Issue Responsiveness in Canadian Politics: Are Political Parties Responsive to Climate Change's Public Salience in the Question Period?

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Abstract

Are political representatives responsive to the public in determining the issues they publicly address? Our paper takes a novel approach to this question with innovative data and state-of-the-art methodology. While previous research on issue responsiveness has focused on the United States and its unique political institutions, we study a multi-party parliamentary setting: the Canadian House of Commons. We focus our analysis on a prominent policy issue: climate change. Using transcripts from the Question Period between April 2006 and June 2021, we measure the attention political parties attribute to the various policy issues. We use Google Trends data to measure policy issues' public salience. We implement an instrumental variable estimation strategy to causally estimate how much climate change's public salience drives elite attention. Our analysis reveals that climate change's public salience significantly affects the attention political parties pay to that policy issue, though with significant partisan heterogeneity. Our study demonstrates that the Question Period effectively compels the government to address unfavorable or embarrassing issues. Finally, we find evidence that one of the parties successfully boosted climate change's public salience while it was in government.

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ARE politicians responsive to the public? Undoubtedly, this question constitutes one of political science's most prominent topics of interest. Accordingly, it is at the heart of a considerable volume of research. Its answer has major normative implications for the proper functioning of representative democracy, since it is generally accepted that it requires political elites to be somewhat responsive to public opinion (Pitkin 1972).

Previous research on political representation has shown that political elites are generally responsive to public opinion. Yet, there remains many outstanding questions. First, with most of the research focused on determining whether political representatives' policy positions are congruent with the public's preferences (i.e, "policy responsiveness"), we still have little understanding of "issue responsiveness," that is, how well the issues politicians pay attention to are consistent with their public salience regardless of the specific positions they take about them (Spoon and Klüver 2014; Wagner and Meyer 2014; Klüver and Spoon 2016; Barberá et al. 2019). Second, a large portion of the research on political representation has focused on the United States and its unique political institutions and may not generalize well to countries with different institutions, such as multi-party or parliamentary systems (Shapiro 2011). Third, most of the previous research on political representation was correlational, not causal. Finally, very few studies have examined political elites' responsiveness with regard to one of our time's most pressing issues: climate change.

This paper seeks to address these outstanding issues. We study political parties' issue responsiveness in a multi-party parliamentary setting, the Canadian House of Commons, over a period of fifteen years, from April 2006 to June 2021. We assess how well the attention political parties pay to climate change reflects its public salience. We are especially interested in determining whether issue responsiveness varies across political parties. Our analysis blends machine learning with causal inference to produce causal estimates of issue responsiveness.

We focus our analysis on Canada for a number of reasons. As in many industrialized countries, climate change has become a prominent issue over the past decade as citizens began to witness the effects of a changing climate, with reports of significant variations in temperature, precipitation, snow, ice, permafrost, and sea levels. At the same time, the production of fossil fuels remains an important part of Canada's economy, making it the world's fourth largest producer of oil and sixth largest producer of natural gas. Like most Western democracies, with the notable exception of the United States, Canada has a multi-party system (Johnston 2017). Three national political parties form the heart of the current party system: the Conservative Party (CPC, right-wing), the Liberal Party (LPC, center), and the New Democratic Party (NDP, left-wing).

Climate change remains a disputed issue, with discernible partisan heterogeneity in attitudes toward it. We anticipate the latter to translate into partisan heterogeneity in issue responsiveness along parties' issue ownership and their institutional roles.

To conduct our analysis, we use novel measures of issue attention and issue salience. In particular, we quantify policy issues' public salience by their popularity on Google's search engine, and the attention political parties pay to issues through the topic composition of the interventions emanating from their members in the Question Period. These measures are representative of the attention and importance politicians and the public attribute to policy issues. Besides, web search data circumvents some of the biases that have afflicted prior work on issue salience.

The Question Period is an important moment in Canada's political life. It occurs every day the House of Commons sits and is extensively relayed by the media. Its purpose is to offer members of Parliament, especially those from opposition parties, an opportunity to seek information on current issues and hold government ministers accountable for their decisions. Political parties' behavior in the Question Period, especially with respect to the topics they choose to bring up, remains poorly understood. This paper contributes to bridging this gap. With several parliamentary institutions having similar procedures, the insights we generate in this article are relevant to other countries (Green-Pedersen and Mortensen 2010; Vliegenthart and Walgrave 2011; Bevan and John 2016; Borghetto and Russo 2018).

From a methodological standpoint, this paper illustrates how machine learning can be used in conjunction with traditional causal identification strategies to answer substantive questions in political science. Our paper belongs to the growing body of research using methods from natural language processing to analyze parliamentary speeches (Rheault et al. 2016; Abercrombie and Batista-Navarro 2020; Guber, Bohr, and Dunlap 2021; Cochrane et al. 2022). Most of this literature has focused on the United States and the United Kingdom. This paper contributes to expanding it beyond these two countries. We use the resulting measures to carry out standard causal analysis. The main hurdle in estimating issue responsiveness is simultaneous causality. Indeed, policy issues' public salience is being influenced by as much as it influences their prevalence in Question Period interventions. To countervail this source of endogeneity, we implement an instrumental variable estimation strategy. In particular, we use as an instrument of climate change's public salience in Canada the analogous measure in the United States. This identification strategy allows us to make causal claims about issue responsiveness.

Our results demonstrate that Canada's three main national political parties adjust the topic composition

of their Question Period interventions to reflect climate change's public salience. There is significant partisan heterogeneity in that regard. Our analysis also demonstrates that the Question Period, by conferring agenda-setting power to opposition parties, is effective at compelling the government to address unfavorable or embarrassing issues. Finally, we find evidence that one of the parties, the Liberal Party of Canada, successfully bolstered climate change's public salience while it was in government.

The paper closest to ours was authored by Penner, Blidook, and Soroka (2006). Like us, the authors consider how well the attention parties pay to policy issues in the Question Period reflects their public salience. We build and improve upon their contribution in multiple ways. First, their analysis is purely correlational, while we implement an identification strategy allowing us to make causal claims about issue responsiveness. They resort to human coding instead of unsupervised machine learning to measure the topic composition of Question Period interventions. Finally, their analysis focuses on important issues, such as education, government debt, health care, and taxes, but does not consider climate change.

The rest of this article is organized as follows. Next, we build our study of issue responsiveness' theoretical foundations and formulate conjectures about its determinants. We then present the data and methodology used to carry out our analysis. Finally, we present our results and explore their implications for the study of political representation and issue responsiveness.

The Relevance of Issue Responsiveness

A great deal of research has examined policy responsiveness, that is, how congruent politicians' policy positions are with their constituents' preferences (Page and Shapiro 1983; Stimson, Mackuen, and Erikson 1995; Erikson, Mackuen, and Stimson 2001; Manza and Lomax Cook 2002; Burstein 2003; Canes-Wrone and Shotts 2004; Canes-Wrone 2005; Shapiro 2011; Achen and Bartels 2017; Caughey and Warshaw 2018). Yet, political competition occurs over at least one additional dimension: besides endorsing different policy positions, politicians attribute varying levels of attention and prominence to policy issues. We believe that issue responsiveness, as measured by the extent to which politicians adjust the attention they pay to policy issues in reaction to shifts in their public salience, deserves as much consideration from political scientists as policy responsiveness. This is especially true for two reasons.

First, since time and attention are scarce resources, which issues officeholders address is as important in determining how well policy outcomes reflect their constituents' preferences as what they specifically do

about those issues. As Barberá et al. (2019, p. 885) put it, "[f]or politicians to be truly responsive to the public, they first need to pay attention to the issues [their] constituents deem relevant, and then their actions must reflect people's preferences on those issues."

Second, most political competition occurs, in the short run, over which issues are at the top of the public agenda. Indeed, it is easier for political actors to alter the importance they attribute to policy issues than to amend the position they embody over each of them. This is because politicians gain over time a reputation for competence in handling certain issues, and parties and candidates eventually come to "own" them (Petrocik 1996; Bélanger and Meguid 2008; Egan 2013; Stubager 2018). Among other things, this reputation stems from politicians' record in office and previous investments in expertise. Its influence is accentuated by the fact that most voters put little effort into keeping abreast of the latest political developments and make choices based on long-held beliefs and preconceptions. On short notice, it is difficult for political actors to alter their reputation, but they can attempt to make certain of its aspects more prominent than others. For example, suppose a party has acquired over time a reputation for competence in handling education and health care. In the short run, this party can seek to highlight either of these policy issues more than the other and more than other issues.

Partisan Heterogeneity in Issue Responsiveness

There is considerable partisan heterogeneity in attitudes toward climate change across Canada's three main national political parties (Mildenberger et al. 2016). In particular, the Conservative Party is widely seen to occupy a weaker position and have a weaker reputation along this policy dimension than the Liberal Party and the NDP. For instance, Figure 1 shows that respondents to the Canadian Election Study who declared having voted for the Conservative Party in October 2019 were less likely to acknowledge the existence of climate change than those who have voted for the Liberal Party or the New Democratic Party. Conditional on acknowledging climate change, Conservative supporters were also less likely to believe that it is the result of human activities, which is the scientific consensus, and more likely to believe that it is the consequence of natural changes. Finally, in March 2021, 54 % of delegates to the CPC's policy convention voted against a resolution to acknowledge the threat posed by climate change in spite of the fact that its adoption was advocated by the party's leader.

Even though all parties have incentives to align their policy priorities with salient issues, we expect par-

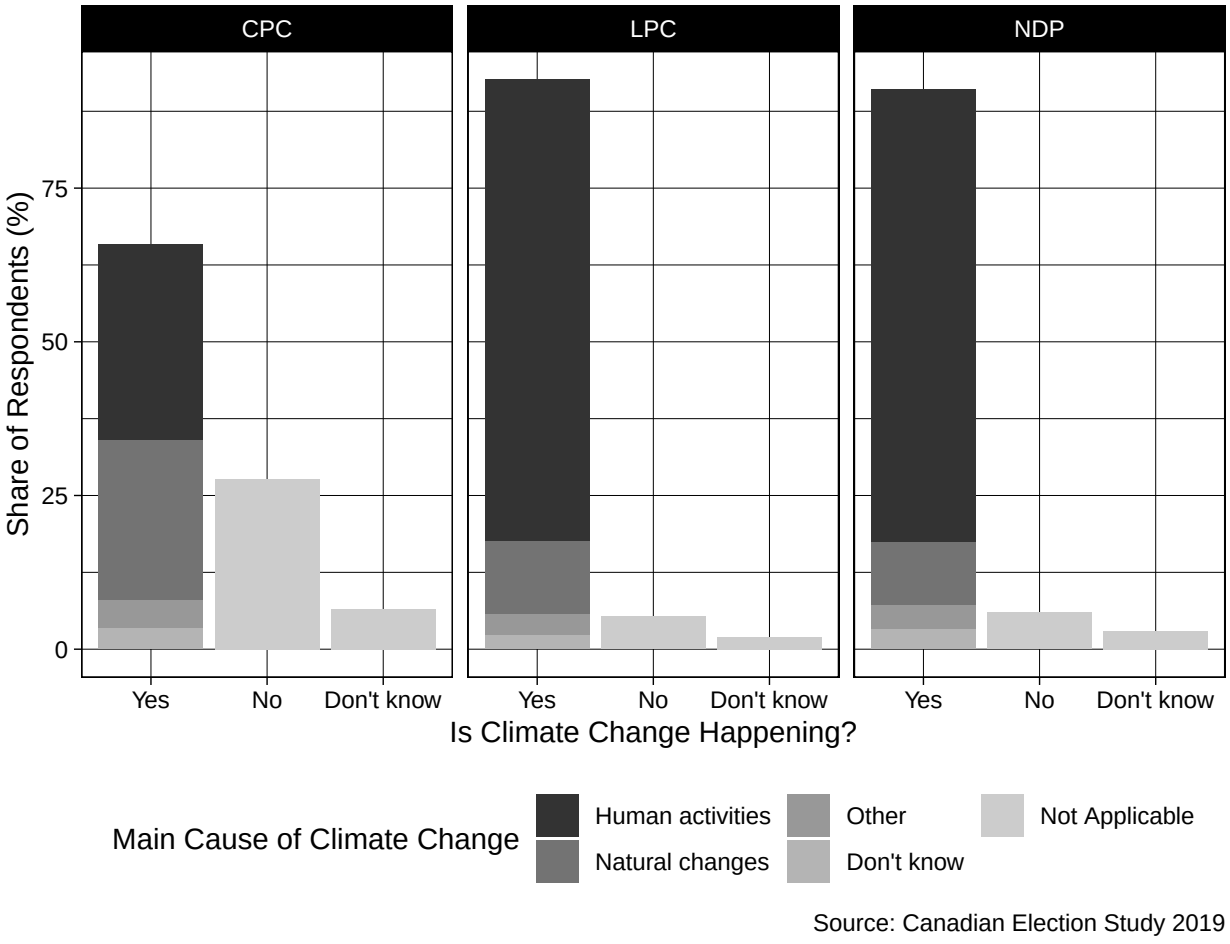

Figure 1: Views on Climate Change and its Main Cause by Party Preference in the 2019 Federal Election

tisan heterogeneity in attitudes toward climate change to result in partisan heterogeneity in issue responsiveness. In particular, we expect issue responsiveness to vary along issue ownership and parties' institutional roles.

