campbell and Wink, 1992; Shelley and Hwang, 1991; ?), recent work on the developing world finds large swings in electoral support in response to campaign events (AMES). A greater impact on voters implies a greater impact on electoral outcomes, as well as a significantly more important role in voter information, accountability, and representation.

Either resolution of the debate (pro-negativity, or anti-negativity), suggests that scholars should seek to understand why campaigns turn confrontational in some contexts and not others. Promising work has explored the role of political competition, undecided voters, and candidate quality in strategy, with one shortcoming: nearly all previous work is exclusively focused on strategy in two-candidate, single-member district elections. Consequently, we know virtually nothing about the dynamics of campaign strategy in most elections globally.

In this paper, I present a general model of campaign strategy that can be applied to any electoral system with any number of candidates. I demonstrate the model by examining five electoral systems, representative of most of the world's elections. The model suggests that campaign strategy is an interactive function of electoral systems, competition, and political system consolidation. I demonstrate empirically using an original dataset of political advertisements collected from Brazil, Colombia, and Mexico.

## Existing Research

Previous theoretical work on campaign strategy varies in the nature of voting and the impact of campaign messages. One of the most important is that of Skaperdas and Grofman (1995). They offer a nonspatial model for two and three candidates races, where candidates simultaneously allocate resources between negative and positive campaigning in order to maximize their lead over their opponent. In their model, negative campaigning reduces turnout and hurts both attacker and victim, and positive campaigning increases turnout. Their model leads to a number of intuitive conclusions: leading candidates are less likely to attack; trailing candidates are more likely to

attack; candidates increase positive campaigning as the fraction of undecided voters increases; and with three candidates, candidates do not engage in negative campaigning against the weakest of the three. These findings are empirically verified in the work of Theilmann and Wilhite (1998). They asked political consultants to choose between negative and positive campaigns given certain hypothetical situations corresponding to theoretical predictions of Skaperdas and Grofman (1995)'s model. The consultants all chose strategies predicted by that model: going negative when behind, going positive when ahead, and so on.

Most other scholarship uses a spatial model, or combination of spatial and valence models of voting. Harrington and Hess (1996) offer a two candidate model of campaigning. Candidates have two distinguishing characteristics: their ideal points and their valence. Voters cast fully informed spatial ballots, picking candidates as a function of proximity and valence. Positive campaigning makes voters see them as "closer"; negative campaigning makes their opponents ideology seem more extreme. A core finding is that candidates with stronger personal characteristics, or valence, dedicate more resources to positive campaigning while candidates with weaker valence components are more likely to "go negative".

More recent work includes Roberson (2004). Following Harrington and Hess (1996), his electoral model includes a spatial policy dimension and a valence or personal image dimension. He fixes policy locations and only allows campaigning on image. His conclusions largely reiterate the findings of Skaperdas and Grofman (1995). A number of other scholars have followed with additional variants. Konrad (2004) models "inverse campaigning", where parties reveal the identity of potential program beneficiaries to convince voters that they will *not* benefit from opponents' policies. Mattes (2007) also offers a model where candidates can campaign on spatial or valence messages, and extends his model to the case of strategic citizen (voter) behavior in response to campaign messages. Polborn and Yi (Polborn and Yi) use a valence model to examine the welfare effects of campaign tone in a game where only candidates can reveal information about each other. They find that negative campaigning can improve welfare, though voters attitudes towards negative messages are endogenously disapproving.

While each of these approaches uses a different model of campaigning, they all share the same basic context: two-candidate, single-member district elections. The only exception is Skaperdas and Grofman (1995), who add a third and trailing candidate to their game. Consequently, these models may not be useful for examining competition with many candidates, or complex vote-pooling electoral rules.

## The Model

In this section I present a model of campaign strategy that can be adapted to any electoral system. In the model, there are  $m$  candidates for office. Candidates receive utility 1 if they are elected to office and 0 if they are not elected, and seek to maximize their expected utility, which is exactly equal to their probability of election. Each candidate begins the campaign period with an initial endowment of valence,  $v_i$ . During the campaign, each candidate  $i$  can either send to voters a positive message ( $p_i$ ) intended to increase their own perceived valence, or a negative message ( $n_{i \neq j}$ ) intended to decrease the valence of a targeted competitor  $j$ . If the candidate chooses a negative message, it may backfire - reducing candidate  $i$ 's valence by  $b_i$ . After the campaign, citizens vote for the candidate with the highest perceived valence - a function of candidates' starting valence, and the positive, negative and backfire effects of the campaign.

Campaign strategies are all risky; they may work as intended, have the opposite effect, or have no impact. Formally, messages' impacts are random variables, drawn from normal distributions. Positive messages' impact is distributed  $N(\mu_p, \sigma_p)$ , negative messages' impact  $N(\mu_n, \sigma_n)$ , and back-

fire effects are distributed  $N(\mu_b, \sigma_b)$ . For all examples explored in this paper, I assume that  $\mu_n > \mu_p$  and  $\sigma_n > \sigma_p$ , that is, negative campaigning is more effective on average than positive campaigning, but is also riskier.

The campaign proceeds in three steps. Nature determines candidates' initial endowments of valence. Candidates simultaneously adopt campaign strategies and send negative or positive messages. The valence of all candidates goes up or down in response to strategies. Voters observe post-campaign valence with error, and vote, and election winner(s) are determined following electoral formulas.

In a simple two-player plurality election, there are four sets of strategies, leading to the post-campaign valences ( $v'_1$  and  $v'_2$ ) presented in the following table. For example, in the first cell, both candidates send positive campaign messages, attempting to improve their own image. Consequently, for  $c_1$ , post-campaign valence is:  $v'_1 = v_1 + p_1$ , and  $c_2$ 's post-campaign valence is  $v'_2 = v_2 + p_2$ . If  $c_1$  issues a positive message, and  $c_2$  attacks  $c_1$ , we have the situation in the upper-right cell.  $c_1$ 's post-campaign valence is now  $v'_1 = v_1 + p_1 - n_2$  - adding the positive message and subtracting the negative message. In the same cell,  $c_2$ 's post-campaign valence is  $v'_2 = v_2 - b_2$ .

