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

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Abstract

We study the nature and determinants of dialogue between political candidates in the context of 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. House and Senate 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 benchmark. Finally, we investigate the determinants of dialogue, including the competitiveness of a race, the time left until the election, and the type of election 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)

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1 Introduction

Discourse between political 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. However, scholarly concern about a lack of dialogue dates back as far as Kelley (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 arguably 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 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

[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.

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 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 U.S.

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. To address the fact that multiple issues may be very similar to each other

[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).

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.[3] 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. 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). We show that the link between competitiveness and similarity remains inherently uncertain, as it hinges on the 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 asymmetry via theme ownership, we find that as the degree of ownership intensifies, the stronger candidate tends to allocate more advertising resources to their competitor's owned issue. Furthermore, heightened ownership is expected to lead to increased convergence.

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

[3]The full list of issues and aggregations is available in Appendix B.2. In Appendix F, we repeat our primary analyses using the disaggregated issue codings for issues mentioned in at least one percent of ad airings in a given year.

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.[4] 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, even after controlling for selection.[5] 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 race competitiveness, time until the election, and differences between House and Senate campaigns. Our empirical strategy focuses on the relationship between two endogenous outcomes—race competitiveness and advertising similarity—rather than estimating primitive parameters of 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.

[4]We measure "biweeks" as two-week periods relative to election day. In Appendix D.2, we also consider data at the race-biweek-affiliate-period level.

[5]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 found with race observations.

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 (including political action committees or PACs) in competitive races. Specifically, we confirm our descriptive findings that dialogue in third-party advertising does not respond to race competitiveness 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 equilibrium 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 com-

peting 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 messaging 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. 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 aggregate race-level and temporally

disaggregated race-biweek-level advertising behavior, demonstrating that race-level aggregation overstates the level of issue convergence. We also introduce a "non-strategic" benchmark of randomly allocated advertising expenditures to qualify the observed levels of advertising convergence. 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, but that the former dominates the latter.

Our work contributes to a broad body of research on advertising that spans economics, political science, and marketing. 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); Anderson 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).[6]

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); Alesina, Miano, and Stantcheva (2020); Djourelova (2023); Djourelova et al. (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 our benchmark and entirely absent from many races. This limited engagement between candidates with differing viewpoints potentially contributes to increased polarization by exposing

[6]Our analysis abstracts from the specific role of advertising in this context. 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) and Schultz (2007). For a discussion of persuasive advertising in politics, see, for example, Franz and Ridout (2007) and Gerber et al. (2011).

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 dialogue in campaign advertising in Section 4. In Section 5, we study the determinants of dialogue, investigating whether and how the competitiveness of a race relates 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 provide a discussion of our findings and 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 candidate chooses which theme to advertise to maximize their probability of winning their election.[7]

2.1 Equilibrium Advertising and Messaging Convergence

We first consider the following normal form game.

[7] In Appendix A.3, we endogenize the candidates' decision to advertise. In particular, we extend the game presented in this section to a two-stage game in which candidates decide whether to advertise in the first stage. Then, conditional on both candidates advertising, they play the game described in this section.

		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

[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 A.2.1 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).

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, 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)}.

[12] In more complex variants, such as the ones presented in Appendix A.2, that is not necessarily the case.
[13] We conduct this comparison in Section 4.4.

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

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 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, $\sigma^{Jaccard} = 1$.[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

[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 $\sigma^{Jaccard} = 0$.

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.1.1.

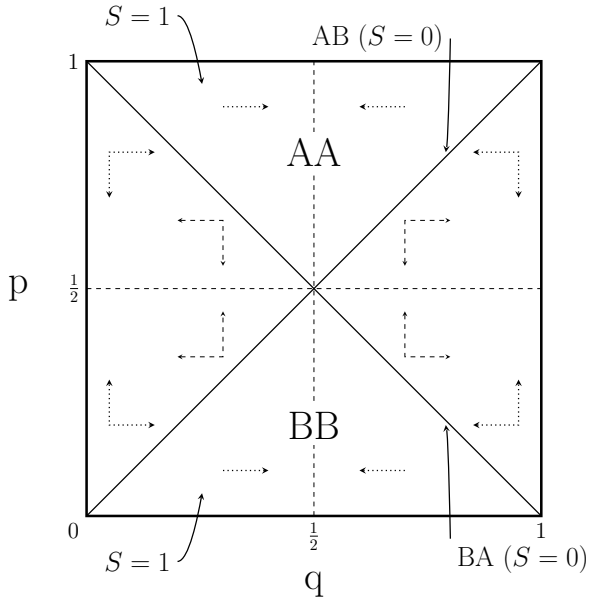
Figure 1a presents the outcomes of this game in (p, q) space. It shows the pure strategy equilibria regions AA and BB, and the mixed strategy equilibria regions as the (unlabeled) left and right triangles.[16] The figure also indicates how competitiveness and similarity change as you move across the 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 the candidates 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—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.

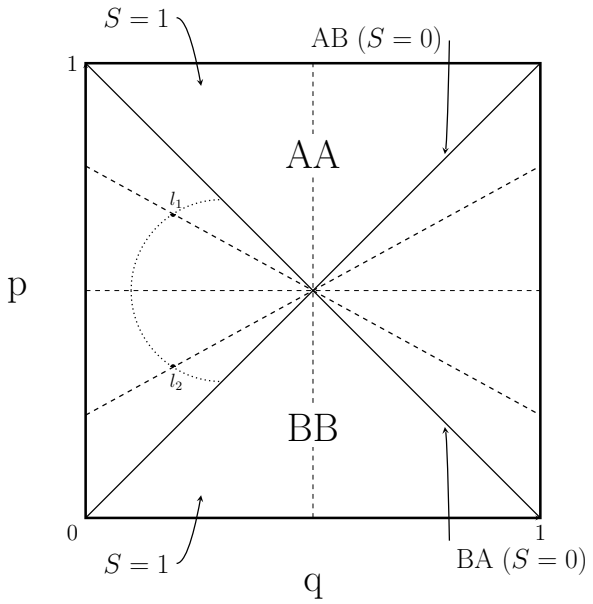
[16] The solid diagonal and off-diagonal lines indicate the presence of the (zero measure) pure strategy AB and BA equilibria, respectively.

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.

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. 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]

		Republican (R): A	Republican (R): 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.[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*

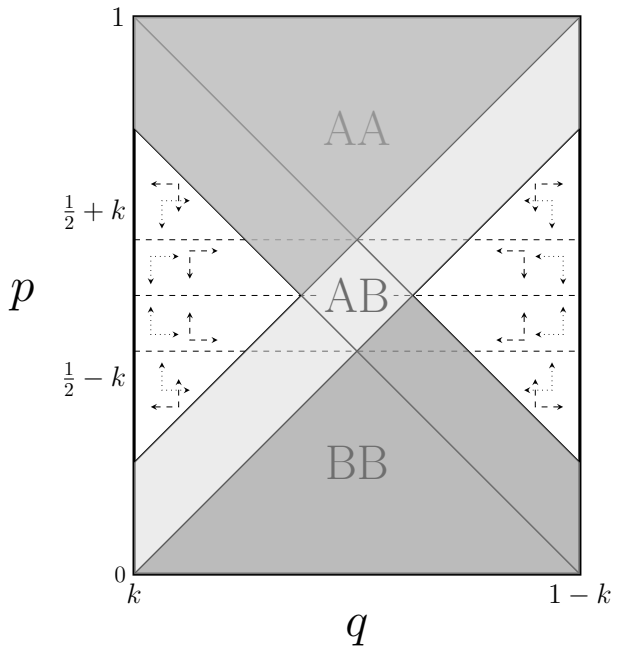
[17] More generally, suppose that D has advantage k_d on theme A and R has advantage k_r on theme B. Whenever a candidate has an advantage, we add to own win-probability in the theme with the advantage and subtract from rival's own win-probability (all matrix entries are zero-sum). Then we have:

		Republican (R): A	Republican (R): 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 A.2.2 considers a more general form of the game that allows for different weights on the two themes in the same manner as Appendix A.2.1, 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.

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

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

while R indifference implies

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

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 (*$\left|p-\frac{1}{2}\right|$*) gets smaller. Both indices increase as prior advantages (*$\left|q-\frac{1}{2}\right|$*) decrease when theme uncertainty is dominated by issue ownership (*$p \in \left(\frac{1}{2}-k, \frac{1}{2}+k\right)$*); but* C *rises while* S *falls when theme uncertainty dominates issue ownership (*$\left|p-\frac{1}{2}\right| > k$*).*

A proof of Proposition 5 is available in Appendix A.1.2.

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 (*$k > \left|p-\frac{1}{2}\right|$*) then both candidates advertise more the weaker candidate's owned issue.*

A proof of Proposition 6 is available in Appendix A.1.3.

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. This means that issue ownership cannot be empirically measured by looking at equilibrium advertising decisions. Second, Proposition 6 (ii) indicates that increased ownership should lead to increased convergence. 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 roughly 40% from 2012 to 2020, and ad-airings increased nearly 150% from 2012 to 2020. The average amount of money spent on an ad was $529.80 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 "Gambling." An ad can mention multiple issues at the same time, of course, while a very

[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 and how they allocate that spending (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	661.5	50	165,000	546,114
2014	1,354	592.5	50	79,800	608,359
2016	1,209	569.6	50	125,000	552,482
2018	1,752	498.9	40	92,580	852,363
2020	2,035	451.7	30	135,370	1,352,698
Affiliate					
ABC	2,065	537.0	30	116,080	998,314
CBS	2,109	513.7	30	123,750	1,103,683
CW	235	417.7	30	79,800	128,656
FOX	1,169	530.0	30	135,370	583,626
NBC	2,232	552.5	30	165,000	1,097,737
Period					
Morning	2,571	377.2	30	123,350	1,303,770
Afternoon	4,041	539.5	30	128,390	1,991,502
Night	1,198	821.0	30	165,000	616,744
Total	7,810	529.8	30	165,000	3,912,016

Notes: Observations are ad airings. Creatives are unique advertisements that can be aired multiple times. Morning is defined as the period from midnight to noon, Afternoon spans noon to 8 pm, and Night covers 8 pm to midnight.

Table 2: Campaign Theme Prevalence by Year

Year	2012	2014	2016	2018	2020
Economic Policy	43.90	35.23	27.56	26.14	27.27
Social Issues	3.87	6.55	17.90	10.22	7.70
Law and Order	0.84	1.05	4.35	7.00	7.81
Social Welfare Issues	29.10	25.86	17.70	26.05	27.90
Foreign/Defense Policy	9.24	12.95	16.80	12.79	10.73
Environment/Energy	5.80	6.94	4.07	2.93	3.33
Government	7.27	11.41	11.61	14.87	15.25

Notes: This table presents the percentage of aired issues attributable to each theme for each election cycle. Themes are aggregations of the campaign issues coded in the WMP data. See Appendix B.2 for additional details on how campaign themes are constructed and Appendix F for analysis of the disaggregated data.

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 use 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 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

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

[22] In Appendix F 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.

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

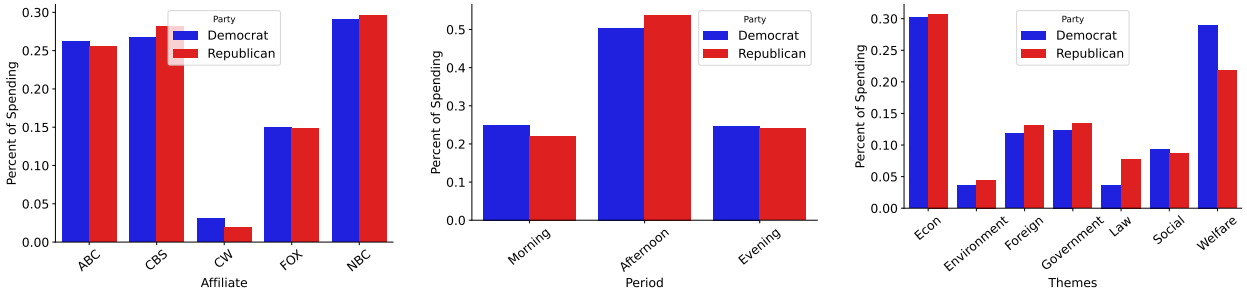
We now turn to characterizing the presence of dialogue across U.S. House and Senate races between 2012 and 2020. In the spirit of Simon (2002), we propose three necessary conditions for dialogue, which reflect the idea that dialogue exists to the extent that the candidates reach the same "eyes and ears" 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.

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

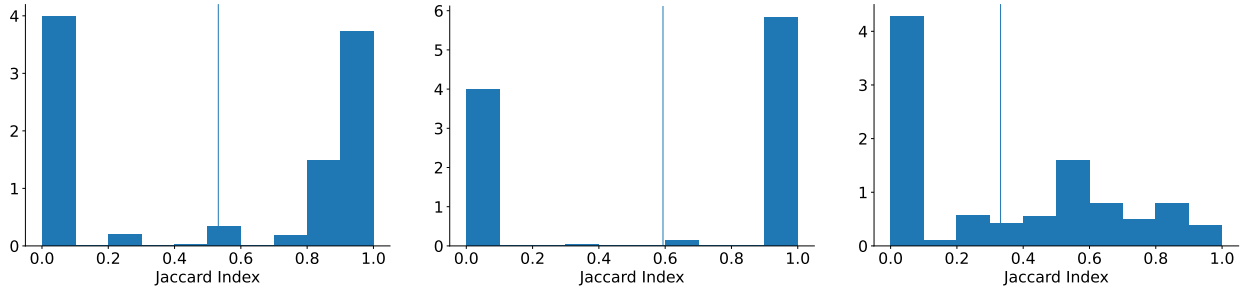
[24]CPR ratings are positively correlated with the final winning margin of a candidate. See Figure B1 for a comparison of a race's CPR rating 3 months before election day to its final vote margin.

Figure 3: Distribution of Advertising Spending



(a) Affiliates (b) Periods (c) Themes

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



(a) Affiliates (b) Periods (c) Themes

Notes: This figure presents the distributions of Jaccard indices (Equation (2)) across races. The vertical lines indicate the average Jaccard index for each distribution.

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.

[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).

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.

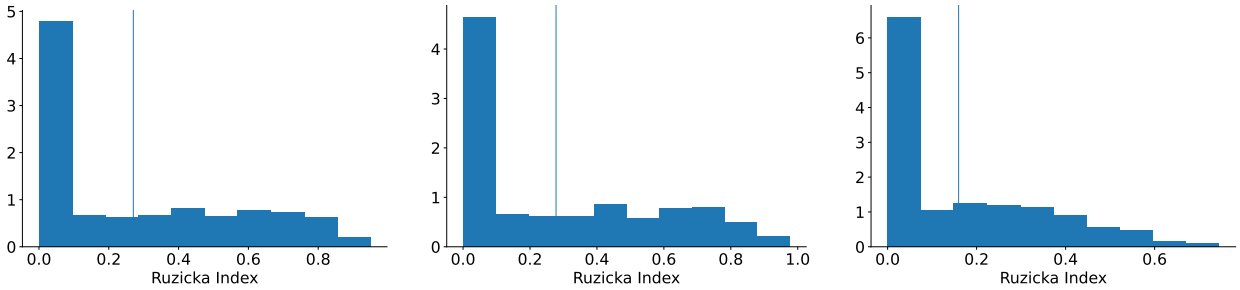
As discussed above, the Jaccard index provides a clear measure of the degree to which candidates overlap on the themes (or affiliates or periods) to advertise. However, it fails to account for disparities in spending on those themes. As a result, a race where, for example, the Democrat places great emphasis (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 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]

[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) Affiliates (b) Periods (c) Themes

Notes: This figure presents the distributions of Ruzicka indices (Equation (6)) across races. The vertical lines indicate the average Ruzicka index for each distribution.

