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

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A re political representatives responsive to their constituents in determining the issues they address? Our paper takes a novel approach to this critical question using innovative data and state-of-the-art methodology. While most previous research on issue responsiveness has looked at the United States and its unique political institutions, we study a multi-party, parliamentary setting: Canada. We focus our analysis on two prominent issues: the environment and climate change. Using transcripts from the House of Commons' Question Period from 2006 to 2021, we measure the attention political parties attribute to the various issues. We use Google Trends data to measure policy issues' public salience. We implement an instrumental variable estimation strategy to identify and estimate how the environment and climate change's public salience drives elite attention. Our analysis demonstrates that public salience significantly affects political parties' interest in the environment and climate change but unveils appreciable partisan heterogeneity in this regard.

Word Count: 8126

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INTRODUCTION

Are political representatives responsive to their constituents? This question has motivated a considerable volume of scholarly research in political science and undoubtedly constitutes one of its most prominent topics of interest. It also has major normative implications for the functioning of representative democracy since it is widely accepted that the latter requires that political elites' actions be, to some degree, congruent with public opinion (Pitkin 1972).

Previous research on political representation has consistently shown that political elites are responsive to public opinion. Yet, there are many outstanding issues. First of all, with most of the research focused on determining whether political representatives' policy decisions are congruent with their constituents' preferences, we still have little understanding of "issue responsiveness," that is, whether and how well the issues representatives pay attention to are consistent with their public salience regardless of the specific decisions politicians take about them (Spoon and Klüver 2014; Wagner and Meyer 2014; Klüver and Spoon 2016; Barberá et al. 2019). Second, a lot of research on political representation has focused on the United States and may not generalize well to countries with different institutions, such as a multi-party and/or a parliamentary system (Shapiro 2011). Third, most of the previous research on political representation and issue responsiveness is correlational, not causal. Finally, few studies have examined political elites' responsiveness when it comes to one of the most pressing issues of our time: the climate crisis.

This paper seeks to address these outstanding issues. We study political parties' issue responsiveness in a multi-party institutional setting: the Parliament of Canada. We assess whether and how well the attention political parties pay to the environment and climate change in their rhetoric reflects these issues' public salience. We especially wish to determine if and how issue responsiveness varies across political parties. Our analysis covers a period of more than fifteen years, from April 2006 to June 2021.

We chose to focus our analysis on Canada for a number of reasons. As in many industrialized countries, the environment and climate change have become prominent issues in Canada over the past decade as citizens began to witness the effects of a changing climate, with reports of significant changes in temperature, precipitation, snow, ice, permafrost, and sea levels. At the same time, the production of fossil fuels remains a significant component of Canada's economy, making it the world's fourth largest

producer of oil and the sixth's 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 political parties form the core of the current party system: the Conservative Party (CPC, right-wing), the Liberal Party (LPC, center), and the New Democratic Party (NDP, left-wing). The environment and climate change remain disputed issues, with discernible partisan heterogeneity in attitudes toward them, and we expect the latter to translate into partisan heterogeneity in responsiveness over these issues.

We use novel measures of issue attention and salience to conduct our analysis. In particular, we quantify the attention political parties pay to the various issues through the topic composition of the speeches emanating from their members during Question Period, and policy issues' public salience by their popularity on Google's search engine. We believe that both measurements are representative of the attention and importance politicians and members of the public respectively attribute to policy issues. Furthermore, Google Trends data circumvents many of the biases that have afflicted previous work on issue salience.

Question Period is a focal moment in Canada's parliamentary life. It occurs every day the House of Commons sits and is frequently relayed by the media. Its purpose is to offer members of Parliament, especially those from opposition parties, an opportunity to seek information on contemporaneous issues and to hold Cabinet ministers accountable for their policy decisions. Political parties' behavior in Question Period remains poorly understood. This paper closes this gap. With many parliamentary regimes having comparable institutions, the insights we produce in this article may be relevant to other countries (Green-Pedersen and Mortensen 2010; Vliegenthart and Walgrave 2011; Bevan and John 2016; Borghetto and Russo 2018).

With respect to methodology, 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 incessantly growing body of research using methods from natural language processing to analyze parliamentary speeches (Rheault et al. 2016; Abercrombie and Batista-Navarro 2020; Guber et al. 2021; Cochrane et al. 2022). Most of this literature has focused on the United States and the United Kingdom, and our work contributes to expanding it beyond these two countries. We use the resulting measurements to carry out standard causal inference. To neutralize the endogeneity

between the attention political parties pay to policy issues and their public salience, we implement an instrumental variables estimation strategy. In particular, we use as an instrument of climate change's public salience in Canada the analogous measure in the neighboring country — the United States. This identification strategy allows us to make causal claims about Canadian political parties' issue responsiveness.

Our results establish that Canada's three main national political parties adjust the topic composition of their speeches in Question Period to reflect the environment and climate change's public salience, but there is significant partisan heterogeneity in that regard. Our analysis demonstrates that Question Period, by conferring agenda-setting power to opposition parties, is effective at compelling the government to address unfavorable or embarrassing issues. We find evidence that the Conservative Party engaged in obfuscation and manipulation in reaction to changes in the environment and climate change's public salience. Finally, we find evidence that one party — the Liberal Party of Canada — successfully engaged in "public agenda-setting" and significantly bolstered climate change's public salience while it was in government.

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

THE RELEVANCE OF ISSUE RESPONSIVENESS

In essence, political representation consists in "making citizens' voices, opinions, and perspectives 'present' in [policy-making] processes" (Dovi 2018). Following Pitkin (1972), scholars admit four conceptions of representation: formalistic, symbolic, descriptive, and substantive. Among these, descriptive representation is the most investigated empirically. This conception stipulates that representatives should resemble those they represent so that politicians' actions and rhetoric ought to be consistent with their constituents' concerns and preferences. As a result, understanding how effective political institutions are at fostering responsiveness is of utmost relevance to political science.

A great deal of previous research has examined policy responsiveness, that is, how congruent

politicians' policy positions are with their constituents' preferences (Page and Shapiro 1983; Stimson et al. 1995; Erikson et al. 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 importance to policy issues. We consider 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 than policy responsiveness. This is especially true for two reasons.

First of all, 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 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 represent over each of them. This is because politicians gain over time a reputation for competence at 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 stature 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 very difficult for political actors to emancipate themselves from this reputation, but they can attempt to make certain of its aspects more prominent than others.

PARTISAN HETEROGENEITY IN ISSUE RESPONSIVENESS

There is considerable partisan heterogeneity in attitudes toward the environment and climate change across Canada's three main political parties (Mildenberger et al. 2016). The Conservative Party is widely seen to occupy a weaker position or have a weaker reputation along this policy dimension than