First, previous research suggests that the attention parties pay to policy issues should be contingent on the reputation they have over them. Parties do not wish to draw attention to problems over which they have a weak reputation as it would highlight their opponents' strengths and weaken their position. All else equal, parties selectively emphasize the issues over which they have a strong(er) reputation and neglect those over which they have a weak(er) reputation. This proposition is known as the "Dominance Principle" (Petrocik 1996; Damore 2004; Sides 2006). Analogously, we conjecture that the incentives to talk more about an issue that suddenly becomes more salient are stronger for a party that owns this issue. In contrast, we expect parties for which climate change is a weakness to be less responsive to variations of its public salience. In our institutional context, this means that we expect the Conservatives to talk less about climate change and to be less responsive to variations in climate change's public salience than the Liberals and New Democrats.

Issue responsiveness should also depend on parties' institutional role. In Question Period, the opposition determines the questions' topics. Through sustained inquiries, opposition parties may compel the government to address issues it would otherwise disregard because they are either disadvantageous or embarrassing (Bevan and John 2016). From a strategic standpoint, it seems optimal for a party aiming to improve its electoral prospects to bring forward policy issues over which its opponents have a weak reputation or that are otherwise demeaning to them. The government can attempt to thwart these tactics and frame the debate in a more favorable light. Indeed, since "[t]here is no explicit rules which govern the form or content of replies to oral questions" beyond very general "standards of order, decorum and parliamentary language," government ministers have considerable freedom in choosing how to answer a question (Bosc and Gagnon 2017, Chapter 11). Theoretically, an answer is simply an opportunity for a minister to give a 45-second statement, and whether its content is related to the question that prompted it is incidental. A minister may very well rise to declare that the issue brought forward by her counterpart is irrelevant and move on to discuss a more favorable topic. Presumably, the government will be more reluctant to answer in a forthcoming way questions about issues over which it has a weak reputation. That said, systematically refusing to answer relevant questions may ultimately be detrimental to the government. Accordingly, we posit that the government will give in to some of the opposition's pressures and address some compromising topics. More specifically, we expect the Conservative Party to be more responsive to climate change's public salience when it is in

government.

Data and Measurement

Our analysis builds upon two dynamic data sets: one measuring climate change's public salience and another the attention parties pay to this issue in their Question Period interventions.

Google Trends Data

We use Google Trends data to measure the evolution of the public's interest for policy issues. This data is computed using a sample of all queries made on Google's search engine and is used for academic research in fields as varied as epidemiology, finance, and marketing. It takes the form of an index measuring the changes in users' relative interest for a predefined topic or some keywords over time. To allow for meaningful comparisons across topics, time, and geographical areas, data points are normalized according to the total search volume in a given region at a given time.

The operationalization and measurement of issue salience is a long-standing issue (Wlezien 2005; Moniz and Wlezien 2020). We believe that Google Trends presents a number of benefits relative to alternative measures such as those derived from survey studies. First, it is available at high frequencies (e.g., daily, weekly, monthly) and for diverse geographic entities (e.g., metropolitan areas, Canadian provinces, American states and territories, countries). This would be too costly to achieve with survey studies. We use weekly data to conduct our analysis.[1]

Second, Google Trends data is directly derived from users' behavior. Accordingly, it circumvents some of the biases that otherwise taint subjects' answers to survey questions (e.g., social desirability bias, subject-expectancy bias). It measures variations in public salience inasmuch as they are reflected in web search behavior. On this point, we believe that seeking information about a policy issue is a serious show of concern and interest: time and attention being scarce resources, people do not investigate problems they consider irrelevant. We expect users to seek more information about the topics they care about the most.

Third, the standard approach, which consists in asking survey respondents "What is the most important issue facing the country?," is restrictive since it elicits a single answer at a time. In contrast, Google Trends

1. Since it is impossible to directly extract from Google Trends' interface weekly data for a period exceeding five years, we constructed our time series by extracting data for multiple five-year periods with a substantial overlap between them and putting the resulting series on a common scale (Tseng 2019).

data simultaneously considers all conceivable topics and is focused on determining the public's relative (rather than absolute) interest for it. Accordingly, our measure yields a more complete portrait of issue salience.

Admittedly, Google Trends data also present limitations (Mellon 2013). Chief among them, one might worry that Google's user base is not representative of the electorate or the general public. This is because even though the Internet is widespread, its usage still varies along socio-demographic characteristics. There might also have been compositional changes in Google Search's user base during our period of study, making out-of-sample generalization difficult. That said, Ripberger (2011), Reilly, Richey, and Taylor (2012), Mellon (2014), and Swearingen and Ripberger (2014) have demonstrated that Google Trends generally produces reliable measures of public salience.

We carry out our analysis using Google Trends' predefined "climate change" topic. We interpret the resulting variable as a measure of climate change's public salience. This variable's evolution in Canada and the United States is represented in Figure 2.

Question Period Transcripts

To supplement our data on climate change's public salience, we gathered the transcripts of each Question Period held in the Canadian House of Commons from the 39th legislature, which launched after the January 23, 2006 election, to the 43rd legislature, which culminated in the September 20, 2021 election. We use the official English transcripts published by the Clerk of the House of Commons, in which interventions in French were professionally translated.

The House of Commons is the Parliament of Canada's lower chamber, where the Prime Minister and other federal Cabinet ministers sit. The Question Period is a focal moment in Canadian political life. This 45-minute segment occurs every day the House sits and is followed closely by the media and public. Its purpose is to offer members of Parliament an opportunity to seek information on the issues of the day and hold the government accountable for its decisions. It is one of the few moments in Parliament during which the opposition rather than the government has control over the topics discussed.

The Speaker usually begins the Question Period by allowing the Leader of the Opposition to ask questions, which typically call for an answer from the Prime Minister. The order for subsequent questions follows an agreed-upon rotation list based on parties' representation in the House. Backbench members of the governing party and independent members are also recognized to ask questions, although not as frequently as

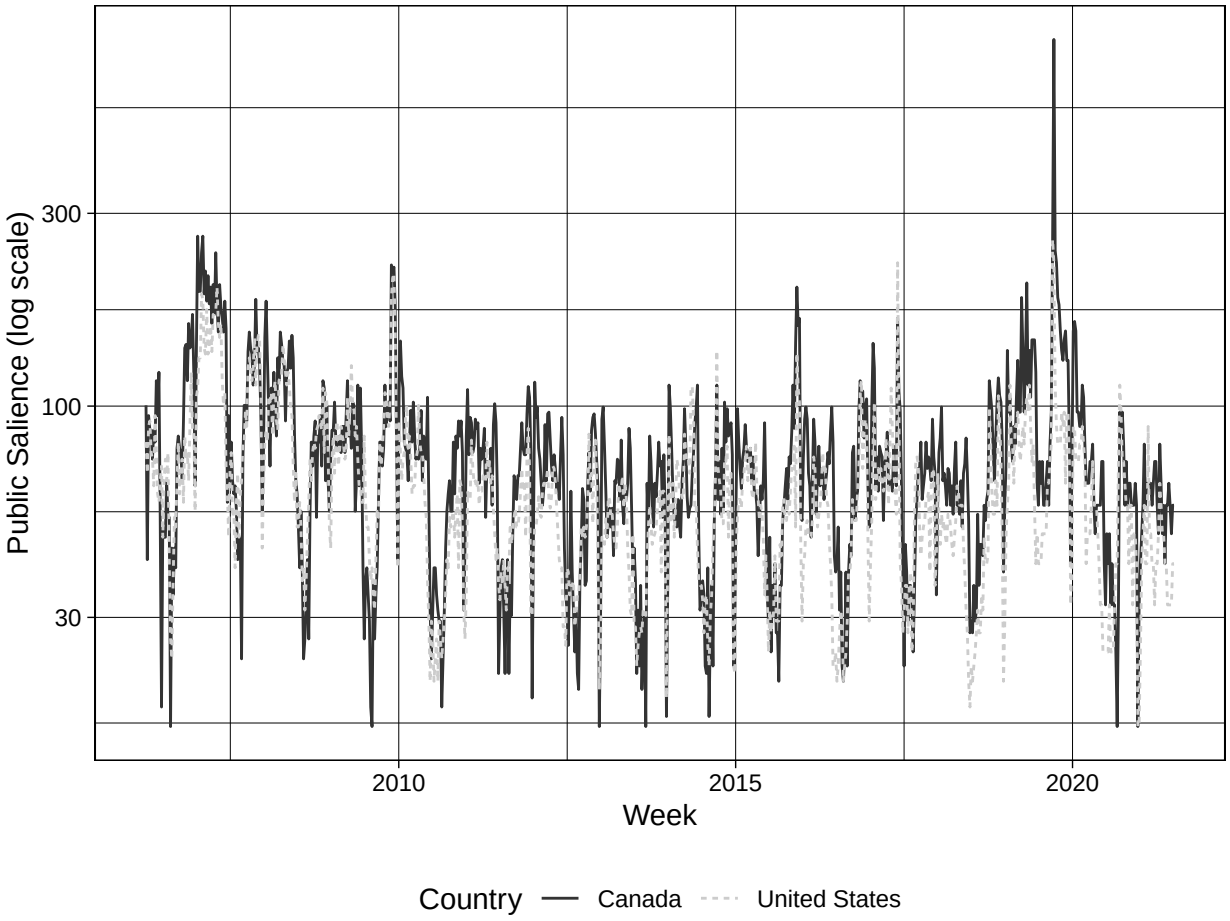

Figure 2: Evolution of Climate Change's Public Salience in Canada and the United States

those from officially-recognized opposition parties.[2] Participation in the Question Period is managed by the party caucuses and their whips: each decides which of its members will participate in the Question Period and provides the Speaker's Office with a list of their names and a suggested order of recognition. It is the government's prerogative to determine which of its members will answer a question and, according to the Cabinet's collective responsibility, any minister may answer any question directed to one of them.

We restrict our analysis to the interventions emanating from Canada's three main national political parties. Those are the only parties having maintained official party status throughout our period of study. The Conservative Party formed the government from January 2006 until October 2015, and the official opposition onward.[3] The Liberal Party formed the official opposition from January 2006 to May 2011, had third-party status from May 2011 to October 2015, and formed the government onward. Finally, the NDP held third-party status throughout our period of study, except from May 2011 to October 2015, when it formed the official opposition.

A regionalist party, the Bloc Québécois, held third-party status from January 2006 to May 2011 and, again, from October 2019 onward. Since the Bloc Québécois has not held official party status throughout our period of study, we only have limited data on the attention it paid to issues between May 2011 and October 2019. Besides, since it only caters to one of the country's ten provinces, the topics it raises in Question Period are likely to be influenced by factors idiosyncratic to this province, which are not necessarily well captured by our national measure of public salience. Because we could not do justice to the subtleties of the Bloc's case, we leave it to future research.

An alternative source of data to measure the attention parties pay to issues would be party platforms. Our data presents many benefits over this alternative. First, the Question Period happens more frequently than the publication of party platforms, which occurs once every general election. Using Question Period interventions, we can measure the attention parties pay to the various policy issues on a weekly basis for most of the year, since the House sits quasi-continuously from late January to June and from late September to mid-December. Second, parties have limited opportunities to address issues in the Question Period, hence they have to be discerning in choosing the topics they bring up. In contrast, parties do not face constraints on the length of their party platforms, hence we expect party platforms' topic composition to be spread out more evenly across policy issues and less representative of the parties' priorities.

2. To be officially recognized, a party must have at least twelve members of Parliament.

3. The largest opposition party forms the official opposition, and its leader becomes the Leader of the Opposition. The smaller opposition parties hold third-party status.

We presume that the topic composition of parties' Question Period interventions reflects the attention they pay to policy issues. To reduce the dimension of inherently high-dimensional text data and uncover their latent topic composition, we use the Latent Dirichlet Allocation (LDA) model (Blei, Ng, and Jordan 2003; Grimmer and Stewart 2013; Grimmer, Roberts, and Stewart 2021). This weakly supervised machine learning algorithm is widely used by social scientists to uncover the topics present in a corpus of documents and classify each document among these topics. We estimate the model using the variational implementation found in R's `stm` package (Roberts et al. 2014).