Post-Campaign Valence as a Function of Strategy

		Candidate 2	
		Positive	Negative
Candidate 1	Positive	$v_1 + p_1, v_2 + p_2$	$v_1 + p_1 - n_{21}, v_2 - b_2$
	Negative	$v_1 - b_1, v_2 + p_2 - n_{12}$	$v_1 - n_{21} - b_1, v_2 - n_{12} - b_2$

Because  $p_i$ ,  $v_i$ , and  $b_i$  are drawn from independent Normal distributions, it is straightforward to calculate the probability of election for each candidate given the strategy set<sup>2</sup>:

Expected Payoffs Associated With Campaign Strategies

		Candidate 2	
		Positive	Negative
Candidate 1	Positive	$\Phi\left(\frac{v_1-v_2}{\sqrt{2\sigma_p^2}}\right),$ $\Phi\left(\frac{v_2-v_1}{\sqrt{2\sigma_p^2}}\right)$	$\Phi\left(\frac{v_1-v_2+\mu_p-\mu_n+\mu_b}{\sqrt{\sigma_b^2+\sigma_n^2+\sigma_p^2}}\right),$ $\Phi\left(\frac{v_2-v_1+\mu_n-\mu_p-\mu_b}{\sqrt{\sigma_b^2+\sigma_n^2+\sigma_p^2}}\right)$
	Negative	$\Phi\left(\frac{v_1-v_2+\mu_n-\mu_p-\mu_b}{\sqrt{\sigma_b^2+\sigma_n^2+\sigma_p^2}}\right),$ $\Phi\left(\frac{v_2-v_1+\mu_p-\mu_n+\mu_b}{\sqrt{\sigma_b^2+\sigma_n^2+\sigma_p^2}}\right)$	$\Phi\left(\frac{v_1-v_2}{\sqrt{2(\sigma_b^2+\sigma_n^2)}}\right),$ $\Phi\left(\frac{v_2-v_1}{\sqrt{2(\sigma_b^2+\sigma_n^2)}}\right)$

In a simple one-vote plurality system like this one, the electorate can be modeled as a single citizen that votes for the candidate with the highest election. But for other electoral rules, where more than one candidate wins, this modeling strategy will not work. Consequently, I assume a very large citizenry where each individual voter perceives candidate valence with error and votes for the candidate with the highest perceived valence. If the errors are distributed iid extreme value and the number of citizens approaches infinity, candidate  $j$ 's vote share will be:

$$V_j = \frac{e^{v'_j}}{\sum_{i=1}^m e^{v'_i}}$$

Several of the unique features of the model deserve additional attention. First, in contrast with previous work, I model all campaign strategies as risky: candidates only know the expected impact of a strategy. However, any strategy's impact *could* be the opposite of the sender's intention. Positive messages may reduce a candidate's valence, negative messages may increase a target's valence. This assumption captures the risk in real campaigns (both marketing and political) where candidates do not know whether their messages will resonate with the public. Actual campaigns are full of examples of positive and negative messages with unintended consequences. Dan Quayle attempted to portray himself as a new JFK, and was humiliated by Lloyd Bentsen. Similarly, negative messages may actually help the intended target, by increasing name recognition or by generating sympathy for the victim of the attack. Finally, attack message can backfire and reduce source valence - but they could also have the opposite effect, as the electorate might perceive the attacker as the only one willing to engage on the tough issues. Examples and counter-examples abound, but the key point is that candidates don't know how their messages will be received. Instead, they just have information about how the electorate might respond.

Second, unlike previous work, candidates in my model derive utility from office-holding, not from receiving votes: candidates maximize their probability of holding office, not their expected number of votes. The difference is subtle, but important. Vote maximization may be a losing strategy under some electoral rules, especially those with complex vote-pooling. Further, even under single-member district elections, changing this assumption will change equilibria strategies

and generate predictions that better fit reality.<sup>3</sup> This approach is more realistic and much more generalizable. The disadvantage is that for complex electoral formulas, expected payoffs cannot be calculated analytically, and must be simulated.

Third, following Skaperdas and Grofman (1995), voting in my model is based on candidates' valence, not their policy positions. As discussed above, most previous work uses policy-based voting, where citizens vote for the candidates perceived to be closest to their own ideal points in a unidimensional policy space. Valence characteristics are uniformly accepted as goods by voters; more is always better. Valence characteristics can be personal traits of politicians (honesty, experience, intelligence, dedication, creativity, charisma) as well as achievements from previous offices (lower crime rates, higher employment, lower inflation, cleaner air, more security). In my model, voters support the candidate perceived to have the highest valence; there are no policies in my election.

I adopt this modeling strategy for two reasons. First, most political messages are in fact valence messages, because politicians would much rather deliver valence than spatial messages. Any spatial message is both mobilizing and alienating. Taking a position on health care, immigration, or taxes is sure to generate support among some voters but alienate others. Valence characteristics have no downside: integrity and competence can increase support uniformly, and do not alienate any voters. For example, a politician would rather claim that she will lower unemployment (a valence message) than explain that she will increase tariffs, keeping more jobs in the United States and lowering unemployment. The first message is uncontroversial and well-received; the second will earn votes among one protectionist voters and alienate free-traders. Spatial voting can also be seen as subset of the more general valence model. I'll examine the implications of spatial voting for campaign strategy.