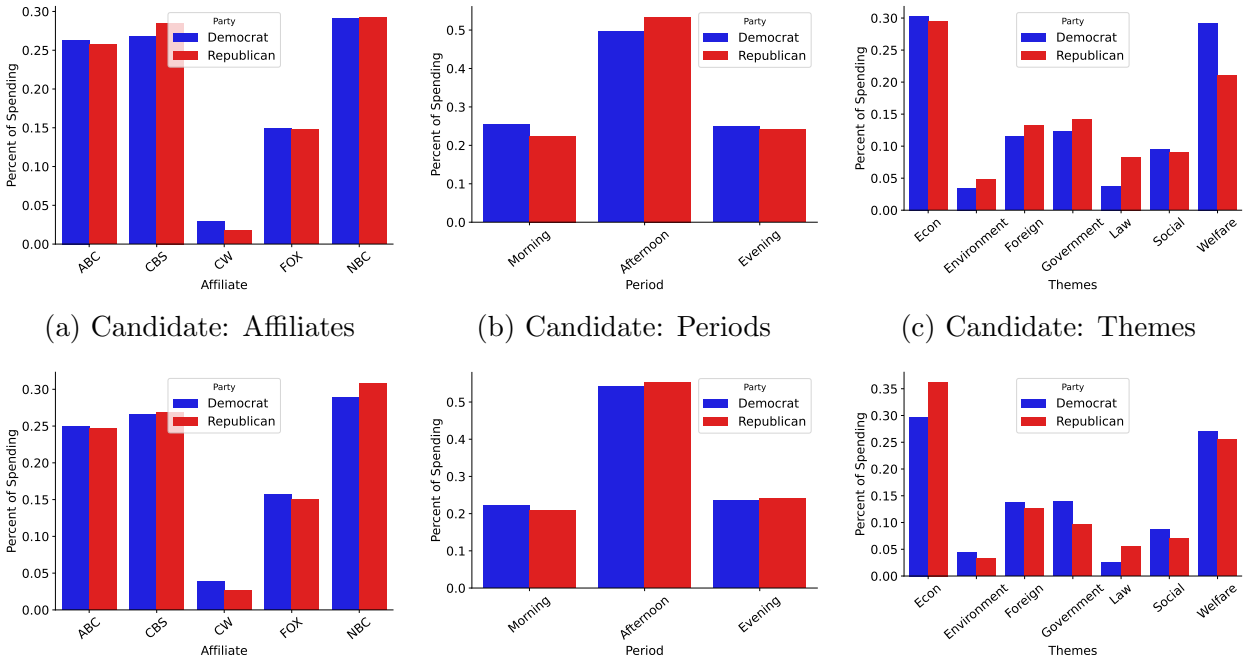
In Figure 5, we show race-level Ruzicka indices for affiliates, periods, and themes. Having now accounted for messaging intensity, we see significant heterogeneity in the level of similarity between the two candidates in each race across all three outcomes. Notably, there are a substantial number of 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 (when in coordination with the candidate) and third parties (including political parties acting independently of the candidate, and PACs). In aggregate, spending percentages by these two entities look similar.

In Figure 7, we present histograms of race-level Ruzicka indices calculated separately for candidate and third-party advertising in each race. For each figure, we present the average Ruzicka index for candidate advertising using the solid blue line, and for third-party advertising using the dashed orange line. Additionally, we report the results of Kolmogorov-

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



(a) Candidate: Affiliates (b) Candidate: Periods (c) Candidate: Themes

(d) Third-Party: Affiliates (e) Third-Party: Periods (f) Third-Party: Themes

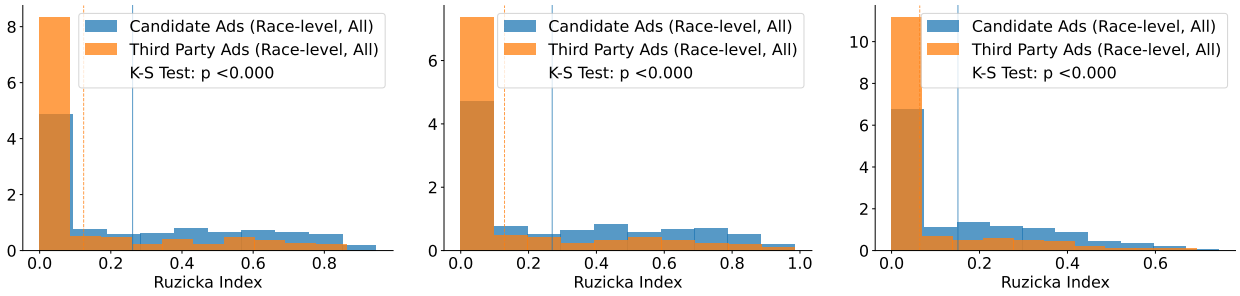
Smirnov tests showing that the distributions are statistically distinct. We can see that across categories, the distribution of third-party spending is significantly different than that of candidate spending, with substantially less overlap in affiliate, period of day, and campaign theme by the third 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 2nd

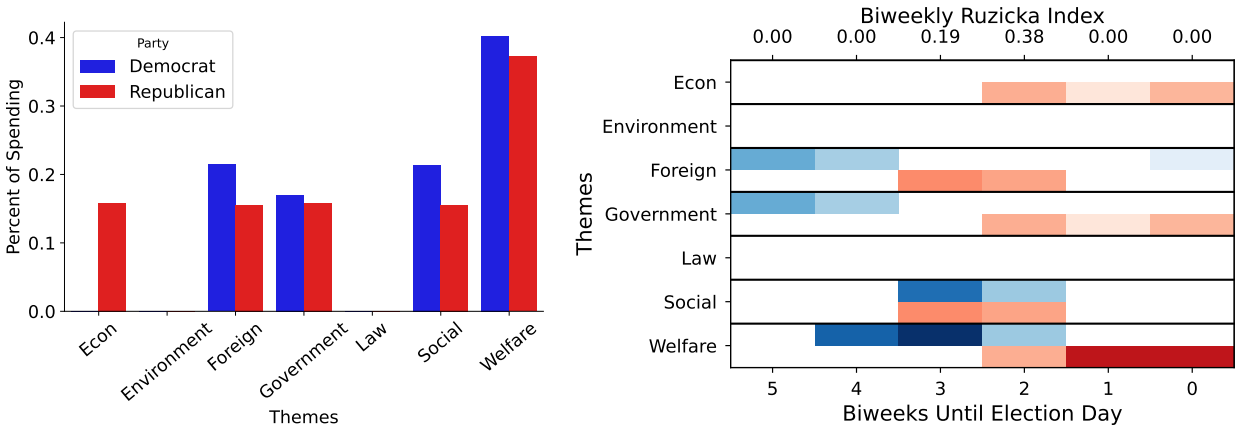
Figure 7: Ruzicka Index of Ad Spending at the Race Level, Candidates vs. Third Parties



(a) Affiliates (b) Periods (c) Themes

Notes: This figure presents the distributions of Ruzicka indices (Equation (6)) for candidate and third-party advertising across races. The solid blue line indicates the average Ruzicka index for candidate advertising, and the dashed orange line indicates the average Ruzicka index for third-party advertising. Each legend presents the result of a Kolmogorov-Smirnov test comparing the equality of the distributions.

Figure 8: Spending on Themes in Virginia's 2nd Congressional District (2014)



(a) Race-level Spending (b) Biweek-level Spending

Notes: While the race-level Ruzicka index is 0.704, indicating a significant overlap in messaging, the biweekly Ruzicka index averages only 0.0095 across weeks. The intensity of the color in the figure is associated with the amount of money spent on that theme, with darker cells reflecting greater spending.

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 $\sigma^{Ruzicka} = 0.704$, 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 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) represents the average 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

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	0.2648	0.3289	0.2211	0.0631	0.0757
Race (Race Selection=1)	0.1755	0.2604	0.2991	0.3429	0.3015	0.2558	0.2651
Biweek	0.0038	0.0463	0.0759	0.1137	0.0758	0.0154	0.0206
Biweek (Race Selection=1)	0.0313	0.0653	0.0845	0.1192	0.1034	0.0626	0.0716
Biweek (Biweek Selection=1)	0.1660	0.2137	0.2188	0.2369	0.2263	0.2097	0.2147

(b) Similarity

Notes: Selection is measured with a binary variable indicating whether both candidates in a race advertise concurrently. Similarity is measured with the Ruzicka index (Equation (6)). 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.

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, 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 0.0757, 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 as before. That is, we focus on the 29% of races where there is the potential for dialogue. In this case, the Ruzicka index jumps to 0.2651, 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 0.0206 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 0.0716. If we restrict the sample further to race-biweek observations where both candidates advertise, the Ruzicka rises to 0.2147.

In summary, the effect of "selection into advertising" on similarity is shown to be critical, and the similarity is lower at the race-biweek level versus the race level.

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 Ruzicka Index. We repeat this process 10,000 times for each race and take the average to construct a simulated Ruzicka Index, $\hat{\sigma}^{Ruzicka}$. This approach, informed by our theoretical model, provides a "non-strategic" measure of messaging overlap against which we can compare observed similarity. If real-world similarity exceeds the simulated benchmark, we can infer that candidates strategically pursue dialogue; conversely, if it falls below, we infer that they strategically avoid dialogue in political advertising.[28]

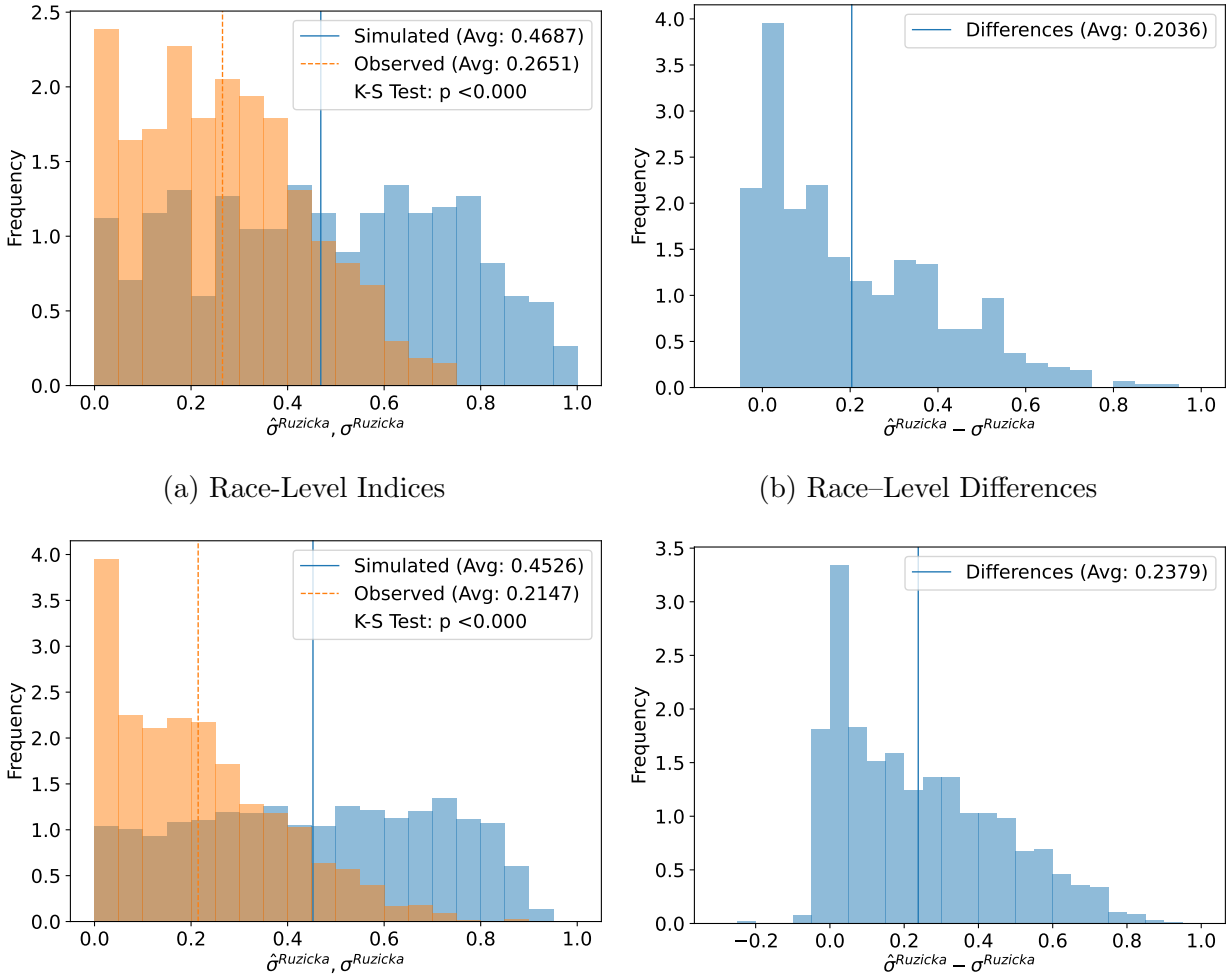
We present the results of this exercise, along with the observed, real-world Ruzicka indices in Figure 9. The distribution of simulated and observed Ruzickas at the race and race-biweek levels are illustrated in Figures 9a and 9c, respectively. Additionally, for each race and race-biweek observation,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

We find in Figure 9a that were candidates to distribute their budget across campaign themes randomly, the average similarity would be $\sigma^{Ruzicka} = 0.4687$, whereas the average in our data (conditional on both candidates in a race advertising at least once) is $\sigma^{Ruzicka} = 0.2651$, or almost half of what we would observe in a world where politicians

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

[28] We recognize that there are multiple ways to construct a benchmark for observed similarity in campaign themes. An alternative to our uniform allocation is one that keeps each candidate's actual advertising allocation the same but permutes the pairing of candidates–effectively randomizing who faces whom within the empirical distribution of spending. However, this approach would still embed many of the strategic considerations that shaped each candidate's actual decisions, including party-level strategic guidance. By contrast, our uniform-allocation benchmark strips away all strategic elements by assuming equal distribution across themes, giving us a clearer baseline to measure how candidates deliberately deviate from non-strategic behavior.

Figure 9: Benchmarking Dialogue



(a) Race-Level Indices

(b) Race–Level Differences

(c) Race-Biweek-Level Indices

(d) Race-Biweek-Level Differences

Notes: This figure compares the observed messaging similarity—measured by the Ruzicka index—with a simulated, non-strategic benchmark that represents the level of overlap one would expect if candidates allocated their advertising spending randomly across themes. Panels (a) and (c) display the distribution of these simulated indices alongside the actual observed values at both the race and race-biweek levels. Panels (b) and (d) present the race- and race-biweek-level differences between the simulated and observed indices. Vertical lines indicate the average for each distribution. The results indicate that observed dialogue is systematically lower than the random benchmark, particularly at the more disaggregated race-biweek level.

were randomly throwing darts at a board.[29] In an average race, this represents a difference between the simulated and observed of $\hat{\sigma}^{Ruzicka} - \sigma^{Ruzicka} = 0.2036$. These results suggest that candidates strategically avoid dialogue. We similarly find evidence of strategic avoidance of dialogue in the race-biweek analysis, presented in Figures 9c and 9d with an average difference of $\hat{\sigma}^{Ruzicka} - \sigma^{Ruzicka} = 0.2379$. Overall, this exercise suggests that dialogue in political advertising is indeed low, as candidates strategically seek to avoid dialogue with their political opponents.

