Dialogue in Political Advertising: Evidence from U.S. Political Campaigns 2012-2020*

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November 7, 2024

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Abstract

We study the nature and determinants of dialogue between political candidates in the context of political television advertising. We characterize dialogue as the occasion where both candidates advertise on the same campaign theme (e.g., "Economic Policy"). We develop a model of dialogue that characterizes candidates' propensity to engage in dialogue and links the competitiveness of a race with the degree of messaging overlap. We show that it is theoretically ambiguous whether candidates will engage in more or less dialogue as races become more competitive. Using data on political television advertising for U.S. Senate and Congressional races from 2012 to 2020, we document rich heterogeneity in candidates' overlap in messaging across races and within races over time. The level of dialogue is less than would be expected under a theoretically-motivated, "non-strategic" advertising placement benchmark. Finally, we investigate the determinants of dialogue, including the role of the time left until the election, the type of election, and how competitive the race is using a model that allows us to separate the effects of these characteristics on selection into advertising and messaging similarity. We find that dialogue is increasing in a race's competitiveness, but this effect is dominated by the impact of competitiveness on selection into advertising. (JEL: D72, M37)

*We thank Ricard Gil, Karam Kang, Ariel Pakes, Jesse Shapiro, Maria Ana Vitorino, and the seminar/-conference participants at the 13^{th} Workshop on the Economics of Advertising and Marketing, the UVa Quantitative Collaborative, the University of Wisconsin, the 21^{st} IIOC, Cornell University, Instituto Tecnológico Autónomo de México, and the 2023 Cornell-Penn State Conference on Econometrics and IO for their constructive feedback. We also thank Yiren Ding, Mo Van de Sompel, and Natasha Swindle for outstanding research assistance. Anderson and Ciliberto acknowledge the Bankard Fund for Political Economy at the University of Virginia for support.

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1 Introduction

Political discourse between candidates represents one potential mechanism through which democratic societies process information about the candidates' positions on various issues. These exchanges can be instrumental in helping voters understand the candidates they are voting for. To the extent that dialogue between candidates serves this role, it is arguably an important input to a well-functioning democracy. However, scholarly concern about a lack of dialogue dates back as far as Kelley Jr. [1960], who identifies "dissatisfaction" with respect to "the character of political campaigns in the United States." Campaigns, he writes, "should expose the grounds on which candidates disagree and the differences between the candidates." Thus, dialogue is a necessary input to a functioning democracy.[1]

The economic benefits of policies based on dialogue and broad political support are significant. Such policies promote economic stability and certainty in the business environment, which are associated with economic growth [Alesina et al., 1996]. In the absence of dialogue, polarization becomes more likely, potentially leading to policy gridlock and making it more challenging to address growing inequality [Bonica et al., 2013]. Dialogue is essential for fostering productive discourse and consensus-building, which are crucial for mitigating these risks. Consequently, studying political dialogue is vital for understanding the factors that contribute to a stable and prosperous economy.

In this paper, we investigate the nature and determinants of political dialogue in U.S. political campaigns. Specifically, we investigate political dialogue in the context of spot broadcast television advertising campaigns in U.S. House and Senate races from 2012 to 2020. Following Simon [2002], we operationalize dialogue as the occasion where both candidates discuss the same campaign theme, such as "Economic Policy" or "Foreign and Defense Policy." We aim to characterize the degree to which U.S. political candidates engage in dialogue and to understand better the mechanisms that facilitate or hinder productive political discourse. Ultimately, our goal is to gain insight into the factors that contribute to a healthy democratic process.

Studying political advertising is a powerful way to understand which issues candidates have chosen to prioritize, as advertising remains the primary means by which candidates and parties reach their voters directly [Petrocik, Benoit, and Hansen, 2003; Kaplan, Park, and Ridout, 2006]. Candidates are incentivized to think carefully about the content of their ads because they invest large and increasing amounts of money in advertising campaigns. Spending on broadcast TV advertising has more than tripled since 2012. In 2014, 1.3 billion

[1] We discuss the relationship between dialogue, democracy, and public welfare, as well as the limitations of our assumptions about these relationships, in more detail in Section 7.

was spent on broadcast TV advertising (compared to 0.3 billion on cable ads). This figure rose to 1.7 billion (vs. 0.5 billion) in 2016, 2.5 billion (vs. 0.7 billion) in 2018, and 5.3 billion (vs. 1.6 billion) in 2020 [AdImpact, 2023].[2] Analyzing the content of these ads provides direct insight into the issues candidates prioritize, in contrast to relying on newspaper interviews or media reports, which are inherently filtered through the perspectives of the reporters. However, one limitation of our analysis is that we only observe broadcast ads and must assume that they are representative of candidate behavior on other platforms as well.

To conduct our analysis, we use data from the Wesleyan Media Project (WMP), which provides scholarly access to Kantar Media/CMAG tracking data and video files covering all broadcast television political advertising from the 210 media markets in the United States. The unit of observation in the raw dataset is a single ad airing, which includes information such as the candidate for whom the ad was run, the amount spent on the ad, the day the ad was run, and the channel on which the ad was shown. This comprehensive data allows us to examine advertising across multiple years and a wide range of ideologically diverse states and congressional districts in the US.

Most importantly, we observe the issues that were promoted in each advertisement. For example, we can see whether an ad mentioned the issue of "Energy Policy" or the "Minimum Wage." The dataset accounts for 63 issues in 2012, 65 in 2014, 73 in 2016, 84 in 2018, and 100 in 2020.[3] To address the fact that multiple issues may be very similar to each other and coding them separately might lead us to conclude that there is less dialogue than there actually is, we aggregate issues into "themes." For example, the issues "Afghanistan/War in Afghanistan" and "Middle East" can be reasonably assumed to be part of the same theme.[4] Following the political science literature, we operationalize dialogue by measuring the overlap among the themes that candidates address in their campaigns using similarity indexes. In particular, we use the Jaccard and Ruzicka indices.

We conduct our analysis in three parts. First, we introduce a novel political game where candidates choose which campaign themes to advertise. We show that the primitives of the model, namely the potency of each message (p) and the likelihood of candidates securing victory in the absence of political advertising (q), determine both the competitiveness of the race and the similarity of candidates' advertising. Additionally, we show that the link between competitiveness and similarity remains inherently uncertain, as it hinges on the

[2]In comparison, digital video advertising amounted to only 0.7 billion in 2018, though it increased substantially to 2.6 billion in 2020 [AdImpact, 2023].

[3]We focus on issues mentioned at least one percent of the time for each year, where the percentages represent the number of ad airings each issue was present in for a given year.

[4]The full list of issues and aggregations is available in Appendix C.2. In Appendix G, we repeat our primary analyses using the disaggregated issue codings.

relative magnitude of the shifts in p and q within the data, which cannot be directly observed. Furthermore, even in the basic symmetric game that serves as the foundational model, observing data on similarity and competitiveness alone is insufficient to identify the potency of the messages. As we extend our model to allow for theme ownership and asymmetry, we find that as the degree of ownership intensifies, the stronger candidate tends to allocate more advertising resources to their competitor's owned issue, which is relatively weaker for the stronger candidate. Furthermore, heightened ownership is expected to lead to increased convergence while attenuating the relationship between competitiveness and similarity.

We next provide a descriptive analysis of dialogue in political advertising in U.S. House and Senate races between 2012 and 2020. We identify and explore three conditions that we argue are necessary for dialogue to occur: (i) candidates must address the same theme, (ii) candidates must advertise on the same broadcast channel, and (iii) candidates must advertise at the same time of the day. While we consider these conditions to be necessary for dialogue, we acknowledge that there may be alternative perspectives on what constitutes dialogue in political advertising. We investigate whether candidates' ads satisfy one or more of these conditions at both the race and race-biweek level.[5] Our findings reveal that at the national, aggregate level, there is clear evidence of messaging overlap across the two parties, whether we examine political themes, TV channels, or the time of the day.

Our analysis of individual races, particularly over disaggregated race-biweeks, reveals substantially less overlap in advertising strategies, even after controlling for selection.[6] We observe significant heterogeneity across race-biweeks in terms of when and where candidates air ads and the topics they discuss. Furthermore, we show that third-party spending differs significantly from candidate spending, with third-party ads exhibiting substantially less overlap in affiliate selection, period of day, and campaign theme, indicating a lower likelihood of engaging in dialogue across these dimensions. Ultimately, using a "non-strategic" benchmark inspired by our model, our findings suggest that politicians strategically avoid engaging in dialogue, with the average similarity in campaign advertising being nearly half of what we would expect if politicians randomly selected their advertising themes.

Next, in our investigation of the determinants of dialogue, we consider the role of time until the election, differences between House and Senate campaigns, and race competitiveness. Our empirical strategy focuses on the relationship between two endogenous outcomes—race competitiveness and advertising similarity—rather than estimating primitive parameters of

[5]We measure "biweeks" as two-week periods relative to election day. In Section 5.2.3, we also consider data at the race-biweek-affiliate-period level.

[6]Importantly, our results are not driven by data thinning, as random draws would yield an average value of the Ruzicka index with race-biweek observations that is nearly identical to the value of 1 found with race observations.

message potency and baseline victory probability. While this approach cannot separately identify these primitives, it allows us to test comparative statics derived directly from the model. Our econometric analysis employs a fractional regression model while controlling for selection into advertising.

We find that competitiveness is associated with higher issue convergence, although this effect is stronger at the race level than at the disaggregated race-biweek level. This effect is primarily driven by a lack of dialogue in the least competitive races, which is a novel result. Notably, the effect of competition operates mainly through the extensive margin (selection into advertising) rather than the intensive margin (degree of messaging overlap), which is also a novel finding. Furthermore, we find that Senate races experience more advertising and are associated with greater similarity compared to House races, possibly due to the ideological diversity of the districts involved and the generally less partisan nature of Senate races.

Our regression analysis also provides fresh insights into the role of third-party advertisers (e.g., political action committees or PACs) in competitive races. Specifically, we confirm our descriptive findings that third-party advertising does not contribute to dialogue in a meaningful way despite PACs being very active in political advertising. This suggests that third-party organizations might have different objectives than winning a race, such as raising funds on a specific issue and running ads solely on that issue.

We conclude our analysis by examining how issue ownership—the notion that parties hold advantages on specific policy domains—affects campaign dialogue. Our theoretical model yields a counterintuitive result: stronger issue ownership leads to greater convergence in messaging, as candidates increasingly advertise on their competitor's owned issues. This creates a methodological challenge, as we cannot measure ownership through advertising patterns themselves. We address this by constructing a novel issue ownership index based on a survey of voting-age U.S. citizens. Using this more exogenous measure, we find that stronger issue ownership indeed increases dialogue convergence while attenuating the relationship between race competitiveness and convergence. These findings demonstrate that voters' perceptions of parties' relative strengths significantly shape campaign dialogue dynamics.

Our work contributes to a vast literature investigating political dialogue, with two competing theories dominating the discourse. The first, characterized as a salience or "median voter" argument, posits that candidates will discuss issues that voters care about, resulting in a back-and-forth on similar topics [Downs, 1957; Ansolabehere and Iyengar, 1994; Sigelman and Buell Jr., 2004; Banda, 2013; Di Tella et al., 2023]. Alternatively, the theory of issue ownership suggests that candidates may be perceived as better able to handle specific issues due, for example, to their party affiliation, leading competing politicians to focus on

different subjects [Budge and Farlie, 1983; Petrocik, 1996; Ansolabehere and Iyengar, 1994; Petrocik, Benoit, and Hansen, 2003].

In practice, both theories are likely to be operational across or even within races. Recent research has sought to determine when dialogue is present and to what extent. One compelling explanation is that increased race competitiveness leads candidates to converge on the issues and engage in more dialogue. Three papers from this literature are particularly relevant to our work.

Simon [2002] develops a model of candidate advertising where candidates allocate spending across issues based on voters' ideal points, predicting that candidates only advertise on the issue they are closest to, and dialogue never develops. In contrast, our model permits dialogue and allows both convergence and divergence in response to changes in race competitiveness. We also show that increased issue ownership leads to increased convergence and moderates the convergence-competition relationship. Our model micro-founds the similarity indices used to empirically measure dialogue, which relate to those used by Sigelman and Buell Jr. [2004] and Kaplan, Park, and Ridout [2006]. Kaplan, Park, and Ridout [2006] investigates whether issue convergence is greater in more competitive U.S. Senate races, finding a positive correlation between competitiveness and convergence, albeit with lower convergence than in presidential races. Similarly, Minozzi [2014] examines the relationship between issue ownership, salience, and convergence in U.S. House races, proposing that the ownership-convergence relationship may depend on the salience of an issue. He finds support for the view that dialogue increases with ownership among high-salience issues in competitive races but not for low-salience issues.

Our analysis extends these works by considering both race-level aggregate and temporally disaggregated advertising behavior, demonstrating that race-level aggregation overstates issue convergence. We also introduce a "neutral" benchmark of randomly allocated advertising expenditures to compare observed advertising levels. Finally, our empirical analysis disentangles the extensive (selection into advertising) and intensive (degree of messaging overlap) effects of competition on dialogue, finding that competition drives convergence along both margins, with the extensive margin dominating.

Our work contributes to a broad body of research on the role of advertising, which spans economics, political science, and marketing.[7] Our work is particularly relevant to a line of research regarding advertising content decisions dating back to Resnik and Stern [1977] and continuing through the present day (see, for example, Pieters, Warlop, and Wedel [2002]; An-

[7]Our analysis abstracts from the role of advertising. However, other research has considered the role of specifically informative or persuasive advertising. For a discussion of informative advertising in political settings, see, for example, Coate [2004]; Schultz [2007]. For a discussion of persuasive advertising in politics, see, for example, Franz and Ridout [2007]; Gerber et al. [2011].

derson and Renault [2006]; Pieters, Wedel, and Zhang [2007]; Becker and Gijsenberg [2023]). While we do not explicitly model how advertising may divert voters from one candidate to another, the advertising considered here has relevance to the literature on comparative advertising [Barigozzi, Garella, and Peitz, 2009; Beard, 2013; Anderson, Ciliberto, and Liaukonyte, 2013; Anderson et al., 2016].

Finally, our work also contributes to the broader discussion surrounding societal polarization and media slant (see, e.g., Gentzkow and Shapiro [2006, 2010]; DellaVigna and Kaplan [2007]; Boxell, Gentzkow, and Shapiro [2017, 2024]). Just as there is concern about individuals participating in "echo chambers," we may worry that citizens only engage with the political opinions of their preferred candidates and party. Our findings suggest that while dialogue between competing candidates does occur across various races, it is often low compared to a non-strategic benchmark and entirely absent from many races. This limited engagement between candidates with differing viewpoints potentially contributes to increased polarization by exposing voters to a narrow range of political perspectives.

This paper proceeds as follows. In Section 2, we develop a game of political competition, where candidates choose which campaign theme to advertise on. Motivated by this, we then turn to our empirical investigation of dialogue in political advertising in U.S. House and Senate races from 2012 to 2020. We describe our data in Section 3 and then provide a descriptive analysis of campaign advertising in Section 4. In Section 5, we study the determinants of dialogue, investigating whether and how the competitiveness of a race and the presence of issue ownership lead to issue convergence. In Section 6, we extend our analysis on the determinants of dialogue to consider the possibility that parties may "own" some issues in the eyes of voter. We conclude in Section 7.

2 A Game of Political Competition Over Themes

In order to better understand whether and under what conditions candidates engage in dialogue, we propose a zero-sum game of political competition over political themes. The game is intentionally a stylized representation of political competition. We consider two candidates, a Democrat (D) and a Republican (R), who can each choose to advertise on one of two themes, A (e.g., "Abortion") and B (e.g., "Business Policy"). Each of the candidates chooses which theme to advertise in order to maximize their probability of winning their election.

2.1 Equilibrium Advertising Behavior and Messaging Convergence

We first consider the following normal form game.

		Republican (R)	
		A	B
Democrat (D)	A	$q,\ 1-q$	$p,\ 1-p$
	B	$1-p,\ p$	$q,\ 1-q$

In this game, p and q are the probabilities of winning the election or, equivalently, the voting probabilities for the median voter. Let q denote the probability of D winning if both candidates choose the same theme, or, alternatively, the probability of D winning in the absence of political advertising.[8] When $q = 1/2$, the candidates have an equal probability of winning when they choose the same theme. We, therefore, define the extent of a race's "prior advantage" as the distance $|q - 1/2|$.

The Democrat has a probability p to win the race if they advertise on A and the Republican advertises on B. In this case, the Republican has a chance $1 - p$ to win the race. The probabilities are reversed if the Democrat advertises on B and the Republican on A.[9] Thus, for asymmetric ad choices, p is the chance that theme A is the "resonant theme" with the electorate, and if $p > 1/2$, whoever covers that is more likely to win the election.[10] In what follows, we characterize a race's "theme disparity" as $|p - 1/2|$.

We now solve for the equilibria of the game. There is a pure strategy equilibrium only if q lies between p and $1 - p$.[11] In this case, both candidates choose the same theme (either AA for $p > 1/2$ or BB otherwise), and the probabilities of winning stay at $(q, 1 - q)$.

If q exceeds both p and $1-p$, D would like to get on the same message as R (on-diagonal), while R prefers to get off-diagonal. If q instead is less than both, the roles are reversed: R would like to have the same message, while D would like to differentiate. In both cases, a "cat and mouse" game develops, where the cat wishes to catch the mouse while the mouse wishes to avoid the cat, and no pure strategy equilibria exist. Under the present specification of the game, the mouse is always the weaker candidate.[12]

Let δ and ρ denote respectively the probabilities of D and R playing A. That is, $\delta \equiv \Pr(d = A)$ and $\rho \equiv \Pr(r = A)$. In order to make R indifferent between choosing A and B,

[8] Thus, if both candidates advertise on the same issue (e.g., AA), their messages will cancel each other out, and the voters' choices will stay at a baseline level, which delivers the probability of D winning as q (this means AA and BB have the same payoffs).

[9] Note that because of the symmetry assumption, a candidate who is very weak in a message-neutral world can become a strongly preferred candidate if they get the right messaging combination. This possibly unrealistic symmetry is relaxed later.

[10] Appendix B.1 generalizes this formulation by allowing for different p's.

[11] Pure strategy equilibria are also present when $p = q$ (AB) or $p - 1 - q$ (BA).

[12] In more complex variants, such as the ones presented in the Appendix, that is not necessarily the case.

D must choose A with probability δ such that

$$\delta(1-q) + (1-\delta)(1-p) = \delta p + (1-\delta)(1-q).$$

Solving for δ and doing likewise for candidate R's mixing probabilities leads to the following result:

Proposition 1. *There exists a non-degenerate mixed strategy equilibrium if and only if* $q < \min\{p, 1-p\}$ *or* $q > \max\{p, 1-p\}$. *At such an equilibrium,* $\delta = \Pr(d = A) = \frac{1-p-q}{1-2q}$ *and* $\rho = \Pr(r = A) = \frac{p-q}{1-2q}$.

Under the mixed strategy equilibrium described in Proposition 1, similarity is maximized when the race's theme disparity is zero, i.e., at $p = 1/2$. At this point, candidates optimally choose each theme with equal probabilities, and as p increases or decreases relative to this threshold, candidates become increasingly dissimilar.

This is a critical finding as it provides a benchmark for our empirical analysis. We can characterize the degree to which candidates engage in dialogue by comparing the observed level of similarity in each race with the similarity we would expect to observe if each theme were chosen randomly with equal probability. In other words, we can ask how close candidates' messaging strategies are to the theoretical, non-strategic, maximum-similarity benchmark.[13]

We next introduce measures of *race competitiveness* and *messaging similarity* (i.e., dialogue). We define race competitiveness C as the probability that the weaker candidate (which is D if $q < 1/2$ and R if $q > 1/2$) will win in equilibrium; that is, min {Pr(D wins), Pr(R wins)}.

$$C \equiv \Pr(\text{weaker candidate wins}) = \begin{cases} \frac{p^2-p+q^2}{2q-1}, & q < \frac{1}{2} \\ 1 - \frac{p^2-p+q^2}{2q-1}, & q > \frac{1}{2} \end{cases} \tag{1}$$

We characterize dialogue as the occasion where both candidates advertise the same theme [Simon, 2002], and we follow the political science literature in measuring dialogue with a similarity index [Sigelman and Buell Jr., 2004; Kaplan, Park, and Ridout, 2006]. In this context, similarity indices summarize the extent to which candidates' messaging choices overlap. Specifically, we characterize messaging similarity with the Jaccard Index, which is defined as

$$\sigma^{Jaccard} = \frac{|I_D \cap I_R|}{|I_D \cup I_R|} \tag{2}$$

where I_D and I_R are the sets of campaign themes discussed by the Democrat and Republican candidates, respectively. So, the index measures the number of common themes over the

[13] We conduct this comparison in Section 4.4.

total number of themes. A value of $\sigma^{Jaccard} = 0$ indicates no overlap in the themes candidates advertise on, while a value of $\sigma^{Jaccard} = 1$ indicates complete overlap in theme choice.

The Jaccard Index illustrates the extent to which candidates overlap in their choice of themes, irrespective of the intensity of their advertising on those themes. This allows us to abstract away from differences in campaign resources and intensity of spending (which are not present in our model). For example, if two candidates advertise only on Taxes, with one spending one dollar and the other spending a million dollars, the race would have an index value of $\sigma^{Jaccard} = 1$.[14]

For pure strategy equilibria, the value of $\sigma^{Jaccard} = 1$.[15] For the mixed strategy equilibria described in Proposition 1, the expected value of the Jaccard index can be expressed as the probability that the candidates choose the same theme. In particular, notice that $\Pr(d = B) = 1 - \Pr(d = A) = \Pr(r = A)$. Then, we can write the probability that D and R choose either AA or BB using the values from Proposition 1.

Proposition 2. *The expected value of the Jaccard Index at the mixed strategy equilibrium is equal to*

$$S = 2\frac{(p-q)(1-p-q)}{(1-2q)^2}. \tag{3}$$

A proof of this proposition is provided in Appendix A.1.