FIGURE 1. Answers to the Question "Do You Think That Climate Change is Happening?" by Party Preference
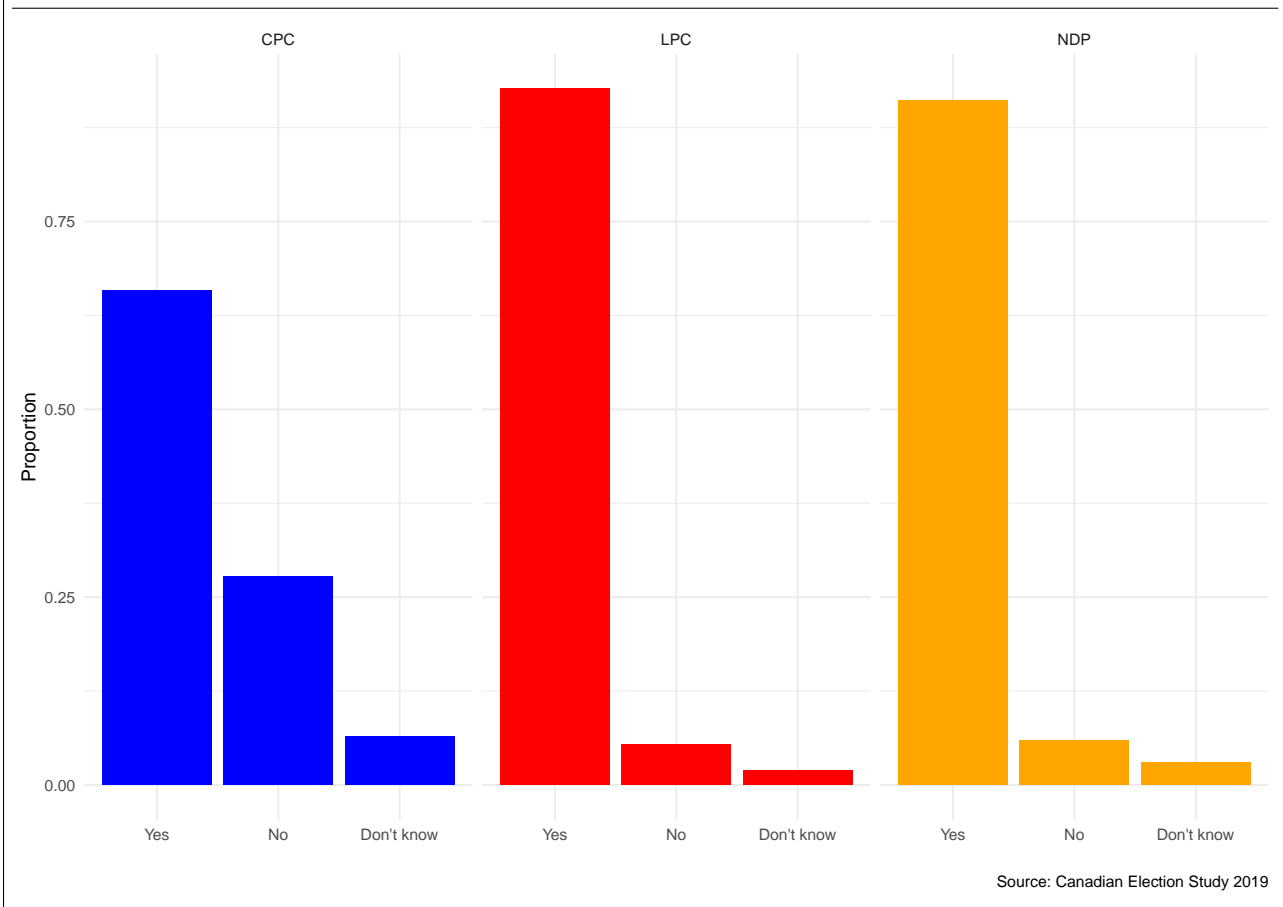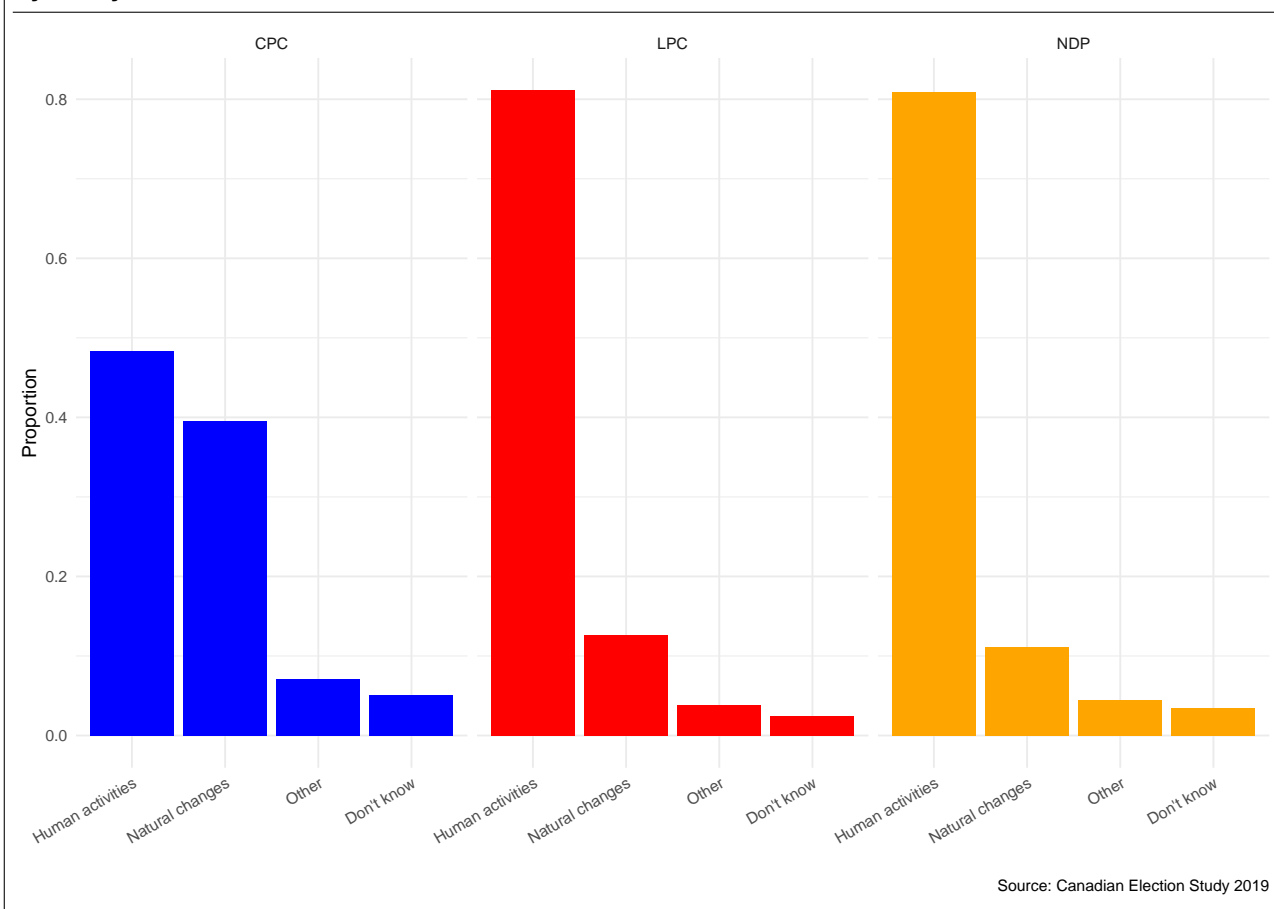

Source: Canadian Election Study 2019

FIGURE 2. Answers to the Question "What Do You Think is the Main Cause of Climate Change?" by Party Preference

Source: Canadian Election Study 2019

the Liberal Party and the NDP. 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. Further, Figure 2 reveals that, conditional on acknowledging climate change, Conservative supporters were less likely to believe that it is the result of human activities and more likely to believe that it is the consequence of natural changes. Finally, delegates at the CPC's policy convention voted at 54 % against a resolution to recognize climate change as a threat in March 2021.

Even though all parties have incentives to harmonize their policy priorities with their constituents', we expect that partisan heterogeneity in attitudes toward the environment and climate change will result in partisan heterogeneity in issue responsiveness. We expect issue responsiveness to vary along two variables: (i) issue ownership, and (ii) institutional roles.

