Research Note

The Thermostat is Rising Again: Canadians' Belief in Anthropogenic Climate Change

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Abstract

Canadian public opinion surveys from five Canadian polling firms in 29 separate surveys from 2007 to 2021 are used to measure changes in belief in anthropogenic climate change in Canada. By applying Stimson's (1991) Dyad Ratio Algorithm to the surveys an index is created which shows a single trend line tracking belief in climate change over time. Belief in climate change declined from 2007 to 2011, then gradually increased to 2021. The research note concludes by suggesting there is an opportunity in Canada for action to address climate change which will continue to solve the problem even when public interest once again declines.

Resumé

Vingt-huit sondages de l'opinion publique canadienne emmenée par cinq maisons de sondages canadiens de 2007 à 2019 sont utilisés pour mesurer le changement de la croyance au changement climatique anthropique au Canada. En appliquant l'Algorithme du rapport dyadique de Stimson (1991) aux sondages, on crée un index montrant une unique ligne de tendance suivant l'évolution de la croyance au changement climatique au fil du temps. De 2007 à 2011, la croyance au changement climatique a diminué, suivie d'une augmentation graduelle jusqu'en 2018. La conclusion de l'article de recherche suggère qu'il y a des opportunités au Canada pour agir contre le changement climatique et qu'ils continueront à résoudre le problème même si l'opinion publique s'en désintéresse.

Key Words: Canada, public opinion and public policy, belief in climate change

Mots-clés : Canada, opinion publique et les politiques publique, croyance dans le changement climatique

Introduction

Anthony Downs (1972) introduced the five-stage issue-attention cycle in 1972 to explain environmental policy adoption. According to Downs, (1972) the "pre-problem stage" (p.39) occurs before an issue comes to public attention. Next, an "alarmed discovery and euphoric enthusiasm" (Downs, 1972, p. 39) to solve the problem sweeps the public until the associated costs, either financial or social, are understood in the third stage the costs associated with the issue begin to be understood by the public. This leads to the fourth stage when public interest in the issue gradually declines. Finally, the issue moves to the "post-problem stage" (Downs, 1972, p. 40) where the public has lost interest but some form of action is usually in place which continues to solve the problem. For example, ozone depletion is no longer an issue of concern to the general public but the regulations put into place to address CFC pollutants continue to serve as an effective mechanism to address this issue. If the policies put in place are ineffective, the issue risks repeating elements of the cycle (Downs, 1972).

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Indeed, as this research note will demonstrate, this appears to be what is taking place with respect to climate change in Canada.

Other scholars have also examined public opinion's influence on public policy more broadly. Soroka and Wlezien (2010), for example, explain Canadian policy changes using the thermostatic model. They argue public opinion is fluid with people changing from supporting an issue to opposing it back again to supporting it easily. They use the metaphor of a thermostat to describe the rising and falling of public support for an issue (Soroka & Wlezien, 2010; Wlezien, 1995). Policymakers adjust their responses based on public opinion, while public opinion shifts as a response to policy changes which result in either more spending or spending cuts depending on public perspectives on an issue (Soroka & Wlezien, 2010). Once the public believes the level of spending is too high (liberal) or too low (conservative), public opinion will often shift to the opposite side of the spectrum (Wlezien, 1995).

This paper seeks to examine where Canadians fit in Downs' issue attention cycle and the thermostatic model. Our analysis reveals two similar possible interpretations, depending on which model is used. Climate change as a policy issue may be following this thermostatic model as public opinion over the last ten years has been shifting. Using Downs' (1972) approach, it can be argued that climate change policy was re-entering the second stage of the issue attention cycle in 2018 as polling data reveals a renewed belief in anthropogenic climate change amongst Canadians. This conclusion is based on an analysis of Canadian public opinion data about climate change from April 3rd, 2007 to April 25, 2021 using the Dyad Ratio Algorithm, developed by Stimson (1991).

Re-entry into the second phase suggests that it may be the ideal time to implement reforms designed to address climate change as the public in this phase is supportive of action.