With regard to the second question of whether race-biweek-level similarity is mechanically lower than race-level similarity, comparing the simulated distributions across Figure 9a and Figure 9c shows that moving to the 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 0.4687 that we find with race observations.

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. We first present the empirical model and discuss the econometric challenges, then we present our main empirical results.

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

5.1 The Empirical Model

We must address two critical empirical challenges present in the study of political dialogue. 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.

Consider a congressional 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:

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

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

We use dummy variables constructed using the Cook Political Report (CPR) ratings to measure race competitiveness, as discussed in Section 3.2 and Appendix B.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. Notably, unobserved race characteristics might simultaneously influence competitiveness and advertising overlap, potentially biasing our results. 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 attenuates the endogeneity concern.[30]

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 (including 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 our descriptive analysis in Section 4.[31] 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

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

where $s_{m,t}$ equals 1 if *both* candidates advertise in m,t, and 0 otherwise, and $\Phi\left(\cdot\right)$ is a standard normal CDF. The variables $Z_{m,t}$ are exogenous and, as discussed below, are at least partially excluded from $X_{m,t}$.

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

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

where ρ measures the correlation between the decision to jointly advertise and the extent

[30] In Appendix D.3, we show that our primary findings presented below are robust to using lagged versions of these competitiveness measures, which would be unaffected by unobserved contemporaneous shocks.

[31] We further document this idea in Appendix C. See, e.g., Figure C1.

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 $X_{m,t}$ and $Z_{m,t}$. We maintain that the sequence of observations $\left\{\left(\sigma_{m,t}^{Ruzicka}, X_{m,t}, Z_{m,t}\right) : m = 1, ..., M; t = 1, ..., T\right\}$ 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.

However, we define $Z_{m,t} = [X_{1,m,t},\ X_{2,m,t},\ S_{m,t}]$ to include variables $S_{m,t}$ that are not included in $X_{m,t}$, 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 $S_{m,t}$ as including two variables that correspond to 1) the product of cumulative expenditures by Democrats in the state and cumulative expenditures 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 $S_{m,t}$ 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 not candidates' prioritization of messaging content, and so we do not expect it to affect the theme choice.[32]

Finally, in our empirical analysis, we present results while excluding third-party advertising, which includes advertising from political action committees (PACs). This helps validate our identification strategy because PACs typically raise funds and spend money on specific

[32]In Appendix D.3, 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.

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 ($S_{m,t}$) is more plausibly exogenous to theme-specific factors.

5.2 Estimation Results

Motivated by our earlier analysis, we present estimation results for both aggregated and disaggregated advertising data. First, we estimate our model at the race level, which corresponds to previous work on this topic by Kaplan, Park, and Ridout (2006), among others. We then disaggregate the data to the race-biweek level, which allows us to investigate how messaging similarity changes as election day approaches. We present further estimation results in Section 6, where we consider the possibility that parties may "own" some issues in the eyes of voters.

5.2.1 Race-Level Results

Table 5 presents the results of estimating our model on aggregate, race-level advertising spending. For example, an observation might be North Carolina's 6$^{\text{th}}$ 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 similarity model, and column (2) reports the corresponding results for the selection model. Recall that the similarity and selection equations are estimated simultaneously.

The first three rows in column (1) of Table 5 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 mono-

Table 5: 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	0.9370***	2.8864***	1.0486***	2.7644***	-0.9573	2.6325***	0.5778***
	(0.1917)	(0.2137)	(0.1864)	(0.1953)	(1.8284)	(0.2496)	(0.0602)
Leaning	0.7482***	2.5271***	0.8780***	2.4169***	-1.0542	2.1402***	0.3998***
	(0.1882)	(0.1748)	(0.1837)	(0.1637)	(1.5034)	(0.2487)	(0.0622)
Likely	0.6219***	1.8069***	0.7507***	1.7009***	-0.6525	1.2048***	0.3343***
	(0.1621)	(0.1206)	(0.1572)	(0.1188)	(0.8741)	(0.2776)	(0.0683)
Senate	0.1544**	1.2022***	0.2388***	1.1309***	-0.2995	1.0141***	0.0623
	(0.0641)	(0.1598)	(0.0660)	(0.1538)	(0.6842)	(0.1812)	(0.0495)
Median Income	-0.0941***	-0.1978***	-0.0933***	-0.1820***	0.0795	-0.2559***	-0.0820***
	(0.0201)	(0.0317)	(0.0206)	(0.0307)	(0.2065)	(0.0683)	(0.0199)
Pct. Unemployed	-3.3760	-22.0836***	-6.6782***	-21.8283***	8.5933	-16.7689***	-1.4720
	(2.1608)	(3.3902)	(2.2468)	(3.4218)	(11.6184)	(6.2371)	(2.0405)
Pct. Age 65+	-2.2817***	0.2329	-1.3930*	0.0829	0.5978	-4.1192	-2.4114***
	(0.6901)	(1.2381)	(0.7318)	(1.1787)	(4.5112)	(3.0813)	(0.7032)
ρ	0.2717*		0.4211***		-0.3181		—
ρ SE	0.1454		0.1544		0.8560		—
N	1878		1878		1878		536

Notes: This table reports race-level estimates from our model of dialogue in political advertising (Equation (9)). Each observation is an individual race. The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), (5) and (6) use third-party ads, and (7) presents the results of estimating the similarity model without the selection model. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

tonicity in the results as the estimated coefficient is increasing as competitiveness increases from *Likely* to *Tossup*. This shows that candidates converge on campaign themes as races become more competitive.

In terms of magnitude, we compute the semi-elasticities and find that relative to *Solid* races, messaging is 1.6 times more similar in a *Likely* race, 2 times more similar in a *Leaning* race, and 2.8 times more similar in a *Tossup* race. These magnitudes are large but consistent with those in Table 4b, 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" (p. 733).[33]

Returning to column (1) of Table 5, 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 5 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 6 times more likely in *Likely* races, 8 times more likely in *Leaning* races, and 8.6 times more likely in *Tossup* races. Concurrent advertising is more than 2.5 times as likely in Senate races than in the House races. There is less advertising in areas with higher median income and with a larger 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 0.2717. A positive correlation means that any unobservable that makes, ceteris paribus, the candidates *more* likely to run ads also increases

[33] 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.

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 by 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 acting independently from candidates and PACs). The results are striking. Comparing columns (3) and (5) indicates that the entirety of the 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.

Table 6: 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	-0.0611***	-0.4773***	-0.0700***	-0.4779***	0.1542***	-0.2272***
	(0.0184)	(0.0254)	(0.0231)	(0.0255)	(0.0560)	(0.0296)
Tossup	0.3788***	1.7614***	0.3472***	1.5496***	-0.4372	1.9635***
	(0.0770)	(0.1224)	(0.0837)	(0.1171)	(1.0250)	(0.3495)
Leaning	0.2992***	1.3832***	0.3099***	1.2715***	-0.2194	1.2937***
	(0.0715)	(0.1111)	(0.0775)	(0.1118)	(0.7446)	(0.3496)
Likely	0.2505***	0.8485***	0.2826***	0.8049***	0.5044	0.4391
	(0.0693)	(0.1107)	(0.0726)	(0.1109)	(0.7212)	(0.4049)
Senate	0.0884*	1.0202***	0.0804	0.9128***	-0.6108***	0.7584***
	(0.0459)	(0.1036)	(0.0505)	(0.1023)	(0.2305)	(0.1385)
Median Income	-0.0732***	-0.2185***	-0.0695***	-0.2009***	0.0387	-0.2487***
	(0.0162)	(0.0315)	(0.0179)	(0.0313)	(0.1388)	(0.0732)
Pct. Unemployed	-4.4122***	-10.7319***	-4.6701***	-11.9987***	-2.6686	-16.0650***
	(1.4990)	(3.1615)	(1.5097)	(3.2468)	(10.0455)	(5.7789)
Pct. Age 65+	-1.5834***	-1.4318	-1.6608***	-1.1094	-0.6265	-0.3356
	(0.5587)	(1.1331)	(0.5854)	(1.2176)	(3.0316)	(2.4597)
ρ	0.0795		0.0617		-0.7146**	
ρ SE	0.0894		0.1017		0.3411	
N	6012		6012		6012	

Notes: This table reports race-biweek-level estimates from our model of dialogue in political advertising (Equation (9)). Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The key takeaways of Table 5 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 Results

We now move to the analysis at the race-biweek level. For example, an observation might now be North Carolina's 6$^{\text{th}}$ 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.[34] Thus, we restrict this stage of the analysis to races where both candidates advertise at least once during the course of the race.[35]

Table 6 shows that the coefficient estimates are remarkably smaller than those in Table 5, suggesting that there is much less responsiveness to the key determinants of dialogue at the bi-week 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 0.9370 to 0.3788. These estimates imply that *Tossup* races are only 74% more similar than *Solid* races. This is a remarkable difference from the 2.8 times difference that was associated with our estimates from the aggregated race-level data in Table 5. The declines for *Leaning* and *Likely* races are similar. The competitiveness results display the same pattern as those in Table 5 with regard to the differences between candidates and third-party advertising.

The relationship between competitiveness and selection into advertising has similarly declined. As in the race-level data, we find that the convergence relationship on the extensive, selection margin dominates the effect on the intensive, similarity margin.

Finally, in the first row of Table 6, we present the relationship between the time until the election (i.e., 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.

[34] In Appendix D.2, we consider a further disaggregation and estimate our model at the race-biweek-affiliate-period level. Results at that level of disaggregation closely mirror the findings presented here.

[35] We consider the unconditional case for biweekly observations in Appendix D.2. The results are qualitatively the same, although the magnitudes are slightly larger because we have so many races that are zero in every biweek.

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 the prediction from our theoretical model that similarity increases as the level of ownership rises. Additionally, we investigate how the competitiveness-similarity relationship documented in Section 5.2 is affected by issue ownership.

Our theoretical model yields a counterintuitive result (see 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 measurement challenge, we conduct a survey of potential voters on a wide range of campaign issues, 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.[36]

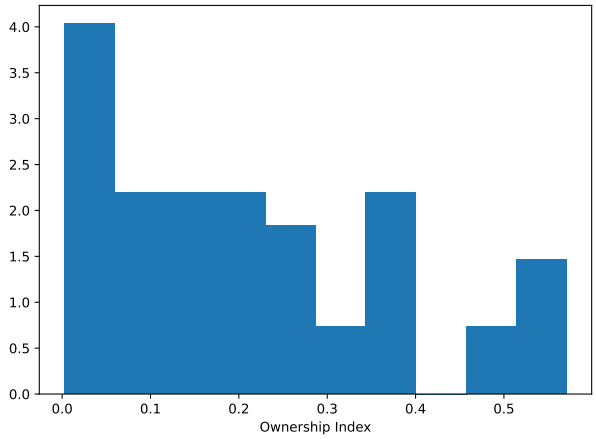
6.1 Measuring Issue Ownership

To measure issue ownership, we conducted a survey through Prolific's online platform, 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.[37] Each participant was

[36]There is precedent for using surveys to measure issue ownership; see discussion of this approach in Therriault (2015) and Walgrave et al. (2016).

[37]We excluded issues appearing in fewer than 1% of advertising airings (see Appendix F). We also omitted "2017 Efforts at Health Reform/AHCA/Trumpcare" as it would be difficult to reliably survey this issue in

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

presented with a randomly selected subset of fifteen issues and asked, "Which party is best qualified to handle each of the following political issues?"[38]

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

$$\omega_k = |p_k^R - p_k^D| \tag{10}$$

where p_k^i represents the proportion of 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 exam-

2024 when the survey was conducted. See Appendix G.1 for complete survey details.

[38]This question phrasing follows methodological insights from Therriault (2015); Walgrave et al. (2016), as further discussed in Appendix G.1.1.

ples. 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 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. The Low Average Ownership sample, our baseline sample, includes all issues included in our ownership survey.[39] This sample represents a relatively low average level of issue ownership. The Medium Average Ownership includes issues scoring above the 25^{th} percentile of ownership, and the High Average Ownership includes issues scoring above the 75^{th} percentile of ownership.

For all samples, when we exclude an issue, we remove its associated spending from the analysis.[40] After this issue-level filtering, we aggregate the remaining issues into themes consistent 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.

[39] We construct this sample in the same way as our primary sample, but restrict to only the issues included in the survey. See Appendix G.1.3 for the complete list of surveyed issues.

[40] 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.

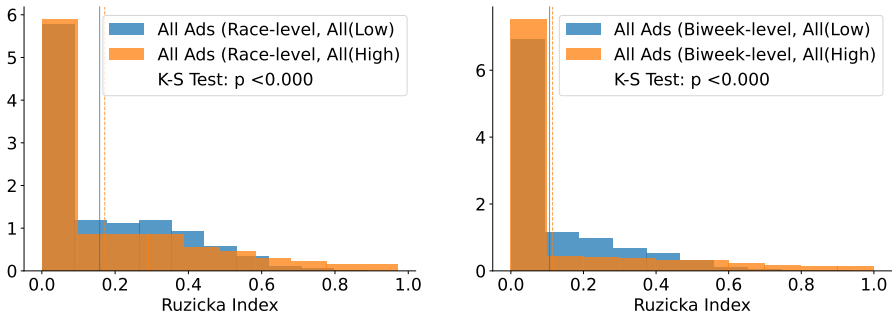
6.2 Characterizing Dialogue in the Presence of Issue Ownership

First, we examine whether stronger issue ownership is associated with greater convergence in messaging, as predicted by our model (Proposition 6 (ii)). 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. In both cases, 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 8.77% ($p = 0.19$) and 7.57% ($p = 0.09$) 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 51.14% ($p < 0.01$) and 64.41% ($p < 0.01$) for race and race-biweek samples, respectively.

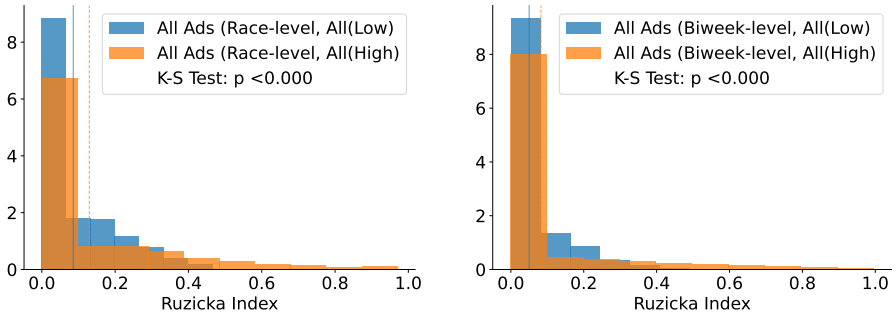
Notably, the magnitude of these shifts should be interpreted in light of our earlier finding that no issues are completely owned by either party. Since even our High Average Ownership sample includes issues that are still contested, the observed increases in convergence, while significant, are necessarily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

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

Panel (a) presents Ruzicka indices at the Race- and Race-Biweek-level, calculated with aggregated campaign themes. Panel (b) 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.