First, previous research suggests that the attention parties pay to policy issues is contingent on the reputation they have over them. Indeed, 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. Thus, 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 simple proposition is known as the "Dominance Principle" (Petrocik 1996; Damore 2004; Sides 2006). Likewise, we conjecture that the incentives to talk more about an issue that suddenly becomes more salient are stronger for the party that owns this issue. In contrast, we expect parties for which this issue 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 be less responsive to variations in the environment and climate change's public salience than the Liberals and New Democrats.

Issue responsiveness may 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). In fact, 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. Even though

the government can thwart these tactics, systematically refusing to answer relevant questions might ultimately be detrimental to it. As a result, we expect the government to ultimately give in to some of the opposition's pressures and address compromising topics. In our institutional context, this means that we expect the Conservative Party to be more responsive to the environment and climate change's public salience when it is in government than when it is in the opposition.
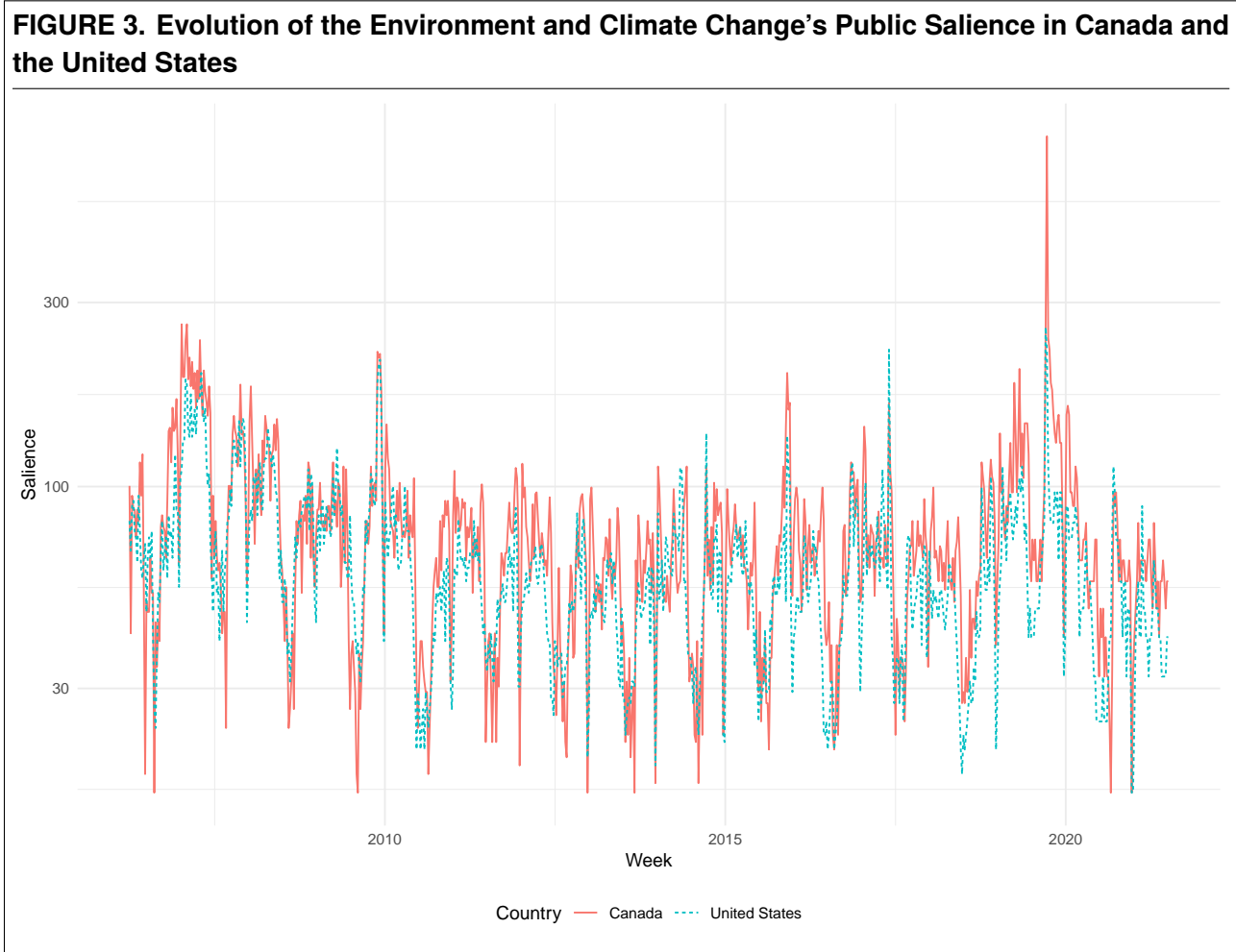
DATA AND MEASUREMENT

Our analysis builds upon two dynamic data sets: one tracking the evolution of the environment and climate change's public salience over time and another the attention politicians pay to these policy issues in public statements.

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 data presents a number of benefits relative to alternative measures. 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 or simply impossible to achieve with a survey study. We use weekly data to conduct our analysis. Since it is impossible to directly extract from Google Trends' platform weekly data for a period exceeding five years, we constructed our time series by extracting data for multiple periods with a significant overlap between them and putting the resulting series on a common scale (Tseng 2019).

FIGURE 3. Evolution of the Environment and Climate Change's Public Salience in Canada and the United States

Second, Google Trends data is directly derived from users' behavior. As a consequence, it circumvents some of the biases that may otherwise taint subjects' answers (e.g., social desirability bias, subject-expectancy bias). It measures variations in public salience inasmuch as they are reflected in Internet search behavior. On this topic, we believe that seeking information about a policy issue is a serious show of interest and concern: time and attention being scarce resources, people do not investigate problems they consider to be 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 data simultaneously considers all conceivable topics and is focused on determining the public's relative (rather than absolute) interest toward them. Overall, our measure yields a more complete portrait of policy issues' salience.

Admittedly, Google Trends data also presents a number of potential caveats and 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 with socio-demographic characteristics. That being said, Mellon (2014) shows that Google Trends data performs relatively well in measuring the salience of multiple policy issues in the United States.

We carry out our analysis using Google Trends' predefined "climate change" topic. We interpret the resulting variable as a measure of the environment and climate change's salience as a policy issue. This variable's evolution in Canada and the United States is represented in Figure 3.

Question Period Transcripts

To supplement our data on policy issues' public salience, we gathered the transcripts of each Question Period held in Canada's 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.

The House of Commons is the Parliament of Canada's lower chamber, where the country's Prime Minister and other federal Cabinet ministers sit. 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 to hold the government accountable for its decisions. It is one of the few moments during which the opposition rather than the government has control over the topics discussed.

The Speaker usually begins 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 chamber. Backbench members of the governing party and independent members are also recognized to ask questions, although not as frequently as those from officially-recognized opposition parties. Participation in Question Period is managed by the party caucuses and their whips: each decides which of its members will participate in 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 member 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 statements 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 February 2006 until October 2015, and the official opposition onward. The Liberal Party formed the official opposition from February 2006 to May 2011, had third-party status from May 2011 to October 2015, and formed the government onward. Finally, the NDP has had third-party status throughout our period of study, except from May 2011 to October 2015, when it formed the official opposition.

An alternative source of data to measure the attention parties pay to policy issues are party platforms. Our data presents many benefits over this alternative. First of all, Question Period occurs more frequently than the publication of party platforms, which only occurs once every general election campaign. Using Question Period speeches, 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 from late January to mid-June and from mid-September to mid-December. Second, parties have limited opportunities to address issues in 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, so we expect party platforms' topic composition to be spread out across policy issues and less representative of the parties' policy priorities.

We presume that the topic composition of parties' speeches during Question Period 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 et al. 2003; Grimmer and Stewart 2013). 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 of them among these topics. We estimate the LDA model using the variational implementation in R's `stm` package (Roberts et al. 2014).

