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## Beliefs, Information, and Institutions: Public Perception of Climate Change Information Provided by Government versus the Market

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# BELIEFS, INFORMATION, AND INSTITUTIONS: PUBLIC PERCEPTION OF CLIMATE CHANGE INFORMATION PROVIDED BY GOVERNMENT VERSUS THE MARKET

CHERIE METCALF\* & JONATHAN R. NASH\*\*

Despite scientific consensus over the threat posed by climate change, governmental actions remain modest or stalled, often because of profound societal polarization: more liberal individuals tend to accept climate change as real, anthropogenic, and as posing a substantial (if not existential) threat, while more conservative individuals tend to doubt such assertions. The standard explanation for this phenomenon is that liberals tend to believe government-provided information—as information about climate change tends to be—while conservatives tend to doubt it. Commentators suggest that market-generated climate change information would more likely sway conservatives.

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But this assertion lacks any empirical support. This Article explores this theory by investigating the link between institutional source of information and personal beliefs using a survey-based experiment. While varying the institutional source generates statistically significant effects, the direction of these effects goes against commentators' assumptions. Market-generated climate risk information is associated with less perceived credibility of the information, a lower level of trust in the informational source, and a lower confidence in the belief in climate change existence and its human attribution. The first two of these effects predominate amongst conservatives, while the latter effect is confined to liberals. These effects suggest that market-generated climate risk information will not have the desired impact of persuading conservatives but may perversely damage the confidence of liberals—whose views more closely track the predictions of climate scientists in the first place. The results raise questions about the need to move beyond governmental institutions to effectively convey climate science information and about the use of corporate environmental, social, and governance disclosure as a means to sway public opinion.

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## INTRODUCTION

Our objective in this Article is to address the link between the institutional source of climate science information and individuals' perception of the credibility and persuasiveness of that information. We examine this question in the context of climate change using an experimental survey method and empirical analysis.<sup>1</sup>

Climate change presents one of the most pressing policy problems facing the global political community.<sup>2</sup> Yet, despite consensus in the scientific community,<sup>3</sup> action by governments remains modest or stalled at the international<sup>4</sup> and domestic<sup>5</sup> levels.<sup>6</sup> In democracies—perhaps most

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<sup>1</sup> See *infra* Part III.

<sup>2</sup> See, e.g., Philip B. Duffy, Christopher B. Field, Noah S. Diffenbaugh, Scott C. Doney, Zoe Dutton, Sherri Goodman, Lisa Heinzerling, Solomon Hsiang, David B. Lobell, Loretta J. Mickley, Samuel Myers, Susan M. Natali, Camille Parmesan, Susan Tierney & A. Park Williams, *Strengthened Scientific Support for the Endangerment Finding for Atmospheric Greenhouse Gases*, SCI., Feb. 8, 2019, at 1, 1, <http://science.sciencemag.org/content/363/6427/eaat5982> [<https://perma.cc/9GA7-WGK6>].

<sup>3</sup> See, e.g., *id.* at 1–2; MAXWELL BOYKOFF, CREATIVE (CLIMATE) COMMUNICATIONS: PRODUCTIVE PATHWAYS FOR SCIENCE, POLICY AND SOCIETY 147–49 (2019).

<sup>4</sup> See, e.g., Brady Dennis & Chris Mooney, *Countries Made Only Modest Climate-Change Promises in Paris. They're Falling Short Anyway.*, WASH. POST (Feb. 19, 2018, 3:49 PM), [https://www.washingtonpost.com/national/health-science/its-not-fast-enough-its-not-big-enough-theres-not-enough-action/2018/02/19/5cf0a7d4-015a-11e8-9d31-d72cf78dbeee\\_story.html](https://www.washingtonpost.com/national/health-science/its-not-fast-enough-its-not-big-enough-theres-not-enough-action/2018/02/19/5cf0a7d4-015a-11e8-9d31-d72cf78dbeee_story.html) [<https://perma.cc/UM5V-92B9>]; Somini Sengupta, *U.N. Climate Talks End With Few Commitments and a 'Lost' Opportunity*, N.Y. TIMES (Dec. 15, 2019), <https://www.nytimes.com/2019/12/15/climate/cop25-un-climate-talks-madrid.html> [<https://perma.cc/UQU7-3L5T>].

<sup>5</sup> See, e.g., Matthew Hoffman & Steven Bernstein, *Why Action on Climate Change Gets Stuck and What to Do About It*, CONVERSATION (Jan. 16, 2020, 5:06 PM), <http://theconversation.com/why-action-on-climate-change-gets-stuck-and-what-to-do-about-it-128287> [<https://perma.cc/M9AF-YD7U>]. The Inflation Reduction Act of 2022 provides for substantial investment in the energy transition but also continues support for fossil fuel industries. Bella Isaacs-Thomas, *What the Inflation Reduction Act Does for Green Energy*, PBS NEWS HOUR (Aug. 17, 2022, 10:57 AM), <https://www.pbs.org/newshour/science/what-the-inflation-reduction-act-does-for-green-energy> [<https://perma.cc/72VV-PJRY>]. Its ultimate impact remains to be seen.

<sup>6</sup> Local governments have been more successful at taking steps toward mitigating climate change. Judith Resnik, Joshua Civin & Joseph Frueh, *Ratifying Kyoto at the Local Level: Sovereignty, Federalism, and Translocal Organizations of Government Actors (TOGAs)*, 50 ARIZ. L. REV. 709, 711–12, 718–19, 721 (2008); Kevin L. Doran, *U.S. Sub-Federal Climate Change Initiatives: An Irrational Means to a Rational End?*, 26 VA. ENV'T L.J. 189, 189–94 (2008); Thomas Forman, *The Role of Cities and States in Combating Climate Change*, GEO. ENV'T L. REV. (Jan. 31, 2017), <https://gielr.wordpress.com/2017/01/31/the-role-of-cities-and-states-in-combating-climate-change/> [<https://perma.cc/UWY4-CFHZ>]; see also Katrina M. Wyman & Danielle Spiegel-Feld, *The Urban Environmental Renaissance*, 108 CALIF. L. REV. 305, 305–12 (2020).

prominently the United States—this government inaction is at least partly attributable to profound polarization among citizens over the existence of, origins of, and threat posed by, climate change.<sup>7</sup> It seems that people with more liberal ideology are more likely to accept that climate change is real and anthropogenic, and poses a substantial (if not existential) threat.<sup>8</sup> In contrast, people with conservative ideology are less likely to accept these assertions.<sup>9</sup>

Commentators, in law and other fields, have suggested that hesitancy about the sources of climate information contributes to this gap in beliefs.<sup>10</sup> Information about climate change has to date, tended to originate from scientific organizations and governmental actors.<sup>11</sup> And, while people with a liberal ideological orientation might tend to accept information from these sources, people with conservative ideological orientation might be more dubious.<sup>12</sup>

Several commentators have taken the argument a step further. Relying on the notion from economics that markets generate (or at least are seen by many to generate) reliable information,<sup>13</sup> these commentators have suggested that it might be possible to reach people with a conservative orientation more effectively through more market-based sources.<sup>14</sup>

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<sup>7</sup> See *infra* Part I.

<sup>8</sup> Cary Funk & Meg Hefferon, *U.S. Public Views on Climate Change and Energy*, PEW RSCH. CTR. (Nov. 25, 2019), <https://www.pewresearch.org/science/2019/11/25/u-s-public-views-on-climate-and-energy/> [<https://perma.cc/XBT5-T7GR>].

<sup>9</sup> *Id.*

<sup>10</sup> Cary Funk & Brian Kennedy, *The Politics of Climate*, PEW RSCH. CTR. (Oct. 4, 2016), <https://www.pewresearch.org/science/2016/10/04/the-politics-of-climate/> [<https://perma.cc/8R8Q-UYKJ>].

<sup>11</sup> See *id.*

<sup>12</sup> See *infra* Part I.

<sup>13</sup> The idea that markets aggregate information better than governments and produce outcomes on which societal action is better premised than outcomes generated by governments, is perhaps associated most prominently with Friedrich Hayek. See FRIEDRICH A. HAYEK, *THE ROAD TO SERFDOM* 226–28 (Bruce Caldwell ed., 1944). The notion is also associated with the Chicago School of Economics, which continues to hold considerable sway at the University of Chicago Law School and beyond. See, e.g., Robin I. Mordfin & Marsha Ferziger Nagorsky, *Chicago and Law and Economics: A History*, UNIV. CHL. L. SCH. (Oct. 11, 2011), <https://www.law.uchicago.edu/news/chicago-and-law-and-economics-history> [<https://perma.cc/Q2GM-466U>].

<sup>14</sup> See Tom W. Bell, *Prediction Markets for Promoting the Progress of Science and the Useful Arts*, 14 GEO. MASON L. REV. 37, 39, 51 (2006); Shi-Ling Hsu, *A Prediction Market for Climate Outcomes*, 83 U. COLO. L. REV. 179, 246–47 (2011); Michael P. Vandenbergh, Kaitlin Toner & Jonathan M. Gilligan, *Energy and Climate Change: A Climate Prediction Market*, 61 UCLA L. REV. 1962, 1972, 1979, 1988, 2016 (2014) [hereinafter Vandenbergh et al., *Energy and Climate Change*]; Gary M. Lucas, Jr. & Felix Mormann, *Betting on*

Perhaps, the argument proceeds, these individuals would put more stock in the reality, origins, and threats posed by climate change if they were to receive relevant information from sources related to the free market. In other words, even if the message is the same, the messenger might matter.

Commentators argue in particular that individuals with a conservative ideological bent might be more receptive to climate information provided by a prediction market.<sup>15</sup> Prediction markets are markets in information that are keyed to whether or not particular events take place by a certain time.<sup>16</sup> The value of a prediction market investment grows the more likely the underlying event is to come to pass.<sup>17</sup> Prediction markets offer the promise of generating predictive information: by aggregating dispersed private information, prediction markets can provide societally valuable predictions about the future.<sup>18</sup> Some commentators are convinced enough about the value of prediction markets that they have teamed up to bring such markets to reality.<sup>19</sup>

While commentators have advanced a theoretical hypothesis, it has not been tested empirically. We do so in this Article. Our experimental investigation is of significant importance, both theoretically and practically. The link between the institutional source of information and individuals' perception of the credibility and persuasiveness of that information is a looming question that goes beyond the context of climate change. Scholars—perhaps most prominently Dan Kahan—have documented how people with different cultural cognitions often perceive the world quite differently.<sup>20</sup> To what extent might it be possible to modify people's beliefs

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*Climate Policy: Using Prediction Markets to Address Global Warming*, 52 U.C. DAVIS L. REV. 1429, 1449, 1457, 1486 (2019); MICHAEL P. VANDENBERGH & JONATHAN M. GILLIGAN, BEYOND POLITICS: THE PRIVATE GOVERNANCE RESPONSE TO CLIMATE CHANGE 326–30, 335–36 (2017) [hereinafter VANDENBERGH & GILLIGAN, BEYOND POLITICS].

<sup>15</sup> See *infra* notes 62–67 and accompanying text.

<sup>16</sup> See, e.g., Michael Abramowicz, *Information Markets, Administrative Decisionmaking, and Predictive Cost-Benefit Analysis*, 71 UNIV. CHI. L. REV. 933, 934 (2004).

<sup>17</sup> See *id.*; see Hsu, *supra* note 14, at 203.

<sup>18</sup> See, e.g., Hsu, *supra* note 14, at 201 (“[M]arkets have always been very effective in knitting together disparate pieces of information and transmitting them in the pithy singularity of a price.”); CASS R. SUNSTEIN, *INFOTOPIA: HOW MANY MINDS PRODUCE KNOWLEDGE* 197 (2006).

<sup>19</sup> See *Vanderbilt Climate Change Prediction Market*, VAND. OFF. PROVOST (Jan. 25, 2021, 3:36 PM), [https://www.vanderbilt.edu/provost/2021/01/25/vanderbilt-climate-change-prediction-market/#:~:text=Vanderbilt%20Climate%20Change%20Prediction%20Market%20\(VCCPM\)%20will%20provide%20a%20unique,at%20a%20specified%20future%20date](https://www.vanderbilt.edu/provost/2021/01/25/vanderbilt-climate-change-prediction-market/#:~:text=Vanderbilt%20Climate%20Change%20Prediction%20Market%20(VCCPM)%20will%20provide%20a%20unique,at%20a%20specified%20future%20date) [https://perma.cc/AK8R-VKR3].

<sup>20</sup> See, e.g., Dan M. Kahan & Donald Braman, *Cultural Cognition and Public Policy*, 24 YALE L. & POL'Y REV. 149, 150–51 (2006); Dan Kahan, *Why We Are Poles Apart on Climate*

by altering the source from which individuals glean information? Our study contributes to this body of literature.

Beyond the theoretical, the results in this Article are of substantial practical importance. While there is widespread scientific consensus that immediate and sweeping action is required to thwart the risks that climate change poses,<sup>21</sup> such action continues to face headwinds created by the deep ideological divide that deprives government of sufficient support to act. To the extent that it is possible that receiving information from different sources might more successfully alter people's beliefs, there might be a way to move beyond the current political stalemate.<sup>22</sup> And, if not, policy makers and lawmakers should rethink efforts to move in this direction and develop new strategies.

In particular, our results raise questions about the basic assumption that something other than a multilateral governmental organization is needed in order to effectively convey climate science information. The evolution of international environmental law has seen the creation of expert advisory bodies with the objective of generating and disseminating credible science on global environmental issues.<sup>23</sup> While these institutions do not persuade all segments of the public, the results of our study suggest that they may do a better job than the alternatives.