Candidates and parties recognize these features of the electoral environment and when forced to take spatial positions deliberately frame them as if they were valence issues. For example, a Democratic candidate will talk about social services, but never mention tax increases, while a Republican candidate will talk about tax cuts, with rare mentions of associated cuts in programs. In the developing world, ideology, partisanship, and issue-ownership are even weaker, and voters care more about results than about ideal points, and these tendencies are only exacerbated by personalistic electoral rules. In the last election in my own Congressional district, all of the mailings from the Republican candidate mentioned his family and history in the community, none mentioned his party, and only ZZZ % mentioned his policy positions.

Fourth, the model can be used to examine consolidated and unconsolidated political systems. Much of the literature on campaigns in consolidated systems suggests that their impact on electoral outcomes is fairly small. Research on new democracies suggests the opposite, with wide swings in candidate support over the course of a campaign (Baker et al., 2006; Lawson and McCann, 2005). Both environments can be examined by adjusting the expectation and variance of the three campaign effects,  $p$ ,  $n$ , and  $b$ . Larger mean effects, and larger variance imply that campaigns matter more and that voters learn more about candidates through the electoral process. Smaller mean effects, and smaller variance imply that campaigns matter less for outcomes than do pre-existing preferences, which may be driven by stable partisan, class, or ethnic cleavages.

Finally, the model is generalizable to any electoral system with any number of candidates. The only challenge is computational. There is an exponential increase in the number of strategy sets ( $S$ ) with the number of candidates ( $S = m^m$ ). With four candidates, there are 256 sets of strategies; with five there are 3,125, and with six, 46,656, and with ten players, ten million sets of strategies. Further, except for two-player, single-member district elections, the expected utility from a strategy cannot be calculated analytically, and must be simulated. Fortunately, computers can solve both of these problems; probabilities can be simulated and equilibria sought using computational tools. The

code used to calculate results below is available on my website.

## Candidate Strategy and Electoral Rules

In this section, I demonstrate how electoral rules, competition, and consolidation affect campaign strategy. I examine equilibria strategies under six sets of electoral rules, with varying degrees of competitiveness, for consolidated and unconsolidated political systems. I proceed by first examining the dynamics of strategy with some specific examples for each type of electoral system and for different levels of competitiveness. I then present a broader comparison of how competition and consolidation interact with electoral rules to determine campaign strategy.

I examine five sets of electoral rules: Single-Member District plurality, single member district run-off, multi-member district plurality, open-list proportional representation, and closed-list proportional representation. These systems are representative of elections worldwide: the great majority of elections globally are held under one of these sets of rules, or a combination of these rules (in the case of mixed electoral systems).

There are  $1 + m + 6$  parameters in the model: the number of candidates ( $m$ ), each of their pre-campaign valences ( $v_i$ ), and the expected value and standard deviation of political messages' effects ( $\mu_p, \mu_n, \mu_b, \sigma_p, \sigma_n, \sigma_b$ ). Varying these last parameters can fundamentally change predictions. For example, as the magnitude of the backfire effect ( $\mu_b$ ) grows, only laggards will adopt negative messages, and only when their campaigns are truly hopeless. As the impact of positive or negative messages grows, that type of message is increasingly likely to be adopted. There are many interesting equilibria that result from different combinations of parameters. However, as my interest is in comparing across electoral rules, I will adopt several restrictions:

$$\mu_n = \sigma_n = 2 * \theta$$

$$\mu_p = 2 * \sigma_p = \theta$$

$$\mu_b = \sigma_b = \frac{1}{2}\theta$$

With these parameter values, negative campaigning has twice the expected impact of positive messages, but also twice the standard deviation. Negative campaigning also has an expected “backfire” effect on the message source, with half the impact of a positive message, and half the standard deviation. In each case, this means that there is a .1586 chance that any message’s impact will have the opposite effect intended. For example, the probability that a positive message reduces one’s own perceived valence is  $\Phi(\frac{-\theta}{\theta}) = \Phi(-1) = .1586$ .

I summarize the core results for five electoral systems: SMD, SMD run-off, MMD, OLPR, and CLPR. I will briefly examine each system, then discuss the general lessons. For all discussion, I index candidates according to their pre-campaign valence: the candidate with the highest valence is candidate one (or  $c_1$ ), the candidate with the lowest valence is candidate  $m$  ( $c_m$ ), and so on. After reviewing the dynamics at play in each system, I will provide a cross-system comparison of campaign strategy.

### SMD

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<sup>1</sup>For the competitive case,  $c_1$  has pre-campaign valence 4 and  $c_2$  has pre-campaign valence 3.9. In the uncompetitive case,  $c_1$  has pre-campaign valence 4 and  $c_2$  has pre-campaign valence 2.4. In both cases,  $\mu_p = \sigma_p = .5$ ,  $\mu_n = \sigma_n = 1$ , and  $\mu_b = \sigma_b = .25$ .

Table 1: Campaign Strategy and Probability of Election

	A. Competitive <sup>1</sup>		B. Uncompetitive	
	$c_2$		$c_2$	
	Positive	Negative	Positive	Negative
$c_1$				
Positive	0.59 , 0.41	0.45 , 0.55	0.98 , 0.02	0.90 , 0.10
Negative	0.62 , 0.38	0.53 , 0.47	0.95 , 0.05	0.86 , 0.14

Table 1 shows the game in normal form for two players with single member districts, and two levels of competitiveness. For both cases, Candidate 1 leads candidate 2. In the competitive case, the pre-campaign standings are very close, with  $c_2$  only slightly behind  $c_1$ . but in the uncompetitive election,  $c_1$  has a commanding lead before the campaign starts, while Candidate 2 is only slightly behind Candidate 1's valence in the competitive case.