LDA is a mixed-membership model, meaning that it is based on the premise that each document represents a mixture of topics and each topic represents a distribution over words so that a given term may be associated with multiple topics. LDA represents each document as a "bag of words" where syntax and the order in which terms occur are neglected. To pin down topics' boundaries, the algorithm leverages the co-occurrence of terms across documents.

Each speech, 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 appropriately 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 across the various topics, we remove all stop words unlikely to convey any meaningful information and only retain features that occur between one and 25 % of documents.

As a weakly supervised algorithm, LDA requires the analyst to fix the number of topics. We assimilate each topic to a policy dimension. After inspection of diagnostic values for various number of topics, we use the model with 15 topics to carry out the analysis since it offers the best combination of likelihood and semantic coherence. The diagnostic values are represented in the Online Appendix's Figure A1. Words representative of the estimated topics are displayed in the Online Appendix's

Table A1.

METHODOLOGY

Description of the Model

Our goal is to estimate parties' issue responsiveness. Formally, our objective is to reach a causal estimate of the parameter β_i in the following equation:

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

where Y_{it} denotes the proportion of party i's speeches in Question Period related to the environment and climate change in week t, X_t our measure of the environment and climate change's public salience in week t, and ε_{it} an error term. Following standard practice in time series analysis of compositional data, we use as the dependent variable the log-ratio rather than the raw proportion of speeches related to the environment and 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 speeches related to the environment and climate change caused by a one-percent increase of these issues' public salience. If β_i is strictly positive, then we conclude that party i is responsive to the environment and climate change's public salience.

Identification Strategy

The previous literature has shown that there 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 (Wagner and Meyer 2014; Klüver and Spoon 2016). Two mechanisms are put forth to justify the relationship between the general public's priorities and their political representatives' agenda.

On one hand, politicians have strong incentives to alter their rhetoric so that it addresses chiefly the policy issues salient to their constituents. Indeed, voters seek politicians whose priorities are congruent with theirs. Electorally-motivated politicians should alter the topic composition of their

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public statements accordingly. More primitively, raising issues voters believe to be important allows parties and candidates to draw more attention from voters than talking about issues the latter considers 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 et al. 2013; Rossiter 2021). As unsophisticated players 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 ascertaining 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 and candidates can exploit this to shape the larger political agenda to their liking, and previous work shows 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' salience. It follows that the relationship between the attention politicians pay to policy issues and their public salience is afflicted by simultaneous causality, as both variables are jointly determined (Page 1994). By naively observing the correlation between the topic composition of politicians' public statements and policy issues' public salience, we might be under the illusion that politicians are being responsive to their constituents when, instead, 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 the environment and climate change's public salience in Canada with the analogous variable for the United States.

The validity of this design relies on two assumptions:

- *Relevance.* The public salience of the environment and climate change in Canada and the United States are not independent; and

- *Exclusion Restriction.* The environment and climate change's public salience in the United States is exogenous conditional on these issues' public salience in Canada, meaning that it affects the topic composition of parties' speeches during Question Period only through the latter.

Even though these assumptions are unfalsifiable, we believe them to be highly sensible. Given the geographic proximity and close relations 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 to be influenced by common factors in both countries. Figure 3 shows that the environment and climate change's public salience in the two countries are indeed related, 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 speeches by Canadian politicians being rarely if ever relayed by the American media, it is realistic to assume that speeches in the House of Commons do not have any discernible impact on climate change's public salience south of the border. The question remains of whether additional variables jointly affect parties' public statements and the environment and climate change's public salience in the United States, possibly resulting in omitted variable bias. It might occur when, for instance, members of Parliament express sympathies or offer support for a natural disaster that occurred in the United States. We do not expect this to generate sustained and systematic bias. In general, it seems unlikely that the environment and climate change's public salience in the United States would have an effect on parties' speeches in Question Period that is not mediated by these issues' public salience in Canada.

Using Topic Composition as Dependent Variable

Our identification strategy involves causal analysis on the latent topic composition of speeches in Question Period as estimated by a weakly supervised machine learning algorithm. As Egami et al. (2018) show, 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 that 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. (2018): 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 train the algorithm. Using the trained model, we estimate the topic composition of the remaining 90 % and carry out our analysis on the resulting time series.

Serial Correlation in Dynamic Regression Models

With its dependent and independent variables being temporal, Equation (1) describes an inherently dynamic process. Since it does not contain a lagged value of the dependent variable on the right-hand side, our model is susceptible to serial correlation. Residuals' temporal correlation 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 $Y_t^\star = Y_t - \hat{\rho} Y_{t-1}$ and $\log(X_t)^\star = \log(X_t) - \hat{\rho} \log(X_{t-1})$;
4. Regress $Y_t^\star$ on $\log(X_t)^\star$ via 2SLS, and save the residuals to produce an updated $\hat{\rho}$; and
5. Repeat the previous steps until convergence in $\hat{\rho}$ is achieved.

In practice, this process is automated in the R environment via the `orcutt` package (Stefano et al. 2018). The reader should keep in mind that steps 2 and 3 involve 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 we can transform these observations. Since the estimates are based on a reduced number of observations,

this reduces the estimation's overall efficiency.

Feedback Effects and Substitution Patterns

Besides estimating parties' issue responsiveness, we are also interested in determining how changes in public salience affect the topic composition of Question Period speeches among the issues other than the environment and climate change. These results will shed light on the parties' supposed obfuscation strategies and show whether they draw attention to other, presumably more favorable topics. Formally, we want to estimate the parameter β_i^j in the following equation:

$$\log \left(\frac{Y_{it}^j}{1 - Y_{it} - Y_{it}^j} \right) = \alpha_i^j + \beta_i^j \log(X_t) + \varepsilon_{it}^j, \tag{2}$$

where Y_{it}^j denotes the proportion of party i's public speeches dedicated to topic j in week t, and ε_{it}^j an error term. The dependent variable is normalized so as to measure the prevalence of a topic among all topics other than the environment and climate change. This normalization neutralizes variations in the proportion of speeches dedicated to the environment and climate change. Hence, it allows us to determine the effect of these issues' public salience on the allocation of speeches across all *other* topics.

RESULTS

Relationship Between Topic Prevalence and Public Salience Over Time

Figure 4 illustrates the evolution over time of the share of parties' speeches devoted to the environment and climate change, which are represented by colored curves, and the public salience of these issues in Canada, which is represented by a thick black curve. In order to cut off the time series' noise, we represent the variables' smoothed values using a local polynomial regression. Remarkably, the four curves follow very similar paths, suggesting that the topic composition of parties' speeches in Question Period and policy issues' public salience are strongly related.