The Dyad Ratio Algorithm was created by Stimson (1991) as a mechanism for combining public opinion polling data from different firms asking different questions into a single trend line. To operationalize the algorithm, he created a computer program, Wcalc, which uses the Dyad Ratio Algorithm to estimate public opinion overtime from multiple public opinion polls. Applying this algorithm, Stimson (1991) discovered public opinion consisted of an ebb and flow towards liberal and conservative values in the United States. He labelled this shifting public opinion policy mood.

According to Stimson (1991), policy mood is the general disposition through which the public perceives every policy issue simultaneously. The algorithm can be used to detect overall policy mood but it is versatile enough to track public opinion overtime towards a specific issue as well.

Notably, Stimson (1991) applied the Dyad Ratio Algorithm to a broad set of public opinion questions on a variety of topics to develop an overall liberal/conservative policy mood measurement. It is also possible to use the Dyad Ratio Algorithm to focus on a single public opinion issue, to get a sense of the public's attitudes towards that single issue.

Stimson's Dyad Ratio Algorithm is well suited as a method for summarizing irregular public opinion polling data and inconsistent question wording on a policy issue (Brulle et al.2012). A chief value of the Dyad Ratio Algorithm is that it reduces measurement error (Enns & Koch, 2013), meaning sample values are closer to the true population value than if only examining a single survey over time. The algorithm also allows an estimate to be made of public opinion during time periods when few or no surveys were placed in the field.

Wcalc was used in the United States by Brulle et al. (2012) to construct an index measuring public opinion towards climate change over time. In order to explain shifts in public opinion, Brulle et al. (2012) compared the index to five different external factors: extreme weather events, access to accurate scientific information, media coverage, elite cues, and media advocacy for and against an issue. Brulle et al. (2012) conclude that elite cues and structural economic factors have the largest impact, with extreme weather events and scientific advocacy having little impact.

While Brulle et al. (2012) were able to construct quarterly measures of public opinion towards climate change in the United States using 14 questions (each asked multiple times) from 6 firms, polling data is more episodic and sporadic in Canada. Nonetheless, over the past fifteen years, 29 Canadian public opinion polls conducted by five different polling firms asked questions that were available for analysis, allowing an annual summary of public opinion toward climate change in Canada.

Methodology

The Dyad Ratio Algorithm combines single survey questions from multiple surveys asked over time to create a measure of central tendency (Brulle et al., 2012; Stimson, 1991). The method compares the variation in survey responses over time to calculate an average trend line (Brulle et al., 2012).

The first step in applying the Dyad Ratio Algorithm is to collect data from surveys conducted over time by multiple survey firms (Brulle et al., 2012). The algorithm compares the differences between different survey questions asked in the same time period (in our case one year) and the differences over time between the same and different questions to calculate the average annual pubic opinion towards the issue (Brulle et al., 2012; Stimson, 1991). Using this approach requires the same survey question to be asked multiple times by the same firm to be included in the analysis.

To examine Canadian belief's in climate change, data from public opinion surveys was collected from 1988 to 2021. Survey questions were first identified in the summer of 2018 from the ODESI database using the keywords "Environment", "Climate", "Global warming", "Pollution", "Emissions", "Greenhouse Effect", "Climate change" and "Kyoto" (note some of these keywords are not related to climate change because the data was gathered as part of a larger study). In the summer of 2018, the Forum Research archives were also searched. In 2019, to verify the accuracy of the first search, a second search occurred using the keywords "climate change" and "global warming" in the ODESI database. The search was expanded to the websites of the polling firms Abacus Data, Environics, Innovative Research, Forum Research, Angus Reid, and Ipsos. In 2021, during revisions to the research note, a third search was conducted focusing only on the five survey questions retained for analysis (this yielded three new surveys for inclusion in the analysis). The search resulted in 120 relevant questions from 60 surveys by 10 polling firms that were publicly accessible for analysis from 1988 to 2021.