6.3 The Determinants of Dialogue in the Presence of Issue Ownership

We next examine how issue ownership affects the competitiveness-similarity relationship. Following our regression analysis framework in Section 5, we test whether the competitiveness-similarity relationship weakens as ownership increases. To do so, we re-estimate our model across the Low, Medium, and High Average Ownership samples using campaign theme data. We present the results of this exercise in Table 7.

The Low sample results closely match our primary findings from Tables 5 and 6, as expected given its similar composition. We find that the competitiveness-similarity relationship progressively weakens as we move from the Low to the Medium and finally High Average Ownership samples. Indeed, we fail to reject the null hypothesis of no competitiveness-similarity relationship in the High Ownership sample.[41]

Overall, the evidence from Figure 11 and Table 7 yields two key findings regarding the role of issue ownership in political dialogue: issue ownership increases dialogue 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

[41] We see similar results when we duplicate this exercise using the disaggregated, issue-level data. We present those results in Appendix G.2

Table 7: Regression Analysis Under Alternative Ownership Samples

	Low		Medium		High	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Tossup	0.8515***	2.8917***	0.7391***	2.8318***	-0.0261	2.2332***
	(0.2043)	(0.2134)	(0.2287)	(0.2054)	(0.5823)	(0.1492)
Leaning	0.6403***	2.5325***	0.4597**	2.5667***	-0.1314	2.1707***
	(0.1987)	(0.1753)	(0.2253)	(0.1758)	(0.5723)	(0.1377)
Likely	0.5539***	1.7934***	0.4776**	1.7763***	-0.0971	1.3998***
	(0.1699)	(0.1201)	(0.1910)	(0.1200)	(0.4274)	(0.1217)
Senate	0.1260*	1.1858***	0.1426*	1.1832***	-0.1304	0.8170***
	(0.0661)	(0.1605)	(0.0728)	(0.1599)	(0.1684)	(0.1579)
ρ	0.1797		0.1269		-0.1995	
ρ SE	0.1488		0.1626		0.3706	
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	-0.0640***	-0.4729***	-0.0424*	-0.4498***	-0.0258	-0.3382***
	(0.0184)	(0.0251)	(0.0233)	(0.0237)	(0.0845)	(0.0218)
Tossup	0.3970***	1.7511***	0.3682***	1.7110***	0.2265	1.2412***
	(0.0790)	(0.1215)	(0.0932)	(0.1147)	(0.3241)	(0.1018)
Leaning	0.3155***	1.3677***	0.2895***	1.3047***	0.0777	0.9382***
	(0.0718)	(0.1103)	(0.0853)	(0.1064)	(0.2580)	(0.0989)
Likely	0.2405***	0.8207***	0.2585***	0.8024***	0.1335	0.5621***
	(0.0700)	(0.1114)	(0.0813)	(0.1083)	(0.1731)	(0.1093)
Senate	0.1027**	1.0053***	0.0548	0.9430***	-0.0758	0.5192***
	(0.0461)	(0.1046)	(0.0529)	(0.0988)	(0.1314)	(0.0910)
ρ	0.1072		0.1000		0.0903	
ρ SE	0.0922		0.1090		0.3856	
N	6012		6012		6012	

(b) Race-Biweek Observations

Notes: This table reports estimates from our model of dialogue in political advertising (Equation (9)) for three levels of issue ownership—Low, Medium, and High Average Ownership—as described in Section 6.1. The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Panel (a) presents race-level estimates and panel (b) reports race-biweek-level results. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Robust standard errors are in parentheses in panel (a), and standard errors are clustered at the race level in panel (b). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

issue ownership leads to increased messaging convergence.

In our empirical analysis, we document significant heterogeneity in dialogue across races. Moreover, we show that 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 indicates candidates strategically avoid dialogue.

Finally, we investigate the determinants of dialogue, with a focus on the competitiveness of the race, the time until the election, and whether the race is for the U.S. House or Senate. 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. 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. We additionally find that dialogue increases as election day approaches, and, perhaps unsurprisingly, dialogue tends to be higher in Senate 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.[42] 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 political 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

[42] 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.

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 Supplementary Materials for Section 2: A Game of Political Competition Over Themes

A.1 Theoretical Proofs

A.1.1 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.1.2 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 $p \in (q+k, 1-q-k)$.[43] Therefore, when q gets closer to $\frac{1}{2}$, both S 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

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

$p \in (1-q-k, q-k)$, $q > \frac{1}{2}$, 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.1.3 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

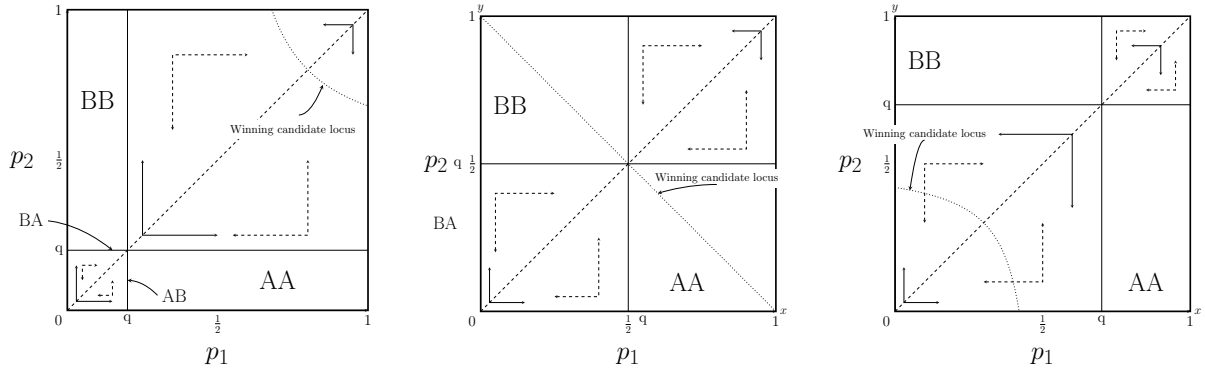
$$\frac{\partial S}{\partial k} = \frac{4k}{(1-2q)^2}$$
$$\frac{\partial C}{\partial k} = \frac{2k}{1-2q} \quad if \quad \frac{(1-p)p+k^2-q^2}{1-2q} \leq \frac{1}{2}$$

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 A1: Solution for the Heterogeneity in Advertising Themes Game



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

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

A.2 Asymmetric Extensions

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.

A.2.1 Asymmetric Extension of the 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.[44] BB is the 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 A1.[45]

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

$$\delta = \Pr(d = A) = \frac{q - p_2}{2q - p_1 - p_2} \quad \text{and} \quad \rho = \Pr(r = A) = \frac{q - p_1}{2q - p_1 - p_2}. \tag{11}$$

Note that these probabilities are in $(0, 1)$ if either (i) $q > \max\{p_1, p_2\}$ or (ii) $q < \min\{p_1, p_2\}$.[46]

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

$$S = 2\frac{(q - p_1)(q - p_2)}{(2q - p_1 - p_2)^2} \tag{12}$$

and the comparative static properties of S with respect to the parameters p_1 and p_2 are shown in Figure A1. For q, the index rises in the lower left-hand region but falls in the upper right-hand region.[47]

The competitiveness index is

$$C = \min\left(\frac{q^2 - p_1 p_2}{2q - p_1 - p_2}, 1 - \frac{q^2 - p_1 p_2}{2q - p_1 - p_2}\right), \tag{13}$$

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 A1. D's chance is also increasing in q.

[44] Figure A1 also indicates the knife-edge asymmetric pure strategy equilibria. We henceforth keep these out of the discussion.

[45] Figure A1a 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 A1c.

[46] 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).

[47] 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.

What are the takeaways from this generalization for the relation between the two indices, C and S? First, as seen from Figure A1, 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.

A.2.2 Asymmetric 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

$$\delta = \Pr(d = A) = \frac{q-k-p_2}{2q-p_1-p_2} \quad \text{and} \quad \rho = \Pr(r = A) = \frac{q-k-p_1}{2q-p_1-p_2}, \tag{14}$$

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

$$S = 2\frac{(q-p_1)(q-p_2)+k^2}{(2q-p_1-p_2)^2}, \tag{15}$$

which increases in k. The competitiveness index is

$$C = \min\left(\frac{q^2 - p_1 p_2 - k^2}{2q - p_1 - p_2}, 1 - \frac{q^2 - p_1 p_2 - k^2}{2q - p_1 - p_2}\right), \tag{16}$$

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.

A.3 Modeling Entry into Advertising

The text analysis assumes that both candidates must advertise either one theme or the other. Here, we analyze endogenous advertising when there is an opportunity cost to advertising, $F \geq 0$ (i.e., the funds could be used elsewhere), as well as a net inherent benefit, z (i.e., increased candidate recognition due to advertising).

We consider a two-stage game with the first stage the choice of whether to advertise or not, and the second stage follows the text analysis if both advertise, presented in Section 2.1. If neither candidate advertises, payoffs are just the prior probabilities of winning, so q for candidate D. We take a simple form for payoffs if only one advertises by simply adding z to that candidate's payoff (and therefore subtracting it from the other's) while taking off the cost to the advertiser. Thus, we assume that the payoff matrix is:

		Republican (R): *Ad*	Republican (R): *Not*
Democrat (D)	*Ad*	$\gamma - F,\ 1 - \gamma - F$	$q + z - F,\ 1 - q - z$
	Not	$q - z,\ 1 - q + z - F$	$q,\ 1 - q$

where $\gamma \in [0, 1]$ represents D's equilibrium probability from the text analysis in the case that both advertise.[48] Indeed, all the relevant win probabilities should be in $[0, 1]$, so $q + z \leq 1$, $q - z \geq 0$, etc.

[48] It is $\gamma = q$ when the equilibrium has both advertising the same theme, and D's mixed strategy equilibrium payoff, $\frac{p(1-p)-q^2}{1-2q}$, otherwise.

We now show that there is almost always a unique equilibrium and it is in pure strategies.[49] These are *strict* equilibria because each agent strictly prefers their equilibrium action given the other's. Because there is (almost always) a single pure strategy equilibrium, there cannot be a non-degenerate Mixed Strategy Equilibrium.

We first determine (by inspection of the matrix) when any strategy pair is an equilibrium. Then we determine the equilibria in the full game by superimposing the advertising conditions over the conditional strategy choices from the text game.

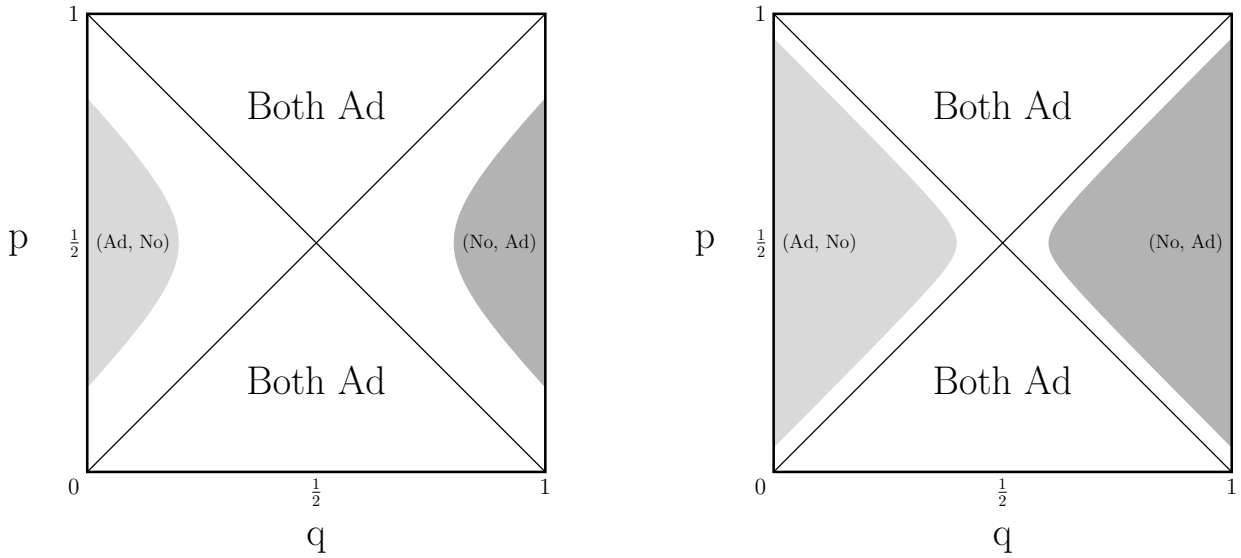
1. (Not, Not) is a strict equilibrium iff $F > z$;
2. (Ad, Not) is a strict equilibrium iff $z > F$ and $\gamma - q > z - F$ (D condition and R condition, respectively);
3. (Not, Ad) is a strict equilibrium iff $q - \gamma > z - F$ and $z > F$;
4. (Ad, Ad) is a strict equilibrium iff $F - z < q - \gamma < z - F$.

It is readily verified that these equilibrium conditions are mutually exclusive, and hence equilibrium is unique. In particular, neither advertising is the unique equilibrium for $F > z$: neither candidates advertise if the cost exceeds the benefit it brings. Conversely, at least one will advertise if $z > F$, and this constitutes the remaining cases. Observe that only the size of the *difference* in net benefit from advertising $z - F$ matters to equilibrium type because this determines the incentive to deviate. Likewise, only the size of win probability difference $\gamma - q$ is important because this is what switches for win probability.

Figure A2 illustrates 2 parameter values with $F < z$ such that at least one candidate advertises. Notice that a larger F, and thus a smaller net benefit from advertising $z - F$, reduces the parameter set with both advertising. Additionally, more symmetry in p makes

[49] We disregard for simplicity knife-edge parameter cases. This means we will find the equilibria to the game above assuming no ties in strategies (e.g., $F \neq z$, $\gamma - q \neq F - z$, $q - \gamma \neq F - z$). It amounts to ruling out zero-probability parameter combinations (e.g., if parameters in any given game were drawn from non-degenerate distributions).

Figure A2: Solution for the Entry Game



(a) F=0.35, z=0.5 (b) F=0.45, z=0.5

Notes: Both candidates advertise in the white regions. In the light grey region (on the left of each figure), only D advertises, and in the dark grey region (on the right of each figure), only R advertises.