We explore the question of the link between institutional sources of information and personal beliefs using a survey-based experiment. Under the survey, respondents—from both the United States and Canada—were provided with information about the effects of climate change. Half the respondents were told (accurately) that the information originated with the United Nations' Intergovernmental Panel on Climate Change ("IPCC"), the body charged with "assessing the science related to climate change."<sup>24</sup> The other half of the respondents were provided with exactly

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*Change*, 488 NATURE 255, 255 (2012) [hereinafter Kahan, *Why We Are Poles Apart on Climate Change*]; Dan M. Kahan, Hank Jenkins-Smith, Tor Tarantola, Carol L. Silva & Donald Braman, *Geoengineering and Climate Change Polarization: Testing a Two-Channel Model of Science Communication*, 658 ANNALS AM. ACAD. POL. & SOC. SCI. 192, 192 (2015).

<sup>21</sup> Eric Roston & Akshat Rathi, *Scientists Reach 'Unequivocal' Consensus on Human-Caused Warming*, BLOOMBERG L. (Aug. 9, 2021, 6:59 AM), <https://news.bloomberglaw.com/environment-and-energy/scientists-reach-unequivocal-consensus-on-human-caused-warming> [<https://perma.cc/W8EJ-L9KW>].

<sup>22</sup> See *supra* notes 4–5 and accompanying text.

<sup>23</sup> See *About the IPCC*, IPCC, <https://www.ipcc.ch/about/> [<https://perma.cc/GV3W-78N5>] (last visited Oct. 17, 2022).

<sup>24</sup> See *The Intergovernmental Panel on Climate Change*, IPCC, <https://www.ipcc.ch/> [<https://perma.cc/6U36-UUFE>] (last visited Oct. 17, 2022).

the same information, but were told that it was gleaned from trading in prediction markets administered by the Chicago Mercantile Exchange (“CME”).<sup>25</sup> While the climate change information provided to these respondents was accurate, the source of the information was not. Although the CME is a real organization,<sup>26</sup> it does not at present, host climate change prediction markets.

The surveys solicited changes in individuals’ beliefs about the existence of climate change and its attribution to anthropogenic causes in response to the information. Respondents also indicated the perceived credibility and trustworthiness of the information. We analyzed these beliefs in light of individuals’ self-reported political views. We tested for a causal connection between the source of the information (government versus market) and both the persuasiveness and perceived accuracy and trustworthiness of information. We also examine the causal effect of information’s source in light of individuals’ political ideology.

In keeping with commentators’ theoretical framework, we hypothesized that individuals with conservative ideology might be more likely to accept climate change information (i.e., to change their beliefs in light of the new information) when that information originated with the market-based source, as opposed to the governmental source. Our results did not bear this hypothesis out.<sup>27</sup> While we do find statistically significant effects of institutional source on our measures of interest, the direction of these effects does not match the working hypotheses in the literature.<sup>28</sup> The use of markets to convey climate risk information is associated with less perceived credibility of the information, a lower level of trust in the information’s source, and a persuasive effect that lowers confidence in the belief in climate change existence and its human attribution.<sup>29</sup> The first two of these effects is predominant amongst self-identified conservatives, while the latter effect is confined to liberals.<sup>30</sup> These results suggest that the use of a market to convey climate risk information will not have the desired impact of persuading conservatives to believe the information and adjust their beliefs, but may perversely

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<sup>25</sup> See CME GRP. INC., <https://www.cmegroup.com/> [<https://perma.cc/N5DF-E98G>] (last visited Oct. 17, 2022).

<sup>26</sup> The CME hosts trading of derivatives and futures contracts. *See id.*

<sup>27</sup> *See infra* Part IV.

<sup>28</sup> *See infra* Part IV.

<sup>29</sup> *See infra* Part IV.

<sup>30</sup> *See infra* Part IV.



damage the confidence of liberals—whose views more closely track the predictions of climate scientists in the first place.

The results here, if generalizable, have implications for designing legal structures to tackle climate change. First, efforts to create climate change prediction markets<sup>31</sup> may be poor investments of time and effort, at least to the extent they are put in place with the goal of influencing public opinion. It may pay to invest more in developing education programs that explain the mechanism and effects of climate change, as opposed to varying the identity of the messenger.<sup>32</sup>

Second, our results raise questions around the value of corporate environmental, social, and governance—commonly called “ESG”—disclosure, a form of disclosure that has grown in recent years, and of which many legal commentators are fond and call for its expansion.<sup>33</sup> Indeed, the U.S. Securities and Exchange Commission has put in place a legal interpretation that mandates certain disclosures about climate change—including the specific impacts of current and prospective legal regulatory regimes—on the part of public corporations.<sup>34</sup> To the extent that these initiatives rest on the notion that information flowing from private actors will more successfully influence public opinion—or at least the opinion of certain pockets of the public—our findings suggest some skepticism is appropriate. Perhaps perception of the prediction market as being more “Wall Street” than “Main Street” undercuts acceptance of information from that source in our study, whereas more generic disclosures by corporations would be more persuasive. Our results suggest that more research should be undertaken to shed light on this question.

This Article proceeds as follows. Part I discusses the science of climate change and individuals’ perception of risk arising out of climate change. Part II provides an overview of the existing literature on the link between institutional sources of information and individual beliefs. Part III presents our empirical analysis, with descriptions of the experimental design and results. Part IV reviews and discusses our findings.

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<sup>31</sup> See *supra* note 19 and accompanying text.

<sup>32</sup> See, e.g., Peter S. Menell, *Structuring a Market-Oriented Federal Eco-Information Policy*, 54 MD. L. REV. 1435, 1465, 1472 (1995) (suggesting that education of the public to environmental concerns itself may be an effective environmental regulatory policy).

<sup>33</sup> See George S. Georgiev, *Too Big to Disclose: Firm Size and Materiality Blindspots in Securities Regulation*, 64 UCLA L. REV. 602, 639–40 (2017) (discussing ESG disclosure and noting the great growth in the area).

<sup>34</sup> For a discussion on mandatory disclosures, see Jonathan S. Masur & Jonathan Remy Nash, *Promoting Regulatory Prediction*, 97 IND. L.J. 203, 230 (2022).

## I. CLIMATE CHANGE, CLIMATE SCIENCE, AND INDIVIDUALS’ PERCEPTION OF CLIMATE CHANGE RISK

Climate change poses a serious threat to nations and individuals. Scientists have concluded with a growing degree of consensus that human activity has led to growing concentrations of greenhouse gases in the atmosphere.<sup>35</sup> The increased concentration of greenhouse gases has already led to more extreme climate events and will lead—especially if it is unabated—to an increase in mean global temperatures<sup>36</sup> with accompanying sea level rise<sup>37</sup> and substantial health and environmental effects.<sup>38</sup>

The international climate regime has been evolving since the United Nations Framework Convention on Climate Change (“FCCC”)<sup>39</sup> was established at the Rio Conference in 1992.<sup>40</sup> One of the cornerstones of the regime was the enlistment of the IPCC on scientific matters.<sup>41</sup> This body of scientific experts voluntarily reviews the state of climate science research around the globe to produce scientifically vetted consensus—to

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<sup>35</sup> See *supra* notes 2–3 and accompanying text.

<sup>36</sup> See, e.g., IPCC, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS 60, 75, 82, 124, 134, 209, 218–19, 505–06, 622–23, 661 (Thomas F. Stocker, Dahe Qin, Gian-Kasper Plattner, Melinda M.B. Tignor, Simon K. Allen, Judith Boschung, Alexander Nauels, Yu Xia, Vincent Bex & Pauline M. Midgley eds., 2013) [hereinafter IPCC, CLIMATE CHANGE 2013], [https://www.ipcc.ch/site/assets/uploads/2018/03/WG1AR5\\_SummaryVolume\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/2018/03/WG1AR5_SummaryVolume_FINAL.pdf) [<https://perma.cc/43NG-FT2K>].

<sup>37</sup> See, e.g., IPCC, THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE: SPECIAL REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 323, 340, 343 (Hans-Otto Pörtner, Debra C. Roberts, Valérie Masson-Delmotte, Panmao Zhai, Melinda Tignor, Elvira Poloczanska, Katja Mintenbeck, Andrés Alegría, Maike Nicolai, Andrew Okem, Jan Petzold, Bardhyl Rama & Nora M. Weyer eds., 2019) [hereinafter IPCC, THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE], [https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/SROCC\\_FullReport\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/SROCC_FullReport_FINAL.pdf) [<https://perma.cc/3P2X-WLGE>].

<sup>38</sup> See, e.g., IPCC, CLIMATE CHANGE AND LAND: AN IPCC SPECIAL REPORT ON CLIMATE CHANGE, DESERTIFICATION, LAND DEGRADATION, SUSTAINABLE LAND MANAGEMENT, FOOD SECURITY, AND GREENHOUSE GAS FLUXES IN TERRESTRIAL ECOSYSTEMS 4, 7, 14–15, 205 (Valérie Masson-Delmotte, Panmao Zhai, Hans-Otto Pörtner, Debra Roberts, Jim Skea, Eduardo Calvo Buendía, Priyadarshi R. Shukla, Raphael Slade, Sarah Connors, Renée van Diemen, Marion Ferrat, Eamon Haughey, Sigourney Luz, Suvadip Neogi, Minal Pathak, Jan Petzold, Joana Portugal Pereira, Purvi Vyas, Elizabeth Huntley, Katie Kissick, Malek Belkacemi & Juliette Malley eds., 2019) [hereinafter IPCC, CLIMATE CHANGE AND LAND], <https://www.ipcc.ch/srccl/> [<https://perma.cc/DHZ3-D2ZV>].

<sup>39</sup> U.N. Framework Convention on Climate Change, May 9, 1992, S. Treaty Doc. No. 102-38, 1771 U.N.T.S. 107 [hereinafter FCCC].

<sup>40</sup> E.g., Kasturi Das, Harro van Asselt, Susanne Droege & Michael Mehling, *Making the International Trade System Work for the Paris Agreement: Assessing the Options*, 49 ENV’T L. REP. 10553, 10554–56 (2018).

<sup>41</sup> FCCC, *supra* note 39, art. 21, § 2.

be endorsed multilaterally by participating governments.<sup>42</sup> The reports of the IPCC are intended to provide an objective, shared consensus on the nature of the problem posed by climate change.<sup>43</sup> Without such information, governments struggling to construct international and domestic climate regimes are regulating in the dark and potentially with different goals in mind. With each of its reports, the IPCC has converged on a consensus that climate change is occurring, is attributable to human causes, and has become more specific about the nature, location, and timeline for attendant risks.<sup>44</sup>

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<sup>42</sup> See *The Intergovernmental Panel on Climate Change*, *supra* note 24 (“The IPCC was created to provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options.”).

<sup>43</sup> See *id.*

<sup>44</sup> See, e.g., John Cook, Dana Nuccitelli, Sarah A. Green, Mark Richardson, Bärbel Winkler, Rob Painting, Robert Way, Peter Jacobs & Andrew Skuce, *Quantifying the Consensus on Anthropogenic Global Warming in the Scientific Literature*, ENV'T RSCH. LETTERS, June 2013, at 1, 2–3; Silke Beck & Martin Mahony, *The IPCC and the New Map of Science and Politics*, WIRES CLIMATE CHANGE, Nov./Dec. 2018, at 1, 10; Coral Davenport, *Major Climate Report Describes a Strong Risk of Crisis as Early as 2040*, N.Y. TIMES (Oct. 7, 2018), <http://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html?module=inline> [<https://perma.cc/GH56-6LJ5>]; Coral Davenport & Kendra Pierre-Louis, *U.S. Climate Report Warns of Damaged Environment and Shrinking Economy*, N.Y. TIMES (Nov. 23, 2018), <http://www.nytimes.com/2018/11/23/climate/us-climate-report.html?module=inline> [<https://perma.cc/7426-2N4H>]. For examples of reports reflecting this consensus, see ENV'T & CLIMATE CHANGE CAN., CANADA'S SECOND BIENNIAL REPORT ON CLIMATE CHANGE 1, 3–4, 18, 23, 47, 51, 53 (2016), [https://unfccc.int/files/national\\_reports/biennial\\_reports\\_and\\_iar/submitted\\_biennial\\_reports/application/pdf/canadas\\_2nd\\_biennial\\_report.pdf](https://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/canadas_2nd_biennial_report.pdf) [<https://perma.cc/NF2X-M625>]; IPCC, GLOBAL WARMING OF 1.5°C 51, 53 (Valérie Masson-Delmotte, Panmao Zhai, Hans-Otto Pörtner, Debra Roberts, Jim Skea, Priyadarshi R. Shukla, Anna Pirani, Wilfran Moufouma-Okia, Clotilde Péan, Roz Pidcock, Sarah Connors, J. B. Robin Matthews, Yang Chen, Xiao Zhou, Melissa I. Gomis, Elisabeth Lonnoy, Tom Maycock, Melinda Tignor, Tim Waterfield eds., 2019), <http://www.ipcc.ch/sr15/> [<https://perma.cc/WZ4W-HB4E>]; Brad Plumer & Henry Fountain, *What's New in the Latest U.S. Climate Assessment*, N.Y. TIMES (Nov. 23, 2018), <https://www.nytimes.com/2018/11/23/climate/highlights-climate-assessment.html> [<https://perma.cc/P8U3-325F>]; U.S. GLOB. CHANGE RSCH. PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II: IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 1, 25–26, 36, 39, 44, 49–50 (David Reidmiller, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, Kristen Lewis, Thomas K. Maycock & Brooke C. Stewart eds., 2018), <https://nca2018.globalchange.gov/> [<https://perma.cc/EZ34-KL8T>]; THE NEW CLIMATE ECON., UNLOCKING THE INCLUSIVE GROWTH STORY OF THE 21ST CENTURY: ACCELERATING CLIMATE ACTION IN URGENT TIMES 8, 12, 19, 32 (2018), [https://newclimateeconomy.report/2018/wp-content/uploads/sites/6/2018/09/NCE\\_2018\\_FULL-REPORT.pdf](https://newclimateeconomy.report/2018/wp-content/uploads/sites/6/2018/09/NCE_2018_FULL-REPORT.pdf) [<https://perma.cc/GV94-PKMN>]; U.N. FCCC, U.N. CLIMATE CHANGE ANNUAL REPORT 2017 7, 17, 20 (2018), <https://unfccc.int/resource/annualreport/media/UN-Climate-AR17.pdf> [<https://perma.cc/Y9AN-6VF5>]; U.S. GLOB. CHANGE RSCH. PROGRAM, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT,

However, the predictions of the IPCC and other scientific bodies whose research feeds its consensus have been far from universally persuasive.<sup>45</sup> While climate scientists have increasingly converged in their certainty that climate change is occurring and attributable to anthropogenic causes, significant portions of the public remain skeptical.<sup>46</sup> A gap exists between the views of scientists and the public on climate change existence and risk.<sup>47</sup> While commentators offer different causal mechanisms to explain the phenomenon,<sup>48</sup> the fact remains that

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VOLUME I 1, 4–6, 10–14, 18, 22 (Donald J. Wuebbles, David W. Fahey, Kathy A. Hibbard, David J. Dokken, Brooke C. Stewart & Thomas K. Maycock eds., 2017), [https://science2017.globalchange.gov/downloads/CSSR2017\\_FullReport.pdf](https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf) [<https://perma.cc/ZV2H-73QN>].