This observation is confirmed by Figure 5, which depicts, on the y-axis, the log-ratio of a party's speeches related to the environment and climate change in a given week and, on the x-axis, the

FIGURE 4. Evolution of the Environment and Climate Change's Prevalence in Parties' Question Period Speeches and Public Salience over Time
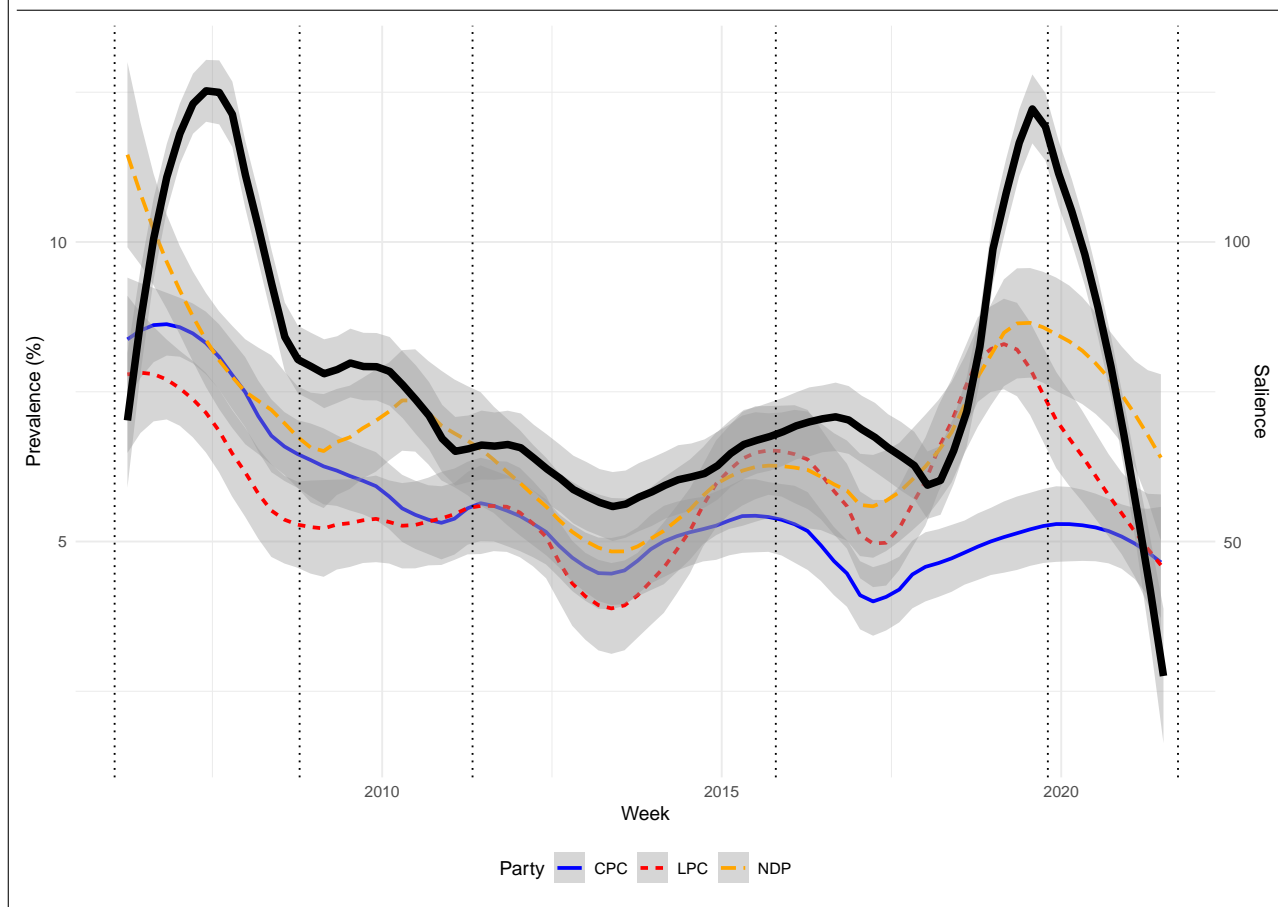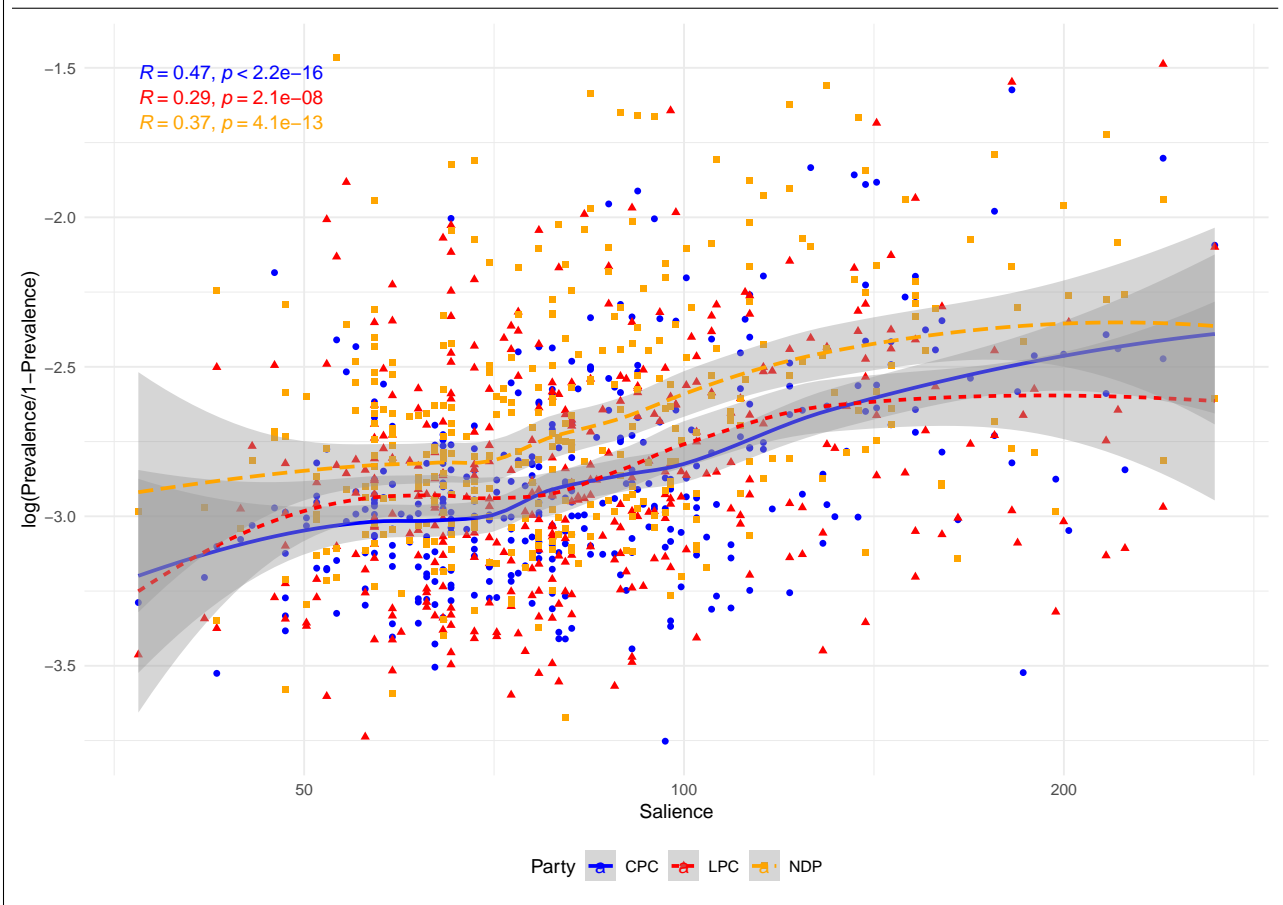
FIGURE 5. Relationship Between the Environment and Climate Change's Prevalence in Question Period Speeches and Public Salience

log-transformed public salience of these policy issues in Canada over the same period. For all three parties, the scatter plot contains a loess curve illustrating the relationship between these variables.

As expected, the three parties allocate a greater share of their speeches in Question Period to the environment and climate change when these issues are more salient. This relationship is essentially linear, validating Equation (1)'s functional form, and its slope is practically indistinguishable between the 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 NDP and, finally, the Liberal Party. This indicates that variations in Question Period speeches' topic composition are best predicted by these issues' public salience for the Conservatives, with other factors playing a larger role in predicting the topic composition of the Liberals' and New Democrats' public statements.