The questions selected for our analysis were narrowed to focus on questions related to belief in anthropogenic climate change. Selecting questions with a single focus was in response to criticisms of the Dyad Ratio Algorithm, which suggested it is inappropriate to use the method to measure questions with different foci (Brulle et al., 2012). There were no usable survey questions asked from 2000 to 2006, while the Dyad Ratio Algorithm can

compute values for missing years this large gap was considered too large to create a reliable estimate from 2000 to 2006, therefore any data prior to 2007 was excluded from the final analysis. Only survey questions asked at least twice by the same polling firm appear in the calculation as the Dyad Ratio Algorithm cannot estimate trend lines from a single question. This left public opinion surveys from five Canadian polling firms in 29 separate surveys from 2007 to 2021, which were available for analysis using Wcalc and the Dyad Ratio Algorithm (Stimson, 1991).

Results

Before analyzing the data, a scatter plot was produced (Figure #1) to show what percentage of respondents on each survey believed in climate change. The responses to the questions showed between 52% and 91% of respondents expressed a belief in climate change over the last twelve years.

Figure 1: Scatter plot representing raw survey answers
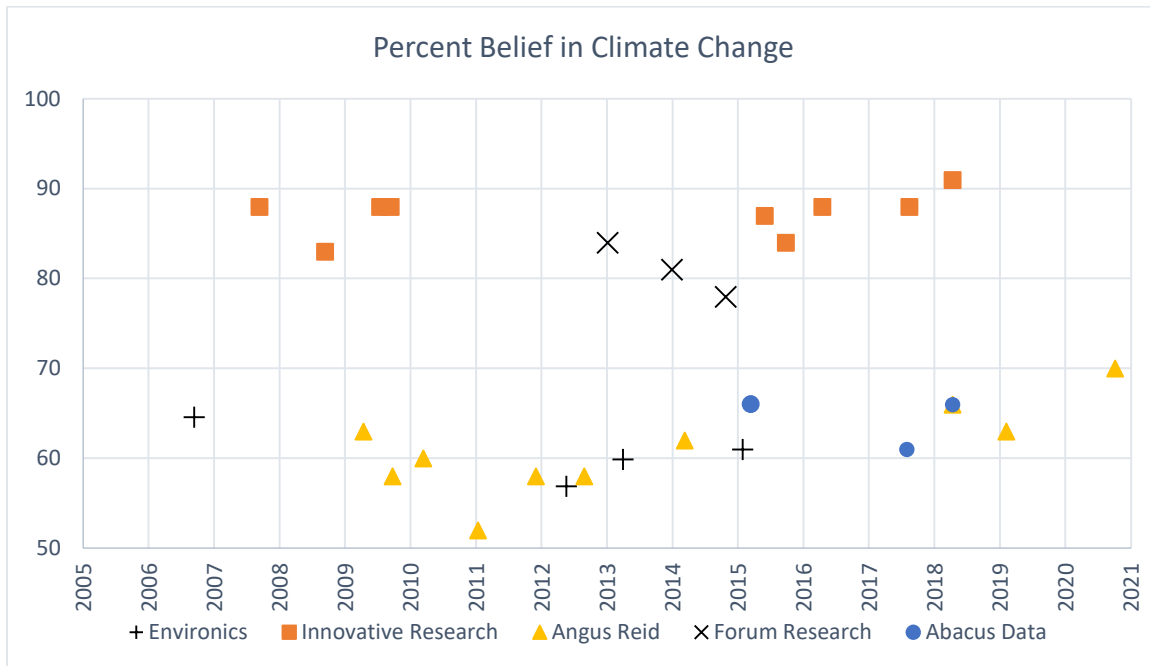
Respondents to surveys by Forum Research and Innovative Research consistently scored higher on belief in climate change than the other polling firms. It is unclear exactly why these firms yield such different results, but one possibility is question-wording. Innovative Research and Forum ask questions about belief in climate change without stating an underlying reason.