<sup>45</sup> See, e.g., Bjørn Lomborg, *The Danger of Climate Doomsayers*, PROJECT SYNDICATE (Aug. 19, 2019), <https://www.project-syndicate.org/commentary/climate-change-fear-wrong-policies-by-bjorn-lomborg-2019-08> [<https://perma.cc/5DJG-9YQE>] (arguing that the dominant view that massive steps need to be taken to mitigate climate change would itself imperil civilization); Teresa A. Myers, Edward Maibach, Ellen Peters & Anthony Leiserowitz, *Simple Messages Help Set the Record Straight About Scientific Agreement on Human-Caused Climate Change: The Results of Two Experiments*, 10 PLOS ONE, no. 3, Mar. 2015, at 1, 1–2, 13.

<sup>46</sup> See, e.g., VANDENBERGH & GILLIGAN, BEYOND POLITICS, *supra* note 14, at 314–15 (noting the gap between climate scientists and the public at large).

<sup>47</sup> See, e.g., *id.*; Myers et al., *supra* note 45, at 2.

<sup>48</sup> See Liisa Antilla, *Climate of Scepticism: U.S. Newspaper Coverage of the Science of Climate Change*, 15 GLOB. ENV'T CHANGE 338, 338, 340, 350 (2005); Seema Arora-Jonsson, *Virtue and Vulnerability: Discourses on Women, Gender and Climate Change*, 21 GLOB. ENV'T CHANGE 744, 744, 747 (2011); Maxwell T. Boykoff, *Public Enemy No. 1? Understanding Media Representations of Outlier Views on Climate Change*, 57 AM. BEHAV. SCIENTIST 796, 797 (2013); Constantine Boussalis & Travis G. Coan, *Text-Mining the Signals of Climate Change Doubt*, 36 GLOB. ENV'T CHANGE 89, 89 (2016); Jason T. Carmichael, Robert J. Brulle & Joanna K. Huxster, *The Great Divide: Understanding the Role of Media and Other Drivers of the Partisan Divide in Public Concern Over Climate Change in the USA, 2001–2014*, 141 CLIMATIC CHANGE 599, 600, 611 (2017); Neil Carter, Robert Ladrech, Conor Little & Vasiliki Tsagkroni, *Political Parties and Climate Policy: A New Approach to Measuring Parties' Climate Policy Preferences*, 24 PARTY POL. 731, 731–32, 740 (2018); Olaf Corry & Dan Jørgensen, *Beyond 'Deniers' and 'Believers': Towards a Map of the Politics of Climate Change*, 32 GLOB. ENV'T CHANGE 165, 165–66 (2015); Simon Dalby, *Canadian Geopolitical Culture: Climate Change and Sustainability*, 63 CAN. GEOGRAPHER 100, 101–03 (2019); Coral Davenport, *Trump Administration's Strategy on Climate: Try to Bury Its Own Scientific Report*, N.Y. TIMES (Nov. 25, 2018), <https://www.nytimes.com/2018/11/25/climate/trump-climate-report.html> [<https://perma.cc/YMS6-A4V4>]; Riley E. Dunlap, *Clarifying Anti-Reflexivity: Conservative Opposition to Impact Science and Scientific Evidence*, 9 ENV'T RES. LETTERS 1, 1–2 (2014); Dana R. Fisher, Anya M. Galli Robertson, Joseph McCartney Waggle, Amanda M. Dewey, Ann H. Dubin & William Yagatch, *Polarizing Climate Politics in America*, 25 ENV'T POL. & SOC'Y 1, 2–5 (2018); William R. Freudenburg & Violetta Muselli, *Reexamining Climate Change Debates: Scientific Disagreement or Scientific Certainty Argumentation Methods (SCAMs)?*, 57 AM. BEHAV. SCIENTIST 777, 778–79 (2013); James Goodman & Jonathan Paul Marshall,

many members of the public are less persuaded than are experts of these risks.<sup>49</sup>

Research suggests that the political and cultural orientations of individuals play a role in their receptiveness to climate information.<sup>50</sup> A significant facet of recent research on climate science perception involves divergence among liberals and conservatives.<sup>51</sup> Research appears to show that conservatives are generally more skeptical about climate change and its impacts than liberals, and perhaps becoming more so.<sup>52</sup> Polling data indicates that people have become increasingly polarized in their opinions about climate change and that the number of skeptics has grown.<sup>53</sup> While this effect has been noted in the United States, it is not

*Problems of Methodology and Method in Climate and Energy Research: Socialising Climate Change?*, 45 ENERGY RSCH. & SOC. SCI. 1, 2, 7–8 (2018); Sophie Guy, Yoshihisa, Iain Walker & Saffron O'Neill, *The Social Psychology of Climate Change: Investigating the Effects of Knowledge and Ideology on Climate Change Beliefs*, 44 EUR. J. SOC. PSYCH. 421, 421, 427–28 (2014); Lawrence C. Hamilton, Joel Hartter, Mary Lemcke-Stampone & David W. Moore, *Tracking Public Beliefs About Anthropogenic Climate Change*, 10 PLOS ONE, no. 9, Sept. 2015, at 1, 2, 10; Ulrike Hahn, Adam J. L. Harris & Adam Corner, *Public Reception of Climate Science: Coherence, Reliability, and Independence*, 8 TOPICS COGNITIVE SCI. 180, 182–83 (2016); Matthew J. Hornsey, Emily A. Harris, Paul G. Bain & Kelly S. Fielding, *Meta-Analyses of the Determinants and Outcomes of Belief in Climate Change*, 6 NATURE CLIMATE CHANGE 622, 623 (2016); Pedro Roberto Jacobi & Roberta de Assis Maia, *Challenges and Strategies to Strengthen Relationship Between Science and Politics Regarding Climate Change*, 19 AMBIENTE & SOCIEDADE 235, 238–40 (2016); Myanna Lahsen, *Anatomy of Dissent: A Cultural Analysis of Climate Skepticism*, 57 AM. BEHAV. SCIENTIST 732, 733, 735 (2013); Matthew T. Ballew, Anthony Leiserowitz, Connie Roser-Renouf, Seth A. Rosenthal, John E. Kotcher, Jennifer R. Marlon, Erik Lyon, Matthew H. Goldberg & Edward W. Maibach, *Climate Change in the American Mind: Data, Tools, and Trends*, 61 ENV'T. SCI. & POL'Y FOR SUSTAINABLE DEV. 4, 4–5 (2019); Anthony Leiserowitz, Edward W. Maibach, Connie Roser-Renouf, Nicholas Smith & Erica Dawson, *Climategate, Public Opinion, and the Loss of Trust*, 57 AM. BEHAV. SCIENTIST 818, 818–20 (2012); Stephan Lewandowsky, Klaus Oberauer & Gilles E. Gignac, *NASA Faked the Moon Landing—Therefore, (Climate) Science Is a Hoax: An Anatomy of the Motivated Rejection of Science*, 24 PSYCH. SCI. 622, 622–23 (2013); Stephan Lewandowsky, John Cook & Elisabeth Lloyd, *The 'Alice in Wonderland' Mechanics of the Rejection of (Climate) Science: Simulating Coherence by Conspiracism*, 195 SYNTHÈSE 175, 184, 190 (2018).

<sup>49</sup> See, e.g., Vandenberg et al., *Energy and Climate Change*, *supra* note 14, at 1970–72.

<sup>50</sup> See, e.g., Dan Kahan, Hank Jenkins-Smith & Donald Braman, *Cultural Cognition of Scientific Consensus*, 14 J. RISK RSCH. 147, 148 (2011); Kahan, *Why We Are Poles Apart on Climate Change*, *supra* note 20, at 255.

<sup>51</sup> See, e.g., Hornsey et al., *supra* note 48, at 622.

<sup>52</sup> See, e.g., *id.*; VANDENBERGH & GILLIGAN, *BEYOND POLITICS*, *supra* note 14, at 315–16 (describing the gap between Democrats and Republicans, and between liberals on the one hand, and conservatives and libertarians on the other).

<sup>53</sup> See, e.g., ANTHONY LEISEROWITZ, EDWARD MAIBACH, SETH ROSENTHAL & JOHN KOTCHER, *POLITICS & GLOBAL WARMING: APRIL 2019 7–19* (2019), <https://climatecommunication>

specific to the country. For example, similar patterns have been identified in Canada.<sup>54</sup> This divergence has prompted questions about how the information gap might be closed.

## II. INDIVIDUAL PERCEPTION OF RISK: IDEOLOGY AND INSTITUTIONS

A large literature has explored the ways in which individuals process information related to risks, particularly in the environmental realm.<sup>55</sup> A significant current in the literature examines the way that individuals' own beliefs and orientation can impact their receptivity to information.<sup>56</sup> Individuals may engage in motivated reasoning, processing information in a way that conforms to their prior beliefs.<sup>57</sup> In addition,

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.yale.edu/wp-content/uploads/2019/05/Politics-Global-Warming-April-2019b.pdf [https://perma.cc/37NV-B8C5]. There is evidence of some regional variation in beliefs. See Blake Hudson & Evan Spencer, *Denying Disaster: A Modest Proposal for Transitioning from Climate Change Denial Culture in the Southeastern United States*, 40 UNIV. ARK. LITTLE ROCK L. REV. 545, 546–47 (2018) (observing that, while Republicans in the southeastern United States are similar to other U.S. Republicans in terms of their skepticism of climate change, Democrats in the southeastern United States are more skeptical of climate change than their national counterparts). For detailed data, see *Democratic and Republican Climate Opinion Maps (2018)*, YALE PROGRAM ON CLIMATE CHANGE COMMUN (July 1, 2020), https://climatecommunication.yale.edu/visualizations-data/partisan-maps-2018/?est=happening&group=dem&type=value&geo=cd [https://perma.cc/7AJM-SEUC].

<sup>54</sup> See, e.g., Aaron Wherry, *Climate Change Is on the Move—But the Political Debate Is Standing Still*, CBC NEWS (Apr. 30, 2019, 4:00 AM), https://www.cbc.ca/news/politics/climate-change-carbon-tax-trudeau-scheer-1.5115109 [https://perma.cc/6P5D-9CN3]; ABACUS DATA, PERCEPTIONS OF CARBON PRICING IN CANADA: A SURVEY OF 2250 CANADIANS (2018), https://ecofiscal.ca/wp-content/uploads/2018/04/Ecofiscal\_Polling\_February2018\_FINAL\_RELEASE.pdf [https://perma.cc/DQU6-FAYD].

<sup>55</sup> See, e.g., Carmen Keller, Ann Bostrom, Margot Kuttscheuter, Lucia Savadori, Alexa Spence & Mathew White, *Bringing Appraisal Theory to Environmental Risk Perception: A Review of Conceptual Approaches of the Past 40 Years and Suggestions for Future Research*, 15 J. RISK RSCH. 237, 237–43 (2012) (environmental risk perception science overview); CASS SUNSTEIN, LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE 3–7 (2005); Kahan, *Why We Are Poles Apart on Climate Change*, *supra* note 20, at 255.

<sup>56</sup> Hornsey et al., *supra* note 48, at 622.