The LDA model is a mixed-membership model, meaning that it is based on the premise that: (i) each document represents a mixture of topics, and (ii) each topic represents a distribution over words so that a given term may be associated with multiple topics. Each document is represented as a "bag of words," in which syntax and the order of words are neglected.

Each intervention, whether it is a question or an answer, is considered as a document in our analysis. For the results to be coherent and meaningful, documents must be processed prior to estimation (Denny and Spirling 2018). Following the best practices, we first remove all numbers, punctuation marks, and extraneous white spaces. All remaining terms are then lower-cased and stemmed according to Porter's algorithm so that all words are reduced to their root. Finally, to pick out the terms that best allow to distinguish the various topics, we remove all "stop words" unlikely to convey meaningful information and only retain tokens that occur between one and 25 % of documents.

The LDA model requires the analyst to fix the number of topics. After inspection of diagnostic values for different number of topics, we decided to use a model with 15 topics to carry out the analysis, because it offers the best combination of held-out likelihood and semantic coherence. For reference, the diagnostic values are illustrated in Figures A1 and A2 (cf., Online Appendix). Words representative of the estimated topics are displayed in Table A1 (cf., Online Appendix). The resulting topics are clearly defined, intelligible, and meaningful.

We assign each topic to a policy dimension. In our analysis, we are especially interested in the topic associated with climate change.[4] Table A2 (cf., Online Appendix) contains ten representative documents randomly chosen among all those for which climate change's prevalence is above the 99$^{\text{th}}$ percentile.

4. Strictly speaking, this topic covers both the environment and climate change. Accordingly, our estimates of issue responsiveness will reflect the effect of climate change's public salience on the prevalence of both the environment and climate change in Question Period interventions. Although these topics are not indistinguishable, they considerably overlap.

Methodology

Model Specification

Formally, our objective is to obtain a causal estimate of the parameter β_i in the following equation:

$$\underbrace{\log\left(\frac{Y_{it}}{1-Y_{it}}\right)}_{\tilde{Y}_{it}} = \alpha_i + \beta_i \log(X_t) + \varepsilon_{it}, \tag{1}$$

where Y_{it} denotes the share of party i's Question Period interventions related to climate change in week t, and X_t climate change's public salience in Canada in week t. Following standard practice in time series analysis of compositional data, we use as the dependent variable the log-ratio rather than the share of interventions related to climate change (Barberá et al. 2019). The value of β_i represents the relative variation (measured in percent) of the ratio of party i's interventions related to climate change caused by a one-percent increase in its public salience. If β_i is positive, then party i is responsive to climate change's public salience.

Identification Strategy

The previous literature has shown that there generally is a strong correlation between the public's priorities and their political representatives' agenda: on average, politicians talk more about the policy issues more salient to their constituents and the public (Wagner and Meyer 2014; Klüver and Spoon 2016). Two mechanisms are put forth to rationalize this relationship.

On the one hand, politicians have strong incentives to alter their rhetoric so that it addresses prominently the policy issues salient to their constituents. Indeed, voters seek politicians whose priorities are congruent with theirs. Electorally-motivated politicians should set the topic composition of their public interventions accordingly. More fundamentally, raising issues voters believe to be important allows parties and candidates to draw more attention from voters than talking about issues they consider mundane.

On the other hand, politicians can engage in "public agenda-setting" and attempt to influence the weight voters attribute to the various policy dimensions (Jones and Baumgartner 2005; Baumgartner and Jones 2009; Boydstun, Glazier, and Pietryka 2013; Rossiter 2021). As unsophisticated agents who pay little attention to politics, voters are uncertain about what represents a serious problem and are ready to believe that any policy issue is important (Chong and Druckman 2007). This makes them susceptible to framing and

priming in determining issues' relative importance. Among other things, news reports and politicians' public statements are interpreted by voters as signals of what is relevant (Iyengar and Kinder 2010; McCombs and Valenzuela 2021). Parties can exploit this to shape the political agenda to their liking. Previous work suggests that they exert substantial efforts to do so (Jacobs and Shapiro 1997, 2000; Druckman and Jacobs 2015).

Reality lies between these two conflicting theories: even if voters' sense of priorities is susceptible to manipulation, politicians cannot control all the relevant factors, as exogenous events (e.g., natural disasters, international events) also alter policy issues' public salience. Put differently, the topic composition of Question Period interventions is as susceptible to influence climate change's public salience as being influenced by it. It follows that the relationship between the attention parties pay to policy issues and their public salience is afflicted by reverse or simultaneous causality, as both variables are jointly determined (Page 1994). By naively observing the correlation between the topic composition of politicians' public interventions and policy issues' public salience, we might be under the illusion that politicians are being responsive to the public when, in fact, citizens' sense of priorities is being distorted by politicians' rhetoric.

Simultaneous causality results in endogeneity, which renders ordinary least squares (OLS) estimates inconsistent. To achieve causal identification of β_i, we implement a two-stage least squares (2SLS) estimation strategy. In particular, we instrument climate change's public salience in Canada with the analogous variable for the United States:

$$\log(X_t) = \delta + \gamma \log(Z_t) + u_t,$$

where Z_t denotes climate change's public salience in the United States in week t.

In short, our estimation strategy's objective is to neutralize the effect of Question Period interventions on climate change's public salience in Canada. To do so, we isolate variations in climate change's public salience that occur concomitantly in Canada and the United States. For this design to be valid, we must assume that Question Period interventions do not affect climate change's public salience in the United States. Under this assumption, variations in public salience common to Canada and the United States must be exogenous. We can then leverage those variations to causally identify issue responsiveness.

Formally, this identification strategy's validity relies on two assumptions:

- *Relevance.* Climate change's public salience in Canada and the United States are not independent;
- *Exclusion Restriction.* Climate change's public salience in the United States is exogenous conditional

on climate change's public salience in Canada.

The exclusion restriction is also known as the "only through" assumption, because it requires climate change's public salience in the United States to affect the topic composition of Question Period interventions only through climate change's public salience in Canada.

Even though these assumptions are unfalsifiable, we believe them to be highly plausible. Given the geographic proximity and close relationship between Canada and the United States, with the two countries sharing the longest undefended border in the world, we expect climate change's public salience in both countries to be influenced by common factors. Figure 2 shows that climate change's public salience in the two countries are indeed linked, with a correlation coefficient slightly above 0.75. Still, since the United States are a much larger country than Canada and news coverage there is centered on its domestic politics, with interventions by Canadian politicians being rarely if ever relayed by the American media, it is reasonable to assume that interventions in the House of Commons do not have a discernible impact on climate change's public salience south of the border.

The question persists of whether additional variables may jointly affect Question Period interventions and climate change's public salience in the United States, resulting in omitted variable bias. For instance, members of Parliament might feel compelled to express sympathies for a natural disaster that occurred in the United States. We do not expect this to generate systematic biases. More generally, we find it improbable that climate change's public salience in the United States would have an effect on Question Period interventions that is not mediated by climate change's public salience in Canada. That said, we recognize that the flow of information between political representatives and their constituents may be mediated by other institutions, such as the mass or social media. While these institutions may filter information, we believe they are not confounding factors susceptible to invalidating our identification strategy.

Using Topic Composition as Dependent Variable

Our identification strategy involves causal analysis on the latent topic composition of Question Period interventions as estimated by a weakly supervised machine learning algorithm. As Egami et al. (2022) argue, carrying out an analysis on this variable leads to a violation of causal inference's fundamental assumption: Stable Unit Treatment Value Assumption (SUTVA). Among other things, SUTVA requires there be no interference between one unit's assigned treatment and other units' outcomes (Imbens and Rubin 2015, p. 10).

Regrettably, the LDA model's estimation induces interference across observations, because a document's estimated topic composition typically depends on the corpus used to train the algorithm. To resolve this issue, we implement the solution proposed by Egami et al. (2022): we train the LDA model on a different corpus of documents from the one over which we carry out causal analysis. In particular, we set aside ten percent of documents, randomly chosen in our entire corpus, on which we run the training algorithm. Using the trained model, we estimate the topic composition of the remaining 90 % of documents and carry out our analysis on the resulting time series.

Correcting for Serial Correlation in Dynamic Regression Models

Equation (1) describes an inherently dynamic process. Since it does not contain the dependent variable's lagged value, our model is susceptible to serial correlation. The latter renders the standard 2SLS estimates inconsistent and the associated inference invalid. To produce consistent estimates, we implement the Cochrane-Orcutt estimation procedure (Box-Steffensmeier et al. 2014, p. 77). This estimation method is as follows:

1. Estimate the model via 2SLS, and save the residuals $\hat{\varepsilon}$;
2. Regress the residuals on their lagged values without an intercept:

$$\hat{\varepsilon}_t = \rho \hat{\varepsilon}_{t-1} + \nu_t;$$

3. Using the resulting estimate of the serial correlation $\hat{\rho}$, transform the data to generate the variables $\tilde{Y}_t^\star = \tilde{Y}_t - \hat{\rho}\tilde{Y}_{t-1}$ and $\log(X_t)^\star = \log(X_t) - \hat{\rho}\log(X_{t-1})$;
4. Regress $\tilde{Y}_t^\star$ on $\log(X_t)^\star$ via 2SLS, and save the residuals to produce an updated value of $\hat{\rho}$;
5. Repeat the previous steps until adequate convergence in $\hat{\rho}$ is achieved.

In practice, this process is automated through the `orcutt` package in R (Stefano et al. 2018). The reader should keep in mind that steps 2 and 3 result in the loss of one observation at the beginning of and after every interruption in our time series, since there is no lagged value with which to transform these observations. It follows that the estimates are based on a reduced number of observations. This reduces the estimation's overall efficiency.

Results

Correlation between Prevalence in Question Period Interventions and Public Salience

Figure 3 illustrates the evolution over time of the share of parties' Question Period interventions devoted to climate change, which are represented by colored curves, and this issue's public salience in Canada, which is represented by a thick black curve. To isolate the variables' trends, we represent their smoothed values computed using a local polynomial regression. Remarkably, the four curves follow very similar paths. This suggests that the topic composition of Question Period interventions and climate change's public salience are strongly correlated.

This observation is confirmed by Figure 4, which depicts, on the *y*-axis, the log-ratio of parties' interventions related to climate change in a given week and, on the *x*-axis, the log-measure of climate change's public salience in Canada over the same period. These variables correspond, respectively, to Equation (1)'s independent and dependent variables. For all three parties, the scatter plot contains a loess curve depicting the relationship between these variables.

As expected, the three parties allocate a greater share of their Question Period interventions to climate change when this issue is more salient. This relationship is essentially linear, validating Equation (1)'s functional form, and its slope is virtually indistinguishable across parties. For all three parties, the correlation between the two variables is positive and statistically significant at the 99 % confidence level. The correlation coefficient is largest for the Conservative Party followed by the New Democratic Party and, finally, the Liberal Party. This indicates that variations in the topic composition of Question Period interventions are best predicted by climate change's public salience for the Conservatives, with other factors playing a larger role in predicting the topic composition of the Liberals' and New Democrats' Question Period interventions.

Even though previous results show that there is a positive correlation between climate change's public salience and the topic composition of Question Period interventions, we cannot affirm at this point that parties are responsive to the public's policy priorities, let alone provide a causal estimate of this responsiveness. As pointed out above, interventions' topic composition may very well explain as much as it is being explained by climate change's public salience. This is best seen in Figure 3: the four curves clearly follow each other closely, but we are unable to determine if and how much each party's curve specifically reacts to public salience. The identification strategy we have set forth allows us to do so.