Innovative Research asks, "Thinking about your own personal view, do you believe that climate change is definitely occurring, climate change is probably occurring, climate change is probably not occurring, or climate change is definitely not occurring?" and Forum Research asks "Do you believe earth's climate is changing or not?". In contrast, Angus Reid and Environics provide reasons behind belief in global warming. Angus Reid asks "Which of the following statements comes closest to your view on climate change (or global warming)?

Global warming is a fact and is caused by emissions from vehicles and industrial facilities, Global warming is a fact and is mostly caused by natural changes or Global warming is a theory that has not yet been proven." Finally, Environics is also relatively similar asking: "Which one of the following best fits your own view about the latest scientific evidence about global warming? Global warming caused mostly by human activity, Not conclusive global warming caused by human activity, or Not yet conclusive that global warming is happening."

However, if question-wording is the cause for this difference, Abacus's question is an outlier as it does not provide an explanation asking only "In your view, is there conclusive evidence, solid evidence, some but not conclusive, little, or no evidence that the average temperature on earth has been getting warmer over the past few decades, or not?"

It is worth noting, that the Dyad Ratio Algorithm does not need to understand the reasons for these differences in result amongst survey firms. The different question wording is not a cause for concern as the Dyad ratio algorithm is specifically designed to combine questions from different surveys with different wording into a single index trendline (Stimson, 1991). Stimson (1991) uses the algorithm at times to combine entirely different topics (e.g. attitudes towards welfare, size of government, and environmental protection). Combing different topics was criticized as an inappropriate use of the algorithm (Brulle et al., 2012). However, this is not an issue in this study as the focus is only on questions examining belief in climate change.

The purpose of the algorithm is to estimate changes in levels of support over time. While these widely different results suggest it is difficult to know exactly what percentage of Canadians believe in climate change, the changes overtime will still be meaningful.

Figure 2: Belief in Climate Change Index over time

Belief in Climate Change Index 2007-2021
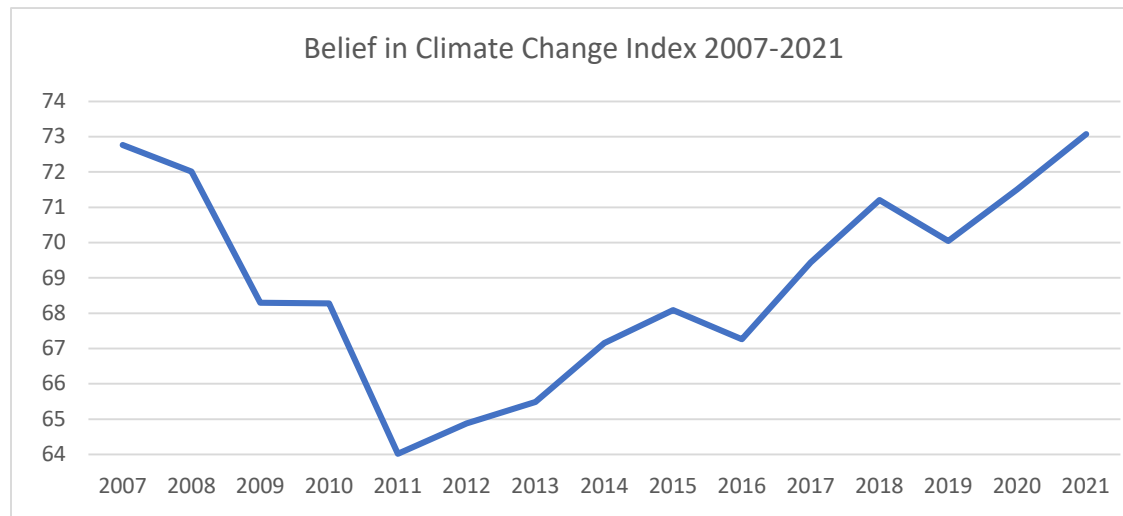
When the 29 survey questions from the five polling firms were analyzed in Wcalc, the Belief in Climate Change Index (BCCI) was calculated. The BCCI values were then used to create a single time series showing the evolution of public opinion toward climate change over the last decade (Figure #2). The trend line shows the BCCI mostly falling from 2007 (when the data begin) to 2011 then mostly rising from 2011 to 2021. It is worth noting that in 2021 the BCCI value passes 2007 levels for the first time. The survey marginal scores processed by Wcalc are depicted in Table 1 along with BCCI loadings for each survey firm. The results show the model is a good fit for the data explaining 80 percent of the variance[i].