<sup>57</sup> See, e.g., Robin Bayes & James N. Druckman, *Motivated Reasoning and Climate Change*, 42 CURRENT OP. BEHAV. SCIS. 27, 27–35 (reviewing models of partisan motivated reasoning in relation to climate change); Kahan, *Why We Are Poles Apart on Climate Change*, *supra* note 20, at 255; Dan M. Kahan, David A. Hoffman & Donald Braman, *Whose Eyes Are You Going to Believe? Scott v. Harris and the Perils of Cognitive Illiberalism*, 122 HARV. L. REV. 837, 842–43, 851–53 (2009) (motivated reasoning in a legal context); Ziva Kunda, *The Case for Motivated Reasoning*, 108 PSYCH. BULL. 480, 480–83 (1990); Laura M. Arpan, Xiaojing Xu, Arthur A. Raney, Chein-fei Chen & Zihan Wang, *Politics, Values and Morals: Assessing Consumer Responses to the Framing of Residential Renewable Energy in the United States*, 46 ENERGY RSCH. & SOC. SCI. 321, 321–24 (2018); Juan D. Carrillo & Thomas Mariotti, *Strategic Ignorance as a Self-Disciplining Device*, 67 REV. ECON.

research has established that individuals are more persuaded when information is mediated through experts they find trustworthy.<sup>58</sup> In the

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STUD. 529, 530, 539 (2000); Heather W. Cann & Leigh Raymond, *Does Climate Denialism Still Matter? The Prevalence of Alternative Frames in Opposition to Climate Policy*, 27 ENV'T POL. 433, 434, 438–39 (2018); Giuseppe Carrus, Angelo Panno & Luigi Leone, *The Moderating Role of Interest in Politics on the Relations Between Conservative Political Orientation and Denial of Climate Change*, 31 SOC'Y & NAT. RES. 1103, 1103 (2018); Hunter Gelbach, Carly D. Robinson & Christine Calderon Vriesema, *Leveraging Cognitive Consistency to Nudge Conservative Climate Change*, 61 J. ENV'T PSYCH. 134, 134–36 (2019); Robert Gifford & Louise A. Comeau, *Message Framing Influences Perceived Climate Change Competence, Engagement, and Behavioral Intentions*, 21 GLOB. ENV'T CHANGE 1301, 1303–05 (2011); Dena M. Gromet, Howard Kunreuther & Richard P. Larrick, *Political Ideology Affects Energy-Efficiency Attitudes and Choices*, 110 PROC. NAT'L ACAD. SCI. 9314, 9315–17 (2013); Douglas Guilbealt, Joshua Becker & Damon Centola, *Social Learning and Partisan Bias in the Interpretation of Climate Trends*, 115 PROC. NAT'L ACAD. SCI. 9714, 9716, 9718 (2018); Dan M. Kahan, *Ideology, Motivated Reasoning, and Cognitive Reflection*, 8 JUDGMENT & DECISION MAKING 407, 408, 416–18 (2013); Björn Kauder, Niklas Potrafke & Heinrich W. Ursprung, *Behavioral Determinants of Proclaimed Support for Environment Protection Policies*, 54 EUR. J. POL. ECON. 26, 26–29 (2018); Aaron M. McCright & Riley E. Dunlap, *The Politicization of Climate Change and Polarization in the American Public's Views of Global Warming, 2001–2010*, 52 SOCIO. Q. 155, 160, 166, 170–71 (2011); Todd P. Newman, Erik C. Nisbet & Matthew C. Nisbet, *Climate Change, Cultural Cognition, and Media Effects: Worldviews Drive News Selectivity, Biased Processing, and Polarized Attitudes*, 27 PUB. UNDERSTANDING SCI. 985, 988–89, 997–98 (2018); Senja Post & Natalia Ramirez, *Politicized Science Communication: Predicting Scientists' Acceptance of Overstatements by Their Knowledge Certainty, Media Perceptions, and Presumed Media*, 95 JOURNALISM & MASS COMM'N Q. 1, 5, 14–15 (2018); Joel Turner, *The Messenger Overwhelming the Message: Ideological Cues and Perceptions of Bias in Television News*, 29 POL. BEHAV. 441, 442, 455–56 (2007); W. Kip Viscusi, *Do Smokers Underestimate Risks?*, 98 J. POL. ECON. 1253, 1257, 1260, 1264–65 (1990). See generally EYAL ZAMIR & DORON TEICHMAN, BEHAVIORAL LAW AND ECONOMICS (2018).

<sup>58</sup> See Dan Kahan, *Fixing the Communications Failure*, 463 NATURE 296, 296–97 (2010); Dan M. Kahan, *On the Sources of Ordinary Science Knowledge and Extraordinary Science Ignorance*, in THE OXFORD HANDBOOK OF THE SCIENCE OF SCIENCE COMMUNICATIONS 14, 23–25 (Kathleen Hall Jamieson, Dan M. Kahan & Dietram A. Scheufele eds., 2017); William R.L. Anderegg, James W. Prall, Jacob Harold & Stephanie H. Schneider, *Expert Credibility in Climate Change*, 107 PROC. NAT'L ACAD. SCI. 12107, 12107, 12109 (2010); Tatyana Deryugina & Olga Shurchkov, *The Effect of Information Provision on Public Consensus About Climate Change*, 11 PLOS ONE, no. 4, Apr. 2016, at 1, 2, 6–7; Malcolm Fairbrother, *Geoengineering, Moral Hazard, and Trust in Climate Science: Evidence from a Survey Experiment in Britain*, 139 CLIMATIC CHANGE 477, 478, 485–86 (2016); Debra Javeline, Jessica J. Hellmann, Jason S. McLachlan, Dov F. Sax, Mark W. Schwartz & Rodrigo Castro Cornejo, *Expert Opinion on Extinction Risk and Climate Change Adaptation for Biodiversity*, ELEMENTA: SCI. OF ANTHROPOCENE, 2015, at 1, 8–9; Aaron M. McCright, Katherine Dentzman, Meghan Charters & Thomas Dietz, *The Influence of Political Ideology on Trust in Science*, ENV'T RSCH. LETTERS, Dec. 2013, at 1, 2, 7; Aaron M. McCright, Riley E. Dunlap & Chenyang Xiao, *Perceived Scientific Agreement and Support for Government Action on Climate Change in the USA*, 11 CLIMATIC CHANGE 511, 515–17 (2013);

climate change setting, this idea has been extended to suggest that public perception of climate science and risk information might be effectively mediated through institutions that align with an individual's political and cultural orientation,<sup>59</sup> and an individual's moral framework.<sup>60</sup> In particular, individuals may be reluctant to accept information from climate scientists because of (at least the perception of) government involvement in scientists' research and output.<sup>61</sup>

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Teresa A. Myers, John Kotcher, Neil Stenhouse, Ashley A. Anderson, Edward Maibach, Lindsey Beall & Anthony Leiserowitz, *Predictors of Trust in the General Science and Climate Science Research of U.S. Federal Agencies*, 26 PUB. UNDERSTANDING SCI. 843, 844–45, 855 (2017); Wanyun Shao, & Feng Hao, *Approval of Political Leaders Can Slant Evaluation of Political Issues: Evidence from Public Concern for Climate Change in the USA*, 158 CLIMATIC CHANGE 201, 203 (2020); see also Graham Parkes, *The Politics of Global Warming (1): Climate Science and Scepticism*, 13 ENV'T PHIL. 51, 63–65, 68–69 (2013); Emily Pechar, Thomas Bernauer & Frederick Mayer, *Beyond Political Ideology: The Impact of Attitudes Towards Government and Corporations on Trust in Science*, 40 SCI. COMMUN 291, 292, 294–96 (2018); Edward H. Stiglitz, *Cost-Benefit Analysis and Public Sector Trust*, 24 SUPREME CT. ECON. REV. 169, 185, 188, 191 (2016); Peter Tangney, *Between Conflation and Denial—The Politics of Climate Expertise in Australia*, 54 AUSTL. J. POL. SCI. 131, 133 (2019).

<sup>59</sup> See Kahan et al., *Cultural Cognition of Scientific Consensus*, *supra* note 50, at 148, 167–69; James N. Druckman & Mary C. McGrath, *The Evidence for Motivated Reasoning in Climate Change Preference Formation*, 9 NATURE CLIMATE CHANGE 111, 111, 113, 116 (2019) (arguing that, while division over preferences with respect to climate change could stem from individuals rejecting new information that contradicts their standing beliefs, the empirical evidence is also consistent with the idea that people strive to form accurate beliefs but differ over what they consider to be credible evidence); David A. Dana & Janice Nadler, *Regulation, Public Attitudes, and Private Governance*, 16 J. EMPIRICAL LEG. STUD. 69, 74–85 (2019) (presenting experiments showing that corporate responses to societal problems tended to convince individuals—but more so conservatives—that legislation was desirable, while government responses tended to do more to convince liberals that legislation was desirable); see also Troy H. Campbell & Aaron C. Kay, *Solution Aversion: On the Relation Between Ideology and Motivated Disbelief*, 107 J. PERSONALITY & SOC. PSYCH. 809, 813, 817, 819–21 (2014) (presenting experiments showing that Republicans may be unsupportive of pro-environmental action not because they doubt the problem but because of the perceived cost and structure of the proposed solutions).

<sup>60</sup> See Kristin Hurst & Marc J. Stern, *Messaging for Environmental Action: The Role of Moral Framing and Message Source*, 68 J. ENV'T PSYCH. 1, 3–9 (2020) (arguing that Democrats subscribe to a subset of the moral considerations to which Republicans subscribe and presenting experiments showing that catering the moral framing of the message will tend to reach Democrats and Republicans more effectively).

<sup>61</sup> See VANDENBERGH & GILLIGAN, *BEYOND POLITICS*, *supra* note 14, at 88–89 (noting the “presumption of government action” as the best, and most likely, response to environmental problems); see also Iris Hui & Bruce E. Cain, *Overcoming Psychological Resistance Toward Using Recycled Water in California*, 32 WATER & ENV'T J. 17, 23 (2018) (noting that “self-identified Republicans . . . express stronger skepticism toward government programs and interventions to regulate water supply. . .”).



Aligning with existing research on risk perception and cultural and political orientation, researchers have suggested that alternative institutions could be harnessed to generate and convey climate science and risk information.<sup>62</sup> One proposal is to develop climate science prediction markets. Several academics have endorsed such a notion, including Tom Bell,<sup>63</sup> Shi-Ling Hsu,<sup>64</sup> Michael Vandenberg, Kaitlin Raimi, and Jonathan Gilligan;<sup>65</sup> Gary Lucas and Felix Mormann;<sup>66</sup> and Maxwell Boykoff.<sup>67</sup> Indeed, some scholars at Vanderbilt University have contributed to the formation of a climate change prediction market.<sup>68</sup>

There are several possible advantages associated with the use of markets to generate and disseminate climate science information. Markets may produce more accurate information, drawing on and assessing broader sources than government agencies.<sup>69</sup> This accuracy may enhance the trustworthiness of information for individuals.<sup>70</sup> Of particular relevance in addressing the public opinion divide, the use of markets may also offset distrust individuals exhibit toward government-sponsored scientists.<sup>71</sup> Distrust of government, faith in markets and climate change skepticism are characteristics shared by significant segments of those who self-identify as political conservatives.<sup>72</sup> As Vandenberg, Raimi, and Gilligan explain:

Conservatives may not fully trust markets to be error-free sources of information, but they may still consider them less

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<sup>62</sup> See, e.g., BOYKOFF, *supra* note 3, at 190–217 (arguing that those wishing to convey information about climate change should consider the nature of the relevant audience); Hudson & Spencer, *supra* note 53, at 562–72 (advocating trying to reach and influence climate change skeptics in the southeastern United States by messaging through the U.S. Armed Forces, Fortune 500 companies, insurance companies, and sports and recreation groups).

<sup>63</sup> See Bell, *supra* note 14, at 51.

<sup>64</sup> See Hsu, *supra* note 14, at 242–47.

<sup>65</sup> See Vandenberg et al., *Energy and Climate Change*, *supra* note 14, at 1991–2011.

<sup>66</sup> See Lucas & Mormann, *supra* note 14, at 1451–52.

<sup>67</sup> See VANDENBERGH & GILLIGAN, *BEYOND POLITICS*, *supra* note 14, at 326–36.

<sup>68</sup> See *Vanderbilt Climate Change Prediction Market*, *supra* note 19.

<sup>69</sup> See Funk & Hefferon, *supra* note 8 and accompanying text.

<sup>70</sup> See Vandenberg et al., *Energy and Climate Change*, *supra* note 14, at 1987–88.

<sup>71</sup> See *id.* at 1997–98 (hypothesizing that this effect may be stronger for climate skeptics who self-identify as having conservative ideology and a preference for free markets over regulation); see also Hsu, *supra* note 14, at 206 (“While some emitters may have an ideological axe to grind in terms of climate policy, it would turn out to be very expensive to allow an ideological filter to affect their valuations of different pieces of climate science.”).

<sup>72</sup> See Vandenberg et al., *Energy and Climate Change*, *supra* note 14, at 1987.

biased or inefficient than the federal agencies that currently provide climate information. For example, research on social trust has found that conservative-leaning participants vary more than liberal-leaning participants in terms of which types of social institutions are worthy of trust regarding the management of environmental issues. . . . Environmental issues that require a national response—such as climate change—thus may be particularly distasteful to conservatives if they are handled by government agencies rather than free markets.<sup>73</sup>

The logic proceeds that conservatives may perceive that prediction markets draw on and assess broader sources than government agencies, and thus produce more accurate information.<sup>74</sup> This perceived increase in accuracy further may enhance individuals' trust in the information.<sup>75</sup> The use of markets may also offset the distrust some individuals exhibit toward government-sponsored scientists.<sup>76</sup> In theory, the use of markets might make accurate climate science information accessible to a broader cross-section of the public, enhancing the prospects for mitigation and adaptation policy development. However, there is little direct evidence that would help test this important institutional argument.<sup>77</sup>

### III. TESTING THE CONNECTION BETWEEN CLIMATE RISK PERCEPTIONS, IDEOLOGY, AND INSTITUTIONS

#### A. *Experimental Design*

The objective of our research here is to address the link between the institutional source of climate science information and individuals' perception of the credibility and persuasiveness of that information. In particular, we are concerned with the question of whether there may be differential effects across political orientations that would drive variation in the uptake of climate risk information depending on the nature of the

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<sup>73</sup> See *id.* at 1987–88.

<sup>74</sup> See Lucas & Mormann, *supra* note 14, at 1449–58.

<sup>75</sup> See Vanderbergh et al., *Energy and Climate Change*, *supra* note 14, at 2010–11.

<sup>76</sup> See *id.* at 2011.

<sup>77</sup> See *id.* at 1988 (“[A]necdotal examples suggest that conservatives trust markets more than government agencies to make policy judgments, although this could result from differing views about the relative ability of markets and agencies to allocate resources or to assess information about future events.”).

institution providing it. We rely upon scholars' arguments in favor of prediction markets<sup>78</sup> to advance the following hypotheses:

**Hypothesis 1 (credibility):** The institutional source of climate science information affects its perceived credibility, with individuals with a conservative ideology finding information provided by markets more credible, and individuals with a liberal ideology finding information provided by a government source more credible.

**Hypothesis 2 (trustworthiness):** The institutional source of climate science information affects its perceived trustworthiness, with individuals with a conservative ideology finding information provided by markets more trustworthy, and individuals with a liberal ideology finding information provided by a government source more trustworthy.

**Hypothesis 3 (persuasiveness):** The institutional source of climate science information affects its persuasiveness, with individuals with a conservative ideology finding information provided by markets more persuasive, and individuals with a liberal ideology finding information provided by a government source more persuasive.