Equilibria strategies closely mirror actual campaigns. In both cases, attacking the front-runner is a dominant strategy for Candidate 2; the probability of election for that candidate is always greater with negative messages than with positive messages. The challenger prefers the greater risk associated with attack advertising to a more conservative strategy that is likely to leave him in second place. The front-runner's strategy depends on competitiveness. In case A, both candidates engage in negative campaigning. For Candidate 1, the greater danger is the mean impact of 2's attacks, not the increased uncertainty associated with attack messages. In case B, when the front-runner is far ahead, she ignores the challenger and delivers only positive messages.  $c_1$  is willing to endure  $c_2$ 's attacks unanswered, in order to preserve her lead. Adopting a negative strategy adds uncertainty to the outcome, and increases the risk that her early lead will be reversed.

Other equilibria are possible with different values for expected message impacts and standard deviations ( $\mu_p, \mu_n, \mu_b, \sigma_p, \sigma_n, \sigma_b$ ). For example, when negative messages' expected impact is equal to positive messages' ( $\mu_p = \mu_n$ ), the front-runner will always adopt positive campaign strategies. Alternatively, in a society where negative campaigning is strongly frowned upon by the electorate, that is, where  $\mu_b$  is larger, both candidates deliver positive messages in competitive districts. The laggard will only go negative and risk a backlash when he is desperate - so far behind that he is very unlikely to win with a positive campaign strategy.

Increasing the number of candidates usually decreases negative campaigning, depending on how competitive the additional competitors are. Table 9 shows some of the expected payoffs in SMD elections with three competitive candidates, where pre-campaign valences for candidates 1, 2, and 3 are ZZZ, ZZZ, and ZZZ, respectively. There are a total of twenty-seven possible strategy sets, but in this example, positive campaigning is always a dominant strategy for player one, so I only show the strategy options for players two and three given that candidate one goes positive. In the example, all three candidates are in a close race, with candidates 2 and 3 just slightly behind candidate one. There is one pure Nash equilibrium: all candidates deliver positive, self-promoting messages (cell 2,3). Note that both lagging candidates would be better off if both simultaneously



Table 2: Player 2 and 3 Expected Payoffs, Competitive Race

	$c_3$		
	Attack 1	Attack 2	Positive 3
$c_2$			
Attack 1,	0.4 , 0.43	0.12 , 0.48	0.05 , 0.74
Positive 2	0.75 , 0.05	0.17 , 0.05	0.34 , 0.31
Attack 3	0.5 , 0.12	0.06 , 0.05	0.05 , 0.19

\* Positive campaigning is a dominant strategy for C1.

attacked  $c_1$  (cell 1,1). However, positive messages are a dominant strategy for both candidates; both face incentives similar to that in a Prisoner's Dilemma. Consequently, in a one-shot game, both candidates deliver positive messages, as does  $c_1$ , so there is no negative campaigning (cell 2,3).

There are several other common results. Where Candidate 3 is less competitive and has little chance of winning, the campaign essentially reverts to a two-candidate SMD competition. Candidate 2 always attacks Candidate 1, and Candidate 1 runs a positive campaign unless Candidate 2's valence is close to that of Candidate 1. In a third case, where Candidate 2 and Candidate 3 are both lagging behind a single front-running Candidate 1, there are two possible results. In most cases, Candidates 2 and 3 play BOTS, with one attacking Candidate 1 while the other runs a positive campaign. Alternatively, if both are far enough behind, negative campaigning against Candidate 1 becomes a dominant strategy for both 2 and 3. Examples of these equilibria are in the Appendix.

### MMD/SNTV

In multimember districts, citizens vote for individual candidates, and the top  $d$  vote-getters win office, where  $d$  is district magnitude. I limit my examination of these systems to the case where citizens cast a single vote, which effectively is the Single Non Transferable Vote electoral system. In other cases, citizens can cast  $d$  votes - as many votes as their are seats, usually with no cumulative voting.

For many levels of electoral competition, MMD operates much like SMD, just transferring the competitive threshold from being between Candidates 1 and 2, to being between candidates  $d$  and  $d + 1$ . Table 3 shows several examples. In the first case, there are three competitive candidates. Candidate 1 is a clear front-runner, and two and three closely matched. In this case, there is a single Nash equilibrium, where  $C_1$  delivers a positive message, and  $C_2$  and  $C_3$  attack each other. When Candidate 3 lags further behind, both front-runners deliver positive messages, and Candidate 3 attacks Candidate 2.

The other cases in Table 3 have four candidates competing for two seats. In this case, negativity is determined by the competitiveness of candidates 2, 3 and 4, and the results closely parallel SMD

Table 3: Equilibria Campaign Strategies, MMD,  $d = 2$ ,

Candidate	A			B			C		
	$v_i$	$S_i$	$E(P_i)$	$v_i$	$S_i$	$E(P_i)$	$v_i$	$S_i$	$E(P_i)$
1	4	+	0.99	4	+	0.53	4.0	+	0.99
2	3	-	0.52	3.9	+	0.51	3.2	+	0.80
3	2	-	0.48	3.8	+	0.49	2.0	-	0.18
4				3.7	+	0.47	0.5	+	0.02

with three candidates. When all four are fairly competitive (Case B), the Nash Equilibrium strategy is for all four to deliver positive messages. As with SMD, laggards might all benefit from jointly attacking front-runners, but all would also have strong incentives to defect and deliver a positive message. Consequently, all deliver positive messages. Case C also has four candidates, but they are less equally matched.  $C_1$  is a clear front-runner,  $C_2$  and  $C_3$  are fairly competitive, and  $C_4$  is a long-shot candidate. In this case, competition emerges around the threshold (between two and three). Candidates One and Four always deliver positive messages in this case, Candidate three always attacks Candidate 2, and Candidate 2 attacks 3 when the two are competitive, and delivers a positive message when she has a comfortable lead.

While many of the results I explored parallel strategy under SMD, just shifting the threshold, there are some unique results. For example, when there are exactly  $m_1$  competitive candidates, with no other strong challengers, there is frequent negative campaigning and there are multiple equilibria, unlike in the SMD case. If all  $m + 1$  candidates were ranked similarly, and all were to deliver positive messages, any one of them could guarantee victory by attacking one of the other  $m$  - pushing that attacked candidate below the threshold, and electing the other  $m$ . In this situation there are  $m * (m - 1)$  pure Nash equilibria multiple equilibria strategies involve  $m - 2$  candidates delivering positive messages while the other two attack each other.