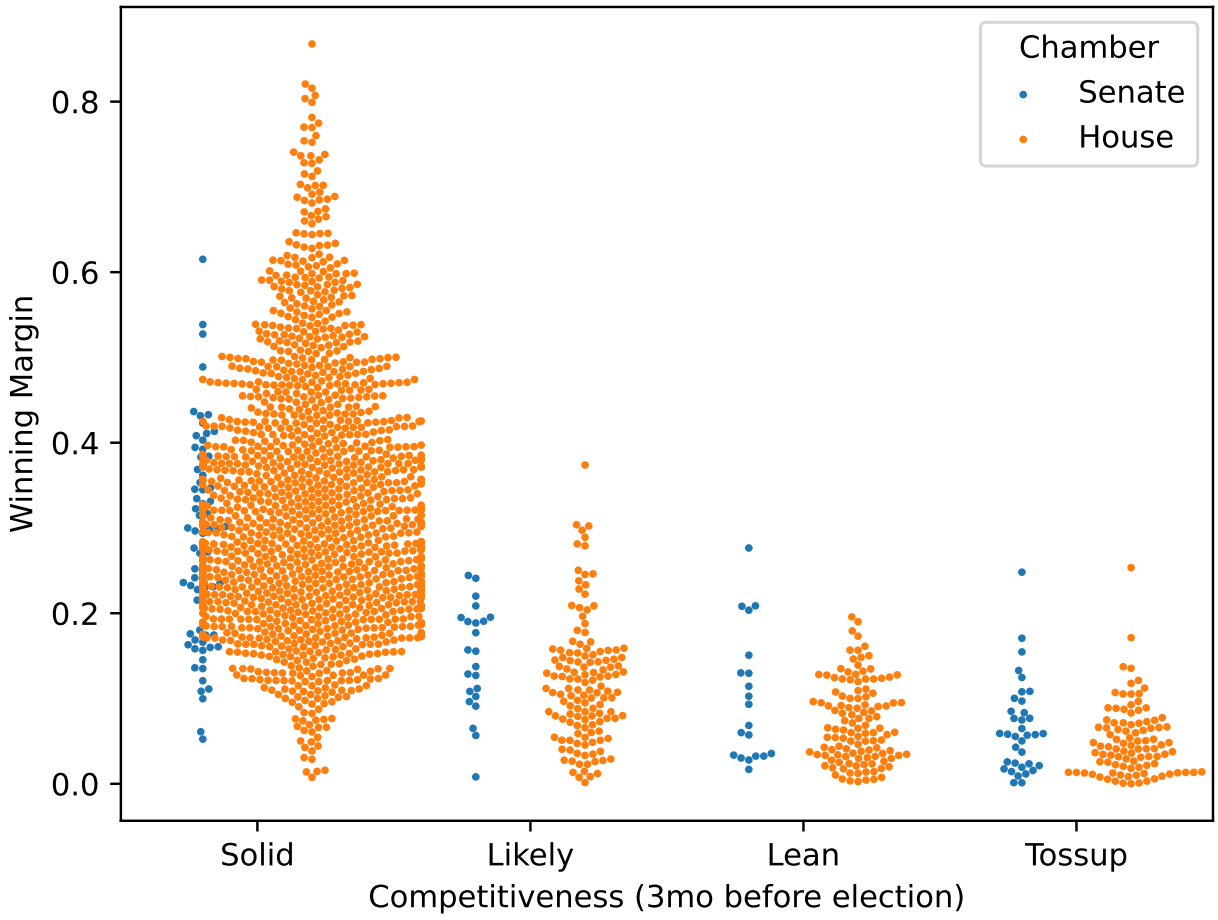
one-sided advertising more likely because it reduces the ability of the candidates to use advertising to differentiate themselves.

Appendix B Supplementary Data Materials

B.1 Cook Political Report Data

Figure B1 presents a validation exercise for our measure of race competitiveness by comparing Cook Political Report (CPR) ratings—recorded three months prior to election day with the corresponding final vote margins. Each point represents a race, with the horizontal axis indicating the categorical CPR ratings and the vertical axis showing the final vote margin. The figure reveals that races rated as more competitive (e.g., Tossup) tend to exhibit narrower margins, whereas those classified as less competitive (e.g., Solid) display wider margins.

Figure B1: Cook Political Report Rating vs. Final Vote Margin



Notes: This figure compares CPR competitiveness ratings from 3 months prior to the election to the race's final winning margin. Each observation is a race.

B.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 B2, we present the list of issues within each theme.

Figure B2: 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

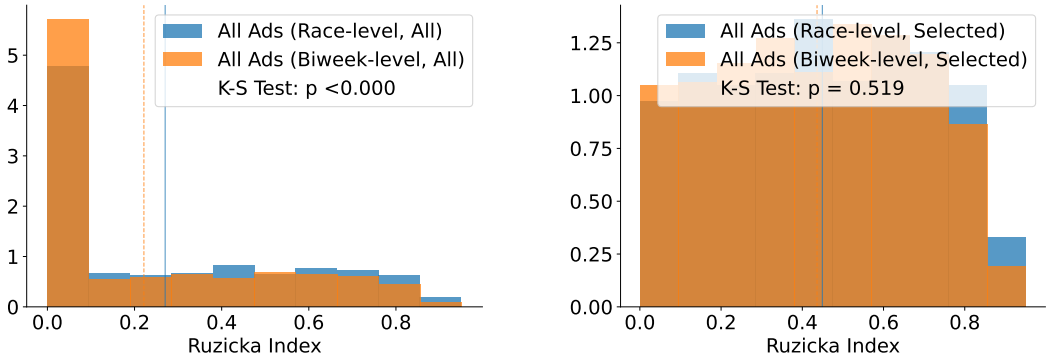
Campaign Finance Reform; Corporate Fraud; DACA/Dreamers; Description of other issue mentioned; Emergency Preparedness/Response; Government Ethics/Scandal; Government Regulations; Government Shutdown; Impeachment; Immigration; Local Issues; Other; Pledge of Allegiance (restrictions on); Socialism; Term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

Appendix C Additional Descriptive Evidence Regarding Dialogue

Figure C1 offers additional descriptive evidence on messaging similarity by displaying the distribution of the Ruzicka index calculated at the race- and race-biweek levels. Panel (a) reports spending by affiliate, panel (b) by period, and panel (c) by campaign theme. For each panel, two distributions are presented. One set reflects all race observations, while the other is restricted to races where both candidates advertise. Notably, Kolmogorov–Smirnov tests reveal that when all ads are considered, the distributions at the race and race-biweek levels differ significantly ($p < 0.000$). In contrast, in the selected sample—where both candidates advertise—the distributions are not statistically distinct for spending by affiliate ($p = 0.649$) and by period ($p = 0.517$). However, the selected sample distributions do differ for spending by campaign theme ($p < 0.000$).

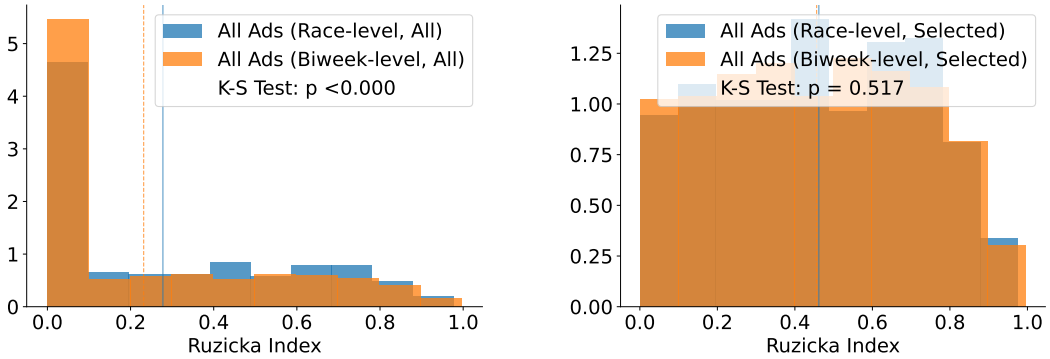
These patterns underscore how, particularly for theme choice, disaggregated data can exhibit different levels of measured similarity. Moreover, the comparisons between the All Airings and Selected Sample case demonstrate that disaggregation can mechanically lower the measured similarity (at least partially), thus highlighting the importance of conditioning on concurrent advertising when interpreting dialogue in political advertising.

Figure C1: Ruzicka Index of Ad Spending at the Race and Race-Biweek Levels



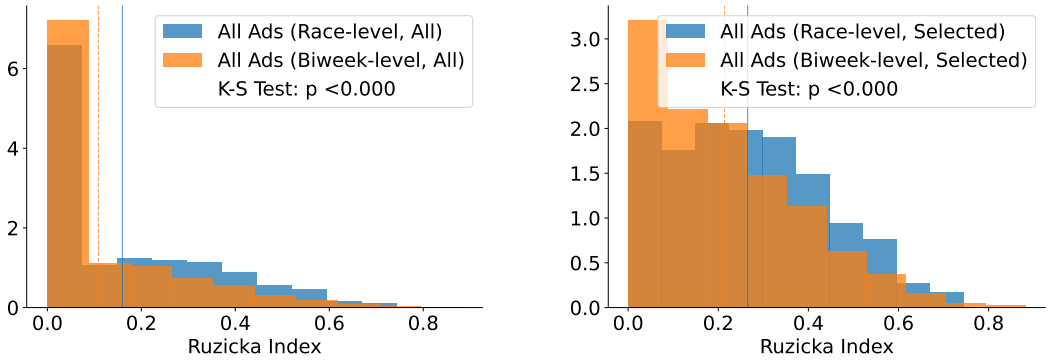
All Airings Selected Sample

(a) Spending by Affiliate



All Airings Selected Sample

(b) Spending by Period



All Airings Selected Sample

(c) Spending by Theme

This figure presents overlapping distributions of the Ruzicka index (Equation (6)) calculated at the race- and race-biweek levels. Panel (a) reports spending by affiliate, panel (b) by period, and panel (c) by campaign theme. The left figure in each panel includes all race observations, while the figure on the right is restricted to races where both candidates advertise. The p-value from Kolmogorov–Smirnov tests comparing the two distributions are presented in the legend of each figure.

Appendix D Additional Results for Section 5: The Determinants of Dialogue in Political Advertising

D.1 Race-Biweek-Affiliate-Period Level

In the main text, we estimate Equation (9) using race- and race-biweek-level data. Here we consider a further disaggregation of the data, where we interpret dialogue as occurring when the ads reach the same audiences and discuss the same topics *in the strictest sense.* The observations are now defined 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 narrow down the definition of dialogue to include the same affiliate and time of day.

D.2 Unconditional Disaggregated Results

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

Table D1: 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	-0.0524	-0.2963***	-0.0282	-0.3124***	0.1071	-0.2001***
	(0.0471)	(0.0137)	(0.0414)	(0.0134)	(0.0669)	(0.0211)
Tossup	0.3583**	0.9260***	0.2199	0.8574***	-0.1454	1.7796***
	(0.1646)	(0.0543)	(0.1415)	(0.0564)	(0.9358)	(0.3137)
Leaning	0.2999**	0.7270***	0.2158*	0.7103***	0.0039	1.2108***
	(0.1374)	(0.0518)	(0.1225)	(0.0547)	(0.6905)	(0.3152)
Likely	0.2445**	0.4871***	0.2024**	0.4892***	0.5536	0.4895
	(0.1073)	(0.0576)	(0.1019)	(0.0595)	(0.6749)	(0.3674)
Senate	0.1379*	0.5097***	0.0795	0.4844***	-0.4629*	0.6128***
	(0.0835)	(0.0446)	(0.0740)	(0.0462)	(0.2379)	(0.1232)
Median Income	-0.0783***	-0.0923***	-0.0618***	-0.0901***	-0.0140	-0.2345***
	(0.0204)	(0.0152)	(0.0206)	(0.0157)	(0.1424)	(0.0686)
Pct. Unemployed	-4.2428***	-3.4738**	-3.6578**	-3.8914**	-5.3676	-14.5386***
	(1.4804)	(1.4527)	(1.4409)	(1.5507)	(9.4097)	(4.5856)
Pct. Age 65+	-1.8486***	-0.8311	-1.6358***	-0.8415	-0.0471	-0.8716
	(0.5330)	(0.6042)	(0.5376)	(0.6494)	(2.8631)	(2.2070)
ρ	0.0445		-0.1195		-0.5232	
ρ SE	0.2494		0.1962		0.4432	
N	144288		144288		144288	

Notes: This table reports race-biweek-affiliate-period-level estimates from our model of dialogue in political advertising (Equation (9)). Each observation is a race-biweek-affiliate-period (e.g., a congressional district or Senate race in a given election cycle for a specific two-week period, on a specific television affiliate, during a given period of the day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.3 Race-Biweek Estimates with Lagged Spending and Competitiveness Measures

In this section, we re-estimate our model, Equation (9), at the race-biweek level with lagged versions of the excluded spending measures $S_{m,t}$ and lagged versions of our competitiveness measures $X_{1,m,t}$.

In our primary analysis, our excluded spending measures, $S_{m,t}$, are constructed as two variables accounting for the product of total expenditure by Democrats in the state and total expenditure by the Republicans in the state (excluding the focal race), and the product of

Table D2: 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	-0.0734***	-0.4464***	-0.0827***	-0.4492***	0.1458**	-0.2226***
	(0.0163)	(0.0210)	(0.0194)	(0.0215)	(0.0667)	(0.0299)
Tossup	0.5778***	2.7916***	0.5230***	2.6218***	-0.5471	2.4004***
	(0.1458)	(0.1074)	(0.1606)	(0.1045)	(1.3460)	(0.3168)
Leaning	0.4855***	2.4038***	0.4757***	2.3272***	-0.3707	1.7182***
	(0.1357)	(0.1001)	(0.1495)	(0.0999)	(1.0035)	(0.3128)
Likely	0.4035***	1.7420***	0.4185***	1.7080***	0.3451	0.8330**
	(0.1182)	(0.0947)	(0.1285)	(0.0952)	(0.8654)	(0.3711)
Senate	0.1401***	1.2438***	0.1275**	1.1666***	-0.5983**	0.7938***
	(0.0521)	(0.0919)	(0.0592)	(0.0918)	(0.2816)	(0.1387)
Median Income	-0.0819***	-0.2108***	-0.0778***	-0.2016***	0.0253	-0.2581***
	(0.0165)	(0.0248)	(0.0183)	(0.0245)	(0.1606)	(0.0720)
Pct. Unemployed	-5.2919***	-16.7289***	-5.5236***	-17.4484***	-3.5661	-16.8521***
	(1.5986)	(2.5643)	(1.6434)	(2.6188)	(11.4551)	(5.6090)
Pct. Age 65+	-1.5463***	-0.1785	-1.6244***	-0.0879	-0.5588	-0.5195
	(0.5579)	(0.9249)	(0.5844)	(0.9219)	(3.1431)	(2.3807)
ρ	0.1591*		0.1390		-0.6597	
ρ SE	0.0858		0.0960		0.4206	
N	20921		20921		20921	