Figure 1a presents the outcomes of this game in (p, q) space. It shows the pure strategy equilibria regions AA and BB, and the mixed strategy equilibria regions as the (unlabeled) left and right triangles.[16] The figure also indicates how competitiveness and similarity change as you move across the space. We use dotted-line arrows to indicate the direction of increasing competitiveness and dashed-line arrows to indicate the direction of increasing similarity. The arrows, therefore, indicate the comparative static properties of the model.

We now connect our theoretical predictions to the descriptive patterns documented in Kaplan, Park, and Ridout [2006]. These authors maintain that competitiveness is positively associated with similarity. Our analysis shows that their statement is about two *derived* measures, which are based on the underlying primitives, p and q, where, at the risk of repeating ourselves, p is the strength of playing theme A against theme B, and q is the probability of D winning if they choose the same theme.

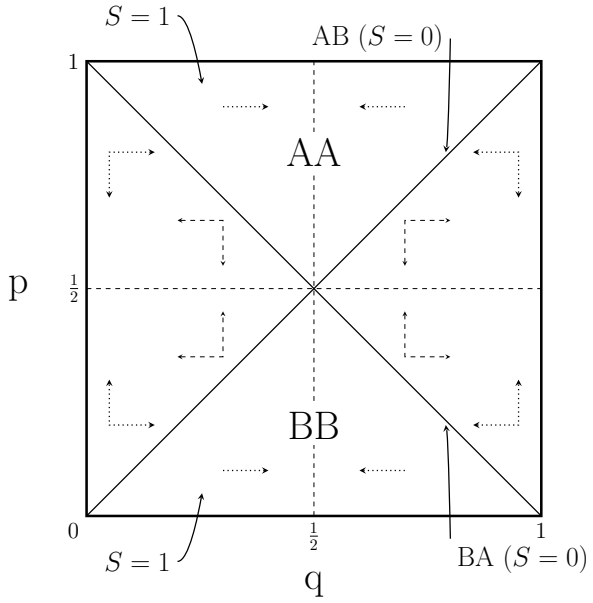
Our micro-foundation of race competitiveness and similarity allows us to see that the homogeneous case holds for changes in p for a given q. As a race's theme disparity decreases—

[14] In our empirical application, we extend this idea to account for differences in advertising intensity. See Section 4.

[15] There are two exceptions, where $p = q$ or $p = 1 - q$, where the pure strategy equilibria are AB or BA and so $\sigma^{Jaccard} = 0$.

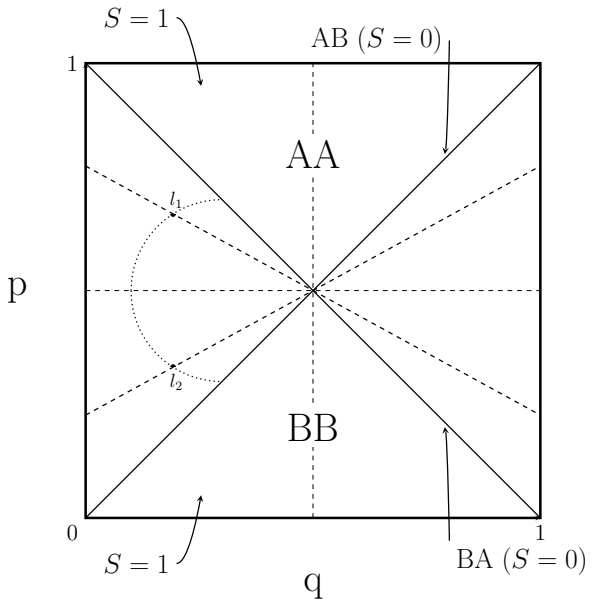
[16] The solid diagonal and off-diagonal lines indicate the presence of the (zero measure) pure strategy AB and BA equilibria, respectively.

Figure 1: Solution for the Basic Game



(a) Equilibria, Competitiveness, and Similarity

The dotted (dashed) lines indicate the direction of increasing competitiveness (similarity). AA and BB and the solid diagonal and off-diagonal lines indicate the pure strategy equilibria regions of the parameter space, while the mixed strategy equilibria are present in the remaining (left and right triangular) regions.



(b) Iso-competitiveness and Iso-similarity curves

Dotted (dashed) lines indicate iso-competitiveness (similarity) curves. AA and BB and the solid diagonal and off-diagonal lines indicate the pure strategy equilibria regions of the parameter space, while the mixed strategy equilibria are present in the remaining (left and right triangular) regions.

i.e., as p gets closer to $1/2$—for a given q, then competitiveness and similarity both increase and, therefore, would be consistent with a positive correlation in the data. However, competitiveness does not co-move with similarity if it is q that changes across races or within a race across time for a given p. In that case, as the race's prior advantages decrease—i.e., q gets closer to $1/2$—then competitiveness is associated with a divergence or decrease in messaging similarity. we formalize these ideas in the following proposition.

Proposition 3. *At any such mixed strategy equilibrium, similarity and competitiveness indices (S and C) increase as theme disparity ($\left|p - \frac{1}{2}\right|$) gets smaller. S rises while C falls when prior advantage ($\left|q - \frac{1}{2}\right|$) decreases.*

These two results, when combined, imply that if both p and q vary across races and time, the relationship between competitiveness and similarity is *a priori* ambiguous. It depends on the strength of the change in p versus the change q in the data, which is not observed.

Figure 1b further leverages the model to provide some insights on our ability to identify the primitives p and q. In the figure, two iso-curves are displayed. First, using a dotted

line, we display an iso-competitiveness curve, and using a dashed line, we display the iso-similarity curve for a value of the similarity index. There are two iso-similarity lines for an observed value of similarity. For an observed value of competitiveness, we observe one possible iso-competitiveness curve since we know which candidate is leading the polls. Those lines and curves intersect at two points, l_1 and l_2, which are the underlying values of the primitives p and q for the corresponding race.

We conclude that, given the level of competitiveness, we can identify the underlying q, but we cannot identify p. This is not surprising since we are looking at an area where the two politicians play a mixed-strategy equilibrium. In practice, we can learn that one of the two themes is associated with p and the other one is associated with $1-p$, but, because the politicians are playing a mixed-strategy equilibrium, we do not know which of the two themes is the stronger one. In general, candidates will advertise multiple themes, and we will have multiple p's rather than one, and we will not be able to identify q and the various p's, given that we will have multiple p's but still only two indices.

The discussion above underscores some crucial aspects of what is coming along in the empirical analysis. First, similarity and competitiveness are functions of the primitives, which are the strength of each message and the probability of candidates winning the race in the absence of political advertising. Second, data on similarity and competitiveness will not identify the strengths of the messages, even in the simple symmetric game that is the baseline model. Third, the relationship between competitiveness and similarity is a priori ambiguous and depends on the strength of the change in p versus the change q in the data, which is not observed.

2.2 Equilibrium Advertising in the Presence of Issue Ownership

The analysis above delivers a simple starting point. But one limitation is its simplifying assumption of symmetry in both the p and q variables. The q variable delivers a prior advantage to one candidate or the other, but that advantage is not associated with a theme. Here, we allow for issue ownership, the idea that a candidate can have a stronger advantage in one topic over the other [Budge and Farlie, 1983; Petrocik, 1996; Ansolabehere and Iyengar, 1994; Petrocik, Benoit, and Hansen, 2003]. This is parameterized by k in the payoff matrix in Table 2. Candidate D has an ownership advantage in theme A for $k > 0$ because D is more likely to win when both play A than when both play B, so R has the issue ownership advantage in theme B.[17]

[17] More generally, suppose that D has advantage k_d on theme A and R has advantage k_r on theme B. Whenever a candidate has an advantage, we add to own win-probability in the theme with the advantage and subtract from rival's own win-probability (all matrix entries are zero-sum). Then we have:

		Republican (R)	
		A	B
Democrat (D)	A	$q+k,\ 1-q-k$	$p,\ 1-p$
	B	$1-p,\ p$	$q-k,\ 1-q+k$

The matrix game above captures three ideas through its parameters. The first two are in the earlier analysis: One candidate may have a prior advantage with the electorate via q, and this is R for $q < 1/2$, and one theme may become more resonant come election day, as expressed through p, and the candidate emphasizing that theme is more likely to win when $p < 1/2$.[18] The additional idea, now expressed though k, is issue ownership as reflected in the supplemented on-diagonal entries, that one party (candidate) may be better suited to one theme than the other.

The importance of $k > 0$ can be seen in Figure 2, which shows the equilibrium types and the directions of increasing competitiveness, C, and the theme advertising similarity index, S. Comparing with Figure 1, we have the following result (which is readily established by inspection of the game matrix).

Proposition 4. *Suppose that $k > 0$. There exist three types of pure strategy equilibrium. AB arises, with each candidate choosing their owned issue, for $p \in [q-k, q+k]$. AA arises for $p \geq q+k$ and $p \geq 1-q-k$, and BB arises for $p \leq q-k$ and $p \leq 1-q+k$. There is no pure strategy equilibrium, BA, with each candidate choosing their rival's owned issue.*

A stylized fact from our empirical analysis that follows is that candidates will never talk about the same theme in some races. From Figure 2 and Proposition 4, this outcome arises when p and q are "close enough;" then candidates air only their owned issues.

To describe the properties of the mixed strategy equilibria, we first derive it. As before, let δ and ρ denote respectively the probabilities of D and R playing A. D indifference (writing the expected pay-off from A equal to the expected pay-off from B) means

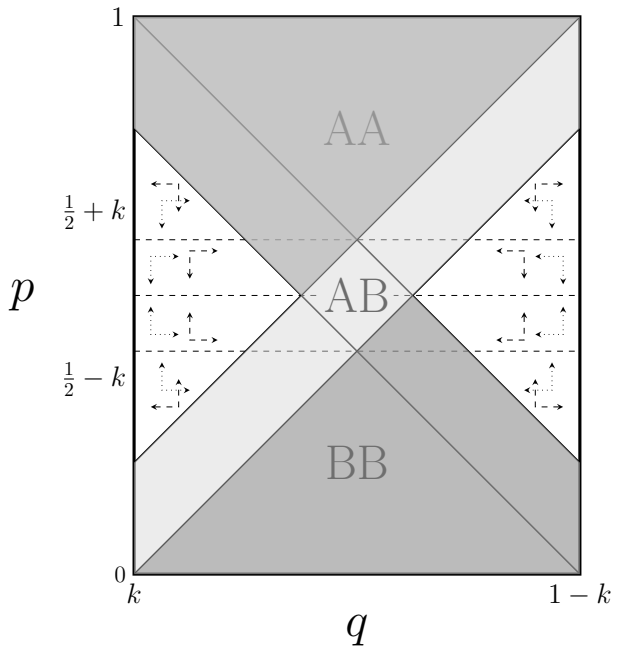
$$\rho\,(q+k) + (1-\rho)\,p = \rho\,(1-p) + (1-\rho)\,(q-k)\,,$$

		Republican (R)	
		A	B
Democrat (D)	A	$q+k_d,\ 1-q-k_d$	$p+k_d-k_r,\ 1-p-k_d+k_r$
	B	$1-p,\ p$	$q-k_r,\ 1-q+k_r$

Under symmetric k's, we have the matrix of the text. Notice in particular that AB and BA are then fully symmetric: BA pits two advantaged candidates while AB pits them both disadvantaged, so (dis-)advantages cancel.

[18] Appendix B.2 considers a more general form of the game that allows for different weights on the two themes in the same manner as Appendix B.1, but now including $k > 0$. We argue that the same broad patterns emerge.

Figure 2: Solution for the Theme Ownership Game



The dotted (dashed) lines indicate the direction of increasing competitiveness (similarity). AA, BB, and AB indicate the pure strategy equilibria regions of the parameter space, while the mixed strategy equilibria are present in the remaining (left and right triangular) regions.

while R indifference implies

$$\delta\left(1-q-k\right)+\left(1-\delta\right)p=\delta\left(1-p\right)+\left(1-\delta\right)\left(1-q+k\right).$$

Solving these implies

$$\rho=\frac{p+k-q}{1-2q}\quad\text{and}\quad\delta=\frac{1-q-p+k}{1-2q}.$$

For $q<1/2$, both of these equilibrium probabilities (of advertising theme A) are increasing in the extent of issue ownership k. Hence, the equilibrium win probability of the (a priori) weaker candidate is increasing in k. This means that the advertising tends to "reinforce strength" of the weaker one, while the stronger candidate is more aggressively attacking this source of strength (or, equivalently here, "resting on laurels" and not wasting much effort on the issue they already own). We expand on this below.

The message similarity index S is the chance of a match for the messages being chosen.

Thus $S = \delta\rho + (1-\delta)(1-\rho) = \frac{p+k-q}{1-2q}\frac{1-q-p+k}{1-2q} + \frac{1-q-p-k}{1-2q}\frac{-q+p-k}{1-2q}$, or

$$S = \frac{2\left((1-q-p)(p-q)+k^2\right)}{(2q-1)^2}. \tag{4}$$

This reveals that more issue ownership k leads to more similarity.

Finally, to derive the expression for the competitiveness index C, it suffices to recall that the MSE involves indifference across strategies. Thus, we can take the expected payoff from either strategy. D's win-probability is $\rho(q+k)+(1-\rho)p$. When D is the weaker candidate (as is the case for the MSE with low q), then

$$C = \frac{(p+k-q)(q+k)+(1-q-p-k)p}{1-2q} = \frac{(1-p)p+k^2-q^2}{1-2q}. \tag{5}$$

The key comparative static properties of the indices in the Mixed Strategy regimes are shown in Figure 2 and summarized below.

Proposition 5. *There exists a non-degenerate mixed strategy equilibrium if and only if* $p \in (q+k, 1-q-k)$ *and for* $p \in (1-q-k, q-k)$. *At such an equilibrium, the Similarity and Competitiveness indices (S and C) increase as theme disparity* $\left(\left|p-\frac{1}{2}\right|\right)$ *gets smaller. Both indices increase as prior advantages* $\left(\left|q-\frac{1}{2}\right|\right)$ *decrease when theme uncertainty is dominated by issue ownership* $\left(p \in \left(\frac{1}{2}-k, \frac{1}{2}+k\right)\right)$*; but C rises while S falls when theme uncertainty dominates issue ownership* $\left(\left|p-\frac{1}{2}\right| > k\right)$.

A proof of Proposition 5 is available in Appendix A.2.

Finally, we break out the relevant properties of the model with respect to issue ownership.

Proposition 6. *At any mixed strategy equilibrium:* (i) *As k rises, both candidates advertise more the issue owned by the weaker candidate;* (ii) *both the Competitiveness and the Similarity indices increase with k;* (iii) *if issue ownership is large relative to uncertainty over the dominant theme* $\left(k > \left|p-\frac{1}{2}\right|\right)$ *then both candidates advertise more the weaker candidate's owned issue;* (iv) *the index ratio S/C decreases with issue ownership, k.*

A proof of Proposition 6 is available in Appendix A.3.

Proposition 6 has important implications for empirical analysis of issue ownership. First, it presents two important results regarding the *measurement* of issue ownership. Proposition 6 (i) and Proposition 6 (iii) indicate that the stronger candidate will advertise more on their (weaker) competitor's owned issue as ownership becomes stronger overall. This means that issue ownership cannot be empirically measured by looking at equilibrium advertising

decisions. Second, Proposition 6 (ii) and Proposition 6 (iv) indicate that increased ownership should lead to increased convergence, but that it should dampen the competitiveness-similarity relationship. We investigate this prediction in Section 6.

3 Data on Political Advertising

We now turn to an empirical analysis of dialogue in political advertising. To do so, we construct a dataset on political advertising in U.S. House and Senate races from 2012 to 2020. We restrict our attention to two-candidate races during the normal election cycle, where a Democrat and Republican are the primary candidates running for office. To construct this dataset, we combine data from several different sources, which we now describe.

3.1 Television Advertising Data

We use data on broadcast television advertising in U.S. House and Senate races from 2012 to 2020 from the Wesleyan Media Project (WMP) [Fowler, Franz, and Ridout, 2015, 2017; Fowler et al., 2019, 2020, 2023]. The WMP provides scholarly access to Kantar Media/CMAG tracking data and video files covering all broadcast television political advertising from the 210 media markets in the United States.[19]

The unit of observation in the WMP dataset is a single ad-airing. We observe the candidate for which the ad was run, an estimate of the amount spent on the ad, when the ad was run, and the channel on which the ad was aired. Table 1 presents summary statistics on this information. The number of unique creatives increased nearly 40% from 2012 to 2020, and ad-airings increased 140% from 2012 to 2020. The average amount of money spent on an ad was $530.90 per airing. We define three time periods: Morning (midnight to noon), Afternoon (noon to 8 pm), and Night (8 pm to midnight). Most ads are shown during the Afternoon period, followed by Morning and then Night. Perhaps unsurprisingly, the three major networks (ABC, NBC, CBS) accounted for the vast majority of ads, followed by Fox and the CW.[20]

Most importantly for our work, we observe the campaign issues that were discussed in each advertisement. For example, we can see whether an ad mentioned the issue of

[19] We include all races under this criteria, even if one of the major party candidates did not air television advertising as they provide information on whether candidates advertise (the "extensive" margin), which is different from how much they spend in advertising (the "intensive" margin). This is a departure from previous work. Kaplan, Park, and Ridout [2006], for example, refer to such non-advertising candidates as "sacrificial lambs" and do not include these races in their analysis.

[20] Note that Fox is the "over-the-air" Fox television network and not the Fox News cable channel. We drop a small number of affiliates that each account for less than 5% of total airings.

Table 1: Ad Airing Summary Statistics

	Unique Creatives	Est. Cost			
	—	Mean	Min	Max	N
Year					
2012	1,460	667.7	50	165,000	559,203
2014	1,354	592.5	50	79,800	608,359
2016	1,210	570.0	50	125,000	553,391
2018	1,751	497.7	40	92,580	856,534
2020	2,035	451.7	30	135,370	1,352,698
Affiliate					
ABC	2,154	539.6	30	116,080	1,003,781
CBS	2,135	514.7	30	123,750	1,108,421
CW	217	417.7	30	79,800	128,730
FOX	1,114	531.0	30	135,370	585,591
NBC	2,190	552.4	30	165,000	1,103,662
Period					
Morning	2,662	377.9	30	123,350	1,310,255
Afternoon	3,954	540.6	30	128,390	2,000,456
Night	1,194	823.4	30	165,000	619,474
Total	7,810	530.9	30	165,000	3,930,185

Table 2: Campaign Theme Prevalence by Year

Year	2012	2014	2016	2018	2020
Economic Policy	44.03	35.23	27.55	26.18	27.27
Social Issues	3.78	6.55	17.92	10.20	7.70
Law and Order	0.82	1.05	4.38	7.02	7.81
Social Welfare Issues	28.84	25.86	17.68	26.09	27.90
Foreign/Defense Policy	9.02	12.95	16.80	12.76	10.73
Environment/Energy	6.23	6.94	4.07	2.92	3.33
Government	7.28	11.41	11.61	14.83	15.25

"Gambling." An ad can mention multiple issues at the same time, of course, while a very small number of ads do not mention any coded issue. The dataset only reports whether or not candidates advertise on each issue and not the candidates' positions on those issues. The number of coded issues has increased each election cycle, beginning with 63 issues in 2012, 65 in 2014, 73 in 2016, 84 in 2018, and 100 in 2020.

We recognize that some issues are tightly related to each other, so in our primary analysis, we aggregate issues into seven "themes." We follow the issue categorization employed by the WMP to assign each issue to a theme. For example, the Environment/Energy theme consists of the BP Oil Spill, Environment (generic reference), Global Warming, Keystone XL Pipeline, and Energy Policy issues.[21] We believe our decision to use aggregate themes instead of issues is a conservative one, as it ensures that we do not record a lack of dialogue as a function of how narrowly defined the issues are.[22]

Table 2 presents our seven themes and shows how the percentage of each has changed over the years. Discussion of Economic Policy has fallen by half, while there was been a significant increase in discussion of Social Welfare Issues and Social Issues. Law and Order is the least common theme, but has seen an increase in use over the sample period.

3.2 Other Datasets

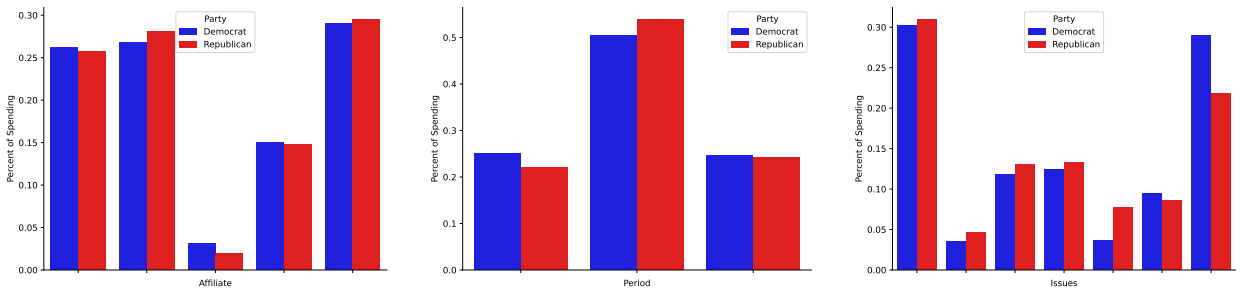
We use information from the Cook Political Report's (CPR) race ratings, which are released regularly throughout an election cycle, to measure the competitiveness of a race [Cook Political Report, 2023].[23] CPR rates races that are "not considered competitive and are not

[21] See Appendix C.2 for a complete mapping of issues to themes.

[22] In Appendix G we present corresponding statistics and analysis using the disaggregated issue codings.