In order to evaluate these hypotheses, we used an experimental survey methodology. Our experiment had a 2x2 design, varying experimental conditions related to climate risk information, and the institutional source generating the information. We used the surveys to solicit some information on control characteristics for respondents, including the strength of their initial beliefs regarding the existence of climate change and its attribution to human causes.<sup>79</sup> Respondents were then introduced to a vignette that conveyed one of two climate science predictions. The surveys presented information related to predicted changes in the severity and extent of cold and hot days and the predicted increase in heavy precipitation events. The factual information conveyed tracked the predictions from the IPCC's Fifth Assessment Report (Physical Science)

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<sup>78</sup> See *supra* notes 62–67 and accompanying text.

<sup>79</sup> The control variables include: country of residence, state/province of residence, age, gender, ethnicity, education, and broad family income category. Climate change beliefs are solicited on a qualitative 7-point scale, ranging from 1 (very unlikely) to 7 (very likely).

(“AR5”).<sup>80</sup> Randomization across these two types of climate science predictions exposed respondents to more and less precise predicted consequences. The scenario for changes in temperature is associated with a lower level of confidence than the heavy precipitation prediction.<sup>81</sup>

The key experimental variable we manipulated was the institutional source of the information. For each of the two prediction scenarios, we randomized the source of the information across two alternatives. In one alternative, the information was ascribed to the IPCC; in the other, it was ascribed to activity on a new market for climate options at the CME. To try to ensure that respondents had similar information about the nature of the institutions, each condition included a brief description of the institution. We intended, and designed, both descriptors to convey the nature of the institution and way it generates information—the IPCC through large-scale scientific review and consensus, endorsed by participating governments and integrated into a governmental institution, and the CME through large-scale market trading on a large, global, and well-established exchange.<sup>82</sup> The conditions followed a consistent structure: introduction of the nature of the climate change related effect, description of the institution providing the prediction information, and prediction of risk of climate change effect. The institutional experimental conditions for the precipitation condition are set out in the Appendix for illustration.

Following exposure to the scenarios, respondents were asked questions that would allow us to probe our central research questions. We first asked individuals to indicate their confidence in the climate

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<sup>80</sup> IPCC, CLIMATE CHANGE 2013, *supra* note 36, at 7. The IPCC has recently released components of the Sixth Assessment Report, but these were not available at the time of our study.

<sup>81</sup> We have adopted the predictions of the IPCC AR5, so that the predicted risk of increased temperature extremes is “likely” (66%–100% probability), while the risk of heavy precipitation events is “extremely likely” (90%–100% probability). While this does potentially confound sensitivity to temperature versus precipitation with sensitivity to precision in the predictions, it would have introduced an additional element of deception into the experimental structure to vary the likelihood within each predicted climate consequence condition. We had no strong priors to believe that individuals would be systematically more sensitive to temperature, rather than precipitation impacts from climate change.

<sup>82</sup> The vignette descriptions of the IPCC and CME draw on the official descriptions provided by each institution. They thus were factually accurate but presented information more concisely than did the official descriptions. For the IPCC’s official description, see *The Intergovernmental Panel on Climate Change*, IPCC, <http://www.ipcc.ch/> [<https://perma.cc/8DET-8QKT>] (last visited Oct. 17, 2022). For the CME’s, see *Driving Global Growth and Commerce*, CMEGRP. INC., <http://www.cmegroup.com/company/history/> [<https://perma.cc/NX3P-QGKA>] (last visited Oct. 17, 2022).

science information to which they had been exposed.<sup>83</sup> In keeping with the standard in the literature, we asked respondents to record their responses on a qualitative “Likert scale.”<sup>84</sup> Our survey offered respondents a seven-point scale,<sup>85</sup> with responses ranging from being “completely confident” in the information provided (coded as a “1”), to “not believ[ing]” the information provided (coded as a “7”). The responses to this question allowed us to explore the causal connection between institutional information source and perceived credibility of information by individuals.

We then asked respondents to indicate the trustworthiness of the institution (IPCC or CME, depending on the survey instrument the respondent had) as the source of the information. We asked respondents to assess their degree of trust in the institutional source on a seven-point Likert scale, with responses ranging from “extremely trustworthy” (coded as a “1”), to “extremely untrustworthy” (coded as a “7”).<sup>86</sup>

Finally, in order to assess the persuasiveness of the climate science information across the experimental conditions to which the respondents were exposed, we asked respondents to revisit their initial climate change beliefs in light of the information provided. Respondents reported updates in their beliefs (again on a seven-point Likert scale<sup>87</sup>) as to both the existence of climate change and its attribution to human causes.

One of the primary goals of our research design was to be able to assess whether there is a relationship between individual responsiveness to information coming from different institutional sources and political beliefs or orientation. Are liberals more likely than conservative respondents to find information credible when generated by a government-endorsed body, like the IPCC? Conversely, are conservatives more readily persuaded by information generated by markets? In order to test for systematic variation in the causal impact of institutional source across political orientation, we collected information for a number of alternative measures.

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<sup>83</sup> Respondents were asked to indicate how confident they were that the climate change information was correct.

<sup>84</sup> “Likert scales are psychometric scales commonly used in questionnaires and survey research. Respondents specify their level of agreement to a given statement when responding to questionnaire items.” Leah M. Christensen, *Enhancing Law School Success: A Study of Goal Orientations, Academic Achievement, and the Declining Self-Efficacy of Our Law Students*, 33 L. & PSYCH. REV. 57, 65 n.57 (2009) (citation omitted).

<sup>85</sup> Likert scales typically include five or seven possible responses. See I. Elaine Allen & Christopher A. Seaman, *Likert Scales and Data Analyses*, 40 QUALITY PROGRESS 64, 64 (2007).

<sup>86</sup> See, e.g., Vanderbergh et al., *Energy and Climate Change*, *supra* note 14, at 61.

<sup>87</sup> See, e.g., *id.*

Respondents were asked to indicate their political affiliation (i.e., party)<sup>88</sup> and also asked to report their political views on a five-point scale.<sup>89</sup>

The survey design allows us to assess the causal impact of institutional source, contrasting the “government” (here, the IPCC) provision of climate science information with a “market” source (here, the CME). We used the between-subjects randomized design to assess whether the credibility and persuasiveness of the information varies across this key experimental condition, and whether there is corresponding variation in the self-reported institutional trust measure. Using individuals’ self-reported political orientation, we were able to examine whether the effect of information source varies by political beliefs.

### *B. Survey Implementation and Data Collection*

In order to implement the study, we administered the survey via internet with a panel data service provider.<sup>90</sup> All respondents were adults (eighteen years old or older) who resided in either the United States or Canada.<sup>91</sup> In order to assess the quality of the responses, the survey included several attention filters as well as a duration check. Respondents who failed any of these quality checks were not included in the data. Similarly, while ethics protocols required that respondents be free to choose whether or not to answer any questions, only data from respondents who answered the complete survey are included in the analysis. Administration of the survey was randomized across experimental conditions, with even distribution across all experimental conditions. This randomization protocol was repeated for both the U.S. and Canadian samples independently. The analysis in this Article is based on our initial administration of the survey, which includes 502 respondents.

Although we use an experimental survey design, we collected data on control characteristics for individual respondents. This allows us to assess the representativeness of our sample of respondents. We are also able to test for any statistically significant relationships between our

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<sup>88</sup> Respondents were asked whether in national politics they considered themselves to be one of the established national parties (e.g., Republican versus Democrat for U.S. respondents), independent, or none of the above.

<sup>89</sup> Respondents were asked to describe their political views on a five-point scale, ranging from “very conservative” (coded as “1”) to “very liberal” (coded as “5”), with “moderate” (coded as “3”) as the midpoint.

<sup>90</sup> Qualtrics panel data services provided the respondent panels.

<sup>91</sup> Respondents were drawn equally from each country. There was also an even gender split between male and female respondents.

measures of interest (perceived information accuracy, trust in institution, persuasiveness of information) and personal characteristics such as gender,<sup>92</sup> education,<sup>93</sup> income,<sup>94</sup> and age<sup>95</sup> that may also influence attitudes toward climate science information.<sup>96</sup>

The use of internet sampling for experimental surveys requires some caution in assessing the significance of the results. The current sample is not especially large relative to the number of experimental conditions. This leads to lack of power for distinguishing significant results.<sup>97</sup> This is particularly true of those who self-identify as conservatives. The sample was not constructed as a nationally representative panel—which would support more general inferences regarding the representativeness of the results. However, there is a broad geographic distribution for respondents, an even gender split, and significant variation in the age, income, and education of respondents. The use of a research panel data service provider is intended to assist in mitigating some of the self-selection bias that researchers ascribe to samples using other common internet recruitment tools, such as American Mechanical Turk.<sup>98</sup> The

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<sup>92</sup> See Seema Arora-Jonsson, *Virtue and Vulnerability: Discourses on Women, Gender and Climate Change*, 21 GLOB. ENV'T CHANGE 744, 744 (2011).

<sup>93</sup> See Tien Ming Lee, Ezra M. Markowitz, Peter D. Howe, Chia-Ying Ko & Anthony A. Leiserowitz, *Predictors of Public Climate Change Awareness and Risk Perception Around the World*, 5 NATURE CLIMATE CHANGE 1014, 1017 (2015) (noting general finding that more education increases likelihood of accepting anthropogenic climate change and associated risks); *but see id.* at 1018 (noting the exceptional nature of data from the United States, suggesting that greater education makes Republicans less likely to accept climate change); Kevin Quealy, *The More Education Republicans Have, the Less They Tend to Believe in Climate Change*, N.Y. TIMES (Nov. 14, 2017), <https://www.nytimes.com/interactive/2017/11/14/upshot/climate-change-by-education.html> [<https://perma.cc/U37L-BHCR>] (relying on Gallup surveys to conclude that Republicans and Democrats diverge with greater education).

<sup>94</sup> See Lee et al., *supra* note 93, at 1016 (noting direct relationship in China between income and acceptance of anthropogenic climate change and associated risks).

<sup>95</sup> See, e.g., Matthew Ballew, Jennifer Marlon, Seth Rosenthal, Abel Gustafson, John Kotcher, Edward Maibach & Anthony Leiserowitz, *Climate Note: Do Younger Generations Care More About Global Warming?*, YALE PROGRAM CLIMATE CHANGE COMM'N (June 11, 2019), <https://climatecommunication.yale.edu/publications/do-younger-generations-care-more-about-global-warming/> [<https://perma.cc/V8DZ-GUJ5>] (finding younger people to have more belief in and concern about anthropogenic climate change).

<sup>96</sup> Cf. Hornsey et al., *supra* note 48, at 625 (finding only small effects for age, income, and gender).

<sup>97</sup> E.g., David H. Kaye & David A. Freedman, *Statistical Proof*, in 1 MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY 365, 438 n.1 (2021) (“[P]ower is the probability of rejecting the null hypothesis when the alternative hypothesis is right.”).

<sup>98</sup> Perhaps most prominently Yale Law School Professor Dan Kahan posted critiques of

experimental design does allow us to investigate the causal relationship between institutional information source and climate science perceptions for those within our sample population. However, as with any single study, some caution is required in generalizing from the results.

### C. Results

We use two empirical strategies to address the three hypotheses. We first test for equivalence of means across our experimental conditions,<sup>99</sup> with our primary focus on the causal impact of the institutional source condition. We also use equivalence of means to test for significant differences across political views. We then use ordered logit regression analysis<sup>100</sup> to more comprehensively test for the influence of the experimental conditions, conditioned on controls and political orientation.

Before we delve into our analysis, it is useful to comment on some general features of the data. We used equivalence of means statistical tests

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the use of data gleaned from Amazon Mechanical Turk on the blog of the Cultural Cognition Project (of which he is a leading member). See Dan Kahan, *A Pigovian Tax Solution (for Now) for Review/Publication of Studies that Use M Turk Samples*, CULTURAL COGNITION PROJECT (June 9, 2015, 8:02 AM), <http://www.culturalcognition.net/blog/2015/6/9/a-pigovian-tax-solution-for-now-for-reviewpublication-of-stu.html> [<https://perma.cc/NER9-TD7J>]; Dan Kahan, *Foiled Twice, Shame on Who? Problems with Mechanical Turk Study Samples, Part 2*, CULTURAL COGNITION PROJECT (July 10, 2013, 9:30 AM), <http://culturalcognition.squarespace.com/blog/2013/7/10/foiled-twice-shame-on-who-problems-with-mechanical-turk-stud.html> [<https://perma.cc/2V4X-6YWF>]; Douglas J. Ahler, Carolyn E. Roush, & Gaurav Sood, *The Micro-Task Market for Lemons: Data Quality on Amazon's Mechanical Turk*, POL. SCI. RSCH. & METHODS, Oct. 2021, at 1, 1–2. We note, however, that other scholars defend, and have presented evidence in support of the validity of empirical studies that rely upon Amazon Mechanical Turk. See Krin Irvine, David A. Hoffman, & Tess Wilkinson-Ryan, *Law and Psychology Grows Up, Goes Online, and Replicates*, 15 J. EMPIRICAL LEG. STUD. 320, 326–48 (2018).

<sup>99</sup> Specifically, we deployed F-tests, that generate “F-statistics,” to test whether mean values of particular responses for different groups of respondents were different with statistical significance:

Essentially, the F-statistic tests the hypothesis that the means are equal. If the F-statistic is high enough, we can reject the notion the means are equal. Instead, with a given level of statistical confidence, we can conclude that the variance in the means is not due to random chance. The higher the F-statistic, the higher the level of statistical significance for the difference between the means.

Robert M. Lawless & Stephen P. Ferris, *Professional Fees and Other Direct Costs in Chapter 7 Business Liquidations*, 75 WASH. U. L. Q. 1207, 1220 n.29 (1997).