Notes: The results in this table correspond to Table 6, which was estimated using a sample of races conditional on both candidates advertising at least once during the election cycle. This table reports *unconditional* race-biweek level empirical estimates from our model of dialogue in political advertising (Equation (9)). Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D3: 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	-0.0676**	-0.2896***	-0.0599*	-0.3034***	0.0963	-0.1968***
	(0.0303)	(0.0130)	(0.0308)	(0.0127)	(0.0800)	(0.0210)
Tossup	0.5170**	1.8428***	0.3514	1.7765***	-0.1509	2.1907***
	(0.2441)	(0.0586)	(0.2380)	(0.0605)	(1.2468)	(0.2914)
Leaning	0.4461**	1.6352***	0.3310	1.6191***	-0.0458	1.6092***
	(0.2241)	(0.0568)	(0.2196)	(0.0584)	(0.9512)	(0.2873)
Likely	0.3641*	1.2654***	0.2899	1.2655***	0.4806	0.8535**
	(0.1858)	(0.0623)	(0.1844)	(0.0634)	(0.8041)	(0.3414)
Senate	0.1875**	0.7334***	0.1365	0.7120***	-0.4346	0.6411***
	(0.0846)	(0.0544)	(0.0851)	(0.0561)	(0.2902)	(0.1241)
Median Income	-0.0864***	-0.1211***	-0.0729***	-0.1194***	-0.0316	-0.2448***
	(0.0194)	(0.0156)	(0.0208)	(0.0158)	(0.1609)	(0.0678)
Pct. Unemployed	-4.9819***	-9.4713***	-4.2628**	-9.9003***	-6.4059	-15.3243***
	(1.7710)	(1.6574)	(1.7615)	(1.7385)	(10.3880)	(4.4704)
Pct. Age 65+	-1.8178***	-0.1300	-1.7074***	-0.1534	-0.0540	-1.0035
	(0.5105)	(0.6650)	(0.5258)	(0.6664)	(2.9528)	(2.1676)
ρ	0.1376		0.0429		-0.4444	
ρ SE	0.1773		0.1675		0.5290	
N	502104		502104		502104	

Notes: The results in this table correspond to Table D1, which was estimated using a sample of races conditional on both candidates advertising at least once during the election cycle. This table reports *unconditional* race-biweek-affiliate-period level empirical estimates from our model of dialogue in political advertising (Equation (9)). Each observation corresponds to a single race-biweek-affiliate-period (e.g., a congressional district or Senate race in a given election cycle for a specific two-week period, on a specific television affiliate, during a given period of the day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D4: 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	-0.0581***	-0.4937***	-0.0681***	-0.4915***	0.1305***	-0.2461***
	(0.0169)	(0.0243)	(0.0191)	(0.0239)	(0.0339)	(0.0340)
Tossup	0.3706***	1.7754***	0.3425***	1.5637***	-0.5582	1.9499***
	(0.0715)	(0.1232)	(0.0747)	(0.1174)	(0.5648)	(0.3487)
Leaning	0.2926***	1.3871***	0.3060***	1.2711***	-0.3676	1.2856***
	(0.0684)	(0.1121)	(0.0717)	(0.1121)	(0.4296)	(0.3487)
Likely	0.2463***	0.8483***	0.2799***	0.8012***	0.3947	0.4330
	(0.0667)	(0.1102)	(0.0686)	(0.1100)	(0.6063)	(0.4044)
Senate	0.0844*	1.0145***	0.0780*	0.9086***	-0.6187***	0.7540***
	(0.0439)	(0.1047)	(0.0464)	(0.1030)	(0.1615)	(0.1390)
Median Income	-0.0722***	-0.2205***	-0.0689***	-0.2025***	0.0408	-0.2450***
	(0.0158)	(0.0313)	(0.0174)	(0.0311)	(0.0965)	(0.0726)
Pct. Unemployed	-4.3638***	-10.5746***	-4.6339***	-11.8633***	-3.3498	-16.0596***
	(1.4783)	(3.1750)	(1.4642)	(3.2503)	(6.4351)	(5.8903)
Pct. Age 65+	-1.5744***	-1.4088	-1.6549***	-1.1381	-0.1412	-0.4609
	(0.5570)	(1.1348)	(0.5851)	(1.2192)	(2.9912)	(2.4570)
ρ	0.0670		0.0541		-0.7122***	
ρ SE	0.0781		0.0837		0.1938	
N	5564		5562		5561	

Notes: This table reports race-biweek-level estimates from our model of dialogue in political advertising (Equation (9)) with lagged spending measures. Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

total expenditure by Democrats in the nation and total expenditure by the Republicans in the nation (excluding the focal race). Here, we construct these measures using lagged rather than contemporaneous expenditure measures to avoid possible contemporaneous shocks that might affect all races. We present the results of this exercise in Table D4. The results using lagged spending measures closely mirror our primary findings, which employ contemporaneous spending measures, presented in Table 6.

Similarly, in the main text of our paper, we use contemporaneous measures of race competitiveness collected from the Cook Political Report. One possible concern with this approach is that contemporaneous shocks should affect both competitiveness and equilibrium messaging selection and similarity. Thus, we re-estimate Equation (9) here using lagged

measures of race competitiveness, which would be unaffected by unobserved shocks at the race-biweek level. We present the results of this exercise in Table D5. The results using lagged competitiveness measures closely mirror our primary findings in the "All" and "Candidate" samples, which employ contemporaneous competitiveness measures, presented in Table 6. This provides reassurance that the primary findings of our paper are not biased by a common, unobserved factor driving both selection and similarity in candidate advertising.

The one possible exception to this finding is column (5), which shows strong evidence of *divergence* by third-party advertisers in response to increased race competitiveness. This differs from our primary finding in column (5) of Table 6 where we failed to find statistically significant evidence of an effect of competitiveness on third-party advertising similarity (though, the estimated coefficients on Leaning and Tossup in Table 6 were both negative).

As a final robustness check, we re-estimate Equation (9) using both lagged spending and lagged competitiveness measures. We present the results of this analysis in Table D6. The results closely mirror those in Table D5.

D.4 Consideration of the Role of Presidential Advertisements in House and Senate Races

Our primary analysis draws on data from U.S. House and Senate races in 2012, 2014, 2016, 2018, and 2020. Three of these election cycles (2012, 2016, and 2020) coincide with a U.S. presidential election. In this section, we examine whether candidates' proclivity for dialogue differs between presidential and non-presidential election cycles. Specifically, we conduct two robustness exercises.

First, we test whether our results hold across different election cycles by reproducing our primary regression analyses using data only from the non-presidential election cycles (2014 and 2018). Second, we consider whether candidates might rely on presidential advertising as part of their overall communication strategy. For instance, advertisements aired by the Republican presidential candidate in a given House district could be seen as part of the

Table D5: Empirical Results: Race-Biweek-Level Themes (Lagged Competitiveness Measures)

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0676***	-0.4838***	-0.0722***	-0.4812***	0.1709***	-0.2356***
	(0.0183)	(0.0248)	(0.0230)	(0.0246)	(0.0359)	(0.0344)
Tossup	0.4091***	1.7837***	0.3660***	1.5667***	-1.7545***	1.8013***
	(0.0766)	(0.1231)	(0.0837)	(0.1172)	(0.4495)	(0.2759)
Leaning	0.2760***	1.3647***	0.2840***	1.2536***	-1.2862***	1.1428***
	(0.0712)	(0.1152)	(0.0776)	(0.1148)	(0.4311)	(0.2787)
Likely	0.2726***	0.8495***	0.2995***	0.8010***	-0.8906	0.4111
	(0.0659)	(0.1107)	(0.0692)	(0.1106)	(0.5441)	(0.3154)
Senate	0.0896**	0.9945***	0.0771	0.8916***	-0.6956***	0.7387***
	(0.0448)	(0.1053)	(0.0493)	(0.1033)	(0.1425)	(0.1394)
Median Income	-0.0757***	-0.2222***	-0.0715***	-0.2043***	0.1148	-0.2532***
	(0.0162)	(0.0315)	(0.0181)	(0.0313)	(0.1014)	(0.0732)
Pct. Unemployed	-4.4077***	-10.5186***	-4.6834***	-11.8032***	1.9936	-16.1529***
	(1.4840)	(3.1992)	(1.4932)	(3.2786)	(7.5795)	(5.8387)
Pct. Age 65+	-1.5993***	-1.5448	-1.6781***	-1.2317	-0.5492	-0.5719
	(0.5573)	(1.1544)	(0.5877)	(1.2393)	(2.6945)	(2.4240)
ρ	0.1093		0.0713		-0.9033***	
ρ SE	0.0878		0.1009		0.1151	
N	5476		5476		5476	

Notes: This table reports race-biweek-level empirical estimates from our model of dialogue in political advertising (Equation (9)) with lagged competitiveness measures. Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D6: Empirical Results: Race-Biweek-Level Themes (Lagged Spending and Competitiveness Measures)

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0681***	-0.4884***	-0.0723***	-0.4872***	0.1763***	-0.2419***
	(0.0185)	(0.0245)	(0.0231)	(0.0241)	(0.0325)	(0.0340)
Tossup	0.4111***	1.7841***	0.3667***	1.5671***	-1.7896***	1.7962***
	(0.0771)	(0.1231)	(0.0844)	(0.1173)	(0.3922)	(0.2754)
Leaning	0.2776***	1.3643***	0.2845***	1.2535***	-1.2724***	1.1413***
	(0.0715)	(0.1150)	(0.0779)	(0.1146)	(0.3913)	(0.2782)
Likely	0.2736***	0.8497***	0.3000***	0.8012***	-0.8121*	0.4125
	(0.0660)	(0.1105)	(0.0693)	(0.1104)	(0.4856)	(0.3156)
Senate	0.0904**	0.9950***	0.0773	0.8930***	-0.7252***	0.7354***
	(0.0449)	(0.1057)	(0.0494)	(0.1037)	(0.1318)	(0.1388)
Median Income	-0.0760***	-0.2218***	-0.0716***	-0.2038***	0.1341	-0.2534***
	(0.0163)	(0.0315)	(0.0181)	(0.0313)	(0.0919)	(0.0732)
Pct. Unemployed	-4.4171***	-10.4963***	-4.6866***	-11.8014***	3.3978	-16.2680***
	(1.4855)	(3.2031)	(1.4939)	(3.2798)	(6.8065)	(5.8589)
Pct. Age 65+	-1.5991***	-1.5224	-1.6769***	-1.2252	-0.4463	-0.7025
	(0.5576)	(1.1492)	(0.5879)	(1.2338)	(2.5791)	(2.4118)
ρ	0.1122		0.0722		-0.9379***	
ρ SE	0.0886		0.1013		0.0688	
N	5476		5476		5476	

Notes: This table reports race-biweek-level empirical estimates from our model of dialogue in political advertising (Equation (9)) with lagged spending and competitiveness measures. Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

advertising portfolio for the Republican House candidate in that district. To explore this possibility, we assign presidential advertisements—which were excluded from our primary analysis—to House and Senate candidates based on party affiliation and the media markets in which the advertisements aired. We then replicate our primary regression analysis with this expanded dataset.

D.4.1 Estimation Results for Non-Presidential Election Cycles (2014, 2018)

In Tables D7 and D8, we present the results of reproducing Tables 5 and 6 using only data from the non-presidential election cycles (2014 and 2018). Across all specifications, the qualitative results remain consistent with the paper's primary findings, although the competitiveness-ownership relationship is somewhat weaker than when all election cycles are included. Unsurprisingly, the estimated coefficients are also less precisely estimated after dropping three of the five election cycles in our data.

D.4.2 Estimation Results Including Presidential Advertisements

During presidential election cycles, down-ballot candidates (such as the House and Senate candidates studied here) may treat advertising by their party's presidential candidate as part of their own messaging strategy. To the extent that voters perceive parties as homogeneous or that down-ballot candidates align themselves with their party's presidential contender, these presidential advertisements could effectively function as messaging for House and Senate campaigns. To test whether this dynamic affects our results, we incorporate presidential advertisements from the 2012, 2016, and 2020 election cycles, treating them *as if they were aired by the corresponding House and Senate candidates*. We then re-estimate Equation (9) using this augmented dataset. In this section, we describe how the combined House/Senate + Presidential dataset was constructed and present the results of the re-estimation.

We use broadcast television advertising data from the Wesleyan Media Project (WMP) (Fowler, Franz, and Ridout, 2015; Fowler et al., 2019, 2023) for the 2012, 2016, and 2020 U.S.

Table D7: Empirical Results for Non-Presidential Election Cycles (2014, 2018): Race-Level Themes

	All		Candidate		Third Party		Only
	Similarity	Selection	Similarity	Selection	Similarity	Selection	Similarity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tossup	0.8754**	2.9891***	0.7844**	2.5711***	-0.9207	2.4871***	0.5558***
	(0.4088)	(0.3607)	(0.3590)	(0.3074)	(0.8017)	(0.3050)	(0.1044)
Leaning	0.6556*	2.3250***	0.6329*	2.2401***	-0.9050	1.8748***	0.3653***
	(0.3793)	(0.2622)	(0.3481)	(0.2530)	(0.6305)	(0.3026)	(0.1035)
Likely	0.3909	1.6306***	0.4047	1.5401***	-0.3856	0.7021**	0.1547
	(0.3231)	(0.1847)	(0.2869)	(0.1817)	(0.4185)	(0.3426)	(0.1137)
Senate	0.1446	1.0820***	0.1879*	1.0764***	-0.3795	0.7658***	0.0804
	(0.1056)	(0.2912)	(0.1094)	(0.2818)	(0.2665)	(0.2938)	(0.0843)
Median Income	-0.1013***	-0.2678***	-0.0906***	-0.2652***	0.1081	-0.3722***	-0.0872***
	(0.0342)	(0.0574)	(0.0350)	(0.0574)	(0.1256)	(0.1046)	(0.0306)
Pct. Unemployed	-2.0650	-26.8893***	-3.2364	-27.9508***	10.2964	-32.9555***	0.0589
	(3.8585)	(5.5929)	(3.7848)	(5.5519)	(8.1475)	(8.8516)	(3.1310)
Pct. Age 65+	-3.1608***	1.9414	-2.3142*	0.7554	1.9943	-1.7172	-3.4543***
	(1.1987)	(2.0288)	(1.2388)	(2.0253)	(3.0948)	(4.1352)	(1.2395)
ρ	0.2414		0.2819		-0.2844		—
ρ SE	0.3019		0.2853		0.3446		—
N	746		746		746		221

Notes: This table reports race-level estimates from our model of dialogue in political advertising (Equation (9)), only using data from non-presidential election cycles (2014 and 2018). Each observation is an individual race. The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), (5) and (6) use third-party ads; and (7) presents the results of estimating the similarity model without the selection model. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D8: Empirical Results for Non-Presidential Election Cycles (2014, 2018): Race-Biweek-Level Themes

	All		Candidate		Third Party	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Biweeks to Election	-0.0570**	-0.4134***	-0.0362	-0.4190***	0.1941	-0.2242***
	(0.0279)	(0.0389)	(0.0471)	(0.0400)	(0.1218)	(0.0352)
Tossup	0.3034**	1.6133***	0.1966	1.3462***	-0.7770	1.7854***
	(0.1389)	(0.2063)	(0.1557)	(0.1962)	(1.5245)	(0.3966)
Leaning	0.2225*	1.3761***	0.1847	1.2946***	-0.0799	0.9996**
	(0.1202)	(0.1748)	(0.1444)	(0.1725)	(1.3146)	(0.3917)
Likely	0.1522	0.6821***	0.1350	0.6518***	0.1912	0.4369
	(0.1110)	(0.1859)	(0.1179)	(0.1801)	(0.9740)	(0.4428)
Senate	0.0793	1.0457***	0.0422	0.9757***	-0.8292***	0.6928***
	(0.0791)	(0.1762)	(0.0974)	(0.1697)	(0.2311)	(0.2362)
Median Income	-0.0506*	-0.2540***	-0.0417	-0.2311***	0.0199	-0.2353**
	(0.0273)	(0.0509)	(0.0325)	(0.0496)	(0.3149)	(0.1084)
Pct. Unemployed	-3.2281	-11.1283**	-2.0146	-9.9633**	2.2297	-14.5986*
	(2.4428)	(4.9426)	(2.2235)	(4.9395)	(18.7060)	(7.5040)
Pct. Age 65+	-1.6712*	-3.7826**	-1.8495*	-3.3246*	-4.2710	3.4015
	(0.9738)	(1.8608)	(0.9481)	(1.8568)	(4.3986)	(3.8543)
ρ	0.0202		-0.0919		-0.8110	
ρ SE	0.1430		0.1951		0.5129	
N	2652		2652		2652	

Notes: This table reports race-biweek-level empirical estimates from our model of dialogue in political advertising (Equation (9)) only using data from non-presidential election cycles (2014 and 2018). Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all ads, (3) and (4) focus on candidate ads (or coordinated party–candidate efforts), and (5) and (6) use third-party ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

presidential elections. This is the same source we use for the House and Senate advertising data (see Section 3.1 of the paper for additional details). Each observation in the WMP dataset corresponds to a single ad airing.