[23] These and similar ratings have been used to measure race competitiveness in prior research. See Banda [2013] for another use of the CPR data for this purpose. Minozzi [2014] and Kaplan, Park, and Ridout [2006] use a similar set of ratings from CQ Weekly. Notably, Minozzi reports finding similar results when duplicating his primary analysis using the CPR ratings.

Figure 3: Distribution of Advertising Spending



(a) Spending by Affiliate (b) Spending by Period (c) Spending by Theme

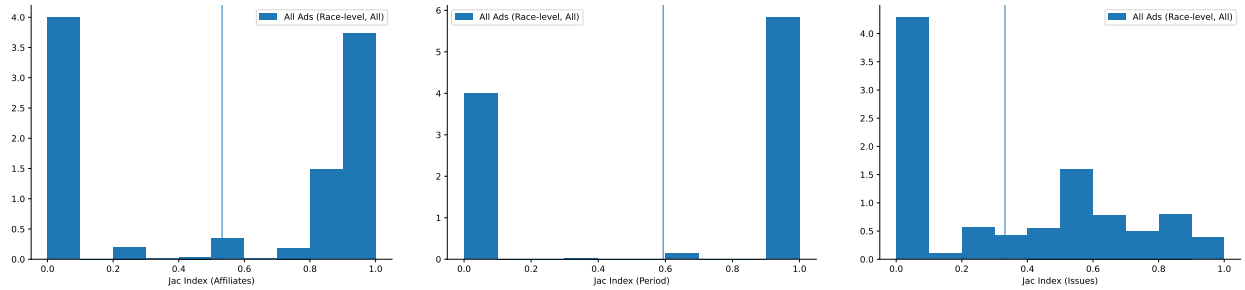
likely to become closely contested" as *Solid*, those that are "not considered competitive at this point but have the potential to become engaged" as *Likely*, races that are "considered competitive . . . but one party has an advantage" as *Leaning*, and "the most competitive races" as a *Tossup* [The Cook Political Report, 2024].[24]

Our demographic data comes from the U.S. Census Bureau's 5-Year American Community Survey (ACS) [U.S. Census Bureau, 2023]. Finally, we use data on general election vote counts from the MIT Election Data and Science Lab [MIT Election Data and Science Lab, 2017a,b].

4 Characterizing Dialogue in Political Advertising

We now turn to characterizing the presence of dialogue across U.S. House and Senate races between 2012 and 2020. In the spirit of Simon [2002], we propose three necessary conditions for dialogue, which reflect the idea that dialogue exists to the extent that the candidates reach the same "eyes and ears" with the same themes. First, we would want the candidates to address the same audiences, which we characterize by the TV affiliate (i.e., channel) the ad is aired on. E.g., the Democrat and Republican both advertise on the local ABC affiliate. Second, we would want the candidates to address their audiences at the same time. For example, both candidates would advertise during the evening news broadcast. Finally, we would want the candidates to address the same themes. For example, both candidates discuss the "Economic Policy" theme.

Figure 4: Jaccard Index of Ad Spending at the Race Level



(a) Spending by Affiliate (b) Spending by Period (c) Spending by Theme

4.1 Dialogue at an Aggregate Level

As a first step, we consider dialogue at the most aggregated level: aggregating across all races and years. Figure 3 shows that advertising spending is similar across parties in terms of which TV affiliates they air ads on, when during the day they air ads, and which themes they advertise about. Thus, at the aggregate level, we find considerable evidence in support of dialogue when defined as advertising to the same audience, at the same time, or on the same campaign themes. This level of aggregation, however, disguises significant variation in the level of dialogue across races, and so we next turn to calculating the Jaccard similarity index (Equation (2)) for each race.

We present these results in Figure 4, which parallels Figure 3 in presenting a measure of candidate similarity by affiliate, time of day, and campaign theme (panels (a), (b), and (c), respectively). In panels (a) and (b), we see that a substantial portion of candidates advertise in overlapping times of day, although there is also a large number of races with $\sigma^{Jaccard}$ at or close to zero, indicating either a one-sided race with one candidate advertising and the other not, or totally divergent advertising strategies.[25] Panel (c) shows a greater level of heterogeneity across races, with some races where candidates advertise on matching sets of themes, while others match on only a subset of the themes they communicate on. Notably, there are a significant number of races where there is no similarity in advertising, which again can result when only one candidate in a race advertises or when both candidates choose to avoid the themes discussed by their competitor completely.

As discussed above, the Jaccard index provides a clear measure of the degree to which candidates overlap on the themes (or affiliates or periods) to advertise. However, it fails to

[24]CPR ratings are correlated with the final winning margin of a candidate. See Figure 13 for a comparison of a race's CPR rating 3 months before election day to its final vote margin.

[25]Note that the gaps in these figures are mechanical—$\sigma^{Jaccard}$ can only take on a few discrete values given a low number of affiliates (5) and times of day (3).

account for disparities in spending on those themes. As a result, a race where, for example, the Democrat places great emphasis (and thus spending) on Social Issues and little emphasis on Law and Order, while their Republican competitor does the reverse, will afford an index of $\sigma^{Jaccard} = 1$ even though there is arguably only minimal dialogue between the two candidates on those two themes. To better account for potential disparities in advertising intensity on each issue, we turn to the Ruzicka Index, which is a generalization of the Jaccard Index that accounts for both theme selection and disparities in spending across themes (or affiliates or periods). The Ruzicka index is defined as

$$\sigma^{Ruzicka} = \frac{\sum_k \min\{R_k, D_k\}}{\sum_k \max\{R_k, D_k\}}, \tag{6}$$

where k indexes campaign issues or themes, and R_k and D_k are the Republican and Democratic candidates' spending on k, respectively. The Ruzicka Index has three attractive properties. First, like the Jaccard, $\sigma^{Ruzicka} \in [0, 1]$. Second, the Ruzicka Index reduces to the Jaccard Index in the case of binary spending measures and, more generally, corresponds directly to the Jaccard Index when candidates advertise with the same intensity for the themes on which they overlap. Third, the Ruzicka Index flexibly captures disparities in spending. If $\sigma^{Ruzicka} = 0$, then there is no dialogue (no overlap), or one of the two candidates is not advertising. If $\sigma^{Ruzicka} = 1$, then the two candidates are matching each other *dollar-for-dollar* on each issue they discuss. And, if a candidate, say the Democrat, exactly matched the Republican's themes but spent fraction $0 < \theta < 1$, then $\sigma^{Ruzicka} = \theta$.[26]

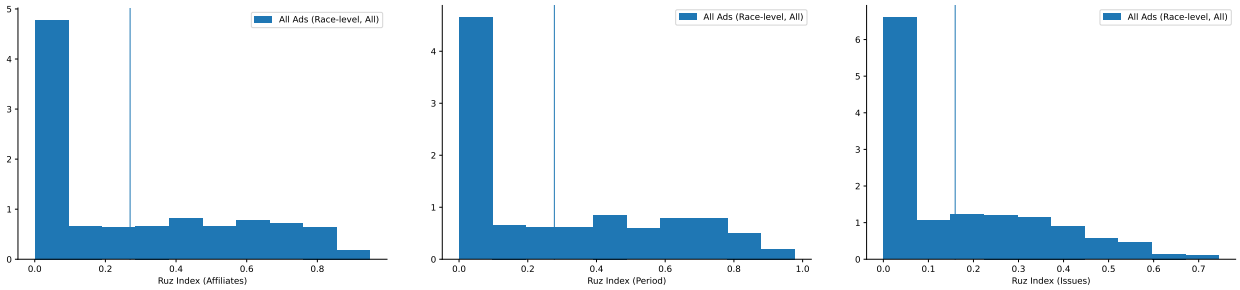
In Figure 5, we show race-level Ruzicka indices for affiliates, periods, and themes. Across all three outcomes, we see significant heterogeneity in the level of similarity between the two candidates in each race. Notably, there are a substantial number of races where the Ruzicka Index is equal to zero.

4.2 Candidate versus Third-Party Advertising

The above analysis considers all broadcast TV advertising in support of a candidate. However, this political advertising can be purchased by a variety of entities: the candidate, the candidate's party (in conjunction with or separately from the candidate), and various third-party entities such as Political Action Committees (PACs). In Figure 6, we distinguish aggregate spending across affiliates, periods of the day, and campaign themes between the candidate and their party (top row) and third parties (bottom row). In aggregate, spending

[26]Similar to the Jaccard, it can be formally shown, with a proof analogous to the one of Proposition 2, that the expected value of the Ruzicka Index is equal to S, the expected similarity index in our theoretical model.

Figure 5: Ruizicka Index of Ad Spending at the Race Level



(a) Spending by Affiliate (b) Spending by Period (c) Spending by Theme

percentages by these two entities look similar.

In Figure 7, we present histograms of race-level Ruzicka indices calculated separately for the candidate and third-party advertising in each race. We can see that across categories, the distribution of third-party spending is significantly different than that of candidate spending, with substantially less overlap in affiliate, period of day, and campaign theme by the third parties relative to the candidates. Third-party ads are far less likely to engage in dialogue across these three dimensions.

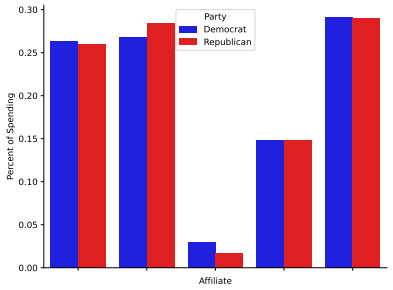
4.3 Disaggregating Dialogue

A fundamental aspect of our analysis is to propose that "dialogue," defined as the concurrent advertising of the same themes by the competing parties, requires that the candidates discuss the same topics *and* address the same audiences (as measured by affiliate and period). Studying aggregated, race-level data can substantially mask the degree to which both conditions are true. To motivate this point, we start by presenting some anecdotal evidence that illustrates our point in a stark and clear fashion.

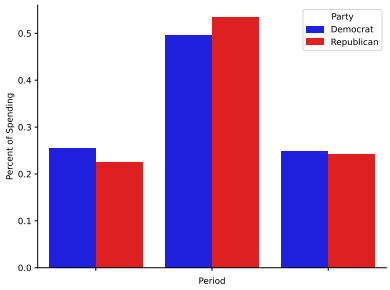
Figure 8 presents two graphs of theme spending in the 2014 election in Virginia's 2^{nd} district between Suzanne Patrick (D) and Scott Rigell (R). Figure 8a shows how the candidates divided their aggregate spending across themes. While disparities exist, most notably in the Economic Policy theme, the candidates appear closely matched. Indeed, the race-level Ruzicka index is 0.704, placing this race in the 99^{th} percentile of all races in our sample.

However, upon temporally disaggregating this data into two-week (biweekly) periods, displayed in Figure 8b, we see that advertising on the same theme is often temporally misaligned. For example, in biweek 3, Patrick (in blue) runs ads where she mentions Social Issues and Social Welfare Issues, while Rigell (in red) mentions the Foreign/Defense Policy and Social Issues themes.

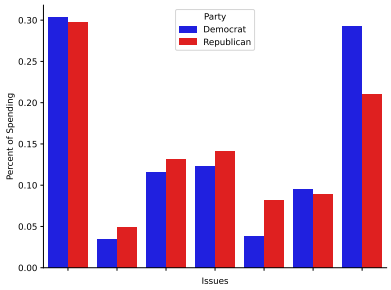
Figure 6: Distribution of Advertising Spending, Candidates vs. Third Parties



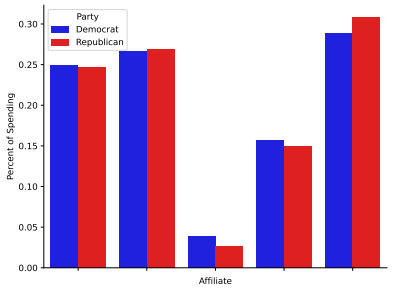
(a) Candidate Spending by Affiliate



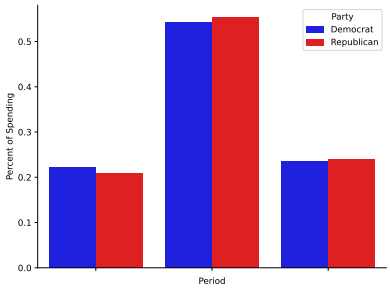
(b) Candidate Spending by Period



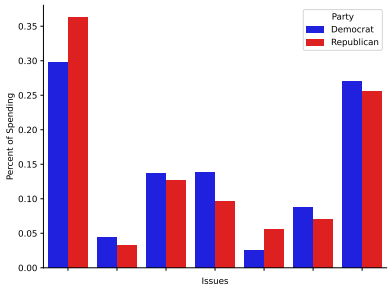
(c) Candidate Spending by Theme



(d) Third-Party Spending by Affiliate

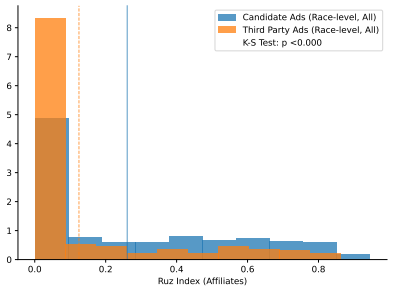


(e) Third-Party Spending by Period

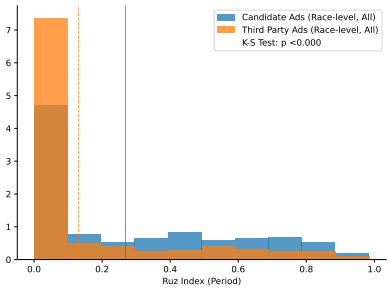


(f) Third-Party Spending by Theme

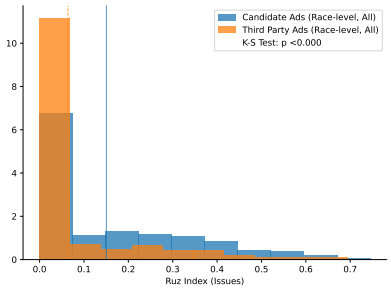
Figure 7: Ruzicka Index of Ad Spending at the Race Level, by Ad Sponsor



(a) Spending by Affiliate

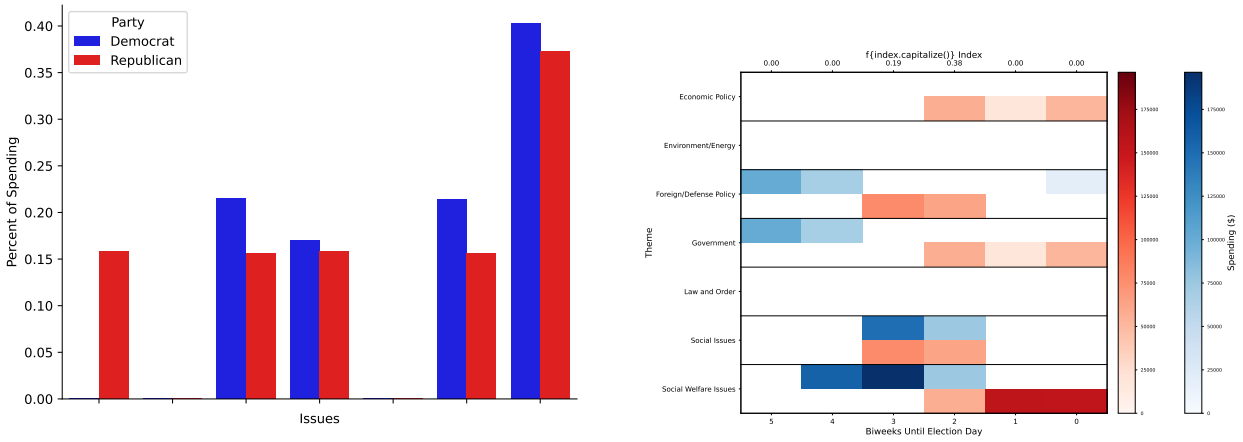


(b) Spending by Period



(c) Spending by Theme

Figure 8: Spending on Themes in Virginia's Second Congressional District (2014)



(a) Race-level Spending

(b) Week-level Spending

While the race-level Ruzicka index is 0.704, indicating a significant overlap in messaging, the biweekly Ruzicka index averages only 0.861 across weeks. The intensity of the color in the figure is associated with the amount of money spent on that theme. For example, the darker the blue, the more money the democratic candidate has spent on a particular issue or "theme."

Figure 8b shows that the aggregation in Figure 8a disguises significant temporal heterogeneity in advertising. For example, both candidates spend roughly 15% of their budgets on the Government theme but, in fact, never overlap on that theme in a given two-week period.

With this exemplary case in mind, we consider the state of U.S. political dialogue in a more disaggregated manner. We begin by assessing the degree to which candidates select into concurrent advertising—irrespective of the similarity of their messaging content—at both aggregate and disaggregated levels. We then turn to the similarity of their messaging, overall and conditional on selection into concurrent advertising.

Table 3 presents the extent to which candidates concurrently advertise and the level of similarity as measured by the Ruzicka index at the race and race-biweek level (and a third, *conditional* race-biweek level, defined below). These statistics are provided for the overall sample ("All"), and broken down by competitiveness and whether the race is for the U.S. Senate or House. Each cell in Panel (a) represents the percentage of races in which both candidates advertise at the specified level of observation, and each cell in Panel (b) represent the average theme-based Ruzicka index.

The first row of panel (a) reflects the selection outcome in race-level aggregated data. When aggregated to this level, both candidates advertise in 29% percent of races. The level of selection, though, varies considerably across competitiveness levels, with concurrent advertising by both sides occurring in only 12% of the least competitive (Solid) races, compared

to nearly 96% of the most competitive (Tossup) races. There is also a substantial difference between Senate and House races, with concurrent advertising occurring in only 25% of House races, compared to 73% of Senate races.

Moving to the second row, we see a remarkable decline in concurrent advertising at the race-biweek level. The topline number falls to only 10%. That is, while both candidates advertise in 29% of races, they often do so at different times in the election cycle (as measured in two-week increments). The results across competitiveness levels are again monotonically increasing in the level of competition but are also substantially lower. Candidates only air advertisements in the same two-week period in 2% of the least competitive races, while candidates in the most competitive races only advertise in the same period roughly half of the time.

Of course, these race-biweek level statistics include both races where both candidates advertise *and* the large fraction of races that never see an advertisement from both sides. In the third row of panel (a), we condition on selection into concurrent advertising at the race level. That is, we present race-biweek statistics for the 29% of races where both candidates advertise. In this case, we see a third of biweek periods feature concurrent advertising overall, with most of this improvement coming from the least competitive races.

In summary, concurrent advertising increases sharply the more competitive races are, senate races see more advertising than house ones, and advertising by both candidates occurs in one-third of the observations at the biweek-race level when we restrict the sample to races where both candidates advertise at least once over the election year.

Next, in panel (b) of Table 3, we investigate similarity in themes. Overall, we find an average Ruzicka index of 0.0759, with greater similarity present in more competitive races and in Senate races. This suggests a dearth of dialogue in U.S. political campaigning. However, it includes both the 29% of races where both candidates advertised—thus making dialogue at least possible—and the remaining races where dialogue could never occur. In the second row of panel (b), we condition on race-level selection, i.e., focus on the 29% of races where there is the potential for dialogue. In this case, the Ruzicka index jumps to 0.2658, providing strong evidence of the role of the extensive margin in analyzing political dialogue.

Similarly, when we investigate similarity in themes across race-biweek observations, we find that the Ruzicka index equals 0.0207 when looking at the entire sample. If we restrict the analysis to race-biweek observations where both candidates air at least one ad during the entire race (not necessarily in the same biweek period), then the Ruzicka increases to 0.0719. If we restrict the sample further to race-biweek observations where both candidates advertise, the Ruzicka rises to 0.2158.

In summary, the effect of "selection into advertising" on similarity is shown to be critical,

Table 3: Selection and Similarity by Competitiveness and Race Type

	Competitiveness						
	Solid	Likely	Leaning	Tossup	Senate	House	All
Race	0.1157	0.6978	0.8851	0.9592	0.7333	0.2465	0.2854
Biweek	0.0226	0.2167	0.3471	0.4798	0.3350	0.0733	0.0958
Biweek (Race Selection=1)	0.1886	0.3054	0.3861	0.5032	0.4568	0.2986	0.3333

(a) Selection

	Competitiveness						
	Solid	Likely	Leaning	Tossup	Senate	House	All
Race	0.0203	0.1817	0.2632	0.3300	0.2195	0.0631	0.0756
Race (Race Selection=1)	0.1752	0.2604	0.2973	0.3441	0.2994	0.2560	0.2649
Biweek	0.0038	0.0461	0.0756	0.1138	0.0753	0.0154	0.0205
Biweek (Race Selection=1)	0.1666	0.2130	0.2177	0.2371	0.2247	0.2100	0.2144
Biweek (Biweek Selection=1)	0.0314	0.0650	0.0841	0.1193	0.1027	0.0627	0.0715

(b) Similarity

Selection is measured with a binary variable indicating whether both candidates in a race advertise concurrently. Similarity is measured with the Ruzicka index (Equation (17)). Each cell presents the average Selection or Similarity measure for the specified slice of the data. "Race Selection=1" conditions on the case where both candidates advertise at least once during a campaign, and Biweek Selection conditions on the case where both candidates advertise in a given biweek period.

and the similarity is lower at the race-week level (Ruzicka equal to 0.2158) vs the race level (Ruzicka equal to 0.2658).

4.4 Benchmarking Dialogue

There are two related questions worth asking at this point. First, can we benchmark dialogue in a way that we can conclude whether there is as much dialogue as one would "expect?" Second, and relatedly, is the finding that the Ruzicka index is lower at the race-biweek than at the race level simply a function of the potentially artificial sparsity induced by the disaggregation of data across a larger number of observations?