Table 1: Belief in Climate Change Index loadings along with variables

| Survey Firm	Number of Survey Questions Asked	Correlation with climate change index	Mean	Standard Deviation
Angus Reid	10	0.933	61.22	4.92
Innovative Research	9	0.61	86.85	2.13
Environics	4	0.95	60.60	2.75
Abacus Data	3	-1.00	64.58	1.44
Forum Research	3	-1.00	81.00	2.45

Eigen estimate 1.24 of possible 1.6, variance explained: 77.44, mean: 68.91, st. dev: 2.76

The BCCI values ranged from a low of 64 to a high of 73 from 2007 to 2021. Public concern over climate change, measured by the BCCI, declined from 2007 to 2011. In 2007, public opinion peaked at 73 then dropping to 69 in 2009, stabilizing briefly in 2010 then dropping to a record low of 64 in 2011. The raw data from the scatter graph depicts the lowest individual survey results on a survey from Angus Reid in 2011 as well. From 2011 onwards, public concern over climate change sees a steady increase until 2015 reaching a score of 68. A slight decline in the BCCI occurred in 2016 to 67. After 2016, the BCCI increased to just 73 in 2021, which is its highest point.

Discussion & Conclusion

From 2007 to 2011 believe in climate change falls before increasing from 2011 to 2021. While the magnitude of the drop and rise may be amplified due to the limited number of survey questions asked in this time period and the possibility of outliers, the overall trend line should be an accurate assessment of shifts in public opinion.

The drop-in support from 2007 to 2011 seems to align with Downs (1972) fourth stage of the issue-attention cycle where the public begins to recognize the financial and social costs associated with combatting climate change. Similarly, the thermostatic model explanation for this change suggests that public expenses related to climate change, lead to a reduction in interest in addressing the issue. Policy mood, also suggests government action to address climate change led to less demand for more action. Indeed, Canada's greenhouse gas emissions fell from 2007 to 2010 (Environment and Climate Change Canada, 2019) (Figure #3).

Figure 3: Greenhouse gas emissions from 2007 to 2019
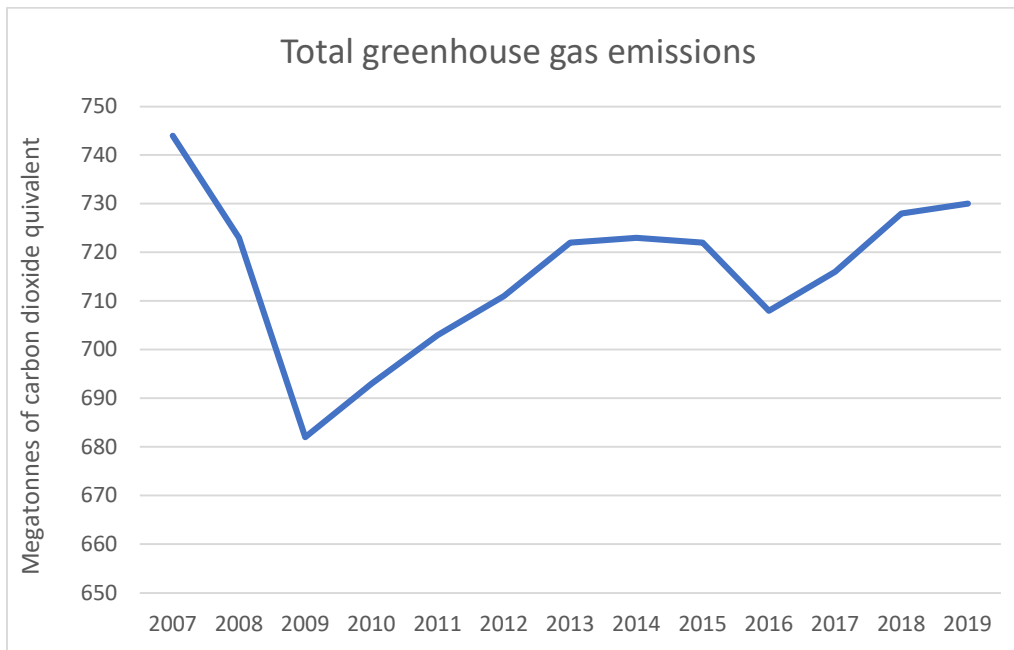
(Environment and Climate Change Canada, 2019)