Each ad airing is assigned a Designated Market Area (DMA), which indicates the media market in which it aired. To associate the presidential advertisements with House and Senate candidates, we proceed as follows. First, for each House and Senate race, we identify all DMAs in which the candidates aired ads. We then assign each presidential ad to *every* race that is linked to the DMA for that airing. For example, consider a Democratic presidential ad aired on a specific day and time in 2012 in Lansing, Michigan (DMA 117). Because DMA 117 is associated with both Michigan's 8$^{\text{th}}$ District House race and the state's Senate race, we associate that single presidential ad airing with the Democratic candidate in Michigan's 8$^{\text{th}}$ District and the Democratic Senate candidate. Consequently, one presidential ad airing can be linked to multiple races. After merging the datasets in this way, we construct the final dataset using the same procedure as in our main analysis.

We present the results of this analysis in Table D9. In columns (1) and (2), we present the estimates using race-level data, which corresponds to columns (1) and (2) of Table 5. In columns (3) and (4) we present the estimates from using race-biweek-level data, which corresponds to columns (1) and (2) of Table 6. Overall, we find that inclusion of the presidential advertising *weakens* the extent of issue convergence. In the race-level analysis (column (1)), we fail to find statistically significant evidence in support of this theory, and in the race-biweek-level analysis (column (2)), the slope of that relationship roughly declines by half. Our finding that the issue convergence relationship weakness (and possibly disappears) when presidential advertisements are considered as part of House and Senate candidates' advertising portfolios suggest that as races becomes more competitive, the issue convergence that occurs is between the local (i.e., House/Senate) candidates, not between the combined local + national campaigns.

Across both the race- and race-biweek-level results, the selection effect remains. This

Table D9: Empirical Results: Race- and Race-Biweek-Level Themes Including Presidential Advertising

	Race-Level		Race-Biweek-Level	
	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)
Biweeks to Election			-0.0235*	-0.3373***
			(0.0129)	(0.0154)
Tossup	0.5047	2.9717***	0.1793***	1.3048***
	(0.3403)	(0.2903)	(0.0618)	(0.1191)
Leaning	0.3235	2.4151***	0.1807***	1.0735***
	(0.3288)	(0.1922)	(0.0580)	(0.1154)
Likely	0.3133	1.6471***	0.1725***	0.6171***
	(0.2707)	(0.1298)	(0.0533)	(0.1132)
Senate	0.0181	1.3054***	0.0445	0.7876***
	(0.1136)	(0.1652)	(0.0390)	(0.1061)
Median Income	-0.0464**	-0.1822***	-0.0496***	-0.1469***
	(0.0234)	(0.0285)	(0.0144)	(0.0352)
Pct. Unemployed	-2.8419	-21.5472***	-3.1306**	-11.2493***
	(3.0619)	(3.1541)	(1.4000)	(3.4326)
Pct. Age 65+	1.4580**	0.8883	0.6992	4.3954***
	(0.7009)	(1.1421)	(0.5341)	(1.4976)
ρ	-0.0274		-0.0953	
ρ SE	0.2972		0.0773	
N	1878		6012	

Notes: This table reports race- and race-biweek-level estimates from our model of dialogue in political advertising (Equation (9)) using a dataset that includes presidential advertisements *as if* they were aired by House and Senate candidates. Presidential ads are associated with congressional candidates based on the DMA in which they aired (see Appendix D.4.2 for more details). Each observation is a single race- or race-biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report race-level estimates using all ads, and (3) and (4) report race-biweek-level estimates using all ads. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors are reported in parentheses. Robust standard errors are reported for the race-level regression in columns (1) and (2), and standard errors are clustered at the race level for the race-biweek regression in columns (3) and (4). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

is likely due to the fact that as House and Senate races become more competitive, the associated districts likely become more competitive for the national candidates as well. For example, if Virginia's 3rd district becomes more competitive for the House, then the presidential candidates may also feel more inclined to battle for votes in that district.

Appendix E Analysis Using Disaggregated Campaign Issues

Table E1 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"[50]

Appendix F Analysis Using Alternative Indices

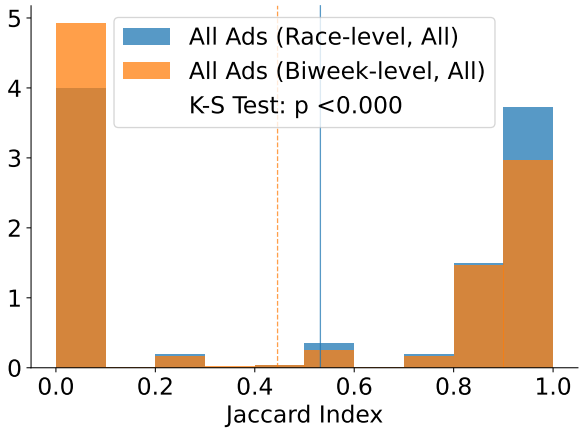
In the paper, we quantify dialogue using the Ruzicka Index Equation (6). In this appendix, we consider alternative approaches to characterizing dialogue. First, we present regression results corresponding to the tables in Section 5.2 that use the Jaccard (rather than the Ruzicka) index. Then, we consider 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.

Table E1: Campaign Issue Prevalence by Year, "1-percent sample"

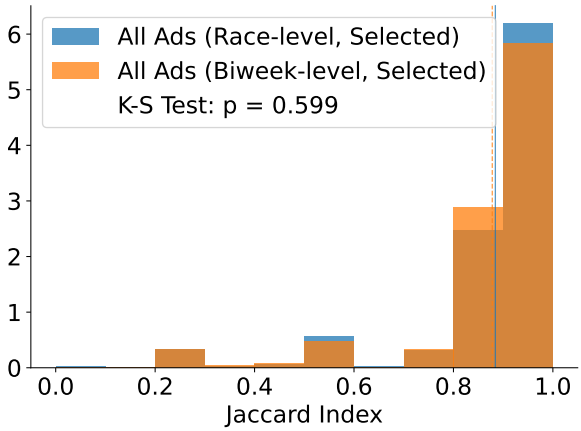
Year	2012	2014	2016	2018	2020
Taxes	14.06	9.30	7.66	8.85	5.41
Gender Discrimination (not LGBTQ-related)			1.94		
Seniors (not Medicare)			1.66	2.29	1.37
Emergency Preparedness					3.55
2017 Efforts at Health Reform/AHCA/Trumpcare				1.73	
Opioids/Rx Drug Abuse				2.03	
Deficit/Budget/Debt	8.95	6.17	2.23	2.42	
Medicare for all					1.99
Government Spending	5.67	4.45	4.16		1.76
Recession/Economic Stimulus	2.52				1.77
Minimum Wage		1.83			
Farming		1.81	1.91	1.41	1.62
Business	5.10	3.39	6.51	7.66	8.50
Employment/Jobs	14.60	13.03	10.01	6.95	6.97
Trade/Globalization	2.36	1.12	3.00	1.39	1.21
Domestic Violence/Sexual Assault/Harassment				1.24	
Disease/COVID19					8.26
Healthcare expansion/access					10.62
Substance Use Disorder				1.60	
Police Brutality/Racial Violence					2.46
Medical Bills					1.89
Economy (generic reference)	3.47	2.85	2.95	2.01	3.17
Protest/Riots					1.48
Tax Reform				1.63	
Abortion	1.76	1.40	1.21		
Moral/Family/Religious Values		1.86	8.78	3.23	1.60
Gun Control		1.58		1.68	1.41
Crime			2.17	2.68	
Narcotics/Illegal Drugs				1.93	
Supreme Court/Judiciary					1.35
Education/Schools	3.81	4.90	4.79	3.49	2.32
Health Care (not prescription drugs)	5.79	3.68	2.95	14.90	10.86
Prescription Drugs				2.32	3.77
Medicare	11.48	6.53	2.91	4.42	2.04
Social Security	5.19	4.94	3.33	3.43	
Women's Health	1.57	1.99	1.40		
Affordable Care Act / Obamacare / Health Care Law / etc.		5.85	1.99		
Military (generic reference)	1.49	3.21	4.48	3.60	3.40
Foreign Policy (generic reference)			1.78		
Veterans	2.68	5.26	5.25	6.21	4.47
China	1.81		1.81		1.83
Terror/Terrorism/Terrorist		1.16	2.48		
Iran			1.28		
Environment (generic reference)		1.32	1.65	1.29	
Energy Policy	3.37	4.11	1.76		1.55
Campaign Finance Reform			1.50	2.78	3.35
Government Ethics/Scandal	1.90	2.34	3.80	2.43	
Immigration		2.70	1.48	4.41	
Government Regulations	2.42	1.47	1.18		
Government Shutdown		1.75			

Notes: This table presents the percentage of advertisements in which a given issue is mentioned for each election cycle. Issues that are mentioned in less than 1% of airings are excluded from this analysis.

Figure F1: Jaccard Index of Ad Spending at the Race and Race-Biweek Levels

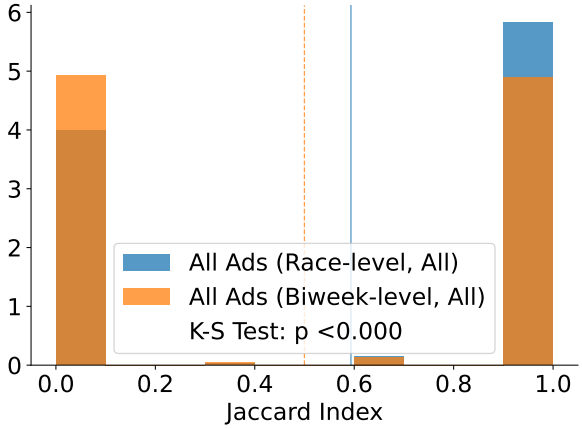


All Airings

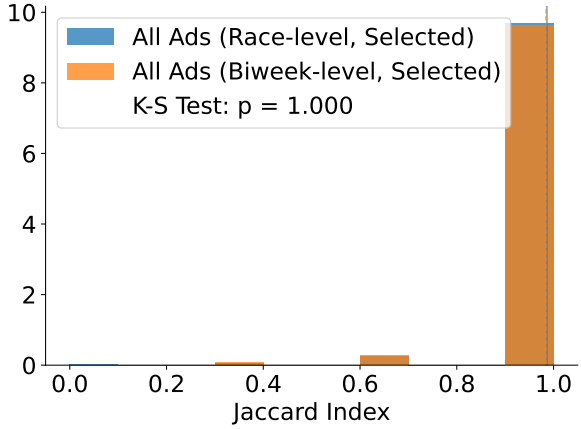


Selected Sample

(a) Spending by Affiliate

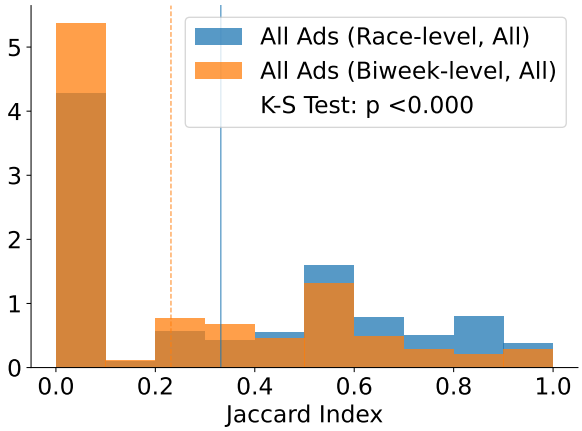


All Airings

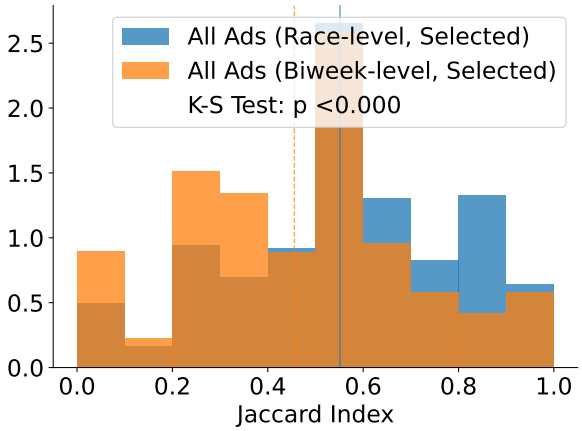


Selected Sample

(b) Spending by Period



All Airings



Selected Sample

(c) Spending by Theme

This figure presents overlapping distributions of the Jaccard index (Equation (2)) calculated at the race- and race-biweek levels. Panel (a) reports spending by affiliate, panel (b) by period, and panel (c) by campaign theme. The left figure in each panel includes all race observations, while the figure on the right is restricted to races where both candidates advertise. The p-value from Kolmogorov–Smirnov tests comparing the two distributions are presented in the legend of each figure.

Table F1: Empirical Results, Jaccard Index

	Similarity		Similarity
	Similarity	Selection	Similarity
	(1)	(2)	(3)
Tossup	1.0104***	2.8850***	0.6498***
	(0.2184)	(0.2134)	(0.0708)
Leaning	0.8666***	2.5278***	0.5195***
	(0.2090)	(0.1747)	(0.0658)
Likely	0.5594***	1.8073***	0.2747***
	(0.1814)	(0.1206)	(0.0749)
Senate	0.3281***	1.2033***	0.2215***
	(0.0798)	(0.1592)	(0.0632)
Median Income	-0.1023***	-0.1976***	-0.0892***
	(0.0217)	(0.0317)	(0.0209)
Pct. Unemployed	-2.3659	-22.1074***	-0.2779
	(2.3197)	(3.3928)	(2.0811)
Pct. Age 65+	-0.7552	0.2428	-0.8402
	(0.9289)	(1.2414)	(0.9459)
ρ	0.2584*		—
ρ SE	0.1470		—
N	1878		536

(a) Race-Level Themes

	Similarity	
	Similarity	Selection
	(1)	(2)
Biweeks to Election	-0.1026***	-0.4462***
	(0.0189)	(0.0211)
Tossup	0.7040***	2.7919***
	(0.1702)	(0.1074)
Leaning	0.6168***	2.4036***
	(0.1564)	(0.1001)
Likely	0.4914***	1.7425***
	(0.1385)	(0.0947)
Senate	0.2225***	1.2441***
	(0.0636)	(0.0918)
Median Income	-0.1018***	-0.2107***
	(0.0180)	(0.0248)
Pct. Unemployed	-4.4537**	-16.7407***
	(1.8608)	(2.5647)
Pct. Age 65+	-1.1161*	-0.1754
	(0.6651)	(0.9246)
State Spending		-405.6597
		(249.8429)
National Spending		-7.2634***
		(1.6609)
ρ	0.1633*	
ρ SE	0.0990	
N	20921	

(b) Race-Biweek-Level Themes

Notes: This table reports race- (panel (a)) and race-biweek-level (panel (b)) estimates from our model of dialogue in political advertising (Equation (9)) when messaging similarity is measured using a Jaccard Index (Equation (2)), rather than a Ruzicka Index as in the main analysis. Each observation is a race- or race-biweek. The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. In both panels, columns (1) and (2) report estimates using all observed advertising. In panel (a), column (3) presents the results of estimating the similarity model without the selection model. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). In panel (a), robust standard errors are in parentheses, and in panel (b) standard errors, clustered at the race level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

F.1 Jaccard Index

F.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

$$\sigma^{Similarity} = 1 - \frac{1}{2}\sum_k \left| \frac{D_k}{D} - \frac{R_k}{R} \right| \tag{17}$$

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.