To address these crucial questions and better characterize whether these calculated indices represent high or low levels of similarity, we construct a simulated benchmark. Recall that under Proposition 1, messaging similarity is maximized at $p = 1/2$. At this point, each candidate will choose among the available themes with equal probability, and as theme disparity (i.e., $|p - \frac{1}{2}|$) increases, the similarity of the candidates' messaging strategies will decrease. Thus, the case where candidates randomly allocate advertising spending across

themes can serve as a benchmark against which to compare actual similarity measures.[27]

Given this, we take the observed budgets for each candidate in each race and randomly (following a uniform distribution) distribute their spending across the seven campaign themes. For example, if a candidate spent \$50 in advertising on a particular theme, we now distribute those \$50 among themes with 50 independent, uniform random draws. Using these simulated advertising decisions, we construct a Simulated Ruzicka Index, $\hat{\sigma}^{Ruzicka}$. We repeat this process 10,000 times for each race and take the average. We take the this approach because it provides a clean test of non-strategic overlap as motivated by our theoretical model.

We present the results of this exercise, along with the observed, real-world Ruzicka indices in Figure 9. We present the distribution of simulated and observed Ruzickas at the race and race-biweek levels in Figures 9a and 9c, respectively. Additionally, for each race and race-biweek observation, we calculate the difference between the simulated and observed Ruzicka indices, $\hat{\sigma}^{Ruzicka} - \sigma^{Ruzicka}$. We present the distribution of these differences in Figures 9b and 9d.[28]

Figure 9a shows that were candidates to distribute their budget across campaign themes randomly, the average similarity would be $\sigma^{Ruzicka} = 0.4681$, whereas the average in our data (conditional on both candidates in a race advertising at least once) is $\sigma^{Ruzicka} = 0.2658$, or almost half as what we would observe in a world where politicians were throwing random darts at a board.[29] In an average race, this represents a difference between the simulated and observed of $\hat{\sigma}^{Ruzicka} - \sigma^{Ruzicka} = 0.2023$. This suggests that candidates strategically avoid dialogue.

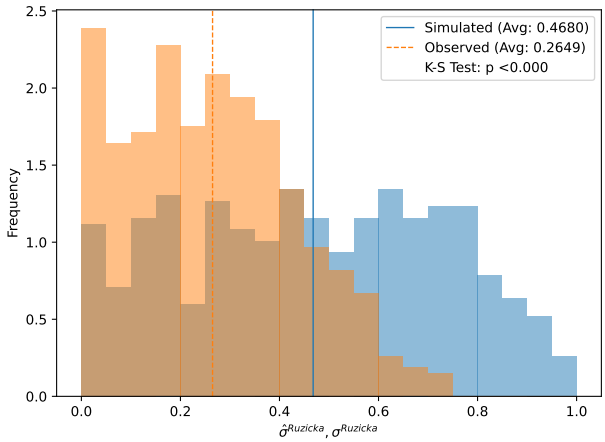
With regard to the second question, Figure 9c shows that moving to race-biweek level of observation *does not mechanically reduce dialogue*. On average, random draws would deliver an average value of the Ruzicka of 0.4526 with race-biweek observations, which is essentially identical to the value of 0.4681 that we find with race observations. Here, too, we see the observed advertising is less similar than one would expect under the randomized benchmark, with an average difference of $\hat{\sigma}^{Ruzicka} - \sigma^{Ruzicka} = 0.2368$.

[27] Our approach builds on an ingenious approach first used by Armenter and Koren [2014] to study trade patterns.

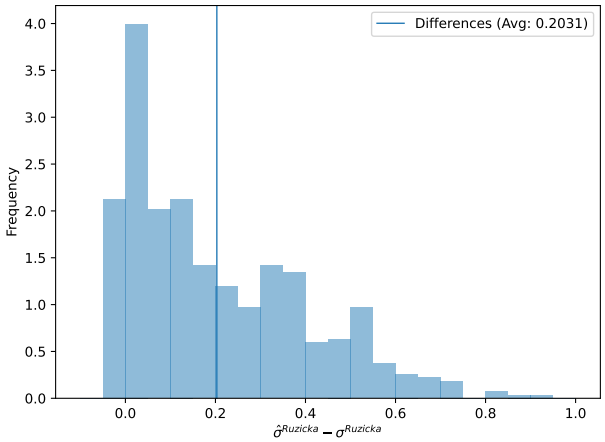
[28] Notably, we find that in 10.63 % of races, and 9.38 % of race-biweeks, the observed similarity exceeds the simulated benchmark.

[29] In Figures 9a and 9c, we present the Kolmogorov-Smirnov test, showing that the distributions are statistically different.

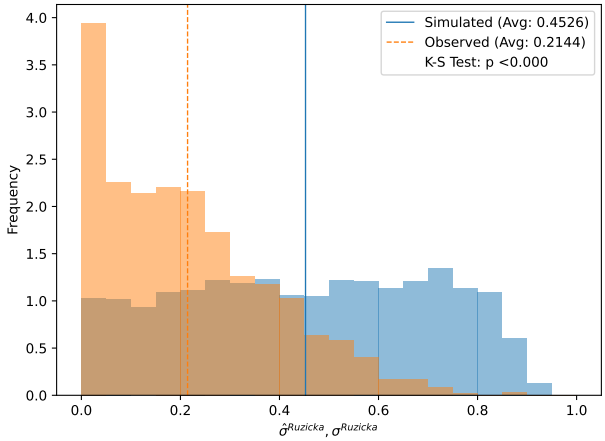
Figure 9: Benchmarking Dialogue



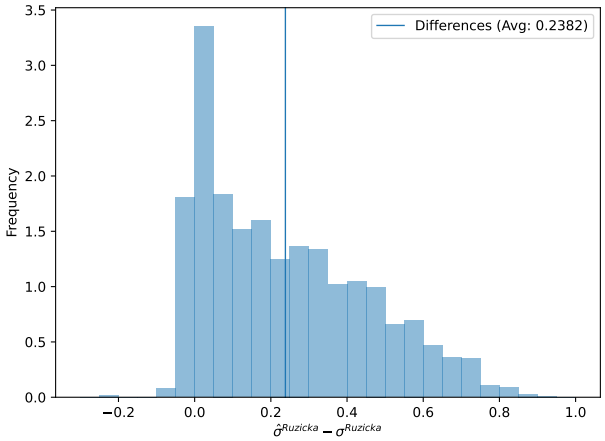
(a) Race-Level Indices



(b) Race–Level Differences



(c) Race-Biweek-Level Indices



(d) Race-Biweek-Level Differences

5 The Determinants of Dialogue in Political Advertising

We now develop and estimate an empirical model of candidates' selection into concurrent advertising and subsequent messaging similarity. The key objective is to investigate the determinants of dialogue, focusing on the competitiveness of races, the type of race, and the time to the election date. We first present the empirical model and discuss the econometric challenges, then our main empirical results.

5.1 The Empirical Model

We must address two critical empirical challenges present in the study of political races. First, the Ruzicka index is bounded between 0 and 1, rendering the standard linear regressions inappropriate for our econometric analysis. To address this challenge, we model advertising similarity (the Ruzicka index) with a fractional regression [Papke and Wooldridge, 1996; Wooldridge, 2010]. Second, candidates can choose not to air advertisements in a given period, potentially introducing sample selection bias in our estimates. To address this second challenge, we model candidates' concurrent selection into advertising with a Probit model. We discuss our formal approach next.

While unobserved race characteristics might simultaneously influence competitiveness and advertising overlap as well, our research design helps mitigate this endogeneity concern. We measure competitiveness only at rare, discrete intervals, roughly once every few weeks, while advertising overlap is observed much more frequently—daily in the raw data, or bi-weekly in our analysis. This temporal separation between measurements reduces the mechanical correlation between these variables.

Consider a district or state m in period t (election cycle or biweek). Following Papke and Wooldridge [1996] and Wooldridge [2010], we specify the conditional mean of messaging similarity as a Probit function:

$$E\left(\sigma_{mt}^{Ruzicka}|X_{mt}\right) = \Phi(X_{mt}\beta), \tag{7}$$

where $\Phi(\cdot)$ is a standard normal CDF, $X_{mt} = [X_{1mt}, X_{2mt}]$ is a vector of race-period covariates. In particular, X_{1mt} are measures of how competitive a race is, and X_{2mt} are other exogenous determinants of messaging similarity.

We use dummy variables constructed using the Cook Political Report (CPR) to measure race competitiveness, as discussed in Section 3.2 and Appendix C.1. Specifically, we include indicators for whether a race is a tossup, competitive and leaning one way, likely to be

competitive, or solidly in one candidate's favor. Other exogenous race characteristics for the race-week level analysis are the number of biweeks to the election, which allows us to capture whether candidates converge to the same issues as the election date nears; an indicator for whether the race is for the Senate vs House, as Senate races are likely to be less polarized; and demographic characteristics, such as the unemployment rate, the percentage of the population aged 65 and older, and median income, to measure race-specific demographic differences.

The second econometric challenge is the potential for sample selection bias, which is suggested by the comparison our descriptive analysis in Section 4.[30] In particular, the Ruzicka similarity index can be zero for two reasons: One of the two candidates does not advertise, or both candidates advertise, but in a completely disjoint manner. In both cases, we know that no dialogue is occurring. However, the two cases should not be confounded.

We model the sample selection as

$$P\left(s_{mt}=1 \mid Z_{mt}\right)=\Phi\left(Z_{mt}\alpha\right), \tag{8}$$

where s_{mt} equals 1 if *both* candidates advertise in mt, and 0 otherwise. We maintain that $\Phi\left(\cdot\right)$ is a standard normal CDF. The variables Z_{mt} are exogenous and, as discussed below, are at least partially not excluded from X_{mt}.

Given the bounded nature of $\sigma_{mt}^{Ruzicka}$, and the presence of sample selection, we follow Papke and Wooldridge [1996], Schwiebert and Wagner [2015], and Wulff [2019], and write:

$$\begin{aligned} E\left(\sigma_{mt}^{Ruzicka} \mid s_{mt}=1, X_{mt}, Z_{mt}\right) &= \frac{\Phi\left(X_{mt}\beta, Z_{mt}\alpha; \rho\right)}{\Phi\left(Z_{mt}\alpha\right)}, \\ E\left(\sigma_{mt}^{Ruzicka} \mid s_{mt}=0, X_{mt}, Z_{mt}\right) &= 0, \end{aligned} \tag{9}$$

where ρ measures the correlation between the decision to jointly advertise and the extent to which the topics chosen by the candidates are similar. Thus, if $\rho=0$, then those two random variables are independent of each other. We should expect $\rho \neq 0$, but we do not have a-priori expectations on the sign of ρ.

Papke and Wooldridge [1996] and Gourieroux, Monfort, and Trognon [1984] show how the model can be estimated using a quasi-maximum likelihood estimator under the assumption of strict exogeneity of X_{mt} and Z_{mt}. We maintain that the sequence of observations $\left\{\left(\sigma_{mt}^{Ruzicka}, X_{mt}, Z_{mt}\right) : m=1,....,M; t=1,....,T\right\}$ are independent across m, but not necessarily within a market m over time. Then, the model is, in theory, identified by the functional form assumptions that we have made.

[30] We further document this idea in Appendix D. See, e.g., Figure 15.

However, we define $Z_{mt} = [X_{1mt}\ X_{2mt}\ S_{mt}]$ to include variables S_{mt} that are not included in X_{mt}, and which satisfy the usual exclusion restriction required in models with sample selection. Therefore, identification is via exogenous variation in observed variables rather than just from functional form assumptions.

We construct S_{mt} as including two variables that correspond to 1) the product of total expenditure by Democrats in the state and total expenditure by the Republicans in the state (excluding race m), and 2) the product of total expenditure by Democrats in the nation and total expenditure by the Republicans in the nation (excluding race m). The economics behind the maintained assumption that S_{mt} affects the decision to advertise but not what issues to mention is the following: The more the parties spend on other races, the less they are able to spend on the focal race, given current fundraising. The available budget affects the decision to advertise, but we do not expect it to affect the theme choice.[31]

In our empirical analysis, we present results while excluding third-party advertising, including advertising from political action committees (PACs). This helps validate our identification strategy because PACs typically raise funds and spend money on specific issues (like abortion or gun rights), meaning their spending levels could be correlated with the underlying importance of those themes in a market. In contrast, candidates and parties raise funds more generally based on overall electoral prospects rather than specific issues. Therefore, by investigating whether the results are robust when excluding third-party advertising, we demonstrate that our findings aren't driven by problematic correlations between issue-specific funding and theme choice, and that the remaining variation in other candidates' spending (S_{mt}) is more plausibly exogenous to theme-specific factors.

5.2 Estimation Results

We present estimation results for three levels of data aggregation. First, we consider specifications where the unit of observation is the race, which corresponds to previous work on this topic by Kaplan, Park, and Ridout [2006], among others. Second, we move to regressions where the unit of observations is at the race-biweek level. Third, we disaggregate further to the race-biweek-affiliate-period level. In Section 6, we consider the possibility that parties may "own" some issues in the eyes of voters.

Table 4: Empirical Results: Race-Level Themes

	All		Candidate		Third Party		Only
	Similarity	Selection	Similarity	Selection	Similarity	Selection	Similarity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tossup	0.9324***	2.8830***	1.0455***	2.7624***	-1.2246	2.6306***	0.5828***
	(0.1899)	(0.2138)	(0.1834)	(0.1954)	(1.6534)	(0.2492)	(0.0602)
Leaning	0.7391***	2.5277***	0.8685***	2.4173***	-1.2653	2.1388***	0.4000***
	(0.1866)	(0.1751)	(0.1808)	(0.1639)	(1.3273)	(0.2484)	(0.0621)
Likely	0.6095***	1.8089***	0.7375***	1.7013***	-0.7647	1.2044***	0.3293***
	(0.1607)	(0.1207)	(0.1548)	(0.1189)	(0.7734)	(0.2774)	(0.0679)
Senate	0.1445**	1.2005***	0.2276***	1.1279***	-0.3954	1.0140***	0.0550
	(0.0635)	(0.1601)	(0.0650)	(0.1540)	(0.6302)	(0.1811)	(0.0488)
Median Income	-0.0925***	-0.1988***	-0.0918***	-0.1829***	0.1004	-0.2557***	-0.0807***
	(0.0201)	(0.0317)	(0.0205)	(0.0307)	(0.1914)	(0.0682)	(0.0199)
Pct. Unemployed	-3.2656	-22.2695***	-6.5675***	-21.9656***	10.1344	-16.7254***	-1.4179
	(2.1554)	(3.4029)	(2.2406)	(3.4326)	(10.6411)	(6.2339)	(2.0433)
Pct. Age 65+	-2.2537***	0.2219	-1.3828*	0.0548	0.9764	-4.1197	-2.3806***
	(0.6900)	(1.2379)	(0.7317)	(1.1786)	(4.1125)	(3.0812)	(0.7029)
ρ	0.2640*		0.4140***		-0.4461		—
ρ SE	0.1432		0.1507		0.7626		—
N	1878		1878		1878		536

5.2.1 Race-Level Results

Table 4 presents the results of estimating our model on aggregate, race-level advertising spending. For example, an observation might be North Carolina's sixth congressional district in 2012. First, consider columns (1) and (2), which report results when our model is estimated on all observed advertising. Column (1) reports the results for the variables entering the similarity model, and column (2) reports the corresponding results for the variables entering the selection model. Recall that the similarity and selection equations are estimated simultaneously.

The first three rows in column (1) of Table 4 show that in races with *Likely*, *Leaning*, and *Tossup* competitiveness ratings, candidates are statistically more likely to cover similar themes than in non-competitive, *Solid* races (the omitted category). Notably, there is monotonicity in the results as the estimated coefficient is increasing as competitiveness increases from *Likely* to *Tossup*. The differences are statistically significant.

In terms of magnitude, we compute the semi-elasticities and find that relative to *Solid* races, messaging is 1.5 times more similar in a *Likely* race, two times more similar in a *Leaning* race, and 2.7 times more similar in a *Tossup* race. These magnitudes are large

[31] In Appendix E.2, we alternatively construct these measures using *lagged* rather than contemporaneous expenditure measures to avoid possible contemporaneous shocks that might affect all races. The results are similar to what we present below. The reason for not using lagged expenditure measures in our primary analysis is that it is not possible to construct such measures for the race-level regressions we estimate.

but consistent with those in Table 3b, which shows the relationships in simple descriptive statistics. These magnitudes are also qualitatively consistent with those in Kaplan, Park, and Ridout [2006], who find that "issue convergence is 4.95 points greater for each one-unit increase in competitiveness."[32]

Returning to column (1) of Table 4, we find that Senate races are associated with greater similarity relative to congressional races. This makes sense as Senate candidates must appeal to many different, often ideologically diverse districts and are generally thought of as less partisan. Additionally, we find that a higher median income, a higher percentage of unemployed, as well as of older population are associated with lower similarity.

Column (2) of Table 4 shows that in *Tossup*, *Leaning*, and *Likely* races candidates are more likely to both run ads. In terms of magnitude, these results mean that relative to *Solid* races, concurrent advertising is almost nine times more likely in closer *Tossup* races, eight times in *Leaning*, and five times in *Likely*. Advertising is more than twice as likely in Senate races than in the House races. There is less advertising in areas with higher median income and with more unemployed population.

Finally, we consider the estimates of ρ, which measures the correlation between the selection into advertising decision and theme similarity. If the two processes are independent, then $\rho = 0$. We estimate ρ equal to 0.2594, and the estimate is statistically significantly different from zero. A positive correlation means that any unobservable that makes, ceteris paribus, the candidates *more* likely to run ads also increases the similarity in themes. This implies that we may *underestimate* the relationship between similarity and competitiveness if we do not control for selection into advertising since the fact that *any* dialogue is observed indicates a higher value of unobserved factors driving up similarity.

This last observation is borne out in our empirical analysis when we compare the results in Column 7, where we estimate the relationship between similarity and competitiveness *without* controlling for selection. Comparing columns (1) and (7), we see that the coefficient estimates on the competitiveness measures are approximately halved, which is consistent with the notion that the estimates of the coefficients are biased downward if we do not control for selection.

In columns (3) and (4), we repeat our analysis while only considering ads run by the candidates (or political parties in coordination with the candidate), and in columns (5) and (6), we restrict our attention to ads run by third parties (e.g., political parties and PACs). The results are striking. Comparing columns (3) and (5) indicates that the entirety of the

[32] A note of caution is warranted, though, as they model the ordinal measure of competitiveness as a count variable, while here, we model it as four different categorical variables. Using categorical variables allows us to avoid assuming a monotonic relationship.

competitiveness-similarity relationship is driven by the candidates' advertising, while we do not find any evidence of this relationship in third-party advertising. Third-party advertising similarity is similarly not driven by race type or demographics. This provides a strong indication that third-party organizations might have different objectives than winning a race. For example, many PACs may raise funds on or promote a specific issue (or set of issues) and, as a result, only run ads on that issue only.

On the extensive margin, presented in columns (4) and (6), candidate and third-party advertisers appear to be more closely aligned. Both are roughly equally responsive to the competitiveness of the race and more likely to concurrently advertise in Senate versus House races. Finally, we note that the estimated sign of ρ differs across the candidate and third-party specifications, although ρ is imprecisely estimated for third-party advertising. This, too, supports the view that candidates, and not third-party advertisers, are the primary drivers of our initial results.

The key takeaways of Table 4 are that (i) it confirms the prior finding in Kaplan, Park, and Ridout [2006] that there is a monotonic, positive relationship between similarity and competitiveness; (ii) senate races show more similar content; and (iii) this positive relationship is driven by candidate and not third-party advertising.

5.2.2 Race-Biweek Level

We now move to the analysis at the race-biweek level. For example, an observation might now be North Carolina's sixth congressional district in the two-week period before the 2012 election. As we anecdotally illustrated with Figure 8, aggregating data to the race level disguises a lot of within-race temporal variation. Thus, we restrict this stage of the analysis to races where both candidates advertise at least once during the course of the race.[33]

Table 5 shows that the coefficient estimates are remarkably smaller than those in Table 4, suggesting that there is much responsiveness to the key determinants of dialogue at the biweek level. In terms of similarity, which we present in column (1), coefficients decline by roughly half. The effect of a *Tossup* (relative to a *Solid* race) falls from 0.9267 to 0.3854. These estimates imply that *Tossup* races are only 75% more similar than *Solid* races. This is a remarkable difference from the 2.7 times difference that was associated with our estimate in Table 4. The declines for *Leaning* and *Likely* races are similar. The competitiveness results display the same pattern as those in Table 4 with regard to the differences between candidates and third-party advertising.

[33] We consider the unconditional case for biweekly observations in Appendix E.1. The results are qualitatively the same, although the magnitudes are slightly larger because we have so many races that are zero in every biweek.

Table 5: Empirical Results: Race-Biweek-Level Themes

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0606***	-0.4766***	-0.0686***	-0.4773***	0.1544***	-0.2272***
	(0.0184)	(0.0255)	(0.0231)	(0.0256)	(0.0555)	(0.0296)
Tossup	0.3766***	1.7619***	0.3433***	1.5500***	-0.4417	1.9634***
	(0.0772)	(0.1224)	(0.0840)	(0.1171)	(1.0151)	(0.3495)
Leaning	0.2919***	1.3839***	0.2980***	1.2722***	-0.2226	1.2937***
	(0.0711)	(0.1111)	(0.0770)	(0.1118)	(0.7380)	(0.3495)
Likely	0.2449***	0.8493***	0.2765***	0.8056***	0.5021	0.4391
	(0.0693)	(0.1107)	(0.0727)	(0.1109)	(0.7180)	(0.4049)
Senate	0.0810*	1.0200***	0.0721	0.9126***	-0.6116***	0.7583***
	(0.0452)	(0.1035)	(0.0498)	(0.1023)	(0.2286)	(0.1385)
Median Income	-0.0730***	-0.2185***	-0.0692***	-0.2009***	0.0392	-0.2487***
	(0.0162)	(0.0315)	(0.0180)	(0.0313)	(0.1378)	(0.0732)
Pct. Unemployed	-4.3971***	-10.7168***	-4.6504***	-11.9823***	-2.6261	-16.0648***
	(1.5000)	(3.1620)	(1.5112)	(3.2470)	(9.9625)	(5.7789)
Pct. Age 65+	-1.5906***	-1.4374	-1.6963***	-1.1171	-0.6249	-0.3356
	(0.5572)	(1.1334)	(0.5839)	(1.2177)	(3.0291)	(2.4597)
ρ	0.0774		0.0585		-0.7161**	
ρ SE	0.0895		0.1019		0.3370	
N	6012		6012		6012	

Finally, in the first row of Table 5, we present the relationship between the time until the election (higher values indicates earlier dates) and the similarity and selection outcomes. Perhaps unsurprisingly, candidates are both more likely to advertise and more likely to engage in dialogue as election day nears. As with the competitiveness results, the extensive margin effect clearly dominates the intensive margin effect.