Even though the previous results show that there is a positive correlation between policy issues' salience and the topic composition of parties' speeches, we cannot affirm at this point that the parties are responsive to their constituents' policy priorities, let alone provide a causal estimate of this responsiveness. As we pointed out above, the topic composition of parties' speeches may very well explain as much as it is being explained by public salience. This is best seen in Figure 4: the four curves clearly shadow each other, 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.

General elections that occurred during our period of study are indicated by vertical dotted lines in Figure 4. The degree to which the Conservative Party alters the topic composition of its Question Period speeches with respect to the environment and climate change's salience seems to fall following the 2015 election, after which the party moved from government to the official opposition. This results in a divergence between the curve representing the topic composition of Conservatives' speeches and that of other parties'. We interpret this as suggestive evidence in favor of our hypothesis that Question Period pushes the party in government to address policy issues it normally would not or more than it otherwise would.

Causal Estimates of Issue Responsiveness

Table 1 presents the results of Equation (1)'s estimation. The table contains the OLS and 2SLS estimates of four model specifications. These specifications differ along two dimensions: (i) whether partisan heterogeneity in issue responsiveness is permitted or not, 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.

We highlight three key results. First of all, all parties are responsive and adjust their statements' topic composition in reaction to exogenous changes in the environment and climate change's public salience. As can be seen in column (5), the ratio of a party's speeches related to the environment and climate change increases on average by 0.388 % following a one percent increase in these policy issues' public salience. This estimate is statistically significant at the 99 % confidence level.

Second, two-stage least squares estimation noticeably alters the coefficients' value and reveals significant heterogeneity in issue responsiveness across the three parties. Somewhat unexpectedly, the Liberal Party is *less* responsive to changes in the environment and climate change's public salience than the Conservative Party and the NDP. This does not imply that the Liberals talk less about the environment and climate change. Indeed, it seems that they do talk about these issues on their own terms and are successful at bolstering their salience. This can be seen by comparing columns (2) and (6): estimation via instrumental variables lowers the estimate of the Liberals' issue responsiveness by 25 %. This suggests that the Liberals have successfully bolstered the environment and climate change's public salience over our period of study. It initially creates the illusion of issue responsiveness, which our causal identification strategy clears by disentangling the effect of public salience on parties' speeches (i.e., what we want to measure) from the effect of speeches on salience. This effect occurs entirely in the period over which the Liberals have been in government: two-stage least squares estimation reduces the estimate of the Liberals' issue responsiveness over this period by 99.1 %, but increases it by 28.7 % 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 the environment and climate change have historically been weaker policy issues for the Conservatives. The fact that the degree to which they react to changes

TABLE 1. Causal Estimates of Issue Responsiveness

Note: Complete regression results are reported in Tables A2 to A5

	OLS					2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\log(X_t)$	0.318*** (0.035)				0.388*** (0.054)			
$\log(X_t)$:Party_CPC		0.350*** (0.051)				0.466*** (0.080)		
$\log(X_t)$:Party_LPC		0.215*** (0.065)				0.166* (0.100)		
$\log(X_t)$:Party_NDP		0.365*** (0.063)				0.480*** (0.098)		
$\log(X_t)$:After_2015			0.250*** (0.065)				0.226** (0.101)	
$\log(X_t)$:Before_2015			0.359*** (0.040)				0.484*** (0.064)	
$\log(X_t)$:Party_CPC:Before_2015				0.430*** (0.058)				0.608*** (0.093)
$\log(X_t)$:Party_LPC:Before_2015				0.241*** (0.076)				0.310*** (0.119)
$\log(X_t)$:Party_NDP:Before_2015				0.389*** (0.074)				0.518*** (0.117)
$\log(X_t)$:Party_CPC:After_2015				0.162* (0.092)				0.138 (0.143)
$\log(X_t)$:Party_LPC:After_2015				0.232* (0.121)				0.002 (0.185)
$\log(X_t)$:Party_NDP:After_2015				0.335*** (0.119)				0.484** (0.189)

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

in the environment and climate change's public salience is not significantly different from the New Democrats' gives credence to the power of Question Period 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 4 had already hinted, the Conservative Party's estimated level of issue responsiveness is 77.3 % lower after 2015 than it was when they were in government. This difference is statistically significant at the 95 % confidence level. In contrast, we have not found a statistically significant difference in the New Democrats' issue responsiveness before and after the October 19, 2015 elections.

## Causal Estimates of Feedback and Substitution Effects

Figure 6 illustrates the results of Equation (2)'s estimation. Point estimates are represented on the x-axis with their 95 % confidence interval. For reference, results of Equation (1)'s estimation are represented in the last row. A positive coefficient indicates that a party increases the prevalence of a topic in its speeches (among all topics other than the environment and climate change) in reaction to a variation of the environment and climate change's public salience. In contrast, a negative coefficient signals that this party reduces the prevalence of this topic following a variation of the environment and climate change's salience.

We found evidence that the Conservative Party engaged in obfuscation in reaction to changes in the environment and climate change's public salience. In particular, following an increase in the environment and 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 speeches. Since economic issues are generally pitted against environmental protection, we expected the Conservatives to obfuscate attention paid to climate change by putting forth economic considerations. Besides, since federalism is one of the fundamental principles over which the CPC was founded, this result seems consistent with the Conservatives' ideological matrix. That being said, it might also be indicative of a systematic attempt to minimize the federal government's responsibility in addressing climate change and, instead, pass it on to the provinces and territories.

In reaction to an increase of the environment and climate change's public salience, the Liberal Party

FIGURE 6. Causal Estimates of Feedback and Substitution Effects

Note: Complete regression results are found in Tables A6 to A19
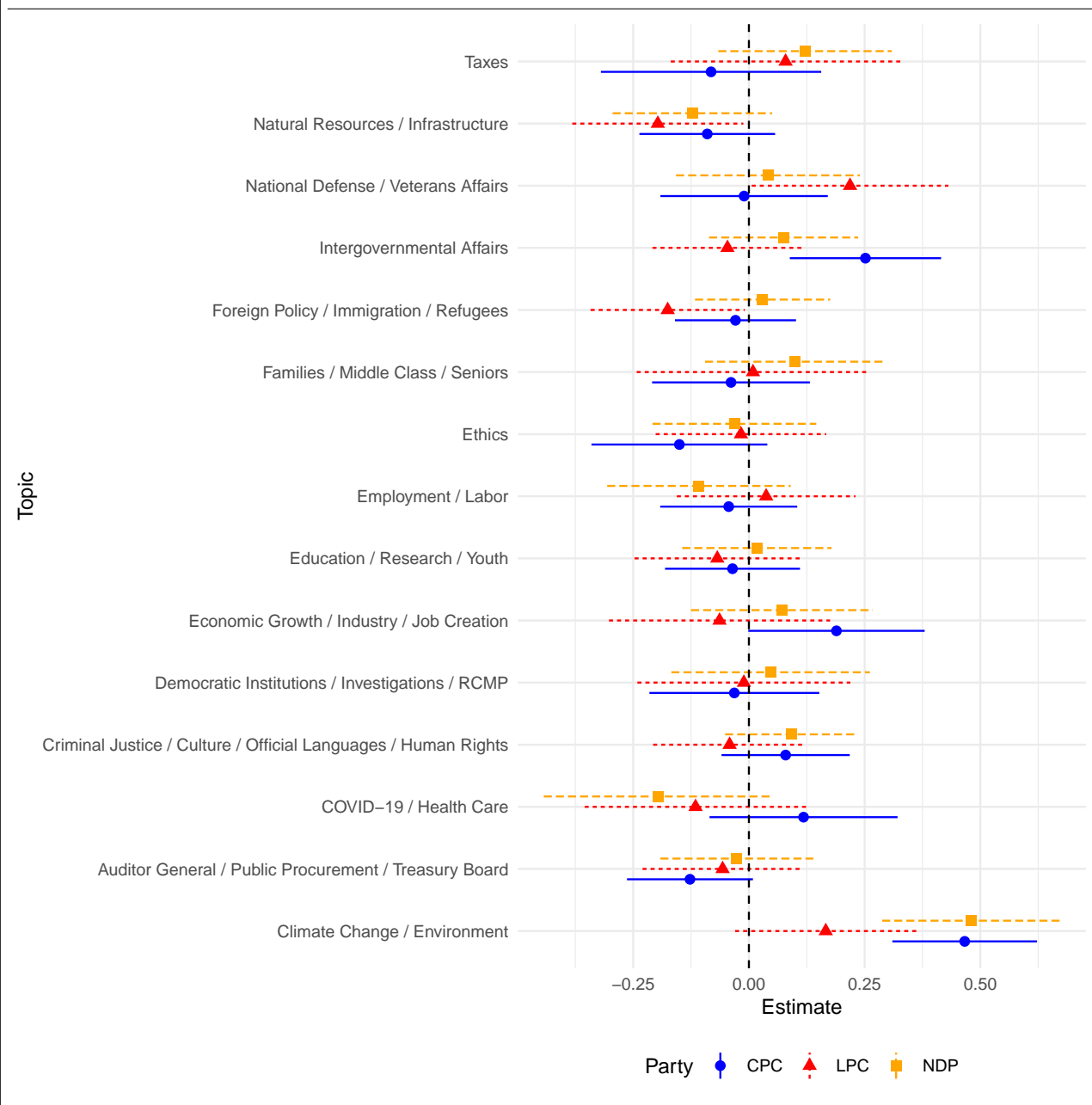
is found to talk less about infrastructure and natural resources. We foresaw this result since there is a widely recognized tension between resource extraction and environmental protection.