<sup>100</sup> Ordered logit regression analysis is appropriate for categorical outcome variables, such as the outcome variables here. See, e.g., Bernard Trujillo, *Patterns in a Complex System: An Empirical Study of Valuation in Business Bankruptcy Cases*, 53 UCLA L. REV. 357, 402 (2005).



to assess the a priori beliefs of the respondents—that is, the respondents' beliefs before being exposed to any information through the survey. Tracking the results of polling data generally, we found a difference that varies across stated political orientation in respondents' prior beliefs in the existence of climate change and its attribution to human causes.<sup>101</sup> Self-described liberals are more confident in the existence of climate change—on average indicating that it is “likely” occurring, while conservatives on average are between indecision and finding it only “somewhat likely” climate change is occurring.<sup>102</sup> Similarly, liberals are also more confident in ascribing climate change to human causes.<sup>103</sup> This is not a U.S. effect—political divergence in beliefs about climate change is present in both the Canadian and U.S. subsamples. We do find that Canadians are somewhat more confident in the existence of climate change and its ascription to human causes than Americans.<sup>104</sup> This result appears to be driven in part by a somewhat less skeptical view of climate change by Canadian conservatives.<sup>105</sup> Although there are strong similarities in the Canadian and U.S. respondent samples on the initial control for prior climate change beliefs, these differences suggest controlling for country when data is sufficient to do so.

Tables 1 and 2 summarize our results. We did not find evidence supporting any of the hypotheses. To the contrary (and summarizing broadly), as Table 1 reflects, both liberals and conservatives found the government a more credible, and trustworthy, source of information,

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<sup>101</sup> We test for equivalence of means across liberal and conservative views, coding those who choose “liberal” or “very liberal” as holding liberal views, and coding for conservative views similarly. Similar results are generally obtained if political party affiliation is used, however this complicates comparability across our national samples. For the purposes of this initial study, as the number of respondents is relatively small, we have focused only on the political views measure of political orientation.

<sup>102</sup> Hypothesis of equal mean responses for existence of climate change rejected:  $F(1,269) = 64.41$  ( $P < .0000$ ). The hypothesis can also be rejected within each country subsample.

<sup>103</sup> Hypothesis of equal mean responses for attribution of climate change to human causes rejected:  $F(1,269) = 67.31$  ( $P < .0000$ ). The hypothesis can also be rejected within each country subsample.

<sup>104</sup> Testing hypothesis that mean confidence in existence of climate change is the same in Canada and the United States:  $H_0 \mu_C = \mu_{US}$ ,  $F(1,502) = 10.69$  ( $P < 0.0012$ ). Testing hypothesis that mean confidence in human cause of climate change is the same in Canada and the United States:  $H_0 \mu_C = \mu_{US}$ ,  $F(1,502) = 17.12$  ( $P < 0.0000$ ).

<sup>105</sup> We can easily reject the hypotheses that conservatives in Canada and the United States have equal mean confidence in the existence of climate change and its human cause:  $H_0 \mu_C = \mu_{US}$ ,  $F(1,107) = 10.71$  ( $P < 0.0014$ ),  $F(1,107) = 8.81$  ( $P < 0.0037$ ). However, there is no statistically significant difference between the views of liberals in Canada and the views of liberals in the United States.

than the market. And, as Table 2 shows, not only did information from the government tend to persuade conservatives about climate change more than did information from the market, but in fact information from the market tended to undercut liberals' certainty about the reality of climate change.

TABLE 1: SUMMARY OF RESULTS FOR HYPOTHESES 1 (CREDIBILITY) AND 2 (TRUSTWORTHINESS)

Hypothesis	Ideology of Respondents	Which institution fared better with respondents?	Statistically significant result?
Hypothesis 1 (credibility)	Liberal	Government	No
	Conservative	Government	Yes
Hypothesis 2 (trustworthiness)	Liberal	Government	Yes
	Conservative	Government	Yes

TABLE 2: SUMMARY OF RESULTS FOR HYPOTHESIS 3 (PERSUASIVENESS)

Nature of Belief	Ideology of Respondents	Institutional Source of Information	In which direction did respondents' beliefs shift?	Statistically significant result?
Does climate change exist?	Liberal	Market	↓	Yes
		Government	↓	Yes
	Conservative	Market	↓	No
		Government	↑	No
Is climate change anthropogenic?	Liberal	Market	↓	Yes
		Government	↓	Yes
	Conservative	Market	↓	No
		Government	↑	No

### 1. Hypothesis 1: Perceived Accuracy of Climate Science Predictions

The first set of results addresses the perceived accuracy of the climate science predictions in our scenarios. We are interested in testing Hypothesis 1, to the effect that the accuracy of information about climate science is tied to its institutional source—contrasting government versus the market as an information provider. In particular, based on the theory above, we test whether liberals are more likely to perceive information from government institutions like the IPCC more favorably than conservatives. We also test the hypothesis that conservatives may be more

inclined to believe in the accuracy of climate science predictions generated by markets.

TABLE 3: MEAN RESPONSES FOR ACCURACY OF CLIMATE PREDICTION BY INSTITUTION

Sample	Mean		F-stat $\mu_G = \mu_M$
	Gov't (IPCC)	Mkt (CME)	
All Respondents	<b>3.27</b> (0.09)	<b>3.53</b> (0.10)	<b>F(1,502) = 3.79</b> <b>P&lt;0.0523</b>
Liberals	<b>2.91</b> (0.15)	<b>3.21</b> (0.16)	<b>F(1,161) = 1.76</b> <b>P&lt;0.1860</b>
Conservatives	<b>3.80</b> (0.20)	<b>4.45</b> (0.45)	<b>F(1,107) = 4.62</b> <b>P&lt;0.0338</b>
L vs C—Mkt Accuracy			<b>F(1,133) = 19.81</b> <b>P&lt;0.0000</b>
L vs C—Gov't Accuracy			<b>F(1,135) = 12.21</b> <b>P&lt;0.0006</b>

\*Standard Errors in parentheses. N.B. 1 = most confident in accuracy; 7 = least confident in accuracy.

The equivalence of means test<sup>106</sup> results, set out in Table 3, indicate that respondents do view the accuracy of information differently, depending on which institutional source condition they are exposed to. Those who are given the market condition in which the data is ascribed to trading on the CME on average perceive it as less accurate than those who receive the IPCC condition. Breaking the means down along political lines, this result is largely driven by variation in conservatives' views. Liberals do not show a statistically significant difference in perceived accuracy of the climate predictions across the experimental conditions. However, conservatives generate a strongly significant difference in mean response across conditions. The mean level of perceived accuracy for the climate predictions in the market condition is approaching slight skepticism, while in the IPCC scenario respondents are between neutral and somewhat confident in the accuracy of the information. When we consider the relative trust in the accuracy of the information across political views, we see that there is a strongly significant difference in both experimental

<sup>106</sup> See IPCC, *supra* note 82.

conditions. Liberals are statistically significantly more confident in the accuracy of the information than conservatives, as shown by the F-statistics in the bottom two rows of Table 3. However, somewhat counter-intuitively, this is driven by greater conservative skepticism about the predictions from the market condition.

The results above give us some insight into the influence of our main experimental condition. However, in order to provide a more robust analysis of the impact of institutional source that incorporates controls simultaneously, we turn to an ordered logit with marginal effects. We included controls for location, gender, ethnicity, education, income, and country of respondents' residence.<sup>107</sup> We use indicator variables to capture our main variables of interest: the institutional source of information in the experimental condition and the existence of strong political views, both conservative and liberal. We ran the ordered logit with and without controls. While the regression was significant in both models, we could not reject the joint hypothesis that our controls were insignificant.<sup>108</sup> The estimated coefficients in ordered logit regressions do not have direct, intuitive interpretations in terms of the relationship between the independent and dependent variables.<sup>109</sup> To see this relationship, we examine the marginal effects for our main variables of interest, presented in Table 4. The marginal effects—represented in the column headings in Table 4 by derivative notation from calculus<sup>110</sup>—by definition shift the

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<sup>107</sup> The controls were based on information collected in the survey. However, because of the nature of the responses and relatively small sample, we did not uniformly implement categorical controls with dummies for each possible index category. Index categories were combined in the controls that follow. Controls included are: *Location* (grouping rural and small town versus suburban and urban); *Gender* (male versus female); *Ethnicity* (grouped to contrast White/European versus Minority); *Education* (three indicator variables, contrasting College, Undergraduate and Graduate/Professional to High School); *Income* controls (grouping to create indicator categories to contrast “middle income” (family income from median range (\$40K–\$60K) to \$80K–\$100K range) and “high” income (\$100K to more than \$200K) with the “low” family income categories (\$0–\$40K)). We also included an indicator variable for *Country*.

<sup>108</sup> The  $\chi^2$  statistic for the regression without controls we use to generate the marginal effects confirms that it offers significant explanatory power:  $\chi^2(4) = 41.93$ ,  $p < 0.0000$ . We cannot reject the hypothesis that the model without controls performs better ( $H_0$ : all controls jointly insignificant; LR Test:  $\chi^2(8) = 4.95$ ,  $p < 0.7626$ ).

<sup>109</sup> See, e.g., WILLIAM H. GREENE & DAVID A. HENSHER, MODELING ORDERED CHOICES: A PRIMER 119–21 (2009).

<sup>110</sup> In calculus, when one (dependent) variable is expressed as a function of another (independent) variable (“ $y = f(x)$ ”), the derivative of the dependent variable with respect to the independent variable—denoted  $dy/dx$ —is the rate at which the dependent variable responds to changes in the independent variable. See, e.g., SILVANUS P. THOMPSON & MARTIN GARDNER, CALCULUS MADE EASY 21, 30, 32 (1998). Thus, for example, in Table 4,

distribution of probability between the available categories of confidence in the accuracy of the predictions that respondents are choosing.<sup>111</sup> By way of example, the “-0.023” in the top row of the second column of data reflects a 2.3% reduction in the likelihood that a respondent would select “complete confidence” in the information-providing institution as that institution shifted from government to market; the two stars reflect statistical significance of this result at the 5% level.

TABLE 4: MARGINAL EFFECTS ON PERCEIVED ACCURACY OF CLIMATE SCIENCE PREDICTIONS

Accuracy	Marginal Effects of Institution Condition & Political Controls			
	Pr(Accuracy)	dPr/dMarket	dPr/dLiberal	dPr/dConservative
Completely Confident	0.069	-0.023** (p<0.036)	0.027* (p<0.052)	-0.051*** (p<0.000)
Fairly Confident	0.237	-0.051** (p<0.031)	0.058** (p<0.036)	-0.131*** (p<0.000)
Somewhat Confident	0.229	-0.012* (p<0.062)	0.011** (p<0.034)	-0.055*** (p<0.002)
Neutral	0.247	0.027** (p<0.036)	-0.032** (p<0.049)	0.048*** (p<0.000)
Somewhat Skeptical	0.137	0.033** (p<0.034)	-0.036** (p<0.031)	0.097*** (p<0.000)
Fairly Skeptical	0.054	0.017** (p<0.041)	-0.018** (p<0.035)	0.058*** (p<0.001)
Do Not Believe	0.026	0.008* (p<0.055)	-0.009** (p<0.048)	0.032*** (p<0.006)

\*Pr(Incent) = probability respondent confidence that information is correct falls in the corresponding category, dPr/dMarket & dPr/dLiberal and dPr/dConservative are changes in probability of category from discrete change in the associated dummy. P-values for estimated marginal effects in brackets, \* = Significant at 10% or lower; \*\* = Significant at 5% or less; \*\*\* = Significant at 1% or less.

the column heading “*dPr/dMarket*” is the rate at which the probability that a respondent’s belief in the accuracy of information increases as we move from a respondent in the “government” condition of the survey to one in the “market” condition.

<sup>111</sup> See GREENE & HENSHER, *supra* note 109, at 120.

The results from the ordered logit regression confirm the findings from the equivalence of means analysis. The presentation of the climate risk information in the market condition is associated with robustly, statistically significant effects on the distribution of perceived accuracy of the information. The impact of presentation in the market condition is to shift the distribution of responses *away from* categories reflecting confidence in the information and *into* categories with increased skepticism as to the accuracy of the predictions. The largest effects are to *decrease* the probability of a respondent choosing “fairly confident” (-5.1%)<sup>112</sup> and *increase* the probability of choosing “somewhat skeptical” (+3.3%).<sup>113</sup>

The impact of political views is also affirmed in the ordered logit results. Holding either liberal or conservative views, in contrast with being a political moderate, produces robustly, statistically significant effects. Liberals are much *more likely* to choose categories expressing confidence in the accuracy of the information and *less likely* to select options reflecting skepticism. The largest effects are to shift responses *into* the “fairly confident” category (+5.8%)<sup>114</sup> and *out of* “somewhat skeptical” (-3.6%).<sup>115</sup> Conversely, conservatives are *more likely* to be skeptical that the climate risk information is accurate. Conservative views have their largest effect in shifting respondents *away from* being “fairly confident” in the accuracy of the information (-13.1%)<sup>116</sup> and *into* feeling “somewhat skeptical” (+9.7%).<sup>117</sup> These effects are strongly statistically significant, especially for conservative views.

The results above are presented pooling across the experimental condition relating to the type of climate risk information (temperature versus precipitation). Disaggregating the analysis to identify the experimental conditions independently generally produces qualitatively and statistically similar results. The exception is that in the temperature experimental condition, the impact of the market condition becomes statistically insignificant.<sup>118</sup> This is interesting, as it suggests that any relative lack of confidence in the accuracy of the market presentation of the

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<sup>112</sup> This corresponds to the “-0.051” in the second row of the second column of data in Table 4.

<sup>113</sup> This corresponds to the “0.033” in the fifth row of the second column of data in Table 4.

<sup>114</sup> This corresponds to the “0.058” in the second row of the third column of data in Table 4.

<sup>115</sup> This corresponds to the “-0.036” in the fifth row of the third column of data in Table 4.

<sup>116</sup> This corresponds to the “-0.131” in the second row of the fourth column of data in Table 4.