5.2.3 Race-Biweek-Affiliate-Period Level

The last step is the one where we interpret dialogue as occurring when the ads reach the same audiences and discuss the same topics *in the strictest sense.* The observations now are at the race-biweek-affiliate-period level.

In this specification, we define dialogue as occurring when competing candidates advertise within the same two-week period, on the same affiliate (i.e., television station), and during the same time of day. By imposing these strict criteria, we ensure that the ads are seen by the same audience at the same time. Surprisingly, the results regarding the similarity of advertising content are nearly identical to those obtained at the race-biweek level. This finding suggests that the critical difference in dialogue arises when we shift our focus from the overall race level to the more granular race-biweek level rather than when we further

Table 6: Empirical Results: Race-Biweek-Affiliate-Period-Level Themes

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0517	-0.2966***	-0.0259	-0.3129***	0.1072	-0.2001***
	(0.0472)	(0.0138)	(0.0415)	(0.0136)	(0.0672)	(0.0211)
Tossup	0.3569**	0.9259***	0.2142	0.8574***	-0.1460	1.7796***
	(0.1652)	(0.0543)	(0.1419)	(0.0564)	(0.9399)	(0.3137)
Leaning	0.2952**	0.7269***	0.2058*	0.7101***	0.0035	1.2107***
	(0.1377)	(0.0518)	(0.1226)	(0.0547)	(0.6934)	(0.3152)
Likely	0.2412**	0.4870***	0.1967*	0.4890***	0.5533	0.4895
	(0.1076)	(0.0576)	(0.1022)	(0.0595)	(0.6760)	(0.3674)
Senate	0.1325	0.5097***	0.0713	0.4844***	-0.4631*	0.6127***
	(0.0836)	(0.0446)	(0.0738)	(0.0462)	(0.2387)	(0.1232)
Median Income	-0.0781***	-0.0923***	-0.0610***	-0.0901***	-0.0139	-0.2345***
	(0.0204)	(0.0152)	(0.0207)	(0.0157)	(0.1430)	(0.0686)
Pct. Unemployed	-4.2244***	-3.4768**	-3.6162**	-3.8929**	-5.3626	-14.5394***
	(1.4829)	(1.4529)	(1.4447)	(1.5506)	(9.4426)	(4.5857)
Pct. Age 65+	-1.8585***	-0.8299	-1.6501***	-0.8419	-0.0474	-0.8726
	(0.5326)	(0.6041)	(0.5368)	(0.6492)	(2.8634)	(2.2071)
ρ	0.0411		-0.1292		-0.5235	
ρ SE	0.2496		0.1958		0.4451	
N	144288		144288		144288	

narrow down the definition of dialogue to include the same affiliate and time of day.

6 The Effect of Issue Ownership on Dialogue in Political Advertising

We investigate the role of issue ownership—the notion that a party may hold an advantage in particular policy domains—in political advertising dialogue [Budge and Farlie, 1983; Petrocik, 1996; Ansolabehere and Iyengar, 1994; Petrocik, Benoit, and Hansen, 2003]. In particular, we test two theoretical predictions from Proposition 6. Namely, whether messaging similarity increases as the level of ownership rises, and whether the ratio of similarity to competitiveness (S/C) decreases as ownership rises.

Our theoretical model yields a counterintuitive result (Proposition 6): as issue ownership becomes more pronounced, the stronger candidate will paradoxically advertise more heavily on their weaker competitor's owned issues. This finding highlights a broader principle: advertising choices are inherently endogenous and thus should not be used to construct ex-ante measurements of issue ownership. Indeed, issue ownership cannot be reliably inferred

from observed advertising patterns.

To address this identification challenge, we develop an alternative measurement approach using a voter survey, yielding a novel dataset for this study. The core methodology involves directly eliciting voters' perceptions of whether Democrats or Republicans "own" particular issues, allowing us to classify issues according to partisan ownership.[34]

6.1 Measuring Issue Ownership

We conducted our survey through Prolific's online platform, specifically using their "USA Representative Sample" which provides a demographically balanced panel of voting-age U.S. citizens based on sex, age, and political affiliation. The survey included 2,500 participants and covered 48 issues from the WMP advertising data.[35] Each participant was presented with a randomly selected subset of fifteen issues and asked, "Which party is best qualified to handle each of the following political issues?"[36]

To quantify issue ownership, we construct an index ω_k for each issue k that measures the strength of issue ownership:

$$\omega_k = |p_k^R - p_k^D|$$

where p_k^i represents the proportion of survey respondents who associated issue k with party i.

The index ranges from 0 to 1, where 0 indicates no clear partisan ownership (equal association with both parties) and 1 indicates complete ownership by one party. For the purposes of our analysis, we construct this index in a way that does not distinguish which party owns each issue. The distribution of ownership scores and the issues at both extremes of the ownership spectrum are presented in Figure 10.

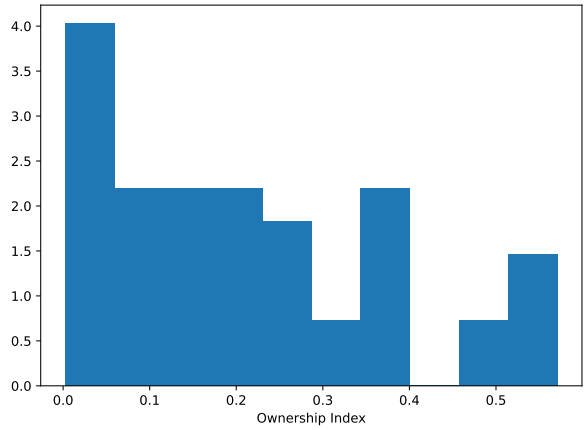
Figure 10 reveals important patterns in issue ownership. Panel (a) demonstrates that no issue is completely dominated by either party; instead, issues exist on a spectrum of partisan association. The distribution shows that most issues are relatively contested, with neither party claiming decisive ownership. Panel (b) illustrates this pattern through specific examples. Some issues show clear partisan lean - such as gender discrimination and Medicare for all - while others like taxes, employment/jobs, and narcotics/illegal drugs are more evenly contested between parties. Importantly, even the most strongly associated issues fall short

[34] There is precedent for using surveys to measure issue ownership; see discussion of this approach in **?** and **?**.

[35] We excluded issues appearing in fewer than 1% of advertising airings (see Appendix G). We also omitted "2017 Efforts at Health Reform/AHCA/Trumpcare" as it would be difficult to reliably survey this issue in 2024 when the survey was conducted. See Appendix H.1 for complete survey details.

[36] This question phrasing follows methodological insights from **??**, as further discussed in Appendix H.1.1.

Figure 10: Issue Ownership Index



(a) Distribution of Issue Ownership Index (ω_k)

Issue	Ownership Index
Gender Discrimination (not LGBTQ-related)	0.571
Medicare for all	0.536
Environment (generic reference)	0.526
Women's Health	0.525
Healthcare expansion/access	0.501
⋮	⋮
Recession/Economic Stimulus	0.013
Veterans	0.011
Employment/Jobs	0.004
Narcotics/Illegal Drugs	0.004
Taxes	0.003

(b) Most and Least Owned Issues

of complete partisan ownership.

While our ownership survey provides national-level measurements, our advertising data operates at the race level. This creates a methodological challenge: ideally, we would analyze how convergence varies with ownership across different races or even within races over time. However, our survey-based approach cannot capture such granular variations in issue ownership, nor can it retrospectively measure ownership perceptions during the elections in our dataset.

To address this limitation, we construct three samples representing different levels of average ownership:

- Low Average Ownership (Baseline): Includes all issues covered in our ownership survey, maintaining our standard methodology but restricted to surveyed issues only (see Appendix H.2.2 for the complete list). This sample represents a relatively low average level of issue ownership.
- Medium Average Ownership: Includes only issues scoring above the 25th percentile of ownership.
- High Average Ownership: Includes only issues scoring above the 75th percentile of ownership.

For all samples, when we exclude an issue, we remove its associated spending from the analysis.[37] After this issue-level filtering, we aggregate the remaining issues into themes con-

[37]For instance, if a $90 ad covers three issues equally ($30 each) and one issue is excluded due to low ownership, we maintain the $30 allocation for each remaining issue rather than redistributing the excluded issue's portion.

sistent with our previous analysis. This approach yields three distinct samples characterized by increasing levels of average issue ownership. We now leverage these three samples to test the empirical predictions of Proposition 6.

6.2 Characterizing Dialogue in the Presence of Issue Ownership

To test our first prediction from Proposition Proposition 6 (ii), we examine whether stronger issue ownership leads to greater convergence in messaging. Figure 11a compares the distribution of Ruzicka indices between the Low and High Average Ownership samples, measured at both race and race-biweek levels. The results show a clear rightward shift in the distribution as we move from Low to High Average Ownership, indicating increased messaging overlap. We reject the null hypothesis that the distributions are identical based on a Kolmogorov-Smirnov test. The average Ruzicka index in the High Ownership sample is 8.89% ($p = 0.19$) and 7.56% ($p = 0.09$) higher than in the Low Ownership sample at the race- and race-biweek-level, respectively.

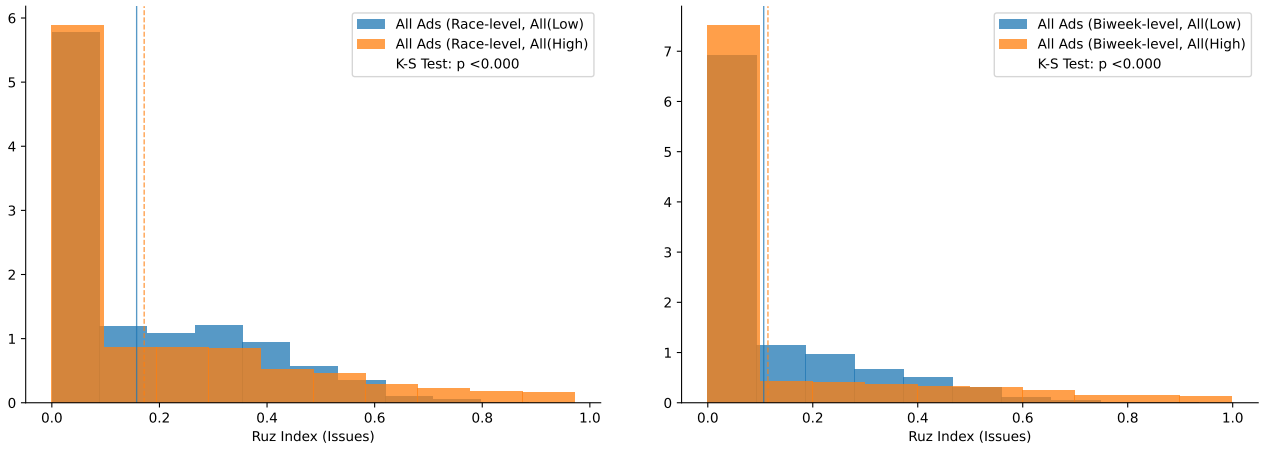
Our theme-level analysis likely provides conservative estimates of the ownership-convergence relationship. Since we aggregate multiple issues into themes and advertisements often contain related issues, dropping low-ownership issues may not substantially affect theme presence in the data. For instance, if a theme remains represented through other constituent issues, its calculated similarity index would change only marginally when excluding low-ownership issues. Indeed, this pattern becomes even more pronounced when we analyze the disaggregated, issue-level advertising data (Figure 11b). At this more granular level, the rightward shift is substantially larger, with the average similarity indices increasing by 51.61% ($p < 0.01$) and 64.83% ($p < 0.01$) for race and race-biweek samples, respectively.

Notably, the magnitude of these shifts should be interpreted in light of our earlier finding that no issues are completely owned by either party. Since even our High Average Ownership sample includes issues that are still notably contested, the observed increases in convergence, while significant, are necessarily modest in absolute terms.

6.3 The Determinants of Dialogue in the Presence of Issue Ownership

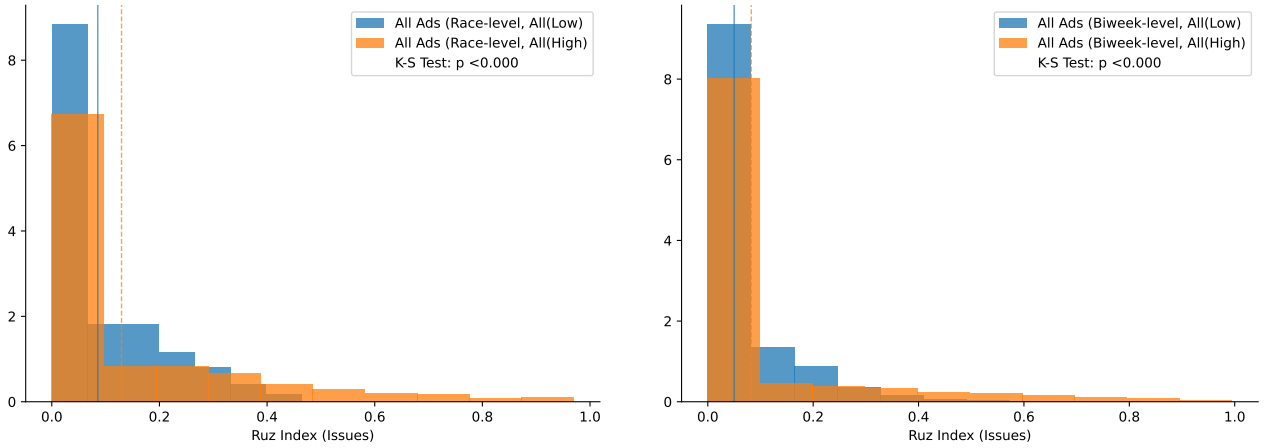
We next examine whether the ratio of similarity to competitiveness (S/C) decreases with higher levels of ownership (Proposition 6 (iv)). Following our regression analysis framework in Section 5, we test whether the competitiveness-similarity relationship weakens as ownership increases. Table 7 presents results from re-estimating our model across the Low, Medium, and High Average Ownership samples using campaign theme data.

Figure 11: Ruzicka Index of Ad Spending Under Low and High Average Ownership



Race-Level Indices | Race-Biweek-Level Indices

(a) Campaign Themes



Race-Level Indices | Race-Biweek-Level Indices

(b) Campaign Issues

Figure 11a presents Ruzicka indices at the Race- and Race-Biweek-level, calculated with aggregated campaign themes. Figure 11b recreates these indices using the disaggregated issue-level data. The solid and dashed vertical lines indicate the mean of the respective distributions. The Low Average Ownership sample accounts for all issues in the survey, and the High Average Ownership sample includes only the top quartile of issues by ownership score.

The Low sample results closely match our primary findings from Tables 4 and 5, as expected given its similar composition. Consistent with our theoretical predictions, the competitiveness-similarity relationship progressively weakens as we move from Low to Medium to High Average Ownership, becoming statistically insignificant in the High Ownership sample.[38]

As predicted by our model, we find that the competitiveness-similarity relationship weaken as we increase the average level of ownership in the sample from the Low to the Medium and finally High Average Ownership samples. Indeed, the relationship is no longer statistically significant in the final, most ownership-heavy sample.[39]

Overall, the evidence from Figure 11 and Table 7 yields two key findings that are consistent with our earlier theoretical analysis: issue ownership increases dialogue convergence while simultaneously weakening the relationship between race competitiveness and convergence.

7 Conclusion

In this article, we investigate the nature and determinants of dialogue between political candidates in the context of broadcast television advertising. To guide our empirical analysis, we first develop a model that characterizes politicians' propensity to engage in dialogue in a two-candidate, two-issue framework. This model simultaneously characterizes race competitiveness and messaging similarity, showing that increased competition can lead to either messaging convergence or divergence. Importantly, this model micro-founds the similarity indices that are used in our subsequent empirical analysis. As an extension, we show that issue ownership leads to increased convergence and is also able to moderate the competition-convergence relationship.

In our empirical analysis, we document significant heterogeneity in dialogue across races. However, race-level, aggregated advertising data masks significant within-race heterogeneity in dialogue as well. While candidates may often discuss the same topic, that does not necessarily mean they do so at the same time or on the same television channels. We compute a benchmark level of messaging similarity for each race—motivated by our theoretical model—and show that observed dialogue is lower than we this benchmark level of dialogue.

Finally, we investigate the determinants of dialogue, with a focus on the time until the election, whether the race is for the U.S. House or Senate, and the competitiveness of the race.

[38] Similar patterns emerge in the disaggregated, issue-level analysis presented in Appendix H.3.

[39] We see similar results when we duplicate this exercise using the disaggregated, issue-level data. We present those results in Appendix H.3

Table 7: Regression Analysis Under Alternative Ownership Samples

	Low		Medium		High	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Tossup	0.8478***	2.8884***	0.7280***	2.8287***	-0.1206	2.2307***
	(0.2023)	(0.2136)	(0.2287)	(0.2056)	(0.5704)	(0.1489)
Leaning	0.6321***	2.5330***	0.4441**	2.5668***	-0.2085	2.1690***
	(0.1968)	(0.1756)	(0.2252)	(0.1760)	(0.5591)	(0.1375)
Likely	0.5423***	1.7954***	0.4707**	1.7786***	-0.1470	1.3985***
	(0.1683)	(0.1202)	(0.1909)	(0.1200)	(0.4164)	(0.1217)
Senate	0.1164*	1.1840***	0.1421*	1.1817***	-0.1503	0.8120***
	(0.0655)	(0.1608)	(0.0728)	(0.1602)	(0.1632)	(0.1578)
ρ	0.1730		0.1151		-0.2733	
ρ SE	0.1467		0.1619		0.3526	
N	1878		1878		1878	

(a) Race Observations

	Low		Medium		High	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0635***	-0.4722***	-0.0438*	-0.4489***	-0.0346	-0.3384***
	(0.0184)	(0.0252)	(0.0233)	(0.0238)	(0.0826)	(0.0219)
Tossup	0.3949***	1.7516***	0.3752***	1.7114***	0.2538	1.2413***
	(0.0792)	(0.1215)	(0.0927)	(0.1147)	(0.3161)	(0.1017)
Leaning	0.3082***	1.3685***	0.2944***	1.3056***	0.0985	0.9383***
	(0.0714)	(0.1103)	(0.0850)	(0.1064)	(0.2538)	(0.0988)
Likely	0.2348***	0.8215***	0.2638***	0.8032***	0.1384	0.5622***
	(0.0701)	(0.1114)	(0.0809)	(0.1083)	(0.1704)	(0.1092)
Senate	0.0954**	1.0050***	0.0605	0.9429***	-0.0635	0.5196***
	(0.0453)	(0.1046)	(0.0528)	(0.0987)	(0.1308)	(0.0910)
ρ	0.1052		0.1074		0.1253	
ρ SE	0.0923		0.1087		0.3791	
N	6012		6012		6012	

(b) Race-Biweek Observations

Importantly, our model allows these factors to differentially affect the extensive margin—whether candidates concurrently select into advertising—and the intensive margin—the similarity of advertising (conditional on selection). We find that dialogue increases as election day approaches, and, perhaps unsurprisingly, dialogue tends to be higher in Senate races. We find that increased competitiveness does indeed increase convergence, although the effect on the extensive margin dominates the intensive margin effect. Moreover, the effect is primarily due to differences between the least competitive races, those that are solidly in one candidate's favor versus the others. There is limited, although not zero, sign of this effect among the more competitive races.

Overall, by combining our original theoretical model with extensive empirical analysis, we contribute to the study of political communication and campaign strategies, building upon and extending existing research in economics and political science and, more generally, to a longstanding body of research regarding political dialogue, advertising, and societal polarization.

The extent to which candidates engage in dialogue may have implications for the ongoing debate surrounding societal polarization and media slant [Gentzkow and Shapiro, 2006, 2010; DellaVigna and Kaplan, 2007; Boxell, Gentzkow, and Shapiro, 2017, 2024]. As concerns grow about the prevalence of "echo chambers" in which individuals are exposed only to ideas that conform to their existing beliefs, it is worth considering whether political discourse might be affected by a similar lack of diverse perspectives. Our paper offers a preliminary exploration of this issue. On one hand, the presence of dialogue between competing candidates across a wide range of races suggests that voters are not entirely isolated from opposing viewpoints. This finding provides some reassurance that political discourse has not become completely polarized.[40] On the other hand, our analysis reveals that the level of dialogue falls short of what would be expected in the absence of strategic considerations, and many races are characterized by a complete absence of dialogue. These results highlight the need for further research to better understand the factors that influence the exchange of ideas in the political sphere and its potential impact on polarization. If political dialogue is indeed limited, it may contribute to voters increasingly retreating into ideological silos.

While our analysis provides substantial insight into the recent state of political dialogue in the United States and the role of key determinants, there are several limitations in our analysis that we plan to explore in future works.

First, and foremost, our work builds on a foundational assumption that dialogue in po-

[40] Lipsitz [2013] provides an alternative perspective in an article provocatively titled, "Issue Convergence Is Nothing More than Issue Convergence," where he argues that dialogue, as considered here, is no more likely to benefit voters as it is to harm them.

litical campaigns contributes positively to democratic discourse and, by extension, to public welfare. This assumption follows a tradition in democratic theory that values deliberative engagement and informed political debate. However, we recognize that the relationship between our specific measure of dialogue—the similarity in candidates' advertising themes, timing, and outlets—and democratic outcomes remains an open empirical question. Future research might investigate whether and how this form of campaign dialogue affects voter knowledge, political polarization, or policy outcomes. Such work would help establish whether the patterns of dialogue we identify truly enhance democratic functioning and public welfare, thereby complementing our theoretical and empirical analysis of dialogue's determinants.