### Run-off

- Add some equilibria to Table for 3 players.
- Verify something? Letters in table.
- MMD, dm=3, m=4 - Try this to verify.
- Look through the results to see what is going on.

Perhaps not surprisingly, candidate strategy under SMD-Run-Off is almost identical to that under SMD. DETAILS.

There are two features of the model that preserve this result. First, the campaign does not “start” over in the second round. Instead, candidates in the run-off election start the second round campaign with valences  $v'_i$ . Consequently, the effects of the first round strategy are felt in the second round, and voters do not forget the messages received in the first round. Second, transfers of support are unconstrained. Voters that supported a candidate that lost in the first round will

Table 4: Hypothetical Election Results

Rank	Party X		Party Y		Party Z	
	Candidate	Votes	Candidate	Votes	Candidate	Votes
1	Miriam	7	Ruy	11	Cesar	18
2	João	6	Eudoro	7	Marta	8
3	Angelica	4	Jorge	6	Trinidade	7
4	Darcy	3	Udson	4	Ze	4
5	Carlos	2	Patricia	1	Walter	1
List votes	Party X	1	Party Y	8	Party Z	2
Total votes		23		37		40
Seats		1		1		2

*Parameters: 4 seats, 3 parties, 15 candidates, and 100 voters.*

ZZZ in the second round. Note that if vote transfers were constrained, say if voters of one ethnic group would only vote for co-ethnics, then ZZZ. Need better anecdote.

## OLPR

Open-list proportional representation requires some additional explanation and comment. Under OLPR, legislators are elected from districts with two or more seats. voters cast a single ballot for a single candidate. After the election, seats are distributed to parties based on the total votes received by all candidates from that party. Finally seats are distributed to candidates based on their vote share - the top vote-earner gets the first seat, and so on. Table 4 illustrates with a hypothetical election of 100 voters, four seats, and three parties. Based on the total votes received by candidates in each, Party X earned one seat, Party Y earned one seat, and Party Z earned two seats. These seats are granted to the top vote getters in each party: Cesar and Marta in Z, Ruy in Y, and Miriam in X.

This electoral formula creates complex incentives and opportunities for negative campaigning. Candidates may benefit from sending negative messages against candidates from other parties or even against their own running mate. For example, in the table above, Trinidade might attack Marta, hoping to take her seat. Alternatively Eudoro might attack Cesar, hoping to knock party Z down far enough for party Y to earn an extra seat. In equilibria, both inter and intra-party attacks appear in equilibria, as well as all positive campaigning, depending on the values of the key parameters.

Table 5 shows several examples under different levels of competition. In the first, a fairly competitive race, all candidates choose positive strategies. In the second, where each party has a strong and a weak candidate, the front-runners go positive and the laggards attack the leaders in the other party. Intra-party competition in this case would risk loss of a seat to another party.

The third case shows strategy when campaign effects are much smaller ( $\frac{1}{4}$ th their size in the previous example). In this case, there is within party competition, with the laggards attacking the front-runners. Because campaign effects are much smaller, both parties are virtually assured of earning one seat. Consequently, the only real competition is between members of the same list.

Table 5: Equilibria Campaign Strategies, OLPR,  $d = 2$ ,  
PASTE IN OLPR STRATEGIES - THESE ARE FROM MMD

Candidate	A			B			C		
	$v_i$	$S_i$	$E(P_i)$	$v_i$	$S_i$	$E(P_i)$	$v_i$	$S_i$	$E(P_i)$
A1	4	+	0.99	4	+	0.53	4.0	+	0.99
A2	3	-	0.52	3.9	+	0.51	3.2	+	0.80
B1	2	-	0.48	3.8	+	0.49	2.0	-	0.18
B2				3.7	+	0.47	0.5	+	0.02

### Closed-List Proportional Representation

Under closed-list proportional, voters choose between party lists, not individual candidates. While, one could model strategy for individual candidates with interesting results, under CLPR party discipline is usually very high, and party organizations act as agents, not individual legislators. Consequently, parties make decisions about message tone and target, not individual legislators. The most important implication is that we must consider the behavioral incentives of parties, not individual legislators, and in most cases, the implication is that parties will maximize vote share.

If parties are acting as agents, there are at least two possible behavioral incentives. The first is that parties may be seeking majority status, and may maximize the probability that they have a majority. Such a strategy is most likely in a two-party system, or a system with a single dominant party. In this case, parties will behave much as legislators do in single-member, two candidate elections. The leading party will seek to preserve its lead; the lagging party will attack the leader in hopes of taking the majority.

However, in multiparty systems, most parties know that they will not have a majority, and instead are motivated to maximize their negotiating power in post-election coalition formation. The natural implication of this is to maximize seats, or to maximize vote share, which implies an entirely positive campaign strategy.<sup>4</sup> Indeed, for every CLPR case I examined with more than two parties, all positive campaigns were always the only pure Nash equilibrium.

### Cross-System Comparisons

The preceding examples only examine a few representative cases in order to provide some intuition for campaign strategy, but there are many other possible equilibria for different levels of competitiveness, numbers of candidates, and campaign effect magnitudes. Rather than try to explore the many subtleties of each combination of factors, I will focus on summarizing the key differences across each system.