Elections that occurred during our period of study are indicated by dotted vertical lines in Figure 3. The

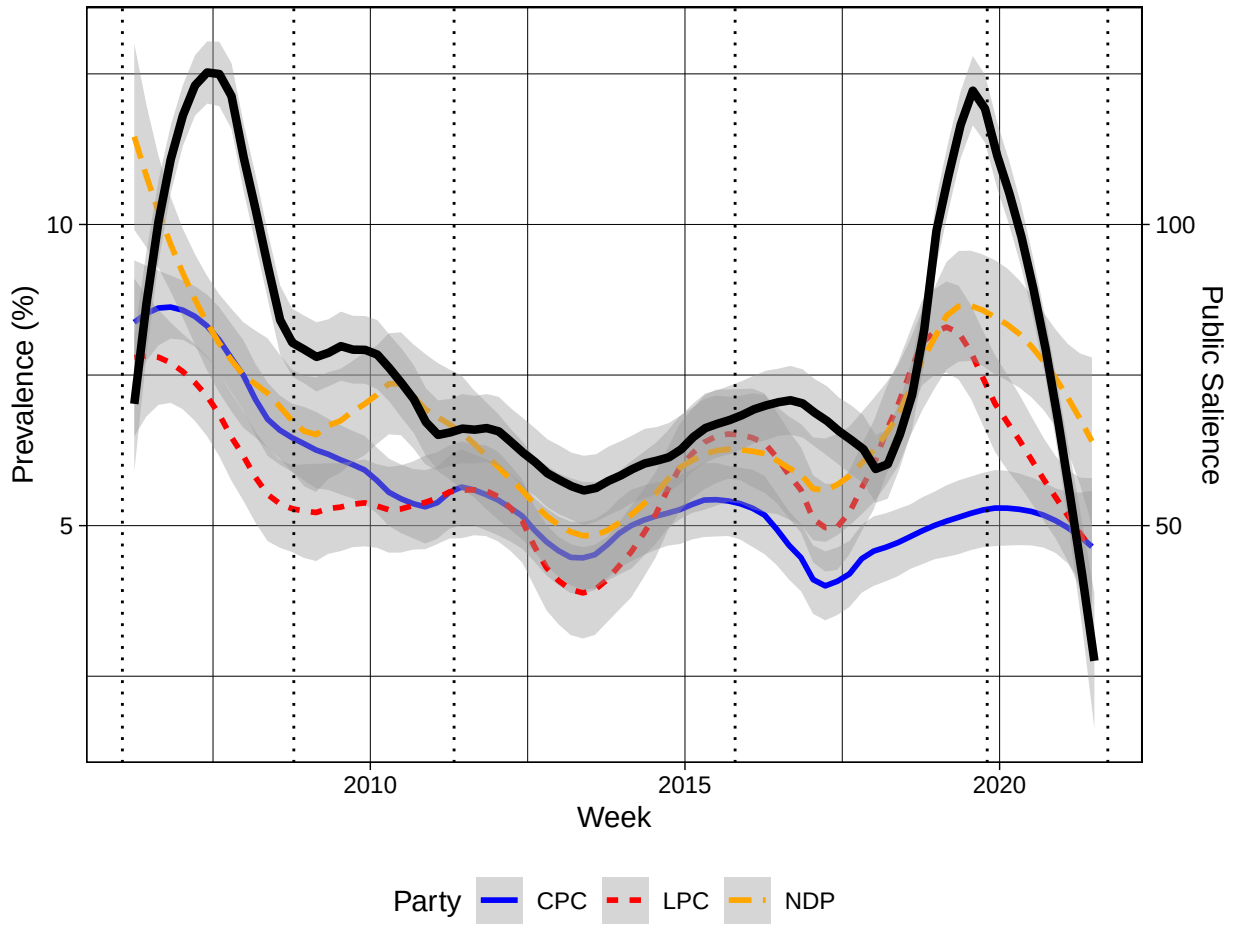

Figure 3: Evolution of Climate Change's Prevalence in Question Period Interventions and Public Salience over Time

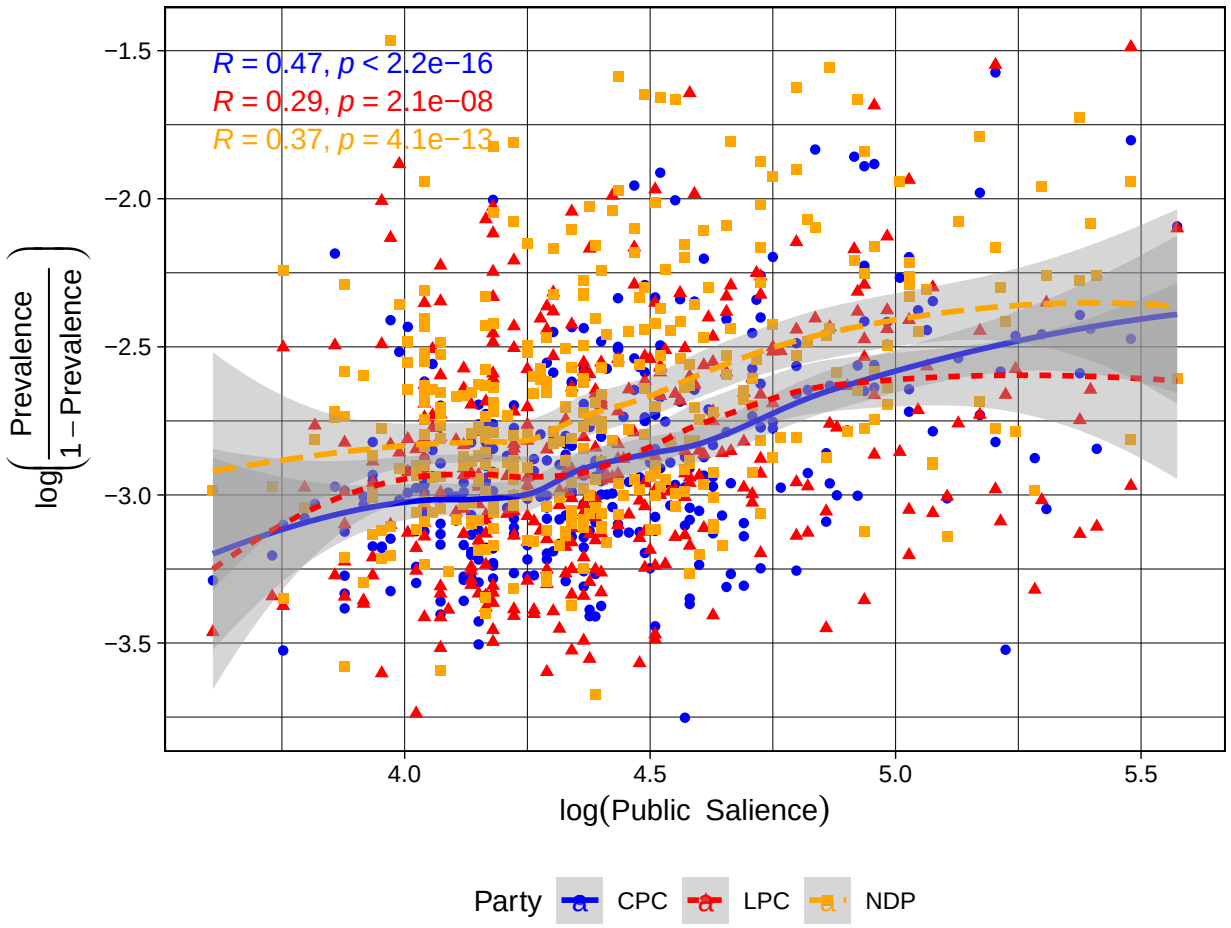

Figure 4: Relationship between Climate Change's Prevalence in Question Period Interventions and Public Salience

degree to which the topic composition of the Conservative Party's Question Period interventions varies with climate change's public salience seems to fall after the 2015 election, when this party moved from government to the opposition. This results in a divergence between the curve representing the topic composition of the Conservatives' Question Period interventions and that of other parties'. The divergence between the topic composition of the Conservatives' and the Liberals' Question Period interventions indicates that the latter have discussed climate change significantly more than the official opposition party during their time in government. In turn, this corroborates that government ministers have considerable flexibility in framing their answers to the opposition's questions.

Causal Estimates of Issue Responsiveness

Table 1 presents the results of Equation (1)'s estimation. The table contains OLS and 2SLS estimates of four model specifications. These specifications differ along two dimensions: (i) whether partisan heterogeneity in issue responsiveness is permitted, and (ii) whether issue responsiveness is allowed to differ after the 2015 election, when the Liberal Party of Canada replaced the Conservative Party of Canada in government. Columns (1) to (4) contain OLS estimates, and columns (5) to (8) 2SLS estimates. Columns (1) and (5) contain estimates of all three parties' average issue responsiveness over the full period of study. Columns (2) and (6) contain estimates of individual parties' issue responsiveness over the full period of study. Columns (3) and (7) contain estimates of parties' average issue responsiveness before and after the 2015 election. Finally, columns (4) and (8) contain estimates of individual parties' issue responsiveness before and after 2015. Results in columns (3), (4), (7) and (8) allow us to assess whether the government change that occurred in 2015 lead to a structural break in issue responsiveness.

We wish to highlight three key results. First, all parties are responsive and adjust the topic composition of their Question Period interventions in reaction to exogenous variations in climate change's public salience. As can be seen in column (5), the ratio of a party's Question Period interventions related to climate change increases on average by 0.4 % following a one percent increase in this issue's public salience. This estimate is statistically significant at the 99 % confidence level.

Second, two-stage least squares estimation discernibly changes the coefficients' value and reveals significant heterogeneity in issue responsiveness across the three parties as can be seen in column (6). Somewhat unexpectedly, the Liberal Party ends up being *less* responsive to variations in climate change's public salience than the Conservative Party and the New Democratic Party. This does not indicate that Liberals

Table 1: Causal Estimates of Issue Responsiveness

	OLS				2SLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\log(X_t)$	0.318***				0.388***			
	(0.035)				(0.054)			
$\log(X_t)$:Party_CPC		0.350***				0.466***		
		(0.051)				(0.080)		
$\log(X_t)$:Party_LPC		0.215***				0.166*		
		(0.065)				(0.100)		
$\log(X_t)$:Party_NDP		0.365***				0.480***		
		(0.063)				(0.098)		
$\log(X_t)$:After_2015			0.250***				0.226**	
			(0.065)				(0.101)	
$\log(X_t)$:Before_2015			0.359***				0.484***	
			(0.040)				(0.064)	
$\log(X_t)$:Party_CPC:Before_2015				0.432***				0.597***
				(0.060)				(0.098)
$\log(X_t)$:Party_LPC:Before_2015				0.274***				0.305**
				(0.078)				(0.123)
$\log(X_t)$:Party_NDP:Before_2015				0.371***				0.530***
				(0.073)				(0.117)
$\log(X_t)$:Party_CPC:After_2015				0.120				0.057
				(0.089)				(0.131)
$\log(X_t)$:Party_LPC:After_2015				0.205*				0.006
				(0.106)				(0.153)
$\log(X_t)$:Party_NDP:After_2015				0.337**				0.404**
				(0.125)				(0.200)

Note: *p<0.1; **p<0.05; ***p<0.01

talk less about climate change overall. Indeed, it seems that they do talk about this issue on their own terms and are successful at bolstering its public salience. This can be seen by comparing columns (2) and (6): instrumental variables estimation lowers the estimate of the Liberals' issue responsiveness by about 25 %. This is consistent with the Liberals having successfully bolstered climate change's public salience over our period of study. It would initially create the illusion of issue responsiveness, which our causal identification strategy clears by disentangling the effect of public salience on Question Period interventions from the effect of interventions on climate change's public salience. This "reverse effect" seems to occur entirely in the period over which the Liberal Party has been in government: two-stage-least-squares estimation reduces the estimate of the Liberals' issue responsiveness over this period by around 99 %, but increases it by about 29 % for the period prior to 2015.

Third, the Conservative Party and the New Democratic Party have the same estimated level of issue responsiveness. This is remarkable, because climate change has historically been a weaker policy issue for the Conservatives. The fact that the degree to which they react to changes in climate change's public salience is not significantly different from the New Democrats' gives credence to the Question Period's power in pushing the party in government to address embarrassing or otherwise unfavorable policy issues. This interpretation is further supported by the fact that, as Figure 3 had already hinted, the Conservative Party's estimated level of issue responsiveness is around 77 % lower after 2015 than it was when they were in government. After 2015, the Conservatives' issue responsiveness cannot statistically be distinguished from zero, consistently with the Dominance Principle. This difference is statistically significant at the 95 % confidence level. In contrast, there is no statistically significant difference in the New Democrats' issue responsiveness before and after the 2015 election.

Causal Estimates of the Government's Issue Responsiveness

To the previous exercise, one might object that assessing the government's issue responsiveness is futile in the Question Period's context. After all, the government's function should be to answer the opposition's questions. Certainly, we expect the government to respond to some of the opposition's queries. If opposition parties are sensitive to climate change's public salience when selecting their questions and the government answers them in a forthcoming way, then by transitivity we should also observe that the government is being responsive to climate change's public salience. Accordingly, part of the government's issue responsiveness may be mediated by the opposition's inquiries. That said, the government has considerable flexibility in

choosing how to respond to the opposition's questions. A Cabinet minister may very well rise to declare that the issue brought up by her opposition counterpart is irrelevant and move on to discuss a more favorable topic. Therefore, we do not expect the entirety of the government's issue responsiveness to be mediated by the opposition's inquiries.

In this section, we assess how much of the government's issue responsiveness is mediated by the opposition's questions. To do so, we estimate a regression model akin to Equation (1) in which we include as covariates the share of each opposition party's Question Period interventions devoted to climate change:

$$\tilde{Y}_{it} = \alpha_i + \beta_i \log(X_t) + \sum_{j \neq i} \lambda_{ij} \tilde{Y}_{jt} + \varepsilon_{it}. \tag{2}$$

In this equation, the value of β_i represents the portion of party i's issue responsiveness that is not mediated by opposition parties' inquiries.