Second, our analysis is static. While we think there is a great deal that can be learned from analyzing political races as a repeated static game, this implicitly assumes myopic candidates and thus rules out a variety of rich behaviors that could be studied in future work. Examples include call-and-response or pulsing dialogue or the fact that candidates must dynamically manage their campaign budgets.

Third, while the data employed here provides a rich perspective on campaign advertising, our analysis is limited by the fact that we cannot observe the actual language candidates employ in these advertisements. Such data would allow us to better characterize candidates' positions on the issues and to what extent they are actually engaged in debate (versus talking past each other on the same topics). In future work, we will analyze the advertisement videos themselves in order to determine exactly what candidates are saying about the issues that are discussed. Of course, the usefulness of such an analysis necessarily requires some degree of dialogue—in the Simon [2002] sense—to be present. Thus, we see this paper as a crucial first step in a broader analysis of dialogue in political advertising.

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Appendix A Theoretical Proofs

A.1 Proof of Proposition 2

Proof. The expected Jaccard index is equal to the probability of both choosing A plus the probability of both choosing B. At the mixed strategy equilibrium, the values from Proposition 1 give the expression in Proposition 2. □

A.2 Proof of Proposition 5

Proof. First, consider how S and C change as p changes. The partial derivatives of S and C with respect to p are

$$\frac{\partial S}{\partial p} = \frac{2\left(1-2p\right)}{\left(1-2q\right)^2}$$
$$\frac{\partial C}{\partial p} = (1-2p)/(1-2q) \;\; if \;\; \frac{(1-p)p+k^2-q^2}{1-2q} \leq \frac{1}{2}$$

Notice that $\frac{\partial S}{\partial p} \geq 0$ iff $p \leq 1/2$ and vice versa. Then, for $\frac{\partial C}{\partial p}$, notice that in the mixed strategy equilibrium with $p \in (q+k, 1-q-k)$, $\frac{(1-p)p+k^2-q^2}{1-2q} < 1/2$, D is the weak candidate; while in the mixed strategy equilibrium with $p \in (1-q-k, q-k)$, $\frac{(1-p)p+k^2-q^2}{1-2q} > 1/2$, R is the weak candidate.

First, consider the MSE with $p \in (q+k, 1-q-k)$. As shown in Figure, $q < 1/2$ if $k > 0$, so $\frac{\partial C}{\partial p} \geq 0$ iff $p \leq 1/2$. For the MSE with $p \in (1-q-k, q-k)$, $q > 1/2$, but since R is the weak candidate, $\frac{\partial C}{\partial p} = -\frac{\partial \Pr(D \; wins)}{\partial p} = (1-2p)/(2q-1) \geq 0$ iff $p \leq 1/2$. Therefore, both $\frac{\partial S}{\partial p}$ and $\frac{\partial C}{\partial p}$ are positive (negative) if p is below (above) 1/2. In other words, both S and C increase as p gets closer to 1/2.

Next, consider how S and C change as q changes. The partial derivatives with respect to q are

$$\frac{\partial S}{\partial q} = \frac{2\left(2p-2k-1\right)\left(2\left(p+k\right)-1\right)}{\left(2q-1\right)^3}$$
$$\frac{\partial C}{\partial q} = \frac{2\left(\left(q-1\right)q-\left(p-1\right)p+k^2\right)}{\left(2q-1\right)^2} \;\; if \;\; \frac{(1-p)p+k^2-q^2}{1-2q} \leq \frac{1}{2}$$

Again, first consider the MSE with $p \in (q+k, 1-q-k)$. Since $2q-1<0$, $\frac{\partial S}{\partial q} \geq 0$ iff $2p-2k-1<0$ and $2p+2k-1>0$; that is, $\frac{1}{2}-k \leq p \leq \frac{1}{2}+k$. If $p > \frac{1}{2}+k$ or $p < \frac{1}{2}-k$, $\frac{\partial S}{\partial q} < 0$. $\frac{\partial C}{\partial q} > 0$ for $p \in (q+k, 1-q-k)$.[41] Therefore, when q gets closer to $\frac{1}{2}$, both S

[41] To see this, notice that $\frac{\partial C}{\partial q}$ is increasing in p, and $p = q+k$ would yield $\frac{\partial C}{\partial q}|_{p=q+k} = \frac{k-2qk}{(2q-1)^2}$.

and C increases if $\frac{1}{2}-k \leq p \leq \frac{1}{2}+k$, C rises while S falls if $|p-\frac{1}{2}|>k$. In the MSE with $p \in (1-q-k, q-k)$, $q>\frac{1}{2}$, and $\frac{\partial C}{\partial q}=-\frac{\partial \Pr(D\ wins)}{\partial q}=-\frac{2\left((q-1)q-(p-1)p+k^2\right)}{(2q-1)^2}<0$. $\frac{\partial S}{\partial q} \geq 0$ iff $2p-2k-1>0$ or $2p+2k-1<0$; that is, $|p-\frac{1}{2}|>k$. Therefore, we can conclude that in MSE, both indices increase as prior advantages ($|q-\frac{1}{2}|$) decrease when theme disparity is dominated by issue ownership ($p \in (\frac{1}{2}-k, \frac{1}{2}+k)$; but C rises while S falls when theme disparity dominates issue ownership ($|p-\frac{1}{2}|>k$).

□

A.3 Proof of Proposition 6

Proof. (i) Since $\rho=\frac{p+k-q}{1-2q}$ and $\delta=\frac{1-p-q+k}{1-2q}$, in the MSE with $p \in (q+k, 1-q-k)$, both would increase if k increases as $q \leq \frac{1}{2}$. Here A is owned by player D, the weaker candidate. Similarly, in the MSE with $p \in (1-q-k, q-k)$, $q \geq \frac{1}{2}$, and R is the weak candidate. So both ρ and δ decrease as k increases, increasing the probability of advertising B.

(ii) The partial derivatives are

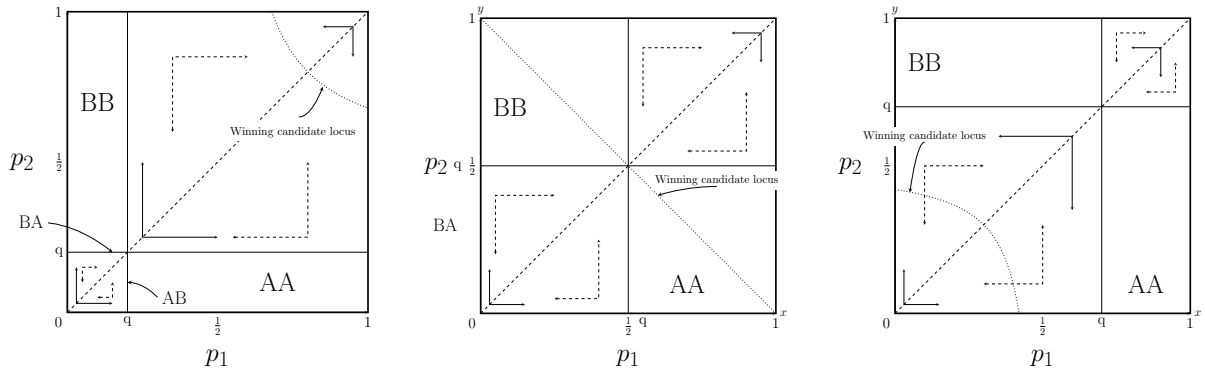
$$\frac{\partial S}{\partial k}=\frac{4k}{(1-2q)^2}$$
$$\frac{\partial C}{\partial k}=\frac{2k}{1-2q} \quad if \quad \frac{(1-p)p+k^2-q^2}{1-2q} \leq \frac{1}{2}$$

S is always increasing in k. But for C, remember that when $q \geq \frac{1}{2}$, D is the stong candidate now, so $\frac{\partial C}{\partial q}=-\frac{\partial \Pr(D\ wins)}{\partial q}=\frac{2k}{2q-1}$.

(iii) $\rho=\frac{p+k-q}{1-2q}=\frac{p+k-\frac{1}{2}+\frac{1}{2}-q}{1-2q}=\frac{1}{2}+\frac{p+k-\frac{1}{2}}{1-2q}$ and $\delta=\frac{1-q-p+k}{1-2q}=\frac{\frac{1}{2}-q+\frac{1}{2}-p+k}{1-2q}=\frac{1}{2}+\frac{\frac{1}{2}-p+k}{1-2q}$. In the MSE where D is the weak candidate, $q \leq \frac{1}{2}$, so $\rho>\frac{1}{2}$ iff $p>\frac{1}{2}-k$ and $\delta>\frac{1}{2}$ iff $p<\frac{1}{2}+k$. In other words, both advertise A more if $k>|p-\frac{1}{2}|$. In the MSE where R is the weak candidate, $q \geq \frac{1}{2}$, so $\rho<\frac{1}{2}$ iff $p>\frac{1}{2}-k$ and $\delta<\frac{1}{2}$ iff $p<\frac{1}{2}+k$. Again, both advertise B more if $k>|p-\frac{1}{2}|$.

□

Figure 12: Solution for the Heterogeneity in Advertising Themes Game



(a) $q < 0.5$ (b) $q = 0.5$ (c) $q > 0.5$

Red arrows show the direction of increasing index while black arrows show increasing probability of the weaker candidate winning.

Appendix B Asymmetric Extensions of A Game of Political Competition Over Themes

One limitation of the analysis of the first game in the text is that we have assumed symmetry in both p and q, which implies that voters are not impacted by who is talking about which issue. The second game in the text introduces q heterogeneity, interpreted as issue ownership. In this Appendix, we allow for heterogeneity in the p's for both games in the main text.

B.1 Extension of Baseline Game

		Republican (R)	
		A	B
Democrat (D)	A	$q,\ 1-q$	$p_1,\ 1-p_1$
	B	$p_2,\ 1-p_2$	$q,\ 1-q$

In Section 2.1, the win probabilities on the off-diagonal were interpreted as the chance that a theme is the resonant theme for the electorate come election day. They were not attached to the candidates. We now take an alternative viewpoint in order to emphasize the role of asymmetries in candidate strength on a theme. In the game given, $p_2 > p_1$ means that D has a better chance with theme B against theme A than with theme A against theme B. Note that we revert to the first model if we set $p_2 = 1 - p_1$.

From the matrix, there are two non-overlapping pure strategy equilibria.[42] BB is the

[42]Figure 12 also indicates the knife-edge asymmetric pure strategy equilibria. We henceforth keep these out of the discussion.

unique equilibrium if $p_1 < q < p_2$ and AA is the unique equilibrium if $p_2 < q < p_1$. Now, turn to the mixed strategy equilibria. The equilibria are illustrated in Figure 12.[43]

To find the mixed strategy equilibria, we can use the same rival-indifference method as in Proposition 1. It is readily shown that at any mixed strategy equilibrium

$$\delta = \Pr(d = A) = \frac{q - p_2}{2q - p_1 - p_2} \quad \text{and} \quad \rho = \Pr(r = A) = \frac{q - p_1}{2q - p_1 - p_2}. \tag{10}$$

Note that these probabilities are in $(0, 1)$ if either (i) $q > \max\{p_1, p_2\}$ or (ii) $q < \min\{p_1, p_2\}$.[44]

From these expressions, the advertising theme similarity index over the mixed strategy region can be written as

$$S = 2\frac{(q - p_1)(q - p_2)}{(2q - p_1 - p_2)^2} \tag{11}$$

and the comparative static properties of S with respect to the parameters p_1 and p_2 are shown in Figure 12. For q, the index rises in the lower left-hand region but falls in the upper right-hand region.[45]

The competitiveness index is

$$C = \min\left(\frac{q^2 - p_1 p_2}{2q - p_1 - p_2}, 1 - \frac{q^2 - p_1 p_2}{2q - p_1 - p_2}\right), \tag{12}$$

where the first expression is the probability that D wins and the second one is the chance R does. D's chance is increasing in both p_1 and p_2, and the consequences are shown in Figure 12. D's chance is also increasing in q.

What are the takeaways from this generalization for the relation between the two indices, C and S? First, as seen from Figure 12, the indices respond in the same or different directions to parameter changes. This itself is not surprising given the model extends the early one, which already exhibited such ambiguity. Some patterns are now more nuanced. In the first version of the game, both competitiveness and message similarity go up as q gets closer to $1/2$. In the current extension, competitiveness increases with q as long as D is weaker, but D is only weaker in part of the larger mixed strategy region (because the winning candidate locus is inside the larger mixed strategy region), while S falls with q throughout that whole region.

[43] Figure 12a is drawn for $q < 1/2$. As q rises, the lower mixed strategy region expands, and the higher one contracts as q moves apace along the diagonal. The directional arrows stay the same, but the Winning Candidate Locus moves from the top left to the bottom right for $q > 1/2$ as indicated in Figure 12c.

[44] Checking the matrix, it is readily verified that no pure strategy equilibrium exists if either (i) or (ii) hold (best replies circle clockwise or counter-clockwise around the matrix, respectively).

[45] We have $\frac{dS}{dq} = 2\frac{(p_2 - p_1)^2}{(2q - p_1 - p_2)^3}$ which is positive when q exceeds both p_1 and p_2.

B.2 Extension of Issue Ownership Game

We can also introduce the issue ownership parameter into this model, hence extending the second model in the text in the same manner we extended the first version above. Then, we write the game matrix as

		Republican (R)	
		A	B
Democrat (D)	A	$q+k,\ 1-q-k$	$p_1,\ 1-p_1$
	B	$p_2,\ 1-p_2$	$q-k,\ 1-q+k$

Then the mixed strategy equilibrium over the region where it exists is

$$\delta = \Pr(d = A) = \frac{q-k-p_2}{2q-p_1-p_2} \quad \text{and} \quad \rho = \Pr(r = A) = \frac{q-k-p_1}{2q-p_1-p_2}, \tag{13}$$

which gives a simple extension of previous expressions. Likewise, C and S are quite similar expressions. First,

$$S = 2\frac{(q-p_1)(q-p_2)+k^2}{(2q-p_1-p_2)^2}, \tag{14}$$

which increases in k. The competitiveness index is

$$C = \min\left(\frac{q^2-p_1p_2-k^2}{2q-p_1-p_2}, 1-\frac{q^2-p_1p_2-k^2}{2q-p_1-p_2}\right), \tag{15}$$

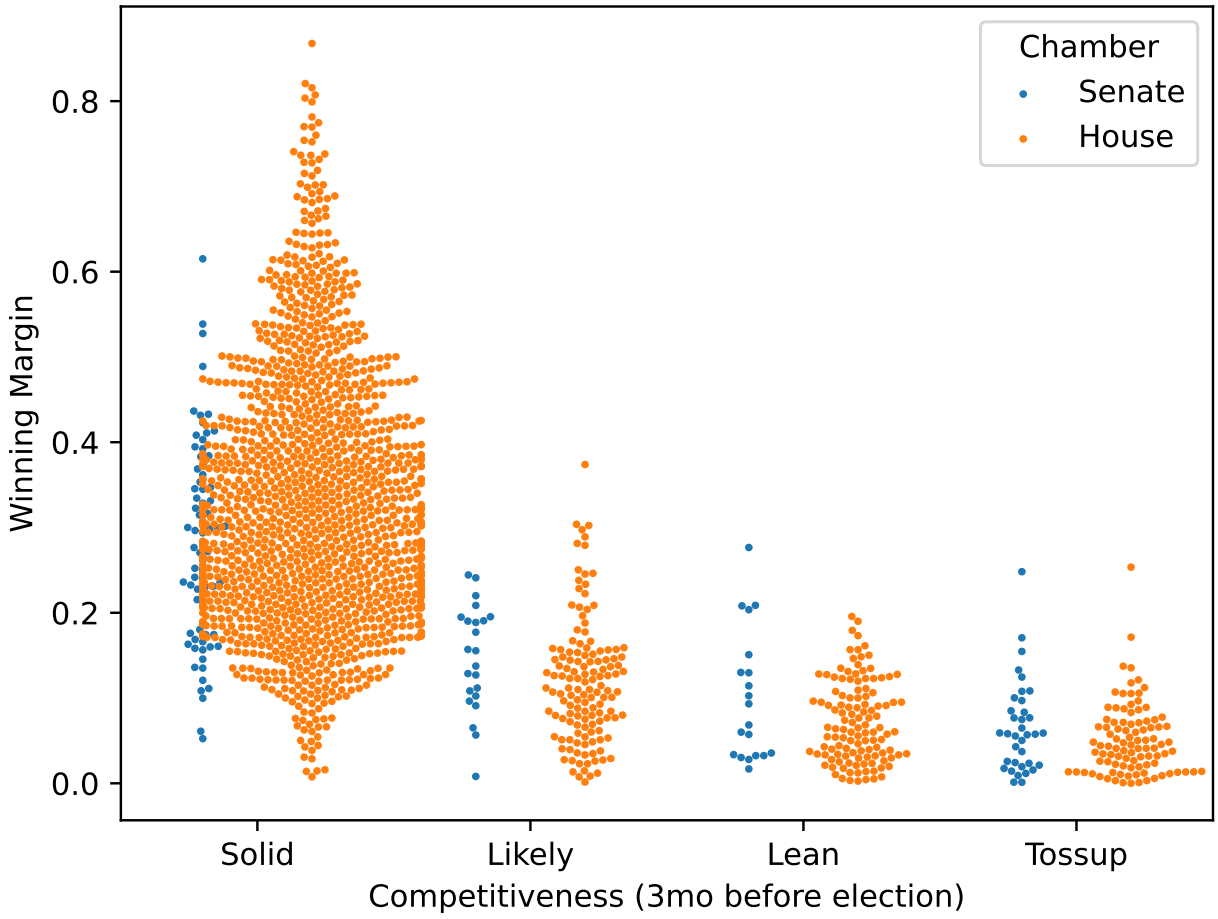
with the first expression being the probability that D wins. Thus C is increasing in k over the portion of the mixed strategy region for which q exceeds both p's, and here more issue ownership both renders more competitiveness and more advertising similarity.

Appendix C Data Appendix

C.1 Cook Political Report Data

Figure 13 shows that the CPR ratings are closely related to the final margin of victory, which lends validity to the CPR as a measure of race competitiveness.

Figure 13: Cook Political Report Rating vs. Final Vote Margin



C.2 Constructing Themes by Aggregating Issues

In our primary analysis, we use campaign "themes," which are aggregations of the campaign issues coded by the Wesleyan Media Project. In Figure 14, we present the list of issues within each theme.