Figures 1 through 2 show the relationship between competitiveness, electoral formulas, system consolidation, and the number of candidates. In each graph, the x axis is Candidate 1's pre-campaign valence, and the y axis is Candidate 2's pre-campaign valence. The shading of each graph provides information about the level of negativity in the campaign. Darker boxes mean that a higher percentage of candidates used negative message; lighter boxes mean that a lower percentage of candidates used negative messages. Under mixed strategy equilibria, the weighted mean of negativity is shown. At the extreme, a black box means that all candidates were negative,

and a white box means that none of the candidates chose to deliver negative messages in pure Nash equilibria. In cases with more than one equilibrium, the shading represents the mean number of candidates choosing negative strategies across all equilibria. Note that the equilibria were evaluated only for discrete points, and are not continuous.

For example, the graphs in Figure ?? show negativity under SMD for two and three candidates, and two levels of system consolidation. For example, The upper-left graph in Figure ?? shows results for a Single-Member District, with two candidates competing, in a consolidated system. The key findings echo the earlier discussion: when the race is competitive, or close to the 45% line, both candidates adopt negative strategies, represented by the area shaded black. When one of the candidates lags behind, the front-runner delivers positive messages and the laggard delivers negative messages, so the result is 50% negativity, as represented by the grey-shaded area.

Changing to an unconsolidated system significantly increases the range in which both candidates adopt negative strategies in equilibria - the black-shaded area is much larger. This result reflects the fact that a candidate that appears a dark horse in a consolidated system still has a chance in an unconsolidated system, where campaigns matter more. Consequently, the front-runner must adopt a negative strategy for a much wider range of values.

The two graphs in the lower half of the figure show equilibria strategies with three candidates. The graphs show a small change from two-candidate SMD elections - just adding one additional candidate - can lead to very different patterns of competition. For this case, where there are three candidates but only two dimensions to the graph, I fixed Candidate 3's pre-campaign valence at 4.0. So all three candidates are equally competitive in the upper-right hand corner of the graph (cell 4,4). KEY RESULTS: 1. All close, no negative. As one lags, mixed, then one, then two. As two lag, mixed, or mixed when unequal. Eventually, as both 1 and 2 far behind 3 (c1,1, right), both laggards may go negative on 1.

Less negativity with more candidates, especially when comparing competitive candidates. Further, effect of consolidation REVERSES. EXPLAIN.

Key findings:

- SMD, 2 candidates

Both candidates go negative when competitive. Leader likes to go positive, but expected impact of  $n_i$  outweighs additional variance introduced.

When not as competitive, laggard always goes negative on leader.

Unconsolidated systems have more negativity, all else equal. The black shaded area is larger for unconsolidated systems.

- SMD, 3 candidates

Many opposite results.

No negative campaigning when three-way competitive race (c(4,4) region).

Reverts to SMD2 when one candidate is uncompetitive (c(4,0), c(0,4))

Mixed strategies in between (2,2, or 3,2, for example).

Both laggards attack leader when far enough behind and fairly equal (c(1,1))

Impact of consolidation *reverses* when compared with 2 candidate race. Unconsolidated leads to less negative campaigning, instead of more. Demonstrates importance of modeling more than SMD, 2 candidates, to learn anything about rest of world.

Figure 1: Campaign Strategy - Single Member District Elections

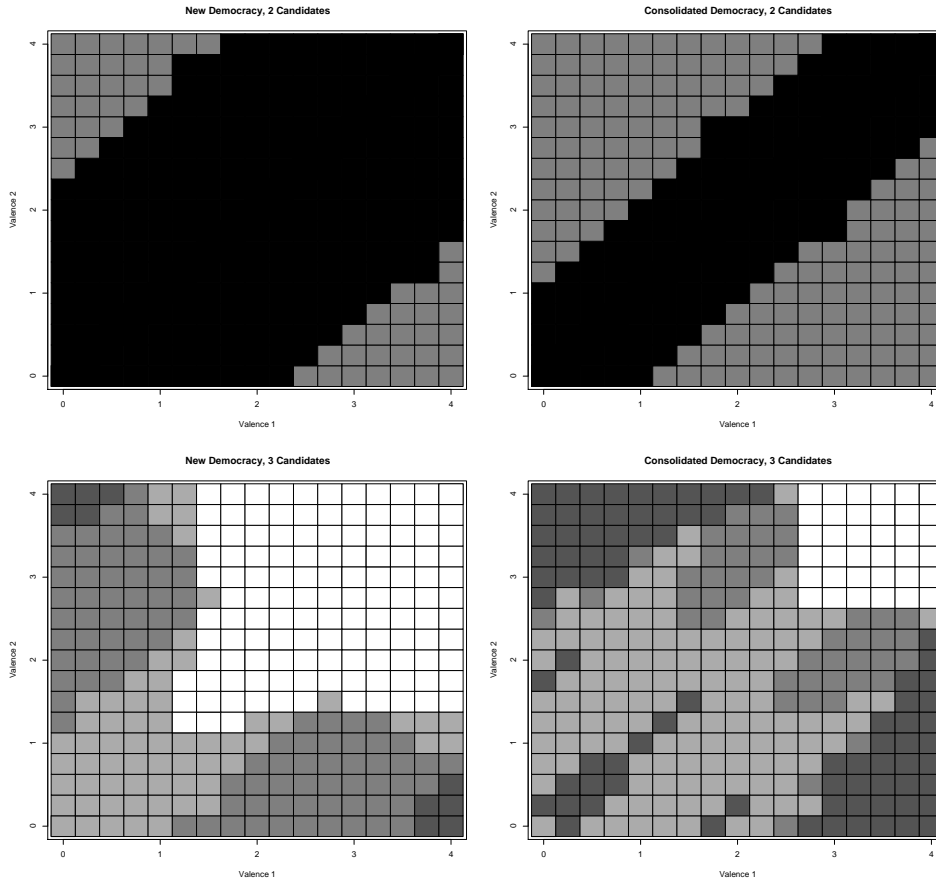


Figure 2 shows equilibria strategies for three electoral systems (in columns), with four candidates (x and y axis for players 1 and 3, players 2 and 4 set to valence 2.0), for consolidated (top row) and unconsolidated systems (bottom row). Shading as above, but in this case there are no pure Nash equilibria for some configurations; these are shaded red. For OLPR, C's 1 and 2 are in party 1 and C's 3 and 4 are in party 2. Key findings:

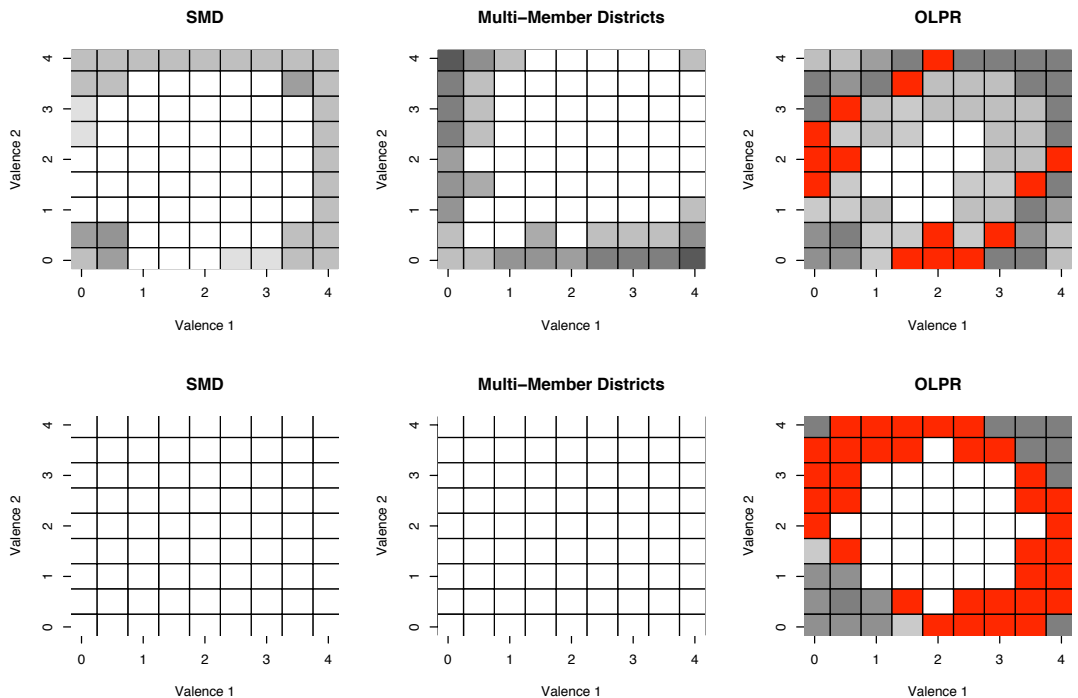
- Increasing the number of candidates reduces negativity (SMD)
- For unconsolidated systems, negativity is lower.
- Increasing the number of thresholds increases negativity (MMD, OLPR)
- For OLPR, there are some (apparent) cases where there are only equilibria in mixed strategy. I need to explore these a bit more carefully and run larger  $n$  simulations to be sure this isn't an artifact of some rare events.
- Discuss the key system-specific findings:

In MMD, most of the action is the laggard attacking the 2nd place candidate. Sometimes #2 fires back.

For OLPR, there are equilibria of inter and intra party negativity.

Consider alternative fixed values for C1 and C3, instead of 4,4.

Figure 2: Campaign Strategy - SMD, MMD, and OLPR



## General Hypotheses

Electoral formula specific findings suggest some general principals to guide comparative studies of campaign tone. I propose ZZZ hypotheses:

1. Say something about  $\mu_p$  and  $\mu_n$ .
2. Laggards target leaders, adopting higher-risk strategies to jump ahead.
3. Targets increase with the effective number of electoral thresholds, not simply with district magnitude.
4. Attack advertising decreases as the number of competitive candidates increases. In some cases, candidates play an  $m$  member prisoner's dilemma where all would be better off if they attacked the front-runner, but they all have strong incentives to defect.
5. Negative campaigning decreases with candidate uncertainty about current standings and the identity of thresholds.

6. Restrictions on patterns of vote transfers increase negative campaigning.
1. Electoral rules matter. The targets and sources of attack messages vary across system, as does the overall quantity of negative advertising. The highest levels of negative campaigning are found in single-member district systems with two competitive candidates.
2. Negativity is more frequent in more consolidated political systems. The more campaigns matter for electoral outcomes, the less negativity observed. Note that there are exceptions for some electoral systems: DETAILS.
3. Increasing the number of competitive candidates decreases the frequency of attack messages.
4. The number of thresholds, not the number of seats, determines the opportunities for attack advertising. Comparing MMD and OLPR, note that both elect two legislators, but there is more negativity under OLPR. The reason is that with MMD, there is just one threshold around which candidates will compete - those above and below have no need to engage. With OLPR's vote-pooling and within-party thresholds, there are many more opportunities for negative campaigning.
5. Restrictions on vote transfers increase negative campaigning. Where voters are committed to supporting a candidate from a particular party or ideology, the competition is constrained to that subgroup, reducing the number of candidates and increasing the possibilities for negative campaigning.

## Caveats

Finally, it is worth considering some of the ways in which these models differ from reality, and how adding additional zzz might affect results.

**Political Parties** The models presented above do include party membership and vote pooling within party, at least in the case of OLPR. However, all the agency is with individual politicians, which sometimes leads to within-party attack advertising. Political parties may not tolerate within-party attack messages. Individual candidates, like ZZZ in Table 5 Case A may have incentives to attack their copartisans, party leaders have different incentives. They wish to maximize their overall vote share and seats in the legislature. Consequently, they will want all messages to be either positive messages or attacks on *other* parties. This logic applies as well to other multi-member district systems. For example, under MMD, case ZZZ. In this context, candidate three and candidate two delivered negative messages against each other. But if both were in the same party, this strategy might not be an option. Effectively, strong parties will eliminate many possible strategies for candidates.