Finally, our results reveal that the Liberal Party increases the prevalence of national defense and reduces the prevalence of foreign policy in reaction to changes in the environment and climate change's public salience. We interpret this result as a manifestation of the Liberals' emphasis on a multilateral approach to environmental protection and the fight against climate change.

DISCUSSION AND CONCLUSION

This article makes notable contributions to the study of political representation and issue responsiveness in Canadian politics.

First, we have demonstrated the power of Question Period in delivering democratic accountability. Indeed, the Conservative Party's estimated level of issue responsiveness is identical to the New Democratic Party's when the former was in power. This is remarkable because the Conservatives are commonly perceived to hold a weaker position along this policy dimension and their supporters are less likely to believe in anthropogenic climate change than Liberal or NDP supporters. By attributing agenda-setting power to opposition parties, Question Period allows them to compel the party in government to address issues salient to the public that it may otherwise avoid or neglect.

Our analysis also reveals that the Conservative Party engaged in obfuscation by, for instance, systematically putting forth economic considerations in reaction to changes in the environment and climate change's public salience. By doing so, the Conservatives activate the tension between the economy and environmental protection to counteract climate change's enhanced salience and cast the policy debate into a different light. This result is consistent with the Dominance Principle, according to which parties selectively emphasize policy issues over which they have a strong reputation, such as the economy for the Conservative Party.

We have uncovered evidence that, during its time in government, the Liberal Party has successfully bolstered the environment and climate change's public salience through its rhetoric. It seems that, throughout their time in office, the Liberals have been talking about these issues on their own terms, and this has had a significant effect on their public salience. This result stresses the importance of

parties' role in shaping the political agenda and drawing attention to emerging policy concerns such as the climate crisis.

All three parties appeared to be responsive to the environment and climate change's public salience in Question Period, although to various degrees. Among them, the New Democratic Party has consistently been the most responsive to changes in climate change's public salience. This is consistent with the fact that it is the smallest of the three parties, never having served in government and having had third-party status throughout our period of study, except for a tenure as the official opposition from May 2011 to October 2015. This presumably makes it more arduous for the NDP to obfuscate or manipulate the public agenda. In any case, this result is contingent on the fact that the party has a strong reputation over the environment and climate change, hence it is beneficial for it that these policy issues be salient.

With respect to methodology, this paper exemplifies how machine learning, including methods from natural language processing, can be combined with standard causal identification strategies to answer substantive questions in political science. The methodological innovations we have introduced will considerably benefit to the literature on political representation and issue responsiveness. At any rate, we believe that further causal studies on political representation are strongly needed.

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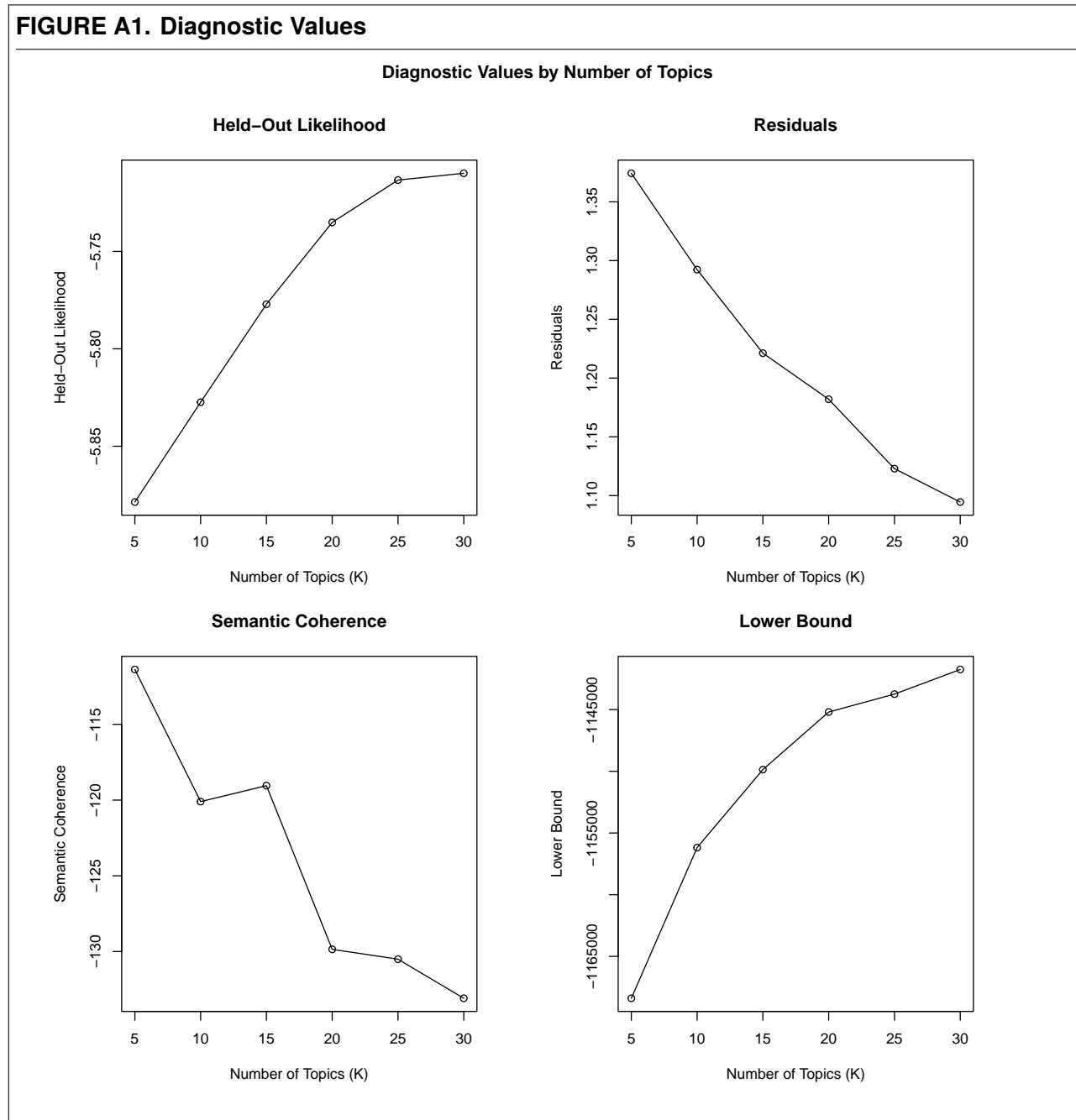Erikson, Robert S. , Michael B. Mackuen, and James A. Stimson (2001). *The Macro Polity*. Cambridge University Press.