<sup>117</sup> This corresponds to the “0.097” in the fifth row of the fourth column of data in Table 4.

<sup>118</sup> The  $p$ -value on the estimated coefficient in the ordered logit for the market condition in the temperature scenario is  $p = 0.305$ .

climate risk information is not a reflection of greater distrust in the vague scenario. Instead, it is an effect that is most apparent when the predicted risk is relatively precise. It is the more precise climate risk information that is associated with the relative lack of trust in market accuracy.

## 2. Hypothesis 2: Trustworthiness of Information Source

Our second research question explores the link between the institutional source of the information and the perceived trustworthiness of the institution. We tested to see if perceived trust is higher for government (IPCC) versus market (CME) provision of the information, and how this varies by political orientation. Do those with conservative views express greater trust in market institutions to generate climate risk information, rather than government endorsed scientists?

Again, we begin with an equivalence of means analysis. Results are set out in Table 5. The analysis reveals that the nature of the institution does generate a statistically significant difference in the perceived trustworthiness as a source of climate risk information. When we consider all respondents, there is a statistically significant difference in expressed trustworthiness across experimental conditions. Respondents in the market condition were closer to “neutral” in their assessment of trustworthiness, while those in the government condition on average found the IPCC “somewhat trustworthy” as a source of the climate risk information. Breaking the results down across political views produces somewhat surprising results. As we might expect, liberal respondents are more trusting on average of the IPCC as a source of climate change information relative to the CME market alternative. Liberals also have greater trust in institutions in general; on average their level of trust in both the IPCC and the CME is statistically significantly higher than that of conservatives. What is surprising is that conservative respondents’ skepticism is more acute in the market condition. Conservative respondents are less inclined to endorse the trustworthiness of the CME as a source of the climate risk information in the scenarios. This does not appear to be a country-specific effect. In both Canada and the United States, the pattern of statistically significant differences between expressed trust in government as opposed to the market in Table 5 is replicated.<sup>119</sup>

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<sup>119</sup> We also did not find a significant difference across countries in the level of institutional trust on average or in the level of institutional trust in the market condition as between Canadian and U.S. respondents; however, Canadians were statistically significantly more trusting than Americans in the IPCC condition.

TABLE 5: MEAN RESPONSES FOR TRUSTWORTHINESS OF INSTITUTION AS INFORMATION SOURCE

Sample	Mean		F-stat $\mu_G = \mu_M$
	Gov't (IPCC)	Mkt (CME)	
All Respondents	<b>3.05</b> (0.08)	<b>3.71</b> (0.09)	<b>F(1,502) = 28.60</b> <b>P&lt;0.0000</b>
Liberals	<b>2.82</b> (0.15)	<b>3.46</b> (0.17)	<b>F(1,161) = 8.28</b> <b>P&lt;0.0046</b>
Conservatives	<b>3.47</b> (0.20)	<b>4.37</b> (0.20)	<b>F(1,107) = 10.00</b> <b>P&lt;0.0020</b>
L vs C—Mkt Trustworthiness			<b>F(1,133) = 11.83</b> <b>P&lt;0.0008</b>
L vs C—Gov't Trustworthiness			<b>F(1,135) = 6.78</b> <b>P&lt;0.0102</b>

\*Standard Errors in parenthesis. N.B. 1 = most trustworthy; 7 = least trustworthy.

As before, we complement the equivalence of means analysis with an ordered logit regression to generate marginal effects for our variables of interest: institutional experimental condition and political views. Results for marginal effects are shown in Table 6.<sup>120</sup> As in the previous section, the results below are based on a model without additional controls, as we could not reject the hypothesis that they were jointly insignificant.<sup>121</sup>

<sup>120</sup> For discussion and explanation of the nomenclature in the column headings, see Lee et al., *supra* note 93 and accompanying text.

<sup>121</sup> We use the  $\chi^2$  statistic for the regression without controls to generate the marginal effects confirming that it offers significant explanatory power:  $\chi^2(4) = 52.85$ ,  $p < 0.0000$ . We cannot reject the hypothesis that the model without controls performs better ( $H_0$ : all controls jointly insignificant; LR Test:  $\chi^2(8) = 2.97$ ,  $p < 0.9360$ ). We again retained the country control to test for any significant effect across respondent samples.



TABLE 6: MARGINAL EFFECTS ON PERCEIVED TRUSTWORTHINESS OF INSTITUTIONAL SOURCE

Trust Level	Marginal Effects of Institution Condition & Political Controls			
	Pr(Trust)	dPr/dMarket	dPr/dLiberal	dPr/dConservative
Extremely Trustworthy	0.058	-0.051*** (p<0.000)	0.018 (p<0.108)	-0.034*** (p<0.000)
Fairly Trustworthy	0.226	-0.132*** (p<0.000)	0.047* (p<0.089)	-0.101*** (p<0.000)
Somewhat Trustworthy	0.270	-0.037*** (p<0.001)	0.012* (p<0.066)	-0.046** (p<0.011)
Neutral	0.280	0.095*** (p<0.000)	-0.036* (p<0.095)	0.066*** (p<0.000)
Somewhat Untrustworthy	0.083	0.056*** (p<0.000)	-0.019* (p<0.080)	0.050*** (p<0.002)
Fairly Untrustworthy	0.057	0.047*** (p<0.000)	-0.015* (p<0.080)	0.044*** (p<0.006)
Extremely Untrustworthy	0.025	0.023*** (p<0.001)	-0.007* (p<0.095)	0.023** (p<0.016)

\*Pr(Incent) = probability respondent confidence that information is correct falls in the corresponding category, dPr/dMarket & dPr/dLiberal and dPr/dConservative are changes in probability of category from discrete change in the associated dummy. *P*-values for estimated marginal effects in brackets, \* = Significant at 10% or lower; \*\* = Significant at 5% or less; \*\*\* = Significant at 1% or less.

Results from the ordered logit analysis again confirm the patterns identified in the equivalence of means analysis. We find a strong statistically and quantitatively significant effect in the market condition relative to the (omitted) government condition. Respondents in the market condition are much *less likely* to choose a category of positive trustworthiness in the institution. The effect of the market condition is to shift respondents *into* choosing the categories of higher institutional skepticism. The largest effects of the market condition come in *decreasing* the likelihood of choosing to find the institution “fairly trustworthy” as a source of the climate risk institution (-13.2%),<sup>122</sup> and instead *increasing* the likelihood

<sup>122</sup> This corresponds to the “-0.132” in the second row of the second column of data in Table 6.

of choosing to rate it as “neutral” (+9.5%).<sup>123</sup> While the effect of liberal views is to shift the distribution of trustworthiness assessment *toward* greater trust categories and *away* from distrust, the effects of this political viewpoint are quantitatively smaller and only weakly significant. The presence of conservative views, in contrast, generates stronger and statistically robust effects. Individuals are shifted *away* from the probability of choosing high trustworthiness levels, with the greatest reduction in choice of “fairly trustworthy” (-10.1%).<sup>124</sup> Respondents move *into* lower trust categories, with the greatest increase in probability of choosing neutrality (6.6%),<sup>125</sup> followed closely by “somewhat untrustworthy” (5.0%).<sup>126</sup> The country control we include is always insignificant by a wide margin, which supports the equivalence of means analysis in suggesting the results are not a country-specific effect.<sup>127</sup>

The results above are again, presented pooled across our experimental conditions for type of climate risk information. In disaggregating the analysis to control for this experimental condition independently, we again find that the pattern above is replicated for the two scenarios. In particular, the market condition generally results in the same statistically and quantitatively significant reduction in the level of trust seen above. Similar to the situation with perceived accuracy, the effect is somewhat muted in the temperature scenario, which has a vaguer prediction range (66%–100% probability) than the precipitation scenario (90%–100% probability). However, the effect of the market condition remains significant even in the vague prediction scenario. The degree of trust in the institution thus appears to be somewhat less sensitive to the precision of the predicted climate risk information. However, it remains the case that distrust is sharper in the more precise market condition, not the vague scenario. Distrust in the market appears paradoxically to be exacerbated by a more precise market prediction.

### 3. Hypothesis 3: Persuasiveness of Climate Science Information

The final component of our analysis relates to the persuasiveness of the climate risk information. In this section, we test for a significant effect of institutional source on the ability of the climate risk information

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<sup>123</sup> This corresponds to the “0.095” in the fourth row of the second column of data in Table 6.

<sup>124</sup> This corresponds to the “-0.101” in the second row of the fourth column of data in Table 6.

<sup>125</sup> This corresponds to the “0.066” in the fourth row of the fourth column of data in Table 6.

<sup>126</sup> This corresponds to the “0.050” in the fifth row of the fourth column of data in Table 6.

<sup>127</sup> See *supra* note 102 and accompanying text.

to alter the initial climate change beliefs of our respondents. The public opinion research discussed above reveals a gap between the beliefs of many members of the public and the consensus opinions of scientists about climate change and its attendant risks,<sup>128</sup> as well as a gap between ideological groups.<sup>129</sup> One of the core questions at the heart of the project is the role that institutions might play in bridging this gap between experts and the public, and among members of the public. In particular, we ask whether the use of market institutions to generate information about climate change and its risks might be a more accessible, more persuasive source of information for political conservatives, who are often distrustful of government.<sup>130</sup>

To test the persuasiveness of the climate risk information across our institutional experimental condition, we use an equivalence of means analysis.<sup>131</sup> We compare the initial average level of confidence in the existence and human cause of climate change with the reported means provided by respondents in light of the climate risk information provided in the scenarios. The results are shown in Table 7.

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<sup>128</sup> See Masur & Nash, *supra* note 34, at 218; Duffy et al., *supra* note 2, at 1; BOYKOFF, *supra* note 3, at 207; IPCC, CLIMATE CHANGE 2013, *supra* note 36, at 8–29.

<sup>129</sup> See IPCC, THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE, *supra* note 37, at 6–35; IPCC, CLIMATE CHANGE AND LAND, *supra* note 38, at 5–34; FCCC, *supra* note 39, art. 21, § 2; Das et al., *supra* note 40, at 10572.

<sup>130</sup> See VANDENBERGH & GILLIGAN, BEYOND POLITICS, *supra* note 14, at 334; Antilla, *supra* note 48, at 340, 350; Kahan et al., *Cultural Cognition of Scientific Consensus*, *supra* note 50, at 148; Hornsey et al., *supra* note 48, at 622; LEISEROWITZ ET AL., *supra* note 53, at 7; see also Kahan & Braman, *supra* note 20, at 158–59.

<sup>131</sup> See IPCC, *supra* note 82.

TABLE 7: PERSUASIVENESS OF CLIMATE RISK INFORMATION BY SOURCE CONDITION

Sample	Mean		F-stat $\mu P = \mu U$
	Prior Beliefs	Updated Beliefs	
<b>Climate Change Existence</b>			
<u>Market Condition (CME)</u>			
Liberals	<b>6.28</b> (0.11)	<b>5.62</b> (0.16)	<b>F(1,165) = 11.84</b> <b>P&lt;0.0007</b>
Conservatives	4.78 (0.23)	4.54 (0.23)	F(1,101) = 0.53 P<0.4674
<u>Government Condition (IPCC)</u>			
Liberals	<b>6.02</b> (0.15)	<b>5.64</b> (0.16)	<b>F(1,157) = 2.98</b> <b>P&lt;0.0862</b>
Conservatives	4.64 (0.21)	4.85 (0.20)	F(1,113) = 0.49 P<0.4832
<b>Climate Change—Human Cause</b>			
<u>Market Condition (CME)</u>			
Liberals	<b>6.19</b> (0.12)	<b>5.62</b> (0.16)	<b>F(1,165) = 7.78</b> <b>P&lt;0.0059</b>
Conservatives	4.35 (0.28)	4.25 (0.28)	F(1,101) = 0.06 P<0.8009
<u>Government Condition (IPCC)</u>			
Liberals	<b>5.93</b> (0.16)	<b>5.53</b> (0.17)	<b>F(1,157) = 2.99</b> <b>P&lt;0.0858</b>
Conservatives	4.39 (0.24)	4.59 (0.23)	F(1,113) = 0.39 P<0.5316

\*Standard Errors in parentheses. N.B. 1 = least confident; 7 = most confident.

Several interesting conclusions are apparent in the results. First, we do not find evidence of persuasion amongst conservatives based on exposure to the climate risk information. This is true whether the information is presented to conservative respondents via the market (CME) condition or via the government (IPCC) condition. In addition, although the results cannot be distinguished statistically, the direction of movement in the means for conservatives across experimental conditions is the reverse of what we expected. When exposed to the market condition, conservatives on average are slightly less confident in existence and human attribution of climate change. In the government condition,

conservatives have slightly higher mean confidence for both climate change beliefs after exposure to the information. In contrast, liberals do exhibit a persuasive effect of being exposed to the climate risk information. We observe statistically significant decreases in their confidence in both the existence and human attribution of climate change after exposure to the information. This is true whether it is presented by either experimental condition; however, the effect is stronger in the market condition. Based on these initial results, while there is a statistically significant effect on persuasiveness of climate risk information depending on the institution generating it, the effect could not close the public opinion gap with experts. Using markets to convey climate risk information appears to simply discourage the beliefs of liberals while doing nothing to persuade conservative respondents to change their beliefs.