F.3 Discounted Ruzicka Index

Finally, we characterize dialogue using a "Discounted Ruzicka" index, which is a variation of Equation (6) 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 period t we calculate

$$\sigma^{Ruzicka} = \frac{\sum_k \min\left\{\tilde{R}_{k,t}, \tilde{D}_{k,t}\right\}}{\sum_k \max\{\tilde{R}_{k,t}, \tilde{D}_{k,t}\}}, \tag{18}$$

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

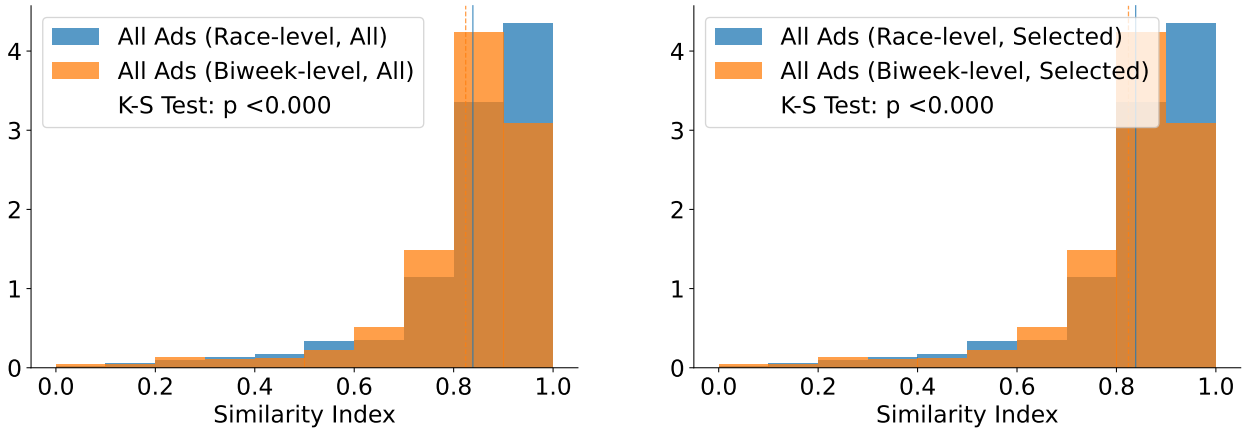
$$\tilde{R}_{k,t} = \sum_{\tau=0}^{t-t_0} \beta^\tau R_{k,t-\tau} \tag{19}$$

$$\tilde{D}_{k,t} = \sum_{\tau=0}^{t-t_0} \beta^\tau D_{k,t-\tau}. \tag{20}$$

In practice, we consider the 24 weeks prior to the election, so, for biweekly data, $t_0 = 12$.

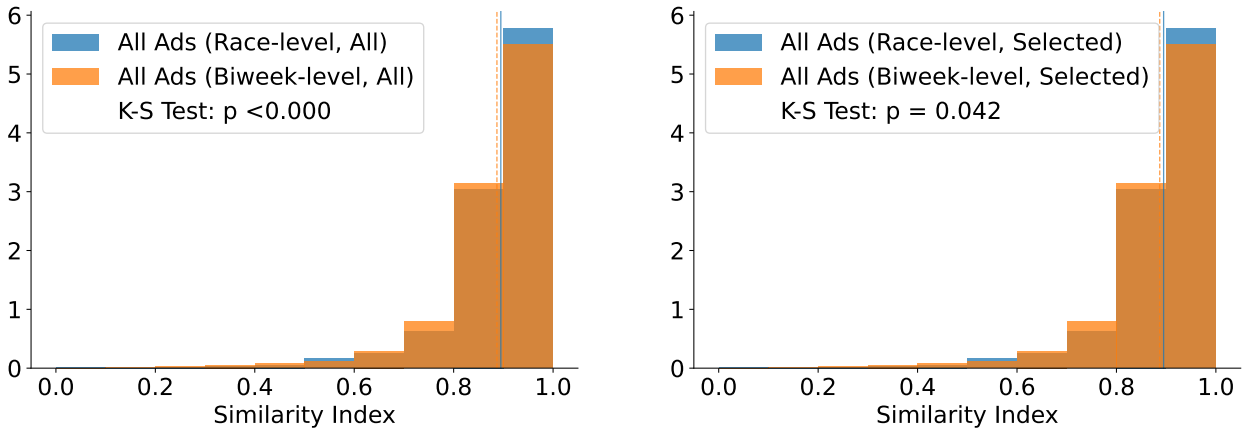
[50] There are two set of issues that we do not include in our analysis. One is "Other Issues," which encompasses a variety of very rarely mentioned issues. The other one is "Local Issues," since that includes a variety of possible local issues.

Figure F2: Similarity Index of Ad Spending at the Race and Race-Biweek Levels



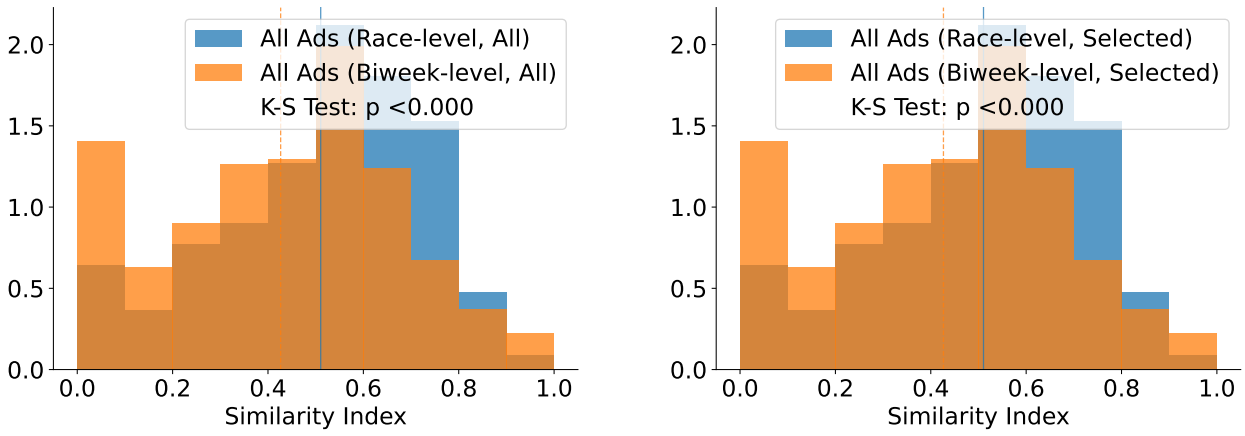
All Airings Selected Sample

(a) Spending by Affiliate



All Airings Selected Sample

(b) Spending by Period



All Airings Selected Sample

(c) Spending by Theme

This figure presents overlapping distributions of the Similarity index (Equation (17)) calculated at the race- and race-biweek levels. Panel (a) reports spending by affiliate, panel (b) by period, and panel (c) by campaign theme. The left figure in each panel includes all race observations, while the figure on the right is restricted to races where both candidates advertise. The p-value from Kolmogorov–Smirnov tests comparing the two distributions are presented in the legend of each figure.

Table F3: Empirical Results, Similarity Index

	Similarity		Similarity
	Similarity	Selection	Similarity
	(1)	(2)	(3)
Tossup	0.7335***	2.8842***	0.4769***
	(0.2177)	(0.2143)	(0.0599)
Leaning	0.5740***	2.5257***	0.3263***
	(0.2112)	(0.1750)	(0.0627)
Likely	0.4008**	1.8071***	0.1974***
	(0.1804)	(0.1207)	(0.0700)
Senate	0.1653**	1.1979***	0.0920*
	(0.0693)	(0.1607)	(0.0534)
Median Income	-0.0753***	-0.1978***	-0.0657***
	(0.0207)	(0.0316)	(0.0201)
Pct. Unemployed	-0.8616	-22.1292***	0.5853
	(2.1995)	(3.3985)	(1.9843)
Pct. Age 65+	-1.1607	0.2404	-1.2166
	(0.7816)	(1.2413)	(0.7863)
ρ	0.1832		—
ρ SE	0.1505		—
N	1878		536

(a) Race-Level Themes

	Similarity	
	Similarity	Selection
	(1)	(2)
Biweeks to Election	-0.0545***	-0.4466***
	(0.0189)	(0.0210)
Tossup	0.3790**	2.7916***
	(0.1741)	(0.1074)
Leaning	0.3109**	2.4033***
	(0.1580)	(0.1001)
Likely	0.2770*	1.7423***
	(0.1415)	(0.0946)
Senate	0.0635	1.2432***
	(0.0628)	(0.0920)
Median Income	-0.0666***	-0.2108***
	(0.0195)	(0.0248)
Pct. Unemployed	-3.3445*	-16.7280***
	(1.8431)	(2.5658)
Pct. Age 65+	-0.3712	-0.1788
	(0.6508)	(0.9250)
State Spending		-411.3296*
		(249.4998)
National Spending		-7.3208***
		(1.6562)
ρ	0.0659	
ρ SE	0.1007	
N	20921	

(b) Race-Biweek-Level Themes

Notes: This table reports race- (panel (a)) and race-biweek-level (panel (b)) estimates from our model of dialogue in political advertising (Equation (9)) when messaging similarity is measured using a Similarity Index (Equation (17)), rather than a Ruzicka Index as in the main analysis. Each observation is a race- or race-biweek. The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. In both panels, columns (1) and (2) report estimates using all observed advertising. In panel (a), column (3) presents the results of estimating the similarity model without the selection model. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). In panel (a), robust standard errors are in parentheses, and in panel (b) standard errors, clustered at the race level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In Table F5, 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 F5: Empirical Results: Discounted Ruzicka ($\beta = 0.95$), Race-Biweek-Level Themes

	Similarity	
	Similarity	Selection
	(1)	(2)
Biweeks to Election	-0.0949***	-0.4775***
	(0.0184)	(0.0255)
Tossup	0.5864***	1.7617***
	(0.0767)	(0.1224)
Leaning	0.4328***	1.3839***
	(0.0736)	(0.1113)
Likely	0.3449***	0.8487***
	(0.0756)	(0.1108)
Senate	0.2066***	1.0198***
	(0.0511)	(0.1036)
Median Income	-0.0948***	-0.2187***
	(0.0186)	(0.0315)
Pct. Unemployed	-4.9491***	-10.7463***
	(1.8096)	(3.1630)
Pct. Age 65+	-2.1618***	-1.4392
	(0.6556)	(1.1334)
State Spending		860.3885
		(702.4794)
National Spending		6.3876
		(3.8888)
ρ	0.1107	
ρ SE	0.0887	
N	6012	

Notes: This table reports race-biweek-level estimates from our model of dialogue in political advertising (Equation (9)) when messaging similarity is measured using a Discounted Ruzicka Index (Equation (18)). Each observation is a race in a given biweek (two-week periods relative to election day). The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Columns (1) and (2) report estimates using all observed advertising. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Standard errors, clustered at the race level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix G Supplementary Materials for Section 6.3: The Determinants of Dialogue in the Presence of Issue Ownership

G.1 Issue 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.

G.1.1 Comment on the 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, Therriault (2015) observes that this traditional phrasing may capture something other than issue ownership. Motivated by this concern, Therriault (2015) 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.

Walgrave et al. (2016) 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, Walgrave et al. (2016) 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 Walgrave et al. (2016).[51]

G.1.2 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

[51] 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.

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

G.1.3 List of Surveyed Issues

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

G.2 Additional Ownership Analyses

In Table G1, 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 G1: Issue-Based Ownership Regression Estimates (Ruzicka Indices)

	Low		Medium		High	
	Similarity	Selection	Similarity	Selection	Similarity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
Tossup	0.8489***	2.8850***	0.8927***	2.8257***	0.6918	2.1703***
	(0.1699)	(0.2132)	(0.1881)	(0.2045)	(0.5701)	(0.1479)
Leaning	0.6949***	2.5278***	0.7681***	2.5593***	0.6121	2.0748***
	(0.1660)	(0.1744)	(0.1899)	(0.1737)	(0.5672)	(0.1358)
Likely	0.5230***	1.7673***	0.5958***	1.6865***	0.3994	1.3904***
	(0.1441)	(0.1198)	(0.1611)	(0.1193)	(0.4229)	(0.1224)
Senate	0.1637***	1.1845***	0.1593***	1.1468***	0.0366	0.8138***
	(0.0548)	(0.1598)	(0.0600)	(0.1597)	(0.1748)	(0.1562)
ρ	0.1934		0.2938*		0.2904	
ρ SE	0.1287		0.1605		0.4285	
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	-0.0532***	-0.4428***	-0.0148	-0.4250***	0.0801	-0.3333***
	(0.0159)	(0.0214)	(0.0209)	(0.0206)	(0.0621)	(0.0219)
Tossup	0.5066***	2.7686***	0.3013*	2.7070***	-0.4777	2.0502***
	(0.1428)	(0.1066)	(0.1716)	(0.1025)	(0.5026)	(0.0937)
Leaning	0.3979***	2.3782***	0.2504	2.2941***	-0.4962	1.7452***
	(0.1352)	(0.0991)	(0.1627)	(0.0958)	(0.4300)	(0.0912)
Likely	0.2879**	1.7055***	0.1876	1.6614***	-0.3118	1.3040***
	(0.1176)	(0.0948)	(0.1353)	(0.0950)	(0.3497)	(0.1009)
Senate	0.1332***	1.2347***	0.0581	1.1625***	-0.2553*	0.6858***
	(0.0505)	(0.0915)	(0.0624)	(0.0901)	(0.1484)	(0.0905)
ρ	0.1040		0.0190		-0.3631	
ρ SE	0.0877		0.1009		0.2955	
N	20921		20921		20921	

(b) Race-Biweek Observations

Notes: This table reports estimates from our model of dialogue in political advertising (Equation (9)) with the disaggregated issue-level dataset for three levels of issue ownership—Low, Medium, and High Average Ownership—as described in Section 6.1. The dependent variables are (i) "Similarity," the Ruzicka index of theme-based overlap, and (ii) "Selection," a binary indicator of concurrent advertising by both candidates. Panel (a) presents race-level estimates and panel (b) reports race-biweek-level results. The competitiveness effects—Likely, Leaning, and Tossup—are estimated relative to Solid races (the omitted category). Robust standard errors are in parentheses in panel (a), and standard errors are clustered at the race level in panel (b). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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