Table 2 contains the results of Equation (2)'s estimation for the Conservative Party. Columns (1) to (3) contain OLS estimates, and columns (4) to (6) 2SLS estimates. For reference, columns (1) and (4) contain estimates of the Conservative Party's issue responsiveness during its time in government as estimated in Equation (1), that is, without controlling for opposition parties' Question Period interventions. Columns (2) and (5) contain estimates of the Conservative Party's issue responsiveness and its responsiveness to opposition parties' inquiries during its time in government as estimated in Equation (2). In columns (3) and (6), responsiveness to opposition parties' questions is allowed to differ before and after the 2011 election. Recall that in May 2011, the Liberal Party and the New Democratic Party switched status, as the latter became the official opposition and the former fell to third-party status. Accordingly, results in columns (3) and (6) allow us to assess whether this change lead to a structural break in responsiveness to opposition parties' inquiries.

Table 3 contains the results of Equation (2)'s estimation for the Liberal Party. Columns (1) and (2) contain OLS estimates, and columns (3) and (4) 2SLS estimates. For reference, columns (1) and (3) contain estimates of the Liberal Party's issue responsiveness during its time in government as estimated in Equation (1). Columns (2) and (4) contain estimates of the Liberal Party's issue responsiveness and its responsiveness to opposition parties' inquiries during its time in government as estimated in Equation (2).

The results contained in Tables 2 and 3 indicate that the party in government is generally responsive to opposition parties' inquiries in Question Period. Indeed, the share of its Question Period interventions the

Table 2: Causal Estimates of the Government's Issue Responsiveness — Conservative Party of Canada

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(X_t)$	0.432***	0.222***	0.220***	0.597***	0.348***	0.361***
	(0.060)	(0.041)	(0.042)	(0.098)	(0.068)	(0.075)
$\tilde{Y}_{\text{LPC},t}$		0.330***			0.298***	
		(0.036)			(0.038)	
$\tilde{Y}_{\text{NDP},t}$		0.356***			0.308***	
		(0.039)			(0.043)	
$\tilde{Y}_{\text{LPC},t}$:Before_2011			0.503***			0.468***
			(0.047)			(0.048)
$\tilde{Y}_{\text{NDP},t}$:Before_2011			0.285***			0.255***
			(0.044)			(0.046)
$\tilde{Y}_{\text{LPC},t}$:After_2011			0.123**			0.101*
			(0.052)			(0.053)
$\tilde{Y}_{\text{NDP},t}$:After_2011			0.483***			0.443***
			(0.072)			(0.074)
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 3: Causal Estimates of the Government's Issue Responsiveness — Liberal Party of Canada

	OLS		2SLS	
	(1)	(2)	(3)	(4)
$\log(X_t)$	0.205*	0.134	0.006	−0.122
	(0.106)	(0.101)	(0.153)	(0.153)
$\tilde{Y}_{\text{CPC},t}$		0.286***		0.309***
		(0.098)		(0.098)
$\tilde{Y}_{\text{NDP},t}$		0.135**		0.166**
		(0.058)		(0.066)
Note:				*p<0.1; **p<0.05; ***p<0.01

government dedicates to climate change increases significantly with the share of their questions opposition parties devote to that policy issue. Furthermore, it seems that the government is more responsive to the official opposition's inquiries than to those of third parties. This can be seen by inspecting Column (6) in Table 2 and Column (4) in Table 3. From 2006 to 2011, the government was significantly more responsive to the LPC, which was then the official opposition, than to the NDP. From 2011 to 2015, the government was significantly more responsive to the NDP than to the LPC. Finally, from 2015 onward, the government was more responsive to the CPC than to the NDP. On the whole, these results demonstrate that the Question Period is an effective mechanism for opposition parties, especially the official opposition, to elicit answers from the government on current affairs.

Not all of the government's issue responsiveness is attributable to opposition parties' inquiries. In fact, accounting for the topic composition of opposition parties' Question Period interventions does not change whether the party in government is found to be significantly responsive to climate change's public salience. Although it decreases in magnitude by approximately 40 %, a statistically significant relationship between the share of the Conservative Party's Question Period interventions devoted to climate change and this policy issue's public salience persists when we account for opposition parties' questions. This suggests that, beyond the opposition parties' inquiries, the Conservative Party had direct incentives to be responsive to climate change's public salience while it was in government. These incentives did not persist beyond the 2015 election. Whether or not we account for the topic composition of opposition parties' inquiries, there is no statistically significant relationship between the share of the Liberal Party's Question Period interventions devoted to climate change and this issue's public salience.

Discussion and Conclusion

This article makes valuable contributions to the study of issue responsiveness in Canadian politics.

To various degrees, all three parties we studied are responsive to climate change's public salience in the Question Period. Among them, the New Democratic Party has persistently been the most responsive to exogenous changes in climate change's public salience. This result is consistent with the NDP being the smallest of Canada's three main national political parties, never having served in government at the federal level and having held third-party status throughout our period of study, except for a spell in the official opposition from May 2011 to October 2015. Presumably, it is harder for smaller parties to obfuscate or

manipulate the public agenda, leading them to be flatly responsive to climate change's public salience. In any case, this result is contingent on the fact that the NDP holds a good reputation over climate change, hence it is somewhat beneficial for this party to talk about this topic.

When the Conservative Party was in power, its estimated level of issue responsiveness was identical to the New Democratic Party's. This is remarkable, because the Conservatives are widely recognized to hold a weaker position along climate change's dimension. In contrast, during their time in opposition, the Conservatives have not been significantly responsive to climate change's public salience. This result demonstrates that the Question Period is a powerful tool in delivering democratic accountability. Indeed, by attributing agenda-setting power to opposition parties, the Question Period allows them to pressure the government to address issues salient to the public that it would otherwise avoid or neglect. Our results indicate that the government is more responsive to the official opposition's inquiries than those of third parties. That said, not all of the government's issue responsiveness is mediated by the opposition's inquiries. Controlling for opposition parties' Question Period interventions does not change whether the government is found to be significantly responsive to climate change's public salience.

We have uncovered evidence that, during its time in government, the Liberal Party of Canada has successfully boosted climate change's public salience. After the 2015 election, it seems that the Liberals have not been responsive to climate change's public salience but have instead been talking about this policy issue on their own terms. This seem to have had a discernible effect on climate change's public salience. Although it initially creates the illusion of issue responsiveness, our research design allows to disentangle issue responsiveness from the effect of Question Period interventions on climate change's public salience. Thanks to this approach, we were able to observe that the Liberals' responsiveness to public salience was effectively null during their time in government. This result highlights parties' contribution in shaping the political agenda and drawing attention to emerging policy concerns, such as the climate crisis. On this point, we conjecture that it is easier for the government than opposition parties to influence the public agenda.

The Online Appendix contains the results of two robustness checks. First, we carry out a placebo test in which we estimate the effect of climate change's public salience on Question Period interventions' topic composition across all other topics. We do not observe a systematic effect of climate change's public salience on Question Period interventions' topic composition across all other topics. Results still suggest that the Conservatives and the Liberals engaged in some limited obfuscation and manipulation. Second, we assess potential geographical heterogeneity in issue responsiveness. Our national measure of public salience

may conceal regional heterogeneity in climate change's public salience. Some scholars have previously conjectured that political representation in the Question Period is "particularized," in the sense that individual parties represent the interests of some constituencies and provinces better than others (Penner, Blidook, and Soroka 2006). On this point, we found little to no evidence that parties respond differently to climate change's public salience in individual provinces.

From a methodological standpoint, this paper exemplifies how machine learning can be combined with standard causal analysis to answer substantive questions in political science. Whereas most of the previous research on political representation is correlational, we are able to make causal claims about issue responsiveness. We believe that the methodological innovations employed in this paper will bring further benefits to the literature on political representation and issue responsiveness.

One might be concerned about our analysis' external validity. Indeed, there may be something distinctive about climate change in Canada that makes it difficult to extend our analysis' insights to other policy issues and institutional contexts. Climate change represents a relatively salient issue, which consistently accounts for five to ten percent of Question Period interventions. This issue is politically contentious as parties have different attitudes toward it, leading to partisan heterogeneity in issue responsiveness. All these characteristics make climate change a relevant and interesting issue to study in the Canadian context. We are confident that other salient and politically contentious issues exhibit similar issue responsiveness patterns. Other institutions, including all ten Canadian provincial legislatures, the British House of Commons, and the French National Assembly, have procedures similar to the Question Period. On that account, the insights we draw from our analysis could be transposed to these institutional contexts. That said, it is unclear whether there are idiosyncrasies to the issue of climate change in the Canadian context. For instance, one may be worried that Canada's position as one of the world's largest fossil fuel producers affects how climate change is perceived by political elites and the public. Overall, we believe generalizations to other policy issues and institutional contexts are feasible but must be made with care and prudence.

To conclude, we believe that further research is needed to fully understand how exchanges between political parties during the Question Period are relayed to the public. Clearly, mass and social media play a critical role in relaying political news to the public. Media may also exert their own influence on the "public agenda" independent of public opinion. Already, Soroka (2000, 2002) explored the interactions between media, the public, and politicians in shaping the public agenda. Understanding how the information flows from political representatives to the public is essential to paint a thorough portrait of issue responsiveness.

References

Abercrombie, G., and R. Batista-Navarro. 2020. "Sentiment and position-taking analysis of parliamentary debates: a systematic literature review." *Journal of Computational Social Science* 3:245–270.

Achen, Christopher H., and Larry M. Bartels. 2017. *Democracy for Realists: Why Elections Do Not Produce Responsive Government.* Princeton University Press.

Barberá, Pablo, Andreu Casas, Jonathan Nagler, Patrick J. Egan, Richard Bonneau, John T. Jost, and Joshua A. Tucker. 2019. "Who Leads? Who Follows? Measuring Issue Attention and Agenda Setting by Legislators and the Mass Public Using Social Media Data." *American Political Science Review* 113 (4): 883–901.

Baumgartner, Frank R., and Bryan D. Jones. 2009. *Agendas and Instability in American Politics.* 368. The University of Chicago Press.

Bélanger, Éric, and Bonnie M. Meguid. 2008. "Issue salience, issue ownership, and issue-based vote choice." *Electoral Studies* 27 (3): 477–491.

Bevan, Shaun, and Peter John. 2016. "Policy Representation by Party Leaders and Followers: What Drives UK Prime Minister's Questions?" *Government and Opposition* 51 (1): 59–83.

Blei, David M., Andrew Y. Ng, and Michael I. Jordan. 2003. "Latent Dirichlet Allocation." *Journal of Machine Learning Research* 3:993–1022.

Borghetto, Enrico, and Federico Russo. 2018. "From agenda setters to agenda takers? The determinants of party issue attention in times of crisis." *Party Politics* 24 (1): 65–77.

Bosc, Marc, and André Gagnon, eds. 2017. *House of Commons Procedure and Practice.* Third Edition.

Box-Steffensmeier, Janet M., John R. Freeman, Matthew P. Hitt, and Jon C. W. Pevehouse. 2014. *Time Series Analysis for the Social Sciences.* Cambridge University Press.

Boydstun, Amber E., Rebecca A. Glazier, and Matthew T. Pietryka. 2013. "Playing to the Crowd: Agenda Control in Presidential Debates." *Political Communication* 30 (2): 254–277.

Burstein, Paul. 2003. "The Impact of Public Opinion on Public Policy: A Review and an Agenda." *Political Research Quarterly* 56 (1): 29–40.

Canes-Wrone, Brandice. 2005. *Who Leads Whom? Presidents, Policy, and the Public.* The University of Chicago Press.

Canes-Wrone, Brandice, and Kenneth W. Shotts. 2004. "The Conditional Nature of Presidential Responsiveness to Public Opinion." *American Journal of Political Science* 48 (4): 690–706.

Caughey, Devin, and Christopher Warshaw. 2018. "Policy Preferences and Policy Change: Dynamic Responsiveness in the American States, 1936–2014." *American Political Science Review* 112 (2): 249–266.

Chong, Dennis, and James N. Druckman. 2007. "Framing Theory." *Annual Review of Political Science* 10 (1): 103–126.

Cochrane, Christopher, Ludovic Rheault, Jean-François Godbout, Tanya Whyte, Michael W.-C. Wong, and Sophie Borwein. 2022. "The Automatic Analysis of Emotion in Political Speech Based on Transcripts." *Political Communication* 39 (1): 98–121.

Damore, David F. 2004. "The Dynamics of Issue Ownership in Presidential Campaigns." *Political Research Quarterly* 57 (3): 391–397.

Denny, Matthew J., and Arthur Spirling. 2018. "Text Preprocessing For Unsupervised Learning: Why It Matters, When It Misleads, And What To Do About It." *Political Analysis* 26 (2): 168–189.

Druckman, James N., and Lawrence R. Jacobs. 2015. *Who Governs? Presidents, Public Opinion, and Manipulation.* The University of Chicago Press.