Figure 14: Lists of Issues by Themes

Economic Policy

Business; Cost of Living; Deficit/Budget/Debt; Economic disparity/income inequality; Economy (generic reference); Employment/Jobs; Farming; Government Spending; Housing/Sub-prime Mortgages; Minimum Wage; Personal Debt; Poverty; Recession/Economic Stimulus; Tax Reform; Taxes; Trade/Globalization; Union

Social Issues

Abortion; Affirmative Action; Assisted Suicide/Euthanasia; Civil Liberties/Privacy; Disability Rights/Benefits; Gambling; Gender Discrimination (not LGPTQ-related); Gun Control; Homosexuality/Gay & Lesbian Rights; #metoo/#timesup; Moral/Family/Religious Values; Race Relations/Civil Rights; Seniors (not Medicare); Tobacco

Social Welfare Issues

2017 Efforts at Health Reform /AHCA/Trumpcare; Affordable Care Act /Obamacare/Health Care Law/etc.; Child Care; Education/Schools; Health Care (not prescription drugs); Healthcare expansion/access; Lottery for Education; Medicaid; Medical bills; Medicare; Medicare for All; Opioids/Rx Drug Abuse; Outbreaks of infectious disease (including Coronavirus); Prescription Drugs; Social Security; Socialized medicine; Substance Use Disorder; Universal healthcare/healthcare for all; Vaccines; Welfare; Women's Health

Foreign/Defense Policy

Afghanistan/War in Afghanistan; China; Foreign Aid; Foreign Policy (generic reference); Iran; Iraq/War in Iraq; ISIL/ISIS; Israel; Middle East; Military (generic reference); North Korea/Kim Jong Un; Nuclear Proliferation; Russia/Putin; September, 11th; Syria; Terror/Terrorism/Terrorist; Ukraine/Zelensky; Veterans

Law and Order

Capital Punishment; Crime; Domestic Violence / Sexual Assault/Harassment; Incarceration / Sentencing; Marijuana; Narcotics/Illegal Drugs; Parkland / Stoneman Douglas High School; Police Brutality / Racial Violence; Protests/ Riots; Supreme Court/Judiciary

Environment/Energy

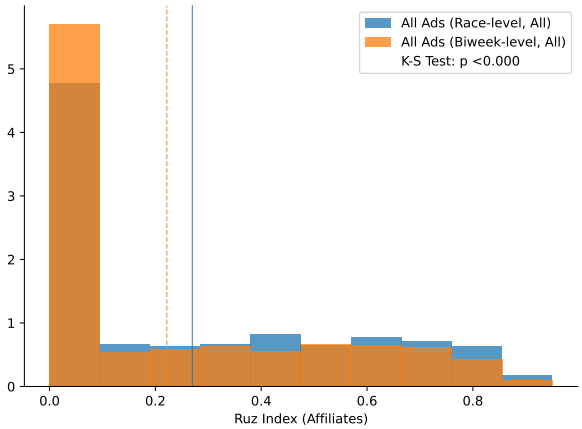
BP Oil Spill; Environment (generic reference); Global Warming; Keystone XL Pipeline; Energy Policy

Other

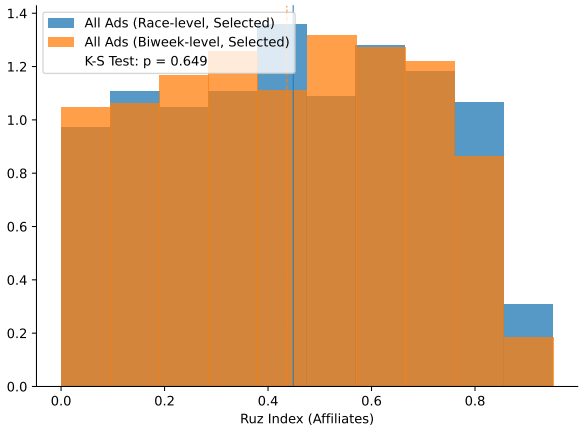
Campaign Finance Reform; Corporate Fraud; DACA/Dreamers; Description of other issue mentioned; Emergency Preparedness/Response; Government Ethics/Scandal; Government Regulations; Government Shutdown; Impeachment; Immigration; Local Issues; Other; Pledge of Allegiance (restrictions on); Socialism; Term Limits; Transportation/Infrastructure

Appendix D Additional Descriptive Evidence Regarding Dialogue

Figure 15: Ruzicka Index of Ad Spending at the Race and Race-Biweek Levels

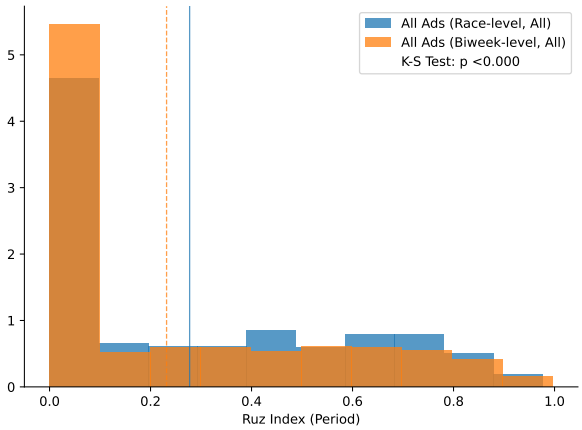


All Airings

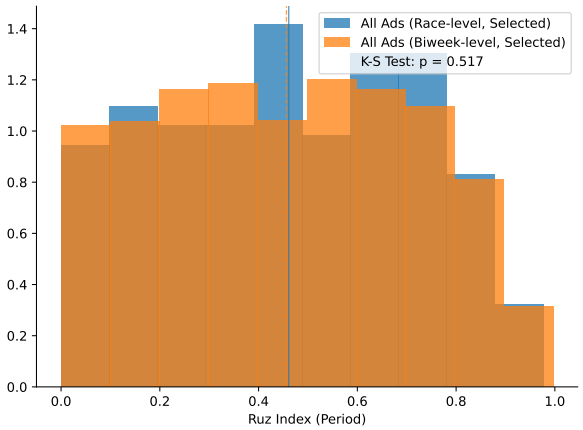


Selected Sample

(a) Spending by Affiliate

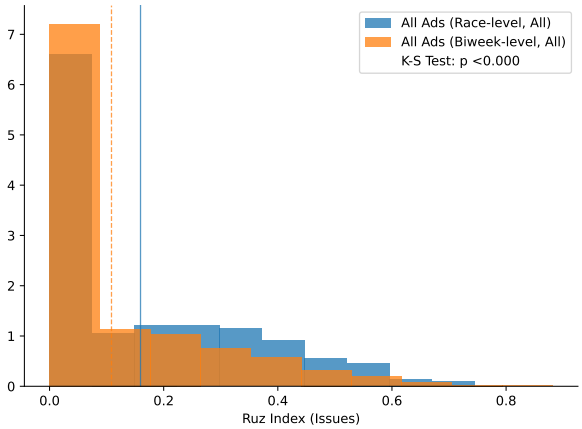


All Airings

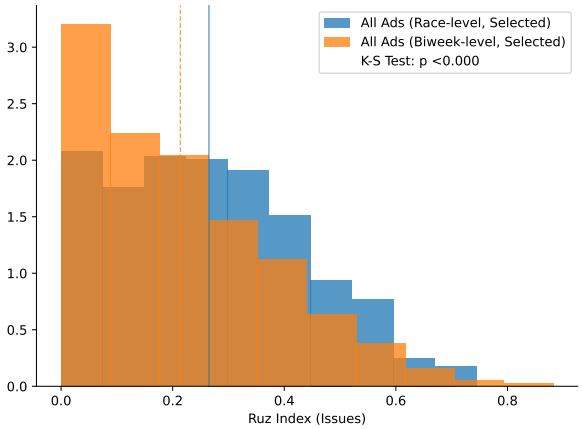


Selected Sample

(b) Spending by Period



All Airings



Selected Sample

(c) Spending by Theme

Table 8: Empirical Results: Race-Biweek-Level Themes (Unconditional)

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0728***	-0.4468***	-0.0811***	-0.4497***	0.1459**	-0.2226***
	(0.0162)	(0.0212)	(0.0194)	(0.0217)	(0.0679)	(0.0299)
Tossup	0.5722***	2.7916***	0.5142***	2.6217***	-0.5506	2.4003***
	(0.1462)	(0.1074)	(0.1609)	(0.1045)	(1.3765)	(0.3168)
Leaning	0.4751***	2.4036***	0.4592***	2.3270***	-0.3733	1.7181***
	(0.1355)	(0.1000)	(0.1489)	(0.0999)	(1.0255)	(0.3128)
Likely	0.3952***	1.7419***	0.4086***	1.7079***	0.3432	0.8329**
	(0.1183)	(0.0947)	(0.1285)	(0.0952)	(0.8777)	(0.3710)
Senate	0.1318**	1.2433***	0.1180**	1.1660***	-0.5989**	0.7937***
	(0.0513)	(0.0919)	(0.0584)	(0.0918)	(0.2863)	(0.1387)
Median Income	-0.0817***	-0.2109***	-0.0773***	-0.2017***	0.0256	-0.2581***
	(0.0166)	(0.0248)	(0.0183)	(0.0245)	(0.1637)	(0.0720)
Pct. Unemployed	-5.2620***	-16.7362***	-5.4824***	-17.4557***	-3.5371	-16.8519***
	(1.5998)	(2.5644)	(1.6446)	(2.6183)	(11.6940)	(5.6093)
Pct. Age 65+	-1.5544***	-0.1796	-1.6615***	-0.0947	-0.5575	-0.5195
	(0.5562)	(0.9249)	(0.5828)	(0.9219)	(3.1465)	(2.3807)
ρ	0.1559*		0.1343		-0.6608	
ρ SE	0.0858		0.0958		0.4298	
N	20921		20921		20921	

Appendix E Additional Estimation Results

E.1 Unconditional Disaggregated Results

In Section 5.2, the results we present at the biweek and biweek-affiliate-period level use a sample that conditions on both candidates advertising at least once in a race (i.e., we drop races m where $s_{mt} = 0 \ \forall t$). Here, we present the corresponding *unconditional* estimates, where we include all races, including those where one or both candidates never advertise.

E.2 Race-Biweek and Race-Biweek-Affiliate-Period Estimates with Lagged Spending Measures

In this section, we re-estimate our model at the race-biweek and race-biweek-affiliate-period levels with all races in our data, including those where one or both candidates never advertise over the course of the race. This differs from our primary approach in the text, where, for these two levels of observation, we condition on that requirement.

Table 9: Empirical Results: Race-Biweek-Affiliate-Period-Level Themes (Unconditional)

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0668**	-0.2900***	-0.0582*	-0.3040***	0.0962	-0.1968***
	(0.0301)	(0.0131)	(0.0308)	(0.0129)	(0.0804)	(0.0210)
Tossup	0.5126**	1.8429***	0.3419	1.7766***	-0.1504	2.1907***
	(0.2433)	(0.0586)	(0.2380)	(0.0605)	(1.2535)	(0.2914)
Leaning	0.4386**	1.6353***	0.3169	1.6192***	-0.0454	1.6092***
	(0.2233)	(0.0568)	(0.2194)	(0.0583)	(0.9561)	(0.2873)
Likely	0.3582*	1.2654***	0.2803	1.2655***	0.4808	0.8535**
	(0.1852)	(0.0623)	(0.1843)	(0.0634)	(0.8065)	(0.3414)
Senate	0.1814**	0.7334***	0.1280	0.7119***	-0.4345	0.6411***
	(0.0842)	(0.0544)	(0.0847)	(0.0561)	(0.2915)	(0.1241)
Median Income	-0.0861***	-0.1211***	-0.0721***	-0.1195***	-0.0317	-0.2448***
	(0.0194)	(0.0156)	(0.0209)	(0.0158)	(0.1616)	(0.0678)
Pct. Unemployed	-4.9481***	-9.4772***	-4.1997**	-9.9056***	-6.4106	-15.3255***
	(1.7706)	(1.6575)	(1.7656)	(1.7383)	(10.4320)	(4.4705)
Pct. Age 65+	-1.8298***	-0.1287	-1.7285***	-0.1561	-0.0547	-1.0044
	(0.5095)	(0.6649)	(0.5245)	(0.6663)	(2.9537)	(2.1676)
ρ	0.1337		0.0352		-0.4442	
ρ SE	0.1764		0.1670		0.5318	
N	502104		502104		502104	

Table 10: Empirical Results: Race-Biweek-Level Themes (Lagged Spending Measures)

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0577***	-0.4932***	-0.0669***	-0.4911***	0.1306***	-0.2461***
	(0.0169)	(0.0243)	(0.0191)	(0.0240)	(0.0341)	(0.0340)
Tossup	0.3688***	1.7755***	0.3391***	1.5638***	-0.5621	1.9499***
	(0.0717)	(0.1232)	(0.0748)	(0.1174)	(0.5706)	(0.3487)
Leaning	0.2857***	1.3874***	0.2946***	1.2713***	-0.3704	1.2856***
	(0.0681)	(0.1121)	(0.0712)	(0.1121)	(0.4329)	(0.3487)
Likely	0.2409***	0.8487***	0.2742***	0.8015***	0.3926	0.4330
	(0.0667)	(0.1102)	(0.0687)	(0.1099)	(0.6070)	(0.4044)
Senate	0.0772*	1.0143***	0.0700	0.9085***	-0.6194***	0.7540***
	(0.0432)	(0.1046)	(0.0456)	(0.1029)	(0.1622)	(0.1390)
Median Income	-0.0721***	-0.2205***	-0.0686***	-0.2025***	0.0413	-0.2450***
	(0.0158)	(0.0313)	(0.0174)	(0.0311)	(0.0970)	(0.0726)
Pct. Unemployed	-4.3508***	-10.5673***	-4.6184***	-11.8548***	-3.3158	-16.0596***
	(1.4793)	(3.1752)	(1.4654)	(3.2503)	(6.4765)	(5.8903)
Pct. Age 65+	-1.5820***	-1.4123	-1.6911***	-1.1425	-0.1405	-0.4614
	(0.5554)	(1.1351)	(0.5836)	(1.2195)	(2.9895)	(2.4569)
ρ	0.0654		0.0517		-0.7135***	
ρ SE	0.0782		0.0837		0.1958	
N	5564		5562		5561	

Table 11: Empirical Results: Race-Biweek-Affiliate-Period-Level Themes (Lagged Spending Measures)

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0439***	-0.3187***	-0.0518***	-0.3414***	0.0337	-0.2856***
	(0.0077)	(0.0181)	(0.0081)	(0.0184)	(0.0258)	(0.0354)
Tossup	0.3313***	0.9488***	0.2940***	0.8752***	0.8090***	1.7121***
	(0.0518)	(0.0766)	(0.0538)	(0.0784)	(0.1357)	(0.3334)
Leaning	0.2749***	0.7506***	0.2728***	0.7351***	0.6654***	1.2261***
	(0.0529)	(0.0771)	(0.0538)	(0.0794)	(0.1837)	(0.3418)
Likely	0.2271***	0.4992***	0.2446***	0.5077***	0.9194	0.5456
	(0.0591)	(0.0785)	(0.0603)	(0.0814)	(0.6218)	(0.3865)
Senate	0.1196***	0.4731***	0.1116***	0.4597***	-0.1994	0.6362***
	(0.0351)	(0.0656)	(0.0377)	(0.0673)	(0.1245)	(0.1387)
Median Income	-0.0757***	-0.0943***	-0.0692***	-0.0929***	-0.1395**	-0.1989***
	(0.0141)	(0.0248)	(0.0153)	(0.0252)	(0.0710)	(0.0717)
Pct. Unemployed	-4.1386***	-4.5468**	-3.9637***	-4.5546**	-13.0868**	-19.6057***
	(1.3303)	(2.1538)	(1.3164)	(2.2014)	(6.0085)	(6.7775)
Pct. Age 65+	-1.8383***	-2.1822**	-1.7288***	-2.1424**	-0.4665	-2.5870
	(0.5051)	(0.9659)	(0.5233)	(1.0073)	(2.9784)	(2.9032)
ρ	-0.0020		-0.0158		0.0503	
ρ SE	0.0168		0.0176		0.0400	
N	28541		27476		7217	

Appendix F Analysis Using Disaggregated Campaign Issues

Table 12 presents the issues that are mentioned at least 1 percent of the time for each year. The percentage is taken over number of ad airings. Some issues are always part of the conversation, such as "Taxes" and "Education/Schools," while other have lost their primary role, such as "Government Regulation," and other have gained importance, such as "Crime"[46]

[46]There are two set of issues that we do not include in our analysis. One is "Other Issues," which encompasses a variety of very rarely mentioned issues. The other one is "Local Issues," since that includes a variety of possible local issues.

Table 12: Campaign Issue Prevalence by Year, "1-percent sample"

Year	2012	2014	2016	2018	2020
Taxes	14.19	9.30	7.65	8.77	5.41
Gender Discrimination (not LGBTQ-related)			1.94		
Seniors (not Medicare)			1.66	2.25	1.37
Emergency Preparedness					3.55
2017 Efforts at Health Reform/AHCA/Trumpcare				1.70	
Opioids/Rx Drug Abuse				2.00	
Deficit/Budget/Debt	9.09	6.17	2.23	2.38	
Medicare for all					1.99
Government Spending	5.76	4.45	4.17	1.16	1.76
Recession/Economic Stimulus	2.58				1.77
Minimum Wage		1.83			
Farming		1.81	1.90	1.39	1.62
Business	4.97	3.39	6.51	7.62	8.50
Employment/Jobs	14.70	13.03	10.01	6.88	6.97
Trade/Globalization	2.30	1.12	3.00	1.37	1.21
Domestic Violence/Sexual Assault/Harassment				1.22	
Disease/COVID19					8.26
Healthcare expansion/access					10.62
Substance Use Disorder				1.58	
Police Brutality/Racial Violence					2.46
Medical Bills					1.89
Economy (generic reference)	3.38	2.85	2.95	2.01	3.17
Protest/Riots					1.48
Tax Reform				1.64	
Abortion	1.71	1.40	1.21		
Moral/Family/Religious Values		1.86	8.80	3.19	1.60
Gun Control		1.58		1.65	1.41
Crime			2.18	2.65	
Narcotics/Illegal Drugs				1.91	
Supreme Court/Judiciary					1.35
Education/Schools	3.71	4.90	4.78	3.47	2.32
Health Care (not prescription drugs)	5.64	3.68	2.95	14.73	10.86
Prescription Drugs				2.28	3.77
Medicare	11.45	6.53	2.91	4.38	2.04
Social Security	5.20	4.94	3.33	3.39	
Women's Health	1.53	1.99	1.40		
Affordable Care Act / Obamacare / Health Care Law / etc.		5.85	1.99		
Military (generic reference)	1.45	3.21	4.47	3.54	3.40
Foreign Policy (generic reference)			1.78		
Veterans	2.61	5.26	5.25	6.12	4.47
China	1.76		1.81		1.83
Terror/Terrorism/Terrorist		1.16	2.49		
Iran			1.28		
Environment (generic reference)		1.32	1.65	1.27	
Energy Policy	3.65	4.11	1.76		1.55
Campaign Finance Reform			1.50	2.74	3.35
Government Ethics/Scandal	1.85	2.34	3.80	2.38	
Immigration		2.70	1.48	4.33	
Government Regulations	2.47	1.47	1.18		
Government Shutdown		1.75			

Table 13: Empirical Results, Jaccard Index (semi-elasticities)

	(1)	(2)	(3)
Tossup	0.8668***	2.2630***	0.4716***
	(0.2654)	(0.0922)	(0.0539)
Leaning	0.7818***	2.1990***	0.3970***
	(0.2589)	(0.0970)	(0.0531)
Likely	0.5604**	1.9415***	0.2308***
	(0.2315)	(0.1022)	(0.0625)
Senate	0.2516***	1.2991***	0.1512***
	(0.0713)	(0.1311)	(0.0409)
Median Income	-0.0849***	-0.2855***	-0.0645***
	(0.0212)	(0.0476)	(0.0153)
Pct. Unemployed	-1.9471	-32.0442***	-0.2008
	(1.9891)	(5.1281)	(1.5037)
Pct. Age 65+	-0.6268	0.3337	-0.6072
	(0.7736)	(1.7833)	(0.6842)
ρ	0.2562*		—
ρ SE	0.1455		—
N	1878		536

(a) Race-Level Themes

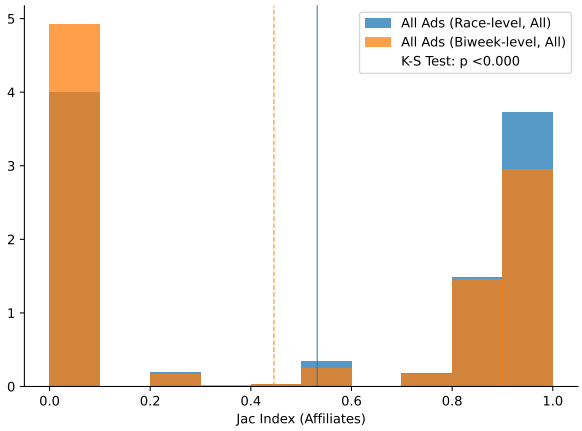
	(1)	(2)
Biweeks to Election	-0.0985***	-1.4199***
	(0.0233)	(0.0971)
Tossup	0.7543***	6.7352***
	(0.2406)	(0.3501)
Leaning	0.6795***	6.1636***
	(0.2260)	(0.3357)
Likely	0.5631***	4.9420***
	(0.2029)	(0.3107)
Senate	0.2069***	3.3961***
	(0.0659)	(0.2328)
Median Income	-0.0978***	-0.6702***
	(0.0205)	(0.0851)
Pct. Unemployed	-4.2771**	-53.2474***
	(1.9035)	(8.4127)
Pct. Age 65+	-1.0725*	-0.5604
	(0.6397)	(2.9408)
ρ	0.1629*	
ρ SE	0.0990	
N	20921	

(b) Race-Biweek-Level Themes

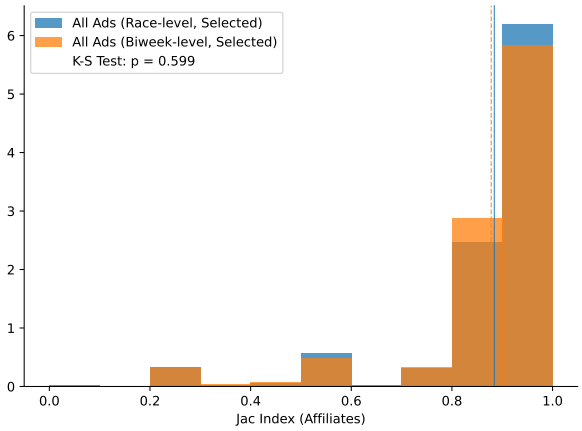
Appendix G Analysis Using Alternative Indices

In the paper, we quantify dialogue using the Ruzicka Index Equation (17). In this appendix, we consider alternative approaches to characterizing dialogue. First, we present regression results corresponding to the tables in Section 5.2 that use the Jaccard (rather than the Ruzicka) index. Then, we consider the Similarity Index, which considers the fraction of total spending that each candidate dedicates to an issue. Finally, we consider a "Discounted Ruzicka" index which captures the fact that advertising from previous periods may be relevant to the calculation of how much dialogue is taking place in a given period.