However, this drop was largely caused by the financial crisis in 2008 and by efforts in Ontario to close coal power plants (Ministry of Energy, Northern Development and Mines, 2017). Despite the initial drops in greenhouse gas emissions from 2007 to 2009, emissions have been higher than 2009 levels every year since. The lack of effective action to limit emissions seems to have been noticed by the public, as the BCCI in 2021 rose to the same levels it had reached in 2007, suggesting the Downs (1972) second stage is being re-entered and there is once again public support to take action and address climate change. The thermostatic model is also consistent with this result. In this interpretation, the public is taking notice that previous actions were insufficient to address the issue of greenhouse gas emissions. The public is, therefore, once again demanding action to address climate change.

Downs (1972), Stimson (1991), and Soroka and Wlezien (2010) provide a cautionary note to this opportunity. While the public may be willing to support action now, the public may shift their preferences quickly once an action is taken. Indeed, Soroka and Wlezien (2010) argue that changes from one spending preference to another are inevitable as a reaction to policy actions. Downs (1972) suggests a straightforward solution to this dilemma: ensure any actions taken continue to work once the public support for action abates.

Notes

1 The questions asked by Abacus and Forum loaded negatively, which was unexpected. In response, scenarios were modelled excluding Abacus' and Forum's survey questions. While the index values changed in these revised models, the time series starts out at it's second highest point in 2007 and then peaks in 2021 following a dip in BCCI in 2011. In response to these unexpected results Stimson, creator of the algorithm, was consulted via email. He explained negative loadings "do NOT mean what negative correlations mean with cross-sectional data…They mean that the particular series is out of phase with the scale, that one is going up while the other is going down. And with 2 or 3 points in a series that is trivial" (personal communication).

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Appendix

Survey Questions on Belief in Climate Change

Question asked	Coded as belief in climate change	Coded as denial	Years asked	Survey Firm
Which one of the following best fits your own view about the latest scientific evidence about global warming?	• Global warming caused mostly by human activity	• Not conclusive global warming caused by human activity • Not yet conclusive that global warming is happening • Other • Don't know	2007, 2012, 2013, 2015	Environics
Thinking about your own personal view, do you believe that…? (Note: prior to 2010 global warming was used instead of climate change)	• Climate change is definitely occurring • Climate change is probably occurring	• Climate change is probably not occurring • Climate change is definitely not occurring • Don't know	2008, 2009, 2010, 2015, 2016, 2018, 2019	Innovative Research
In your view, is there _____ that the average temperature on earth has been getting warmer over the past few decades, or not?	• Conclusive evidence • Solid evidence	• Some but not conclusive evidence • Little evidence • No evidence	2015, 2018	Abacus Data
Which of the following statements comes closest to your view on climate change (or global warming)?	• Global warming is a fact and is caused by emissions from vehicles and industrial facilities	• Global warming is a fact and is mostly caused by natural changes • Global warming is a theory that has not yet been proven • Not sure	2009, 2010, 2011, 2012, 2013, 2014, 2018, **2019, 2021**	Angus Reid
Do you believe the earth's climate is changing or not? OR As far as you know, is earth's climate changing?	• Believe climate is changing/Yes	• Do not believe the climate is changing/No • Don't know	2013, 2014, 2015	Forum Research