Egami, Naoki, Christian J. Fong, Justin Grimmer, Margaret E. Roberts, and Brandon M. Stewart. 2022. "How to make causal inferences using texts." *Science Advances* 8 (42): 1–13.

Egan, Patrick J. 2013. *Partisan Priorities: How Issue Ownership Drives and Distorts American Politics.* Cambridge University Press.

Erikson, Robert S., Michael B. Mackuen, and James A. Stimson. 2001. *The Macro Polity.* Cambridge University Press.

Green-Pedersen, Christoffer, and Peter B. Mortensen. 2010. "Who sets the agenda and who responds to it in the Danish parliament? A new model of issue competition and agenda-setting." *European Journal of Political Research* 49 (2): 257–281.

Grimmer, Justin, Margaret E. Roberts, and Brandon M. Stewart. 2021. "Machine Learning for Social Science: An Agnostic Approach." *Annual Review of Political Science* 24 (1): 395–419.

Grimmer, Justin, and Brandon M. Stewart. 2013. "Text as Data: The Promise and Pitfalls of Automatic Content Analysis Methods for Political Texts." *Political Analysis* 21 (3): 267–297.

Guber, Deborah Lynn, Jeremiah Bohr, and Riley E. Dunlap. 2021. "'Time to Wake Up': Climate change advocacy in a polarized Congress, 1996-2015." *Environmental Politics* 30 (4): 538–558.

Imbens, Guido W., and Donald B. Rubin. 2015. *Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction.* Cambridge University Press.

Iyengar, Shanto, and Donald R. Kinder. 2010. *News That Matters: Television and American Opinion.* Updated Edition. The University of Chicago Press.

Jacobs, Lawrence R., and Robert Y. Shapiro. 1997. "Debunking the Pandering Politician Myth." *The Public Perspective* 8:3–5.

———. 2000. *Politicians Don't Pander: Political Manipulation and the Loss of Democratic Responsiveness.* The University of Chicago Press.

Johnston, Richard. 2017. *The Canadian Party System: An Analytic History.* UBC Press.

Jones, Bryan D., and Frank R. Baumgartner. 2005. *The Politics of Attention: How Government Prioritizes Problem.* 304. The University of Chicago Press.

Klüver, Heike, and Jae-Jae Spoon. 2016. "Who Responds? Voters, Parties and Issue Attention." *British Journal of Political Science* 46 (3): 633–654.

Manza, Jeff, and Fay Lomax Cook. 2002. "A Democratic Polity? Three Views of Policy Responsiveness to Public Opinion in the United States." *American Politics Research* 30 (6): 630–667.

McCombs, Maxwell, and Sebastián Valenzuela. 2021. *Setting the Agenda: Mass Media and Public Opinion.* Third Edition. Polity.

Mellon, Jonathan. 2013. "Where and When Can We Use Google Trends to Measure Issue Salience?" *PS: Political Science and Politics* 46 (2): 280–290.

———. 2014. "Internet Search Data and Issue Salience: The Properties of Google Trends as a Measure of Issue Salience." *Journal of Elections, Public Opinion and Parties* 24 (1): 45–72.

Mildenberger, Matto, Peter Howe, Erick Lachapelle, Leah Stokes, Jennifer Marlon, and Timothy Gravelle. 2016. "The Distribution of Climate Change Public Opinion in Canada." *PLoS ONE* 11, no. 8 (August): 1–14.

Moniz, Philip, and Christopher Wlezien. 2020. *Issue Salience and Political Decisions.* https://doi.org/10.1093/acrefore/9780190228637.013.1361.

Page, Benjamin I. 1994. "Democratic Responsiveness? Untangling the Links between Public Opinion and Policy." *PS: Political Science and Politics* 27 (1): 25–29.

Page, Benjamin I., and Robert Y. Shapiro. 1983. "Effects of Public Opinion on Policy." *American Political Science Review* 77 (1): 175–190.

Penner, Erin, Kelly Blidook, and Stuart Soroka. 2006. "Legislative priorities and public opinion: representation of partisan agendas in the Canadian House of Commons." *Journal of European Public Policy* 13 (7): 1006–1020.

Petrocik, John R. 1996. "Issue Ownership in Presidential Elections, with a 1980 Case Study." *American Journal of Political Science* 40 (3): 825–850.

Pitkin, Hanna F. 1972. *The Concept of Representation.* University of California Press.

Reilly, Shauna, Sean Richey, and J. Benjamin Taylor. 2012. "Using Google Search Data for State Politics Research: An Empirical Validity Test Using Roll-Off Data." *State Politics & Policy Quarterly* 12 (2): 146–159.

Rheault, Ludovic, Kaspar Beelen, Christopher Cochrane, and Graeme Hirst. 2016. "Measuring Emotion in Parliamentary Debates with Automated Textual Analysis." *PLoS ONE* 11 (12): 1–18.

Ripberger, Joseph T. 2011. "Capturing Curiosity: Using Internet Search Trends to Measure Public Attentiveness." *Policy Studies Journal* 39 (2): 239–259.

Roberts, Margaret E., Brandon M. Stewart, Dustin Tingley, Christopher Lucas, Jetson Leder-Luis, Shana Kushner Gadarian, Bethany Albertson, and David G. Rand. 2014. "Structural Topic Models for Open-Ended Survey Responses." *American Journal of Political Science* 58 (4): 1064–1082.

Rossiter, Erin L. 2021. "Measuring Agenda Setting in Interactive Political Communication." *American Journal of Political Science* 66 (2): 337–351.

Shapiro, Robert Y. 2011. "Public Opinion and American Democracy." *Public Opinion Quarterly* 75 (5): 982–1017.

Sides, John. 2006. "The Origins of Campaign Agendas." *British Journal of Political Science* 36 (3): 407–436.

Soroka, Stuart N. 2000. "Agenda-setting dynamics in Canada." PhD diss., University of British Columbia.

———. 2002. "Issue Attributes and Agenda-Setting by Media, the Public, and Policymakers in Canada." *International Journal of Public Opinion Research* 14 (3): 264–285.

Spoon, Jae-Jae, and Heike Klüver. 2014. "Do parties respond? How electoral context influences party responsiveness." *Electoral Studies* 35:48–60.

Stefano, Spada, Matteo Quartagno, Marco Tamburini, and David Robinson. 2018. *orcutt: Estimate Procedure in Case of First Order Autocorrelation.* https://CRAN.R-project.org/package=orcutt.

Stimson, James A., Michael B. Mackuen, and Robert S. Erikson. 1995. "Dynamic Representation." *American Political Science Review* 89 (3): 543–565.

Stubager, Rune. 2018. "What is Issue Ownership and How Should We Measure It?" *Political Behavior* 40:345–370.

Swearingen, C. Douglas, and Joseph T. Ripberger. 2014. "Google Insights and U.S. Senate Elections: Does Search Traffic Provide a Valid Measure of Public Attention to Political Candidates?" *Social Science Quarterly* 95 (3): 882–893.

Tseng, Qingzong. 2019. *Reconstruct Google Trends Daily Data for Extended Period.* Medium. https://towardsdatascience.com/reconstruct-google-trends-daily-data-for-extended-period-75b6ca1d3420.

Vliegenthart, Rens, and Stefaan Walgrave. 2011. "Content Matters: The Dynamics of Parliamentary Questioning in Belgium and Denmark." *Comparative Political Studies* 44 (8): 1031–1059.

Wagner, Markus, and Thomas M. Meyer. 2014. "Which Issues do Parties Emphasise? Salience Strategies and Party Organisation in Multiparty Systems." *West European Politics* 37 (5): 1019–1045.

Wlezien, Christopher. 2005. "On the salience of political issues: The problem with 'most important problem'." *Electoral Studies* 24 (4): 555–579.