**Repeated Games:** with a one-shot game, laggard might all be better off if they would attack the front runner, but each has an incentive to defect, so none deliver negative messages. Practically, campaigns involve hundreds and sometimes thousands of political messages, so laggards have a low-cost opportunity to try and coordinate. DETAILS.

**Side Payments:** Though rare, I have heard of cases where a second-place candidate will make side payments to a long-shot candidate for negative messages. The competitive challenger will deliver all positive messages, while the long-shot candidate will attack the front-runner incessantly.



**Delayed Gratification:** I have modeled utility as being derived from holding office, with candidates maximizing the probability that they will be elected. In many contexts, candidates may have other goals. For example, in systems where campaigns are publicly financed or have free media time for candidates, money and time may be distributed in proportion to the number of votes received in a previous election. Consequently, candidates may choose short-term suboptimal strategies of positive messages with an eye toward gaining additional campaign resources in future elections.

**Equal Resources:** I have modeled each candidate as having one message, and each candidate's message as being equally valuable. Practically, uncompetitive candidates usually do not have as much campaign firepower - they lack the funding, media time, and volunteers needed to send messages with the same power as front-runners. The result is that...

**Other Purposes:** Finally, I assume that the purpose of messages is persuasion, so a negative message is used to reduce support for the target candidate. Others have argued that negative messages can be used for other purposes, especially voter mobilization. Candidates may use negative messages to galvanize their core constituents and to emphasize the stakes of the election.

## Analysis

I test these hypotheses using 10,000 political advertisements collected from fourteen countries: Argentina, Brazil, Colombia, Chile, Ecuador, El Salvador, Finland, Guatemala, Mexico, Nicaragua, Paraguay, Peru, Russia, and Venezuela. This dataset collection effort, supported by NSF #'s, represents the largest comparative dataset of political advertisements, and includes executive and legislative races from national, state, and local elections. The sample includes all electoral systems examined in the study, and several more besides. In most cases, the data cover several months before the election, providing an opportunity to test for shifts in campaign strategy as competitiveness changes.

PENDING....

## Appendix

### Calculating the Probability of Election for a Two-Player Game

Consider the case where both candidates deliver positive message. The probability that Candidate 1 wins is:

$$P(v'_1 > v'_2) = P(v_1 + p_1 > v_2 + p_2) = P(v_1 - v_2 > p_2 - p_1)$$

Since  $p_1$  and  $p_2$  are both normally distributed with mean  $\mu_p$  and standard deviation  $\sigma_p$ , the difference  $p_2 - p_1$  is distributed  $N(\mu_p - \mu_p, \sqrt{\sigma_p^2 + \sigma_p^2})$  (expectation of the difference is the difference of the expectations, and variance of the difference is sum of the variances). The  $\mu_p$ 's cancel out, so  $p_2 - p_1$  is distributed  $N(0, \sqrt{2\sigma_p^2})$ .

Consequently,  $P(v_1 - v_2 > p_2 - p_1) = P\left(\frac{v_1 - v_2}{\sqrt{2\sigma_p^2}} < \epsilon\right)$ , where  $\epsilon \sim N(0, 1)$ . Consequently, the probability can be written as a cumulative normal:

$$\Phi\left(\frac{v_1 - v_2}{\sqrt{2\sigma_p^2}}\right)$$

Table 6: Player 2 and 3 Expected Payoffs, Candidate 3 Lagging

	$c_3$		
	Attack 1	Attack 2	Positive 3
$c_2$			
Attack 1,	0.4 , 0.43	0.12 , 0.48	0.05 , 0.74
Positive 2	0.75 , 0.05	0.17 , 0.05	0.34 , 0.31
Attack 3	0.5 , 0.12	0.06 , 0.05	0.05 , 0.19

\* Positive campaigning is a dominant strategy for C1.

## Details on Simulations and Nash Equilibria

For all simulations, campaign effects are restricted such that:

$$\mu_n = \sigma_n = 2 * \mu_p = 2 * \sigma_p = 4 * \mu_b = 4 * \sigma_b = 2 * \theta$$

## Additional Examples of Equilibria As Discussed in the Text

All these are pending - tables are just placeholders.

**Single Member Districts, Three Candidates**

**Multi-Member Districts, Three Candidates**

**Multi-Member Districts, Four Candidates**

Table 7: Player 2 and 3 Expected Payoffs, Candidate 2 and 3 Far Behind

	$c_3$		
	Attack 1	Attack 2	Positive 3
$c_2$			
Attack 1,	0.4 , 0.43	0.12 , 0.48	0.05 , 0.74
Positive 2	0.75 , 0.05	0.17 , 0.05	0.34 , 0.31
Attack 3	0.5 , 0.12	0.06 , 0.05	0.05 , 0.19

\* Positive campaigning is a dominant strategy for C1.

Table 8: Player 2 and 3 Expected Payoffs, Candidate 2 and 3 Far Behind

	$c_3$		
	Attack 1	Attack 2	Positive 3
$c_2$			
Attack 1,	0.4 , 0.43	0.12 , 0.48	0.05 , 0.74
Positive 2	0.75 , 0.05	0.17 , 0.05	0.34 , 0.31
Attack 3	0.5 , 0.12	0.06 , 0.05	0.05 , 0.19

\* Positive campaigning is a dominant strategy for C1.

Table 9: Player 2 and 3 Expected Payoffs, Competitive Race

	$c_3$		
	Attack 1	Attack 2	Positive 3
$c_2$			
Attack 1,	0.4 , 0.43	0.12 , 0.48	0.05 , 0.74
Positive 2	0.75 , 0.05	0.17 , 0.05	0.34 , 0.31
Attack 3	0.5 , 0.12	0.06 , 0.05	0.05 , 0.19

\* Positive campaigning is a dominant strategy for C1.

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