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ONLINE APPENDIX

FIGURE A1. Diagnostic Values

Diagnostic Values by Number of Topics

Held–Out Likelihood   **Residuals**

Semantic Coherence   **Lower Bound**

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
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. Causal Estimates of Issue Responsiveness

	OLS		2SLS	
	(1)	(2)	(3)	(4)
$\log(X_t)$	0.318*** (0.035)		0.388*** (0.054)	
$\log(X_t)$:Before_2015		0.359*** (0.040)		0.484*** (0.064)
$\log(X_t)$:After_2015		0.250*** (0.065)		0.226** (0.101)
Before_2015:Party_LPC				−0.078 (0.051)
Before_2015:Party_NDP				0.118** (0.051)
After_2015:Party_LPC		0.312*** (0.075)		0.225*** (0.068)
After_2015:Party_NDP		0.220*** (0.075)		0.335*** (0.068)
After_2015		0.313 (0.340)		0.977* (0.528)
Party_LPC	0.032 (0.038)	−0.081* (0.045)	0.032 (0.043)	
Party_NDP	0.195*** (0.038)	0.115** (0.045)	0.197*** (0.044)	
(Intercept)	−4.286*** (0.156)	−4.406*** (0.182)	−4.595*** (0.240)	−4.964*** (0.287)
N	1,065	1,065	1,065	1,065
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE A3. Causal Estimates of Issue Responsiveness
Conservative Party of Canada

	OLS		2SLS	
	(1)	(2)	(3)	(4)
log(X$_t$)	0.350***		0.466***	
	(0.051)		(0.080)	
log(X$_t$):Before_2015		0.430***		0.608***
		(0.058)		(0.093)
log(X$_t$):After_2015		0.163*		0.138
		(0.092)		(0.143)
After_2015		1.010**		1.914**
		(0.482)		(0.751)
(Intercept)	−4.426***	−4.723***	−4.938***	−5.515***
	(0.229)	(0.259)	(0.353)	(0.413)
N	355	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01	

TABLE A4. Causal Estimates of Issue Responsiveness
Liberal Party of Canada

	OLS		2SLS	
	(1)	(2)	(3)	(4)
log(X$_t$)	0.215***		0.166*	
	(0.065)		(0.100)	
log(X$_t$):Before_2015		0.241***		0.310***
		(0.076)		(0.119)
log(X$_t$):After_2015		0.232*		0.002
		(0.121)		(0.185)
After_2015		0.180		1.487
		(0.631)		(0.970)
(Intercept)	−3.799***	−3.963***	−3.582***	−4.270***
	(0.288)	(0.339)	(0.442)	(0.533)
N	355	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01	

TABLE A5. Causal Estimates of Issue Responsiveness

New Democratic Party of Canada

	OLS		2SLS	
	(1)	(2)	(3)	(4)
$\log(X_t)$	0.365***		0.480***	
	(0.063)		(0.098)	
$\log(X_t)$:Before_2015		0.390***		0.518***
		(0.074)		(0.117)
$\log(X_t)$:After_2015		0.336***		0.484**
		(0.119)		(0.189)
After_2015		0.299		0.229
		(0.619)		(0.978)
(Intercept)	−4.300***	−4.433***	−4.809***	−5.006***
	(0.277)	(0.330)	(0.434)	(0.520)
N	355	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01	

TABLE A6. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	COVID-19 / Health Care		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	0.118	−0.115	−0.196
	(0.104)	(0.122)	(0.126)
(Intercept)	−3.672***	−2.563***	−2.169***
	(0.461)	(0.543)	(0.558)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A7. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	National Defense / Veterans Affairs		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.010	0.218**	0.041
	(0.092)	(0.108)	(0.101)
(Intercept)	−2.852***	−3.837***	−3.063***
	(0.408)	(0.480)	(0.448)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A8. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Taxes		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.082	0.079	0.121
	(0.121)	(0.127)	(0.096)
(Intercept)	−2.121***	−3.068***	−3.016***
	(0.540)	(0.561)	(0.423)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A9. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Democratic Institutions / Investigations / RCMP		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.031	−0.011	0.047
	(0.094)	(0.117)	(0.109)
(Intercept)	−1.714***	−1.874***	−2.082***
	(0.416)	(0.522)	(0.485)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A10. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Foreign Policy / Immigration / Refugees		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.029	−0.175**	0.030
	(0.067)	(0.085)	(0.075)
(Intercept)	−2.335***	−1.746***	−2.771***
	(0.295)	(0.376)	(0.330)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A11. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Criminal Justice / Culture / Official Languages / Human Rights		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	0.079	−0.042	0.091
	(0.071)	(0.084)	(0.073)
(Intercept)	−2.760***	−2.306***	−3.005***
	(0.315)	(0.376)	(0.322)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A12. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Economic Growth / Industry / Job Creation		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	0.189*	−0.063	0.071
	(0.097)	(0.122)	(0.100)
(Intercept)	−3.393***	−2.366***	−3.153***
	(0.432)	(0.540)	(0.443)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A13. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Auditor General / Public Procurement / Treasury Board		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.127*	−0.057	−0.026
	(0.069)	(0.088)	(0.084)
(Intercept)	−1.820***	−2.130***	−2.181***
	(0.307)	(0.394)	(0.373)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A14. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Employment / Labor		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.044	0.037	−0.108
	(0.076)	(0.098)	(0.101)
(Intercept)	−2.707***	−3.013***	−2.009***
	(0.335)	(0.437)	(0.447)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A15. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Education / Research / Youth		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.035	−0.068	0.017
	(0.074)	(0.091)	(0.082)
(Intercept)	−2.590***	−2.257***	−2.709***
	(0.330)	(0.403)	(0.364)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A16. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Intergovernmental Affairs		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	0.252***	−0.046	0.075
	(0.083)	(0.083)	(0.082)
(Intercept)	−3.949***	−2.734***	−3.304***
	(0.369)	(0.366)	(0.363)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A17. Causal Estimates of Feedback and Substitution Effects

		Topic:	
		Families / Middle Class / Seniors	
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.039	0.009	0.100
	(0.087)	(0.128)	(0.099)
(Intercept)	−2.975***	−3.137***	−3.553***
	(0.386)	(0.569)	(0.439)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A18. Causal Estimates of Feedback and Substitution Effects

		Topic:	
		Natural Resources / Infrastructure	
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.090	−0.197**	−0.122
	(0.075)	(0.094)	(0.088)
(Intercept)	−2.340***	−1.785***	−2.033***
	(0.331)	(0.419)	(0.389)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01

TABLE A19. Causal Estimates of Feedback and Substitution Effects

	Topic:		
	Ethics		
	(1)	(2)	(3)
	CPC	LPC	NDP
$\log(X_t)$	−0.150	−0.017	−0.031
	(0.097)	(0.094)	(0.090)
(Intercept)	−2.209***	−2.860***	−2.831***
	(0.430)	(0.416)	(0.399)
N	355	355	355
Note:			*p<0.1; **p<0.05; ***p<0.01