Online Appendix

A Choice and Validation of the Number of Topics

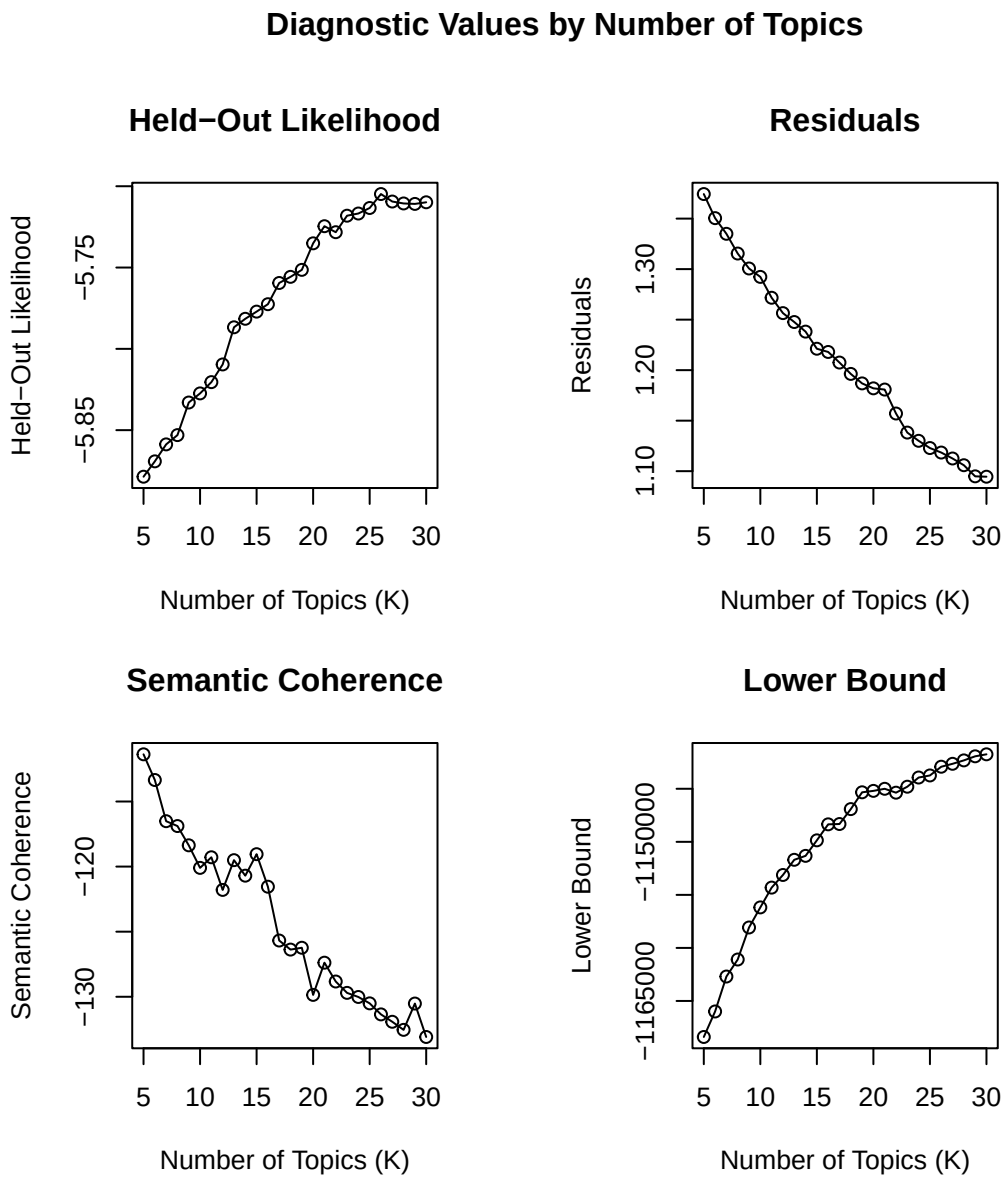

Figure A1: Diagnostic Values by Number of Topics

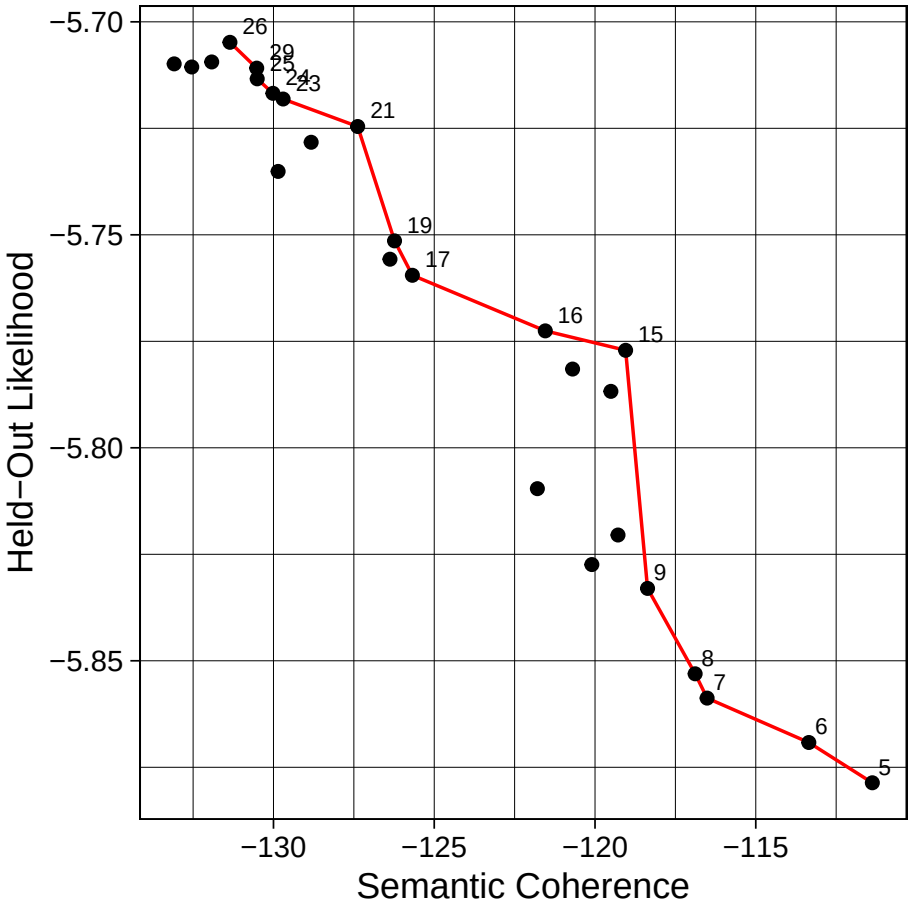

Figure A2: Diagnostic Values by Number of Topics

Table A1: Estimated Topics' Representative Words

COVID-19 / Health Care	health, vaccin, care, manag, crisi, pandem, suppli, drug, deliv, territori, transfer, medic, provinc, emerg, addit, system, product, failur, receiv, quickli
National Defense / Veterans Affairs	veteran, affair, militari, forc, defenc, servic, mission, arm, afghanistan, serv, foreign, honour, war, centr, equip, staff, oper, maintain, deserv, nation
Budget / Taxes	tax, cost, pai, carbon, busi, credit, taxpay, corpor, increas, save, rais, consum, deficit, revenu, bank, financ, billion, budget, balanc, price
Democratic Institutions / Investigations / RCMP	elect, senat, committe, court, answer, appoint, polic, campaign, question, rcmp, leader, alleg, justic, legal, common, stori, expens, simpl, parliament, debat
Foreign Policy / Immigration / Refugees	secur, world, border, intern, immigr, refuge, unit, agenc, china, food, concern, threat, organ, situat, alli, countri, citizen, human, engag, american
Criminal Justice / Culture / Official Languages / Human Rights	offici, women, colleagu, bill, legisl, languag, protect, right, victim, proud, introduc, posit, act, statu, discuss, issu, equal, cultur, commit, human
Economic Growth / Industry / Job Creation	creat, econom, job, sector, economi, growth, industri, lost, manufactur, opportun, creation, grow, innov, market, region, focus, export, plan, thousand, busi
Auditor General / Public Procurement / Treasury Board	board, farmer, contract, report, public, presid, decis, truth, auditor, releas, review, agricultur, transpar, media, treasuri, inform, depart, independ, fire, hide
Climate Change / Environment	chang, climat, environ, emiss, fight, target, clean, reduc, action, greenhous, plan, real, oil, pollut, effect, energi, approach, solut, price, reduct
Employment / Labor	worker, employ, wait, employe, insur, labour, lose, pension, union, fix, leav, peopl, week, paid, extend, program, disabl, post, train, month
Education / Research / Youth	fund, million, program, student, research, cut, school, budget, dollar, strategi, billion, educ, invest, aborigin, hundr, scienc, summer, announc, monei, init
Intergovernmental Affairs	agreement, deal, negoti, feder, british, provinc, provinci, sign, trade, premier, quebec, columbia, free, ontario, respect, jurisdict, met, regul, oppos, reach
Families / Middle Class / Seniors	famili, child, vote, children, middl, class, senior, poverti, benefit, help, choic, invest, lower, middleclass, hard, singl, rate, join, incom, live
Natural Resources / Infrastructure	consult, indigen, project, commun, coast, transport, resourc, infrastructur, pipelin, northern, municip, safeti, build, water, assess, move, nation, citi, natur, toronto
Ethics	commission, rule, ethic, person, law, conflict, matter, trust, recommend, friend, follow, polit, respons, advic, financ, investig, accept, break, violat, account

Table A2: Climate Change / Environment — Representative Documents

1	Mr. Speaker, I agree with the Government of Québec's declaration. However, the measures in Québec's plan will not reduce air pollution enough.We need a strict national regulatory framework that goes beyond Kyoto targets. The clean air act will enable us, for the first time, to implement integrated regulation of air pollution and greenhouse gases.
2	Mr. Speaker, climate change is real and the cost of inaction is enormous. It is disappointing that while climate change is having a real impact on the health and well-being of Canadians, the Conservatives still do not have a plan to protect our environment. If they do not have a plan on climate change, they do not have a plan for the economy or for the future. Can the Parliamentary Secretary to the Minister of Environment please advise this House of the actions our government is taking to fight climate change?
3	Mr. Speaker, the targets for the economy are clear. According to our plans, greenhouse gas emissions must be reduced by 20% by 2020. In the meantime, in the regulatory system proposed and detailed by the Minister of the Environment, it is clear that we are calling for efforts to be made in terms of carbon sequestration, specifically for the oil sands. These are special measures for that sector to help us achieve our results.
4	Mr. Speaker, I agree that those who are trying to sabotage the plan to deal with greenhouse gases should be condemned. It is the Bloc members and the Liberals who should be condemned. This party is a party of action. We have tabled the clean air act and those parties want to stop Canada from moving forward on reducing greenhouse gas emissions. They need to stop their sabotage. They need to get on side with reducing greenhouse gas emissions.
5	Mr. Speaker, the vast majority of Canadians want a real plan to reduce greenhouse gas emissions, not a con job. Canada can and should be a leader on this issue. We should be about renewable energy, about eliminating subsidies that reward pollution, about pushing for energy efficiency, about being leaders in green technology. The government's plan does just the opposite, and no one believes Conservatives take climate change seriously. As the world heads to the Cancun climate conference, will the government be a laughing stock, once again?
6	Mr. Speaker, our government is committed to working with our international partners to address climate change. We have contributed $1.2 billion to developing countries so that they can reduce emissions and adapt to changes. We are also a founding member of an international coalition taking action to reduce pollutants like black carbon. I look forward to meeting with my international counterparts to continue to take action in addressing climate change.
7	Mr. Speaker, there is no question that the world must take action. Here in Canada, we are showing true leadership with our plan for absolute targets to reduce greenhouse gas emissions by 20% by 2020. Perhaps the NDP leader should read today's La Presse. André Pratte wrote that the Prime Minister's attitude is "perfectly reasonable." He said that the Prime Minister "is right: everyone, including the United States, has to sign on to the post-Kyoto strategy." We are taking action.
8	Mr. Speaker, I have good news for the member for Skeena–Bulkley Valley. The Conservative government finally has begun to get rid of the tax subsidies given to the oil sands by our friends opposite in the Liberal Party. We are taking real action to reduce greenhouse gas emissions by an absolute 20%. That will put Canada in a leadership position. We will do more in the next 12 years than virtually any country in the world. While we may not have the full support and enthusiasm of the member for Skeena–Bulkley Valley, we have the full support of the Liberal Party of Canada.
9	Mr. Speaker, I think the Prime Minister himself does not believe his own distortions. He knows very well that in June 2005 the prime minister at the time came forward with a plan for greenhouse gas reductions seven times more than what he wants. He knows very well that a full year was wasted when he killed the plan and the billions of dollars in greenhouse gas reductions. There are a lot of programs that he really just took parts of, and in changing the names, he is trying to fool the Canadian people. Will he show this kind of awful behavior at the G-8 meeting? Will he try to fool the world after he tried to fool Canadians?
10	Mr. Speaker, we are playing a leadership role on the international stage. We have helped more than 65 developing countries to reduce emissions and adapt to climate change. We are doing our part by contributing to the Green Climate Fund. We are a founding member and major financial contributor to the Climate and Clean Air Coalition. We are also addressing short-lived climate pollutants under the chairmanship of the Arctic Council. We will continue to protect our environment while keeping our economy strong.

B Causal Estimates of Substitution Effects

We have previously assessed the extent to which exogenous changes in climate change's public salience alter the share of their Question Period interventions political parties devote to climate change. Now, we are interested in estimating how much changes to climate change's public salience affect Question Period interventions' topic composition across all other policy issues. This statistical exercise amounts to a placebo test: we are evaluating whether our quasi-experimental treatment (i.e., climate change's public salience) influences an outcome other than our outcome of interest (i.e., share of Question Period interventions devoted to climate change). As a general rule, we do not expect climate change's public salience to have a sizeable, systematic effect on Question Period interventions' topic composition across all other policy issues. Nevertheless, these results could shed light on parties' obfuscation strategies and show whether they attempt to draw attention to other, presumably more favorable topics when climate change becomes more salient.

Formally, we estimate the parameter β_i^j in the following equation:

$$\log\left(\frac{Y_{it}^j}{1-Y_{it}-Y_{it}^j}\right) = \alpha_i^j + \beta_i^j \log\left(X_t\right) + \varepsilon_{it}^j, \tag{3}$$

where Y_{it}^j denotes the share of party i's Question Period interventions dedicated to topic j in week t. The dependent variable is standardized so as to measure a topic's prevalence among all topics other than climate change. This standardization neutralizes variations in the share of speeches related to climate change. Accordingly, it allows us to determine the effect of climate change's public salience on the allocation of interventions across all other topics.

Figure B3 represents the results of Equation (3)'s estimation via two-stage least squares. Point estimates are represented on the x-axis with their 95 % confidence interval. For reference, the results of Equation (1)'s estimation are represented in the last row with their 95 % confidence interval. A positive coefficient indicates that a party increases a topic's prevalence in its Question Period interventions in reaction to exogenous variations in climate change's public salience. In contrast, a negative coefficient signals that the party reduces this topic's prevalence following exogenous variations in climate change's public salience.

In general, we do not observe a systematic effect of climate change's public salience on Question Period interventions' topic composition across all other topics. That said, results still suggest that the Conservatives and the Liberals engaged in some limited obfuscation and manipulation. In particular, following an