Figure 16: Jaccard Index of Ad Spending at the Race and Race-Biweek Levels

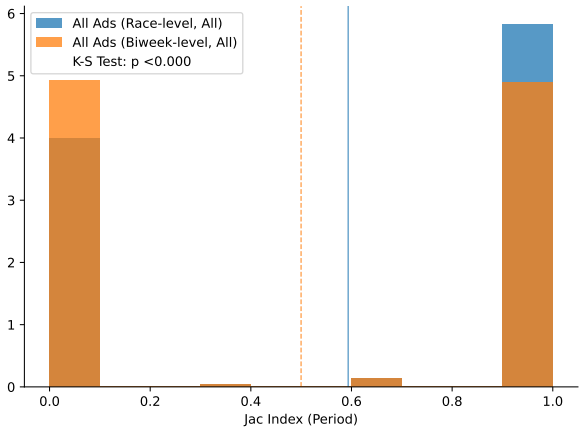


All Airings

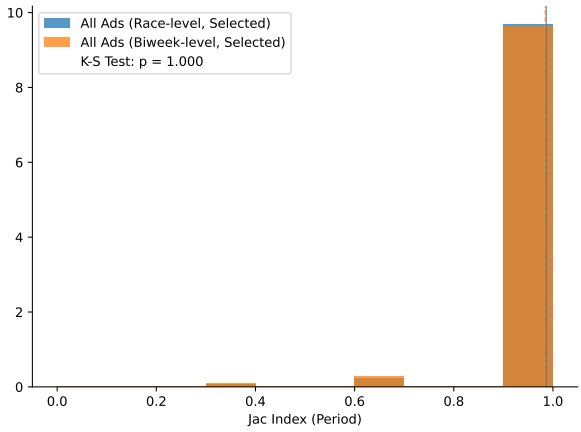


Selected Sample

(a) Spending by Affiliate

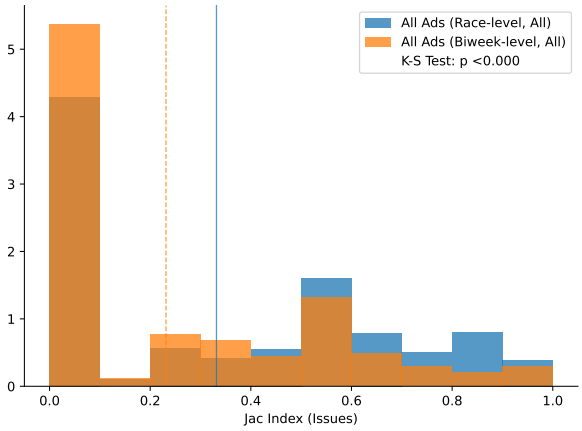


All Airings

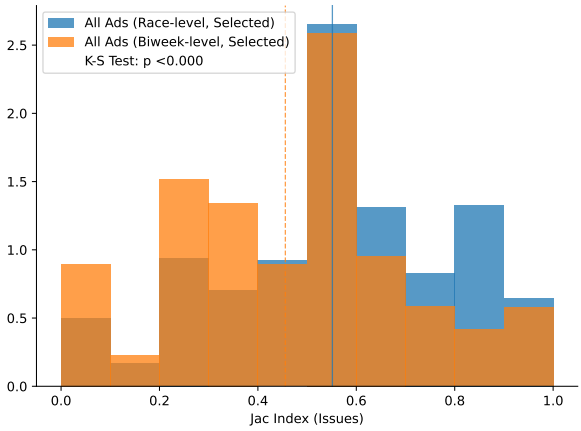


Selected Sample

(b) Spending by Period



All Airings



Selected Sample

(c) Spending by Theme

Table 14: Empirical Results, Similarity Index (semi-elasticities)

	(1)	(2)	(3)
Tossup	0.6473***	2.2627***	0.3726***
	(0.2489)	(0.0923)	(0.0503)
Leaning	0.5366**	2.1983***	0.2702***
	(0.2427)	(0.0971)	(0.0534)
Likely	0.3984*	1.9413***	0.1716***
	(0.2137)	(0.1023)	(0.0607)
Senate	0.1381**	1.2951***	0.0708*
	(0.0627)	(0.1326)	(0.0402)
Median Income	-0.0651***	-0.2858***	-0.0517***
	(0.0199)	(0.0474)	(0.0160)
Pct. Unemployed	-0.7518	-32.0794***	0.4603
	(1.9202)	(5.1366)	(1.5609)
Pct. Age 65+	-1.0019	0.3310	-0.9568
	(0.6737)	(1.7832)	(0.6189)
ρ	0.1850		—
ρ SE	0.1489		—
N	1878		536

(a) Race-Level Themes

	(1)	(2)
Biweeks to Election	-0.0523**	-1.4211***
	(0.0208)	(0.0971)
Tossup	0.3853*	6.7354***
	(0.2076)	(0.3500)
Leaning	0.3234*	6.1636***
	(0.1910)	(0.3356)
Likely	0.2914*	4.9419***
	(0.1733)	(0.3103)
Senate	0.0603	3.3944***
	(0.0615)	(0.2331)
Median Income	-0.0639***	-0.6705***
	(0.0207)	(0.0851)
Pct. Unemployed	-3.2068*	-53.2110***
	(1.8548)	(8.4164)
Pct. Age 65+	-0.3558	-0.5710
	(0.6245)	(2.9425)
ρ	0.0661	
ρ SE	0.1005	
N	20921	

(b) Race-Biweek-Level Themes

G.1 Jaccard Index

G.2 Similarity Index

We next characterize dialogue using a Similarity index, which has previously been employed in Kaplan, Park, and Ridout [2006]. Specifically, this index is

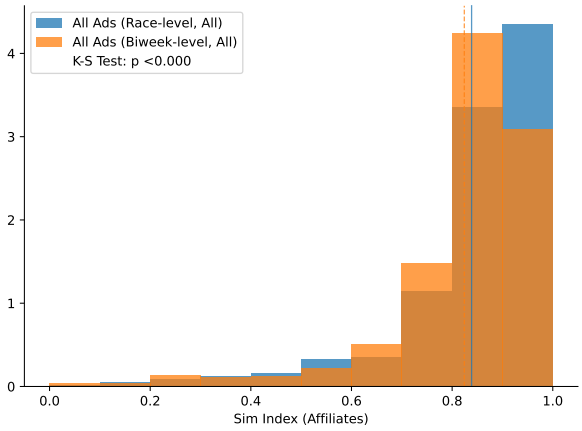
$$\sigma^{Similarity} = 1 - \frac{1}{2}\sum_k \left| \frac{D_k}{D} - \frac{R_k}{R} \right| \tag{16}$$

where D_k and R_k measure the spending by the Democrat and Republican on issue k, and D and R represent the total spending by each candidate across all issues.

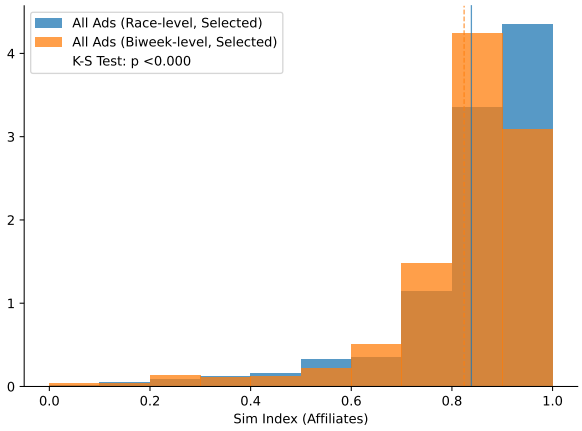
G.3 Discounted Ruzicka Index

Finally, we characterize dialogue using a "Discounted Ruzicka" index, which is a variation of Equation (17) that replaces the contemporaneous measure of advertising for each topic in each period with a discounted sum of spending over all past periods. Specifically, for each

Figure 17: Similarity Index of Ad Spending at the Race and Race-Biweek Levels

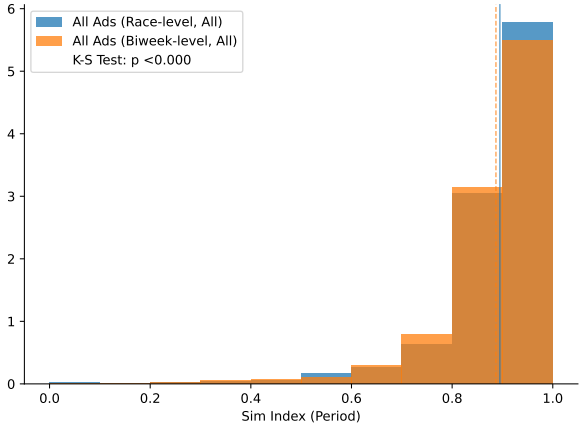


All Airings

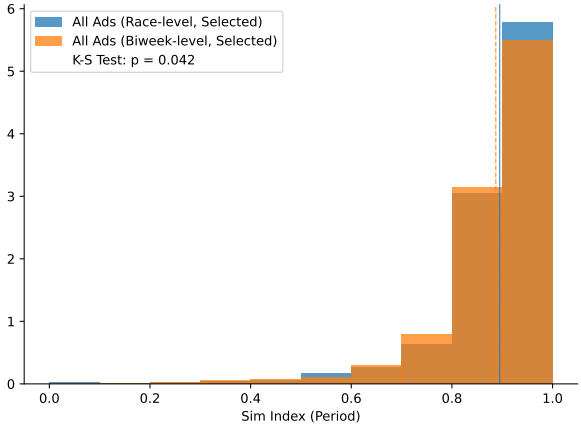


Selected Sample

(a) Spending by Affiliate

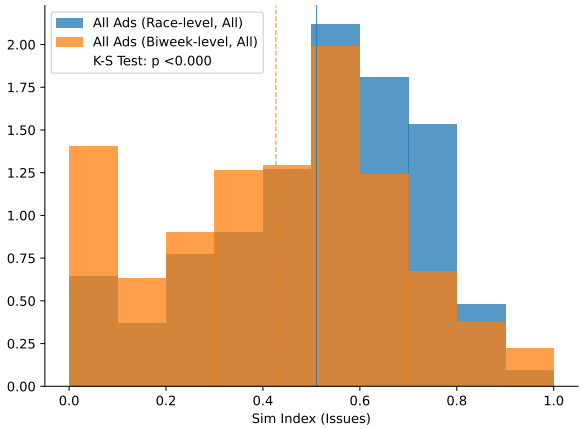


All Airings

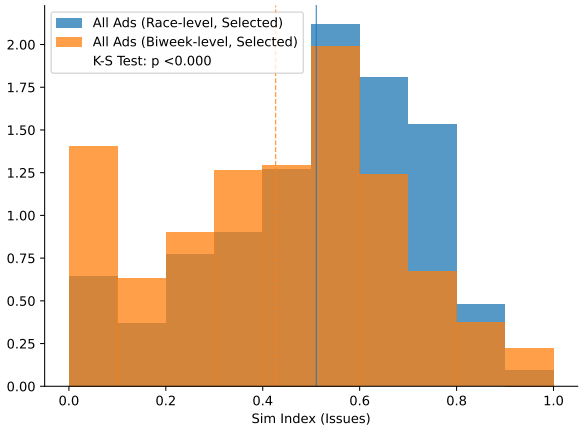


Selected Sample

(b) Spending by Period



All Airings



Selected Sample

(c) Spending by Theme

period t we calculate

$$\sigma^{Ruzicka} = \frac{\sum_k \min\left\{\tilde{R}_{k,t}, \tilde{D}_{k,t}\right\}}{\sum_k \max\{\tilde{R}_{k,t}, \tilde{D}_{k,t}\}}, \tag{17}$$

where $\tilde{R}$ and $\tilde{D}$ are discounted sums of contemporaneous and past spending. Letting t_0 represent the first period of a race, then these sums are

$$\tilde{R}_{k,t} = \sum_{\tau=0}^{t-t_0} \beta^\tau R_{k,t-\tau} \tag{18}$$

$$\tilde{D}_{k,t} = \sum_{\tau=0}^{t-t_0} \beta^\tau D_{k,t-\tau}. \tag{19}$$

In practice, we consider the 24 weeks prior to the election, so, for biweekly data, $t_0 = 12$. In Table 15, we present the results of estimating our biweekly model using $\beta = 0.95$. The estimates suggest slightly greater responsiveness to competitiveness on the intensive margin, but are overall consistent with the results presented in Section 5.2.

Table 15: Empirical Results: Discounted Ruzicka ($\beta = 0.95$), Race-Biweek-Level Themes

	Similarity	
	Similarity	Selection
	(1)	(2)
Biweeks to Election	-0.0935***	-0.4769***
	(0.0185)	(0.0256)
Tossup	0.5851***	1.7622***
	(0.0770)	(0.1224)
Leaning	0.4245***	1.3846***
	(0.0737)	(0.1113)
Likely	0.3403***	0.8495***
	(0.0756)	(0.1108)
Senate	0.1977***	1.0196***
	(0.0509)	(0.1036)
Median Income	-0.0926***	-0.2186***
	(0.0188)	(0.0315)
Pct. Unemployed	-4.8832***	-10.7306***
	(1.8108)	(3.1635)
Pct. Age 65+	-2.1170***	-1.4445
	(0.6568)	(1.1336)
State Spending		850.7909
		(683.5699)
National Spending		6.5036*
		(3.8843)
ρ	0.1050	
ρ SE	0.0888	
N	6012	

Appendix H Issue Ownership

H.1 Ownership Survey

This appendix outlines plans to survey U.S. citizens about their perceptions of the two major U.S. political parties on various issues. The goal of this survey is to construct an index of "issue ownership" across various campaign issues to better understand the extent to which voters perceive one party as having dominance or ownership over each issue. This survey is covered by Cornell IRB Protocol #IRB0148950.

H.1.1 Phrasing the Ownership Survey Question

Previous studies have used a variety of questions to survey voters about issue ownership. Traditionally, many researchers have asked something along the lines of, "For each of the following issues, please tell us whether you think the Republican or the Democrat would do a better job of dealing with that issue." However, **?** observes that this traditional phrasing may capture something other than issue ownership. Motivated by this concern, **?** runs surveys with the traditional phrasing and two alternatives and finds that the traditional working may primarily capture participants' party preferences. For example, of the three versions considered, the traditional version is the least likely to see respondents assign ownership to the party they don't personally support.

? expand on this analysis by suggesting two criteria for a good measure of issue ownership:

1. It should not be contaminated by positional agreement. In other words, the owner of issue X should not always be the party whose position on X the respondent agrees with.

2. It should not be conflated with party preference. In other words, respondents should not mark their preferred party as the owner of all (or the vast majority of) issues.

They evaluate seven versions of the issue ownership question (both drawn from the literature and newly written) and then assess the degree to which ownership responses satisfy these two criteria. authors.

Importantly, **?** distinguish between two types of ownership questions they see used in the literature: competence questions and associative questions. Competence questions are of the type "Which party is best at X," while associative questions are of the type "When you think of X, which party comes to mind first?" They find that associative questions are far more likely to satisfy the two criteria above.

However, since the conceptualization of issue ownership in Section 2.2 most closely aligns with the competence framing, we choose to use the phrasing "Which party is best qualified to handle each of the following political isssues?" which is among the best-performing competence-framed questions considered by **?**.[47]

H.1.2 Target Sample and Randomization

The survey was conducted on the Prolific research platform. Respondents were be restricted to the Prolific sample that is representative of the U.S. population aged 18 years or older based on sex, age, and political affiliation. Some of the questions were randomized across respondents, but this was only done to reduce the number of questions each respondent was asked.

H.1.3 Study Recruitment Details for Prolific Website

Study Name Understanding Voter Perceptions of U.S. Political Parties and Campaign Issues

Study Description In this research study, we are seeking to learn about potential voters' perceptions of how the major political parties relate to a variety of key political issues in the United States.

The survey will only take a few minutes to complete.

There are no requirements for taking part in this study. We just ask you to answer the questions as honestly as you can.

Thank you for your interest in this research.

Device Requirements All devices (Mobile, Tablet, and Desktop) are permitted.

Study Requirements The study does not require any of: audio, camera, microphone, or software download.

Study Label Survey

Content Warning None

[47] Our phrasing ranked second in the degree to which ownership responses "transcend party preference," but is not statistically distinct from the leader in this measure. We choose this phrasing over the top-ranked competence question, "Which party do you think is most able to deliver on its program regarding issue x, regardless of whether you agree with that party or not?" because we felt the top-performing question may have implied a broader sense of ownership than we were looking to capture.

H.2 Informed Consent

We are asking you to participate in a research study titled "Understanding Voter Perceptions of U.S. Political Parties and Campaign Issues," led by Dr. Benjamin Leyden, SC Johnson College of Business, Cornell University.

What the study is about The purpose of this research is to understand voters' perceptions of how political parties relate to key political issues in the United States.

What we will ask you to do We will ask you to complete a survey about which political party you believe is best qualified to handle a variety of political issues. The survey should only take a few minutes of your time. At the end, you will be asked a series of questions about yourself and how you form your political opinions.

Risks and discomforts We do not anticipate any risks from participating in this research.

Benefits There are no direct benefits to you for participating in the survey. However, your responses will contribute to research that may benefit society through a greater understanding of political campaigning in the United States.

Incentives for participation You will be paid $0.80 for participating in this short survey. Payment will come from Prolific and not directly from the researchers.

Privacy/Confidentiality/Data Security This survey is anonymous and will not collect any personally identifying information.

Sharing De-identified Data Collected in this Research De-identified data from this study may be shared with the research community at large to advance science. We will not collect any information that could identify you as part of this survey.

Taking part is voluntary Your participation in this survey is voluntary. You may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled.

If you have questions The main researcher conducting this study is Dr. Benjamin Leyden, a professor at Cornell University. If you have questions, you may contact Dr. Leyden at leyden@cornell.edu or [redacted]. If you have any questions or concerns regarding

your rights as a subject in this study, you may contact the Institutional Review Board (IRB) for Human Participants at [redacted] or access their website at [redacted]. You may also report your concerns or complaints anonymously through Ethicspoint online at [redacted] or by calling toll-free at [redacted]. Ethicspoint is an independent organization that serves as a liaison between the University and the person bringing the complaint so that anonymity can be ensured.

Statement of Consent By clicking "I consent, begin the study" below, I confirm that I have read the information above and I agree to participate in the research study. Otherwise, you may close your browser window to exit the study.

H.2.1 Survey Outline

We solicited 2,500 responses to the following survey from Prolific's nationally representative US sample.

Issue Questions

Which party is best qualified to handle each of the following political issues?

[Participants will be presented with the following options for 15 randomly selected issues from the list of issues. For each issue, participants can choose one option or skip. This stage of the survey included an attention check: One of the "issues" was an explicit instruction to select "The Republican Party." Participants who did not correctly make this selection are excluded from all analyses.]

- The Republican Party
- The Democratic Party

Political Questions

Which party most closely represents your political views? *[Select one]*

- The Republican Party
- The Democratic Party

How often do you read a newspaper? This is an attention check, please select "4-6 times a week." *[Respondents who failed to answer this correctly were dropped from all analyses.]*

- Never
- Once a week
- 2-3 times a week
- 4-6 times a week
- Daily

Which of the following influence your political opinions? You may select all that apply. *[Select multiple]*

- TV Advertising
- Radio Advertising
- Social Media Advertising
- News Coverage
- Door-to-door Canvassing
- Friends and Family
- Other: _____

Demographic Questions

What is your gender? *[Select one]*

- Male
- Female
- Non-binary
- Prefer not to say
- Prefer to self-describe: _____

How old are you? *[Select one]*

- 18-24 years old
- 25-34 years old

- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65+ years old

Which state do you live in? *[List of states provided]*
What is the highest level of education you have completed? *[Select one]*

- Some high school or less
- High school diploma or GED
- Some college but no degree
- Associate's or technical degree
- Bachelor's degree
- Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS, etc.)
- Prefer not to say

H.2.2 List of Issues

Abortion
Affordable Care Act/Obamacare
Business
Campaign Finance Reform
China
Crime
Deficit/Budget/Debt
Domestic Violence/Sexual Assault/Harassment
Economy
Education/Schools
Emergency Preparedness/Response
Employment/Jobs
Energy Policy
Environment
Farming
Foreign Policy
Gender Discrimination (excluding LGBTQ-related discrimination)
Government Ethics/Scandal
Government Regulations
Government Shutdown
Government Spending
Gun Control
Health Care (excluding prescription drugs)
Expanding access to healthcare
Immigration
Iran
Medical Bills
Medicare
Medicare for All (Reform to provide Medicare to every American)
Military
Minimum Wage
Moral/Family/Religious Values
Narcotics/Illegal Drugs
Opioids / Rx Drug Abuse
Outbreaks of infectious disease (including Coronavirus/COVID-19)
Police Brutality/Racial Violence
Prescription drugs
Protests/Riots
Recession/Economic Stimulus
Seniors (excluding Medicare)
Social Security
Substance Use Disorder
Tax Reform
Taxes
Terrorism
Trade/Globalization
Veterans
Women's Health

H.3 Additional Ownership Analyses

In Table 16, we present the results of our issue ownership analysis using disaggregated campaign issues instead of the aggregated campaign theme approach used in the paper. We reach the same conclusion as in Section 6.3, the relationship between similarity and competitiveness weakens as the average level of similarity in the data increases.

Table 16: Issue-Based Ownership Regression Estimates (Ruzicka Indices)

	Low		Medium		High	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Tossup	0.8527***	2.8818***	0.8789***	2.8222***	0.6137	2.1682***
	(0.1679)	(0.2133)	(0.1848)	(0.2047)	(0.6674)	(0.1479)
Leaning	0.7030***	2.5281***	0.7523***	2.5594***	0.5430	2.0738***
	(0.1639)	(0.1747)	(0.1870)	(0.1740)	(0.6588)	(0.1359)
Likely	0.5283***	1.7695***	0.5893***	1.6885***	0.3613	1.3901***
	(0.1426)	(0.1198)	(0.1584)	(0.1193)	(0.4814)	(0.1225)
Senate	0.1638***	1.1830***	0.1565***	1.1455***	0.0264	0.8105***
	(0.0543)	(0.1601)	(0.0596)	(0.1600)	(0.1931)	(0.1570)
ρ	0.1938		0.2754*		0.2225	
ρ SE	0.1270		0.1550		0.4894	
N	1878		1878		1878	

(a) Race Observations

	Low		Medium		High	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0538***	-0.4435***	-0.0162	-0.4251***	0.0744	-0.3338***
	(0.0157)	(0.0214)	(0.0205)	(0.0207)	(0.0637)	(0.0220)
Tossup	0.5174***	2.7682***	0.3170*	2.7051***	-0.4342	2.0503***
	(0.1411)	(0.1066)	(0.1684)	(0.1025)	(0.5140)	(0.0937)
Leaning	0.4094***	2.3784***	0.2651*	2.2934***	-0.4502	1.7448***
	(0.1340)	(0.0991)	(0.1605)	(0.0958)	(0.4428)	(0.0912)
Likely	0.2933**	1.7113***	0.1925	1.6697***	-0.2888	1.3039***
	(0.1175)	(0.0955)	(0.1354)	(0.0954)	(0.3582)	(0.1009)
Senate	0.1323***	1.2408***	0.0588	1.1713***	-0.2454	0.6857***
	(0.0503)	(0.0921)	(0.0627)	(0.0905)	(0.1531)	(0.0905)
ρ	0.1066		0.0252		-0.3438	
ρ SE	0.0868		0.0994		0.3033	
N	20921		20921		20921	

(b) Race-Biweek Observations