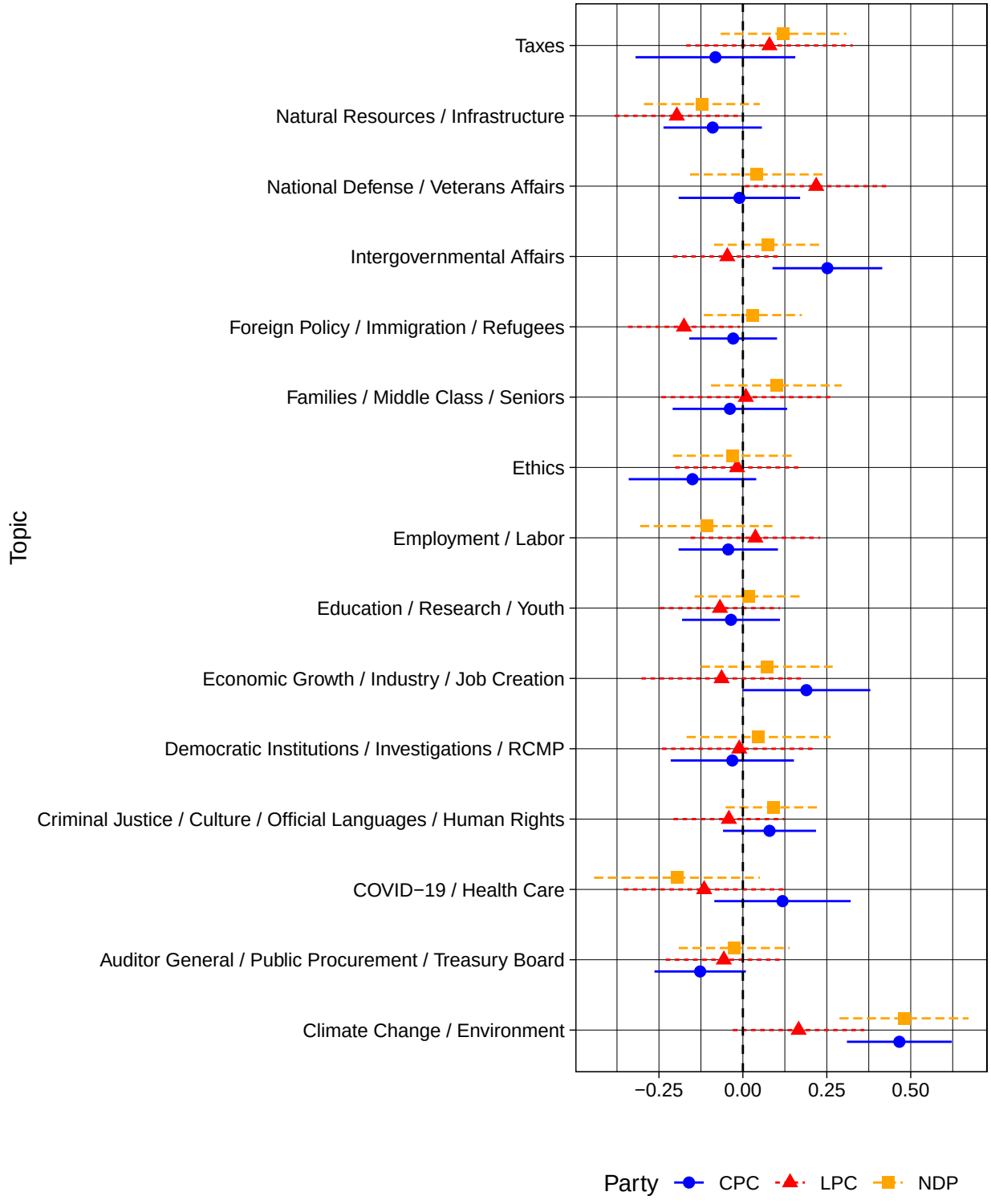

Figure B3: Causal Estimates of Substitution Effects

exogenous increase in climate change's public salience, the Conservative Party significantly increases the prevalence of economic growth and job creation and intergovernmental affairs in its Question Period interventions. Since economic issues are regularly pitted against environmental protection, we expected the Conservatives to obfuscate attention paid to climate change by putting forth economic considerations. By doing so, the Conservatives activate the perceived tension between economic and environmental considerations to counteract climate change's enhanced salience and cast the debate into a different, presumably more favorable light. This result is consistent with the Dominance Principle, according to which parties selectively emphasize policy issues over which they have a strong reputation. In reaction to an increase of climate change's public salience, the Liberal Party is found to talk less about infrastructure and natural resources. This may be attributed to the recognized tension between natural resource extraction and environmental protection. Our results also reveal that the Liberal Party increases the prevalence of national defense and reduced the prevalence of foreign policy in its Question Period interventions in reaction to exogenous changes in climate change's public salience.

C Geographic Heterogeneity in Issue Responsiveness

We have previously focused our analysis on parties' responsiveness to national public salience. This choice is partly based on the premise that parties ought to represent the general public's concerns. Admittedly, the public is not a monolith, and not all of its members have equal weight in parties' decision-making. Penner, Blidook, and Soroka (2006) argue that political representation in the Question Period is "particularized," meaning that political parties represent specific groups' interests. For instance, the views of a party's supporters presumably have a disproportionate weight in its decision-making, and a party's supporters may be concentrated in certain regions of the country. Besides, members of a party's caucus represent geographical areas called ridings of which they may be pressured to represent the idiosyncratic concerns.

Admittedly, our national measure of public salience may conceal regional heterogeneity in climate change's public salience. Canada being a large country, climate change's effects may be felt differently or at different times in various areas, resulting in regional disparities in climate change's salience. Figure C4 illustrates the relationship between climate change's public salience in Canada and its ten provinces. The *y*-axis represents climate change's national public salience and the *x*-axis climate change's public salience in the provinces. Climate change's public salience in the provinces is positively correlated with its national public salience. The intensity of the correlation is determined by a province's size: climate change's provincial public salience has the strongest correlation with national public salience in the largest provinces.

We investigate the possibility that parties be more responsive to some constituencies than others by estimating a regression model in which we account for climate change's public salience at the national and provincial levels. Estimation results are contained in Tables C3 and C4. As mentioned above, the main challenge in estimating issue responsiveness is simultaneous causality: the public's sense of priorities is being influenced by as much as it influences the attention parties pay to policy issues. For instance, Conservative supporters may not consider climate change to be a priority precisely because the Conservative Party does not pay attention to it. The inverse may be true: the Conservative Party may not pay attention to climate change, because its supporters do not think that this issue is important. Although Penner, Blidook, and Soroka (2006) argue that representation in Question Period is particularized, they cannot make the distinction between representation and manipulation. We have set forth a research design that allows to causally identify parties' responsiveness to climate change's national public salience. Unfortunately, this approach cannot be used to causally identify parties' responsiveness to specific sub-populations. Accordingly, we

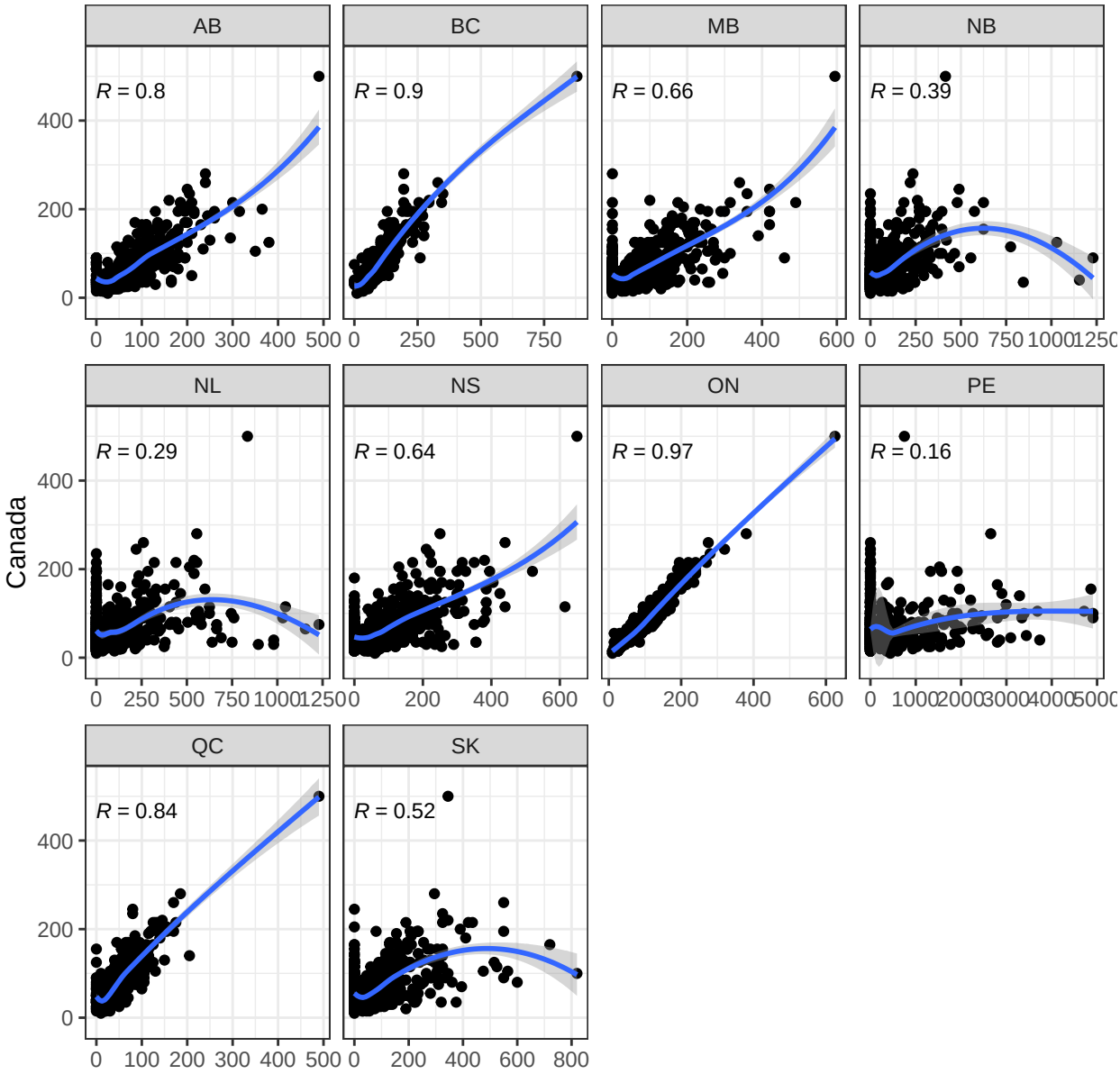

Figure C4: Relationship Between Climate Change's Public Salience at the National and Provincial Levels

Table C3: Regional Heterogeneity in Issue Responsiveness

	CPC		LPC		NDP	
	(1)	(2)	(3)	(4)	(5)	(6)
log(Canada)	0.400***	0.492***	0.282***	0.058	0.355***	0.450**
	(0.048)	(0.145)	(0.062)	(0.187)	(0.056)	(0.190)
log(AB)		−0.011***		−0.010**		−0.005
		(0.004)		(0.005)		(0.005)
log(BC)		0.059		0.156*		0.117
		(0.062)		(0.080)		(0.087)
log(MB)		−0.001		−0.001		0.001
		(0.001)		(0.002)		(0.002)
log(NB)		−0.001		−0.003***		−0.0003
		(0.001)		(0.001)		(0.001)
log(NL)		−0.001		0.001		−0.0004
		(0.001)		(0.001)		(0.001)
log(NS)		0.001		−0.001		0.001
		(0.001)		(0.002)		(0.002)
log(ON)		−0.151		0.106		−0.240
		(0.125)		(0.161)		(0.167)
log(PE)		−0.001		−0.0001		0.0003
		(0.001)		(0.001)		(0.001)
log(QC)		−0.001		0.001		−0.005
		(0.003)		(0.004)		(0.005)
log(SK)		0.001		0.003**		0.0005
		(0.001)		(0.001)		(0.001)
(Intercept)	−4.565***	−4.524***	−4.036***	−4.222***	−4.182***	−4.000***
	(0.201)	(0.226)	(0.263)	(0.291)	(0.238)	(0.280)

Note: *p<0.1; **p<0.05; ***p<0.01

Table C4: Regional Heterogeneity in Issue Responsiveness

	CPC		LPC	
	(1)	(2)	(3)	(4)
log(Canada):Before_2015	0.061***	0.415**	0.301***	0.149
	(0.013)	(0.176)	(0.060)	(0.223)
log(AB):Before_2015		−0.010***		−0.011**
		(0.004)		(0.005)
log(BC):Before_2015		0.060		0.121
		(0.073)		(0.092)
log(MB):Before_2015		−0.0002		0.0001
		(0.001)		(0.002)
log(NB):Before_2015		0.00002		−0.004**
		(0.001)		(0.001)
log(NL):Before_2015		−0.001		0.0005
		(0.001)		(0.001)
log(NS):Before_2015		0.001		0.00002
		(0.001)		(0.002)
log(ON):Before_2015		−0.087		0.092
		(0.149)		(0.188)
log(PE):Before_2015		−0.001		0.001
		(0.001)		(0.001)
log(QC):Before_2015		−0.0005		0.0002
		(0.003)		(0.004)
log(SK):Before_2015		0.001		0.003*
		(0.001)		(0.001)
log(Canada):After_2015		−0.279	0.341***	0.905
		(0.472)	(0.063)	(0.594)
log(AB):After_2015		0.057		0.132
		(0.106)		(0.133)
log(BC):After_2015		0.227		0.057
		(0.141)		(0.177)
log(MB):After_2015		−0.001		−0.008**
		(0.003)		(0.004)
log(NB):After_2015		−0.001		−0.003
		(0.002)		(0.002)
log(NL):After_2015		−0.001		0.001
		(0.002)		(0.002)
log(NS):After_2015		0.002		−0.007**
		(0.003)		(0.004)
log(ON):After_2015		0.257		−0.519
		(0.304)		(0.382)
log(PE):After_2015		−0.0003		−0.001
		(0.001)		(0.002)
log(QC):After_2015		0.059		−0.164
		(0.083)		(0.104)
log(SK):After_2015		0.002		−0.002
		(0.003)		(0.003)
(Intercept)	−3.045***	−4.433***	−4.176***	−4.429***
	(0.044)	(0.225)	(0.256)	(0.286)

simply consider whether there exists a residual correlation between climate change's prevalence in Question Period interventions and its public salience at the provincial level.

There is little to no evidence that parties respond differently to climate change's public salience in the provinces. Accounting for climate change's national public salience, we did not find any residual relationship between climate change's public salience in the provinces and climate change's prevalence in Question Period interventions, except in Alberta for the Conservatives and Liberals before 2015, in New Brunswick for the Liberals before 2015, and in Manitoba and Nova Scotia for the Liberals after 2015. In each of these cases, the residual correlation is negative, meaning that all else equal, parties pay less attention to climate change in their Question Period interventions when climate change is more salient in these provinces. In any case, these residual relationships are negligible in magnitude and are most likely to be "false positives."