In order to test whether this is an effect that might be specific to the particular climate risk scenario, we perform a similar analysis on results for each climate prediction experimental condition. This allows us to test for the possibility that it is a loss of confidence driven by the vague temperature scenario that is producing the results above. The results for the temperature experimental condition are weaker than those above. Conservatives' views about climate change existence and its human causes remain unchanged, while liberals are less convinced. However, the drop in liberal confidence in the market condition is not statistically significant in the vague temperature scenario. Again, it is in the more precise precipitation scenario that we see the impact of the conservative-liberal divide most strongly. Conservatives do not exhibit any statistically significant persuasive effect from exposure to the climate risk information. Liberals become less confident in their beliefs.<sup>132</sup> The size and significance of the effect is most pronounced in the market condition. When we breakdown the sample by climate risk, institution, and political view, the liberal persuasiveness effect becomes insignificant in the government condition. However, despite the small sample size, it remains strongly significant in the market condition. Market presentation of even

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<sup>132</sup> Cf. Viscusi, *supra* note 57, at 1260–64 (presenting evidence that people tend to overestimate the risks of smoking and that smoking might be more prevalent were the actual risks understood); Carrillo & Mariotti, *supra* note 57, at 529–30 (arguing that individuals sometimes avoid more precise data for fear it will undercut their beliefs); Lauren C. Howe, Bo MacInnis, Jon A. Krosnick, Ezra M. Markowitz & Robert Socolow, *Acknowledging Uncertainty Impacts Public Acceptance of Climate Scientists' Predictions*, 9 NATURE CLIMATE CHANGE 863, 865–66 (2019) (“[E]xpressions of fully bounded uncertainty alone may enhance confidence in scientists and their assertions but not when the full extent of inevitable uncertainty is acknowledged.”).

precise climate risk information appears to negatively affect prior liberal confidence in climate change.

#### IV. DISCUSSION

Broadly speaking, we find no evidence supporting any of the hypotheses and some evidence contradicting them. We found with statistical significance—and contrary to Hypothesis 1’s expectation—that conservatives were more likely to find the government a credible source of climate change information than the market. (We found no statistically significant evidence for liberals.) We found with statistical significance that both liberals and—contrary to Hypothesis 2’s expectation—conservatives were more likely to find the government a trustworthy source of climate change information than the market. And, while the results were not statistically significant, we found—contrary to Hypothesis 3’s expectation—that conservatives were more persuaded about the reality of climate change, and that climate change is anthropogenic, by the government source than by the market source.

Our results are based on a relatively small sample, and while our study includes two distinct climate risk prediction scenarios and was administered in two countries, it remains a single study design. Consequently, our findings are by no means definitive. But they do not bode well for the argument that prediction markets may provide a better means of convincing conservatives about the realities of climate change. It may be that prediction markets are substantially more complicated than typical markets,<sup>133</sup> leaving financially unsophisticated respondents

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<sup>133</sup> See, e.g., Saul S. Cohen, *The Challenge of Derivatives*, 63 *FORDHAM L. REV.* 1993, 2000 (1995) (“One of my clients describes derivatives as ‘any financial product that is difficult to understand.’”). Consider that options play a substantial role in the motion picture *Trading Places*, yet many who enjoyed the movie remain at a loss to explain how they actually work (either in the film or in general):

It’s been 30 years since *Trading Places* came out. And, to be honest, I never really understood what happened at the end of that movie. Sure, Louis Winthorpe (Dan Aykroyd) and Billy Ray Valentine (Eddie Murphy) get rich, and the Duke brothers lose all their money. But what actually happens? How does it work? I recently talked to Tom Peronis, a guy who has spent years trading OJ options. He walked me through every step of Winthorpe and Valentine’s plan.

Robert Smith, *What Actually Happens at the End of ‘Trading Places?’*, NPR (July 12, 2013, 4:37 PM), <https://www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places> [<https://perma.cc/8PFB-GF8A>]; see *TRADING PLACES* (Cinema Grp. Ventures & Paramount Pictures 1983).

with questions and doubts about the markets and their output. It may also be that prediction markets are seen as a quintessential “Wall Street” market that drew skepticism among respondents. Thus, our reliance on prediction markets may have played into the “Wall Street–versus–Main Street” divide that has permeated at least U.S. politics for some time.<sup>134</sup> While this divide was perhaps seen at the time we conducted our surveys as more pronounced on the political left,<sup>135</sup> the subsequent election of U.S. President Donald Trump suggests that it was also present (if less recognized) on the political right.<sup>136</sup>

If indeed reliance on prediction markets contributed to our findings, then it may be that information generated by other, more typical markets would in fact sway the views of conservatives. Be that as it may, however, our results at least challenge the view that prediction markets in particular, would be a valuable means of providing conservatives with information about climate change that might change their opinions.

Finally, to whatever extent that prediction markets (or markets in general) yet might be valuable in providing information to conservatives, our results suggest a separate, significant downside. We found that the provision of climate change information through a market actually *undercuts* liberals’ beliefs about climate change. To the extent that this result applies more generally among the public, then any benefit that reliance on prediction markets provides with respect to conservatives must be offset by the deleterious effect it would have on liberals.

We struggle to explain the counterintuitive result that liberals’ beliefs about climate change are undercut by the provision of climate change information—by the market and also by the government. Our best guess is that liberals may have entered the experiment with strong beliefs that climate change poses a serious risk and then found that the actual information with which they were provided—colloquially put, some more hot weather and some more precipitation—actually presented the problem as less severe than they previously thought. Perhaps this incongruence

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<sup>134</sup> See, e.g., NEIL BAROFSKY, *BALLOUT: HOW WASHINGTON ABANDONED MAIN STREET WHILE RESCUING WALL STREET* 226, 234 (2012). Indeed, the notion of “Wall Street” markets serving a small group of the elite and not the general public goes back many decades. See also WILLIAM Z. RIPLEY, *MAIN STREET AND WALL STREET* 20, 22 (1927).

<sup>135</sup> See, e.g., Trina Jones, *Occupying America: Dr. Martin Luther King, Jr., the American Dream, and the Challenge of Socio-Economic Inequality*, 57 *VILL. L. REV.* 339, 344 (2012) (“In some ways, the Occupy Wall Street protestors resemble the civil rights activists of the 1950s and 1960s.”).

<sup>136</sup> See, e.g., Donna Borak & Henry Williams, *Where Trump Stands on Wall Street*, *WALL ST. J.* (Nov. 9, 2016, 1:00 PM), <http://graphics.wsj.com/elections/2016/where-trump-stands-on-wall-street/> [<https://perma.cc/NRY5-BFYL>].

contributed to the shift in liberals' views away from belief in the realities of climate change.<sup>137</sup>

## V. LEGAL IMPLICATIONS

Our results here have important implications for some legal initiatives designed to tackle climate change. For one thing, we noted above the call by some scholars for the emergence of climate prediction markets as a means by which to influence public opinion.<sup>138</sup> Some of those scholars are involved in developing just such a prediction market.<sup>139</sup> If our findings are generalizable—at least from the perspective of affecting public opinion about climate change<sup>140</sup>—then these markets may do more harm than good. They may do no better—and may even fare worse than existing governmental messaging in swaying conservatives, and they may counterintuitively work to reduce liberals' beliefs in climate change.

To be clear, our findings do not refute—and indeed are consistent with—the long-standing notion that education about environmental problems may be valuable and may influence public opinion.<sup>141</sup> But the results here do question the extent to which the *source* of information—as opposed to, say, the details or the accessibility of the explanation for information—will have a strong influence. It may be more rewarding to design a careful approach to educate the public about the mechanisms and impacts of climate change than to consider alternate actors to convey the same information.

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<sup>137</sup> Cf. Cass R. Sunstein, Sebastian Bobadilla-Suarez, Stephanie C. Lazzaro & Tali Sharot, *How People Update Beliefs About Climate Change: Good News and Bad News*, 102 CORNELL L. REV. 1431, 1431 (2017) (presenting empirical finding that people who believe in climate change are more likely to change their beliefs based upon further *bad* news about climate change than in response to *good* news (such as that the effect is not as bad as previously thought)).

<sup>138</sup> See *supra* notes 47–52 and accompanying text.

<sup>139</sup> See *Vanderbilt Climate Change Prediction Market*, *supra* note 19.

<sup>140</sup> There may be other obstacles to designing a functioning prediction market. For discussion, see, for example, Masur & Nash, *supra* note 34, at 216–19 (discussing obstacles to a prediction market in respect of future government action).

<sup>141</sup> See, e.g., Menell, *supra* note 32, at 1471 (suggesting that education of the public to environmental concerns itself may be an effective environmental regulatory policy); Matthew H. Goldberg, Abel Gustafson, Seth A. Rosenthal & Anthony Leiserowitz, *Shifting Republican Views on Climate Change Through Targeted Advertising*, 11 NATURE CLIMATE CHANGE 573, 573 (2021) (finding that advertising based on conservative values increased Republicans' beliefs in climate change and their concern). *But see* Daniel Patrick Moynihan, *Iatrogenic Government: Social Policy and Drug Research*, 62 AM. SCHOLAR 351, 359 (1993) (“[T]he power of government . . . to influence behavior is limited.”).



Next, our findings are suggestive about initiatives to foster acceptance of climate change through corporate actors. Recent years have witnessed a growth in investor interest in corporate environmental behavior, and proposals have proliferated to require corporate ESG disclosure.<sup>142</sup> And, indeed, the U.S. Securities and Exchange Commission has, since 2010, interpreted corporate disclosure requirements to include the effects of climate change (including the effects of existing and proposed laws and regulations at all levels of government) on corporate activities.<sup>143</sup>

Beyond having an impact on investors (and by extension corporations themselves),<sup>144</sup> these disclosure programs and proposals conceivably might have an impact on broader social opinion about climate change.<sup>145</sup> Our findings run against the argument that information generated by these disclosures will be more likely to change the minds of more conservative-minded individuals specifically because the disclosures originate with private actors. At the same time, the results here suggest that more research on these questions would be profitable. Perhaps the particular perception of the prediction market—as being more “Wall Street” than “Main Street”—undercut acceptance of information from that source in our study; whereas more generic disclosures by corporations would be more persuasive, particularly for conservatives. Or maybe, if corporate climate disclosures are required by government, that legal intervention would reduce their persuasiveness for conservatives. We hope to undertake future research to shed light on these questions.

## CONCLUSION

Climate change presents a pressing threat to the global environment, economic, and perhaps ultimately, political security. A significant aspect of the challenge of climate change involves the task of building

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<sup>142</sup> See Menell, *supra* note 32 and accompanying text.

<sup>143</sup> For discussion, see Masur & Nash, *supra* note 34, at 230–32.

<sup>144</sup> See Georgiev, *supra* note 33, at 640 (“[L]arge institutional investors demand the disclosure of ESG information from firms and report that they find such information useful.”).

<sup>145</sup> By way of analogy, Professors Steven Bank and George Georgiev explain how the disclosure of the ratio of the pay of a corporation’s CEO to the pay of its median employee can inform and affect numerous audiences, including the media, policymakers, advocacy groups, corporate decisionmakers and advisors, corporate stakeholders (that is, employees and customers). See Steven A. Bank & George S. Georgiev, *Securities Disclosure as Soundbite: The Case of CEO Pay Ratios*, 60 B.C. L. REV. 1123, 1163–80 (2019) (discussing ESG disclosure and noting the great growth in the area).

institutions that can effectively generate and convey information to the public about climate change and its attendant risks. Without public uptake of this information, the strong mandate required for policy initiatives in democratic countries will be lacking.

A current challenge is the apparent polarization in public perception of climate change and its risks across political lines. This generally takes the form of liberal credence and skepticism among conservatives. Emerging research suggests that the use of alternative institutions might be a way to bridge this divide and the gap between public opinion and the consensus views of climate experts more generally. In particular, the suggestion is that use of more market-based institutions might expand the reach of climate science, making it more accessible and more persuasive to conservatives.

In this Article, we have presented the results of an experimental survey that we used to test these related hypotheses. While we do find evidence that there are variable effects across institutional sources for climate information that track divergent political views, it is not clear that these differences can be harnessed in the suggested ways. The presentation of the information in the market condition is associated with statistically significant reductions in the perceived accuracy of the information. Respondents also express a lower level of trust in the institution when exposed to the market condition. These effects are stronger for conservatives in the market condition than for liberals. In addition, to the extent information in the market condition is persuasive, it serves to reduce the confidence of liberals' prior climate change beliefs while failing to persuade conservatives.

The current sample is relatively small for the number of experimental conditions and controls of interest and although we have multiple prediction scenarios, countries, and institutions, it is a single study design. In order to more rigorously test the proposed relationships, a larger and more representative sample is needed. With the larger sample, we can also test for impacts using our alternative measures of political and cultural orientation. We would also be able to break down scenario results more finely, perhaps taking into account factors such as a respondent's state or province of residence and the history of any climate related extreme events in the recent past. In addition, the specific nature of the market alternative may be influencing the results. An alternative could be the use of prediction data that draws on a cap and trade market or an alternative market instrument. These are among some of the obvious caveats to the generalizability of the present results.

We hope in the future to expand the reach of our investigation; the current results are far from a definitive test of the proposed links between institutional source and differential ability to persuade along political lines. However, the results of this study raise questions about the basic assumption that something other than the IPCC is needed to effectively convey climate science information. A significant aspect of the evolution of international environmental law has been the creation of expert advisory bodies, such as the IPCC, with the objective of generating and disseminating credible science on global environmental issues. While these institutions do not persuade all segments of the public, our results here suggest that they may do a better job than the alternatives.

## APPENDIX: EXPERIMENTAL VIGNETTES

**Climate Change and Heavy Precipitation Events [IPCC Condition]**

One of the potential effects of changes in earth's climate system is an increase in the number of heavy precipitation events.

The United Nations' Inter-governmental Panel on Climate Change (IPCC) has recently released its Fifth Report, *Climate Change 2013: The Physical Science Basis*.

The IPCC is a scientific body associated with the United Nations. It does not do research itself, but reviews the most recent work from scientists around the world. Thousands of scientists voluntarily participate in its work. The governments of all UN member countries can also participate in the IPCC process to review, adopt, and approve its reports. Currently 195 countries are members.

The IPCC's report indicates that it is very likely that there will be an increase in heavy precipitation events, e.g., an increase in the frequency/intensity, and/or amount of heavy precipitation events by the end of this century.

The IPCC predicts that there is a 90%–100% probability that this change in earth's climate will occur.

**Climate Change and Heavy Precipitation Events [CME Condition]**

One of the potential effects of changes in earth's climate system is an increase in the number of heavy precipitation events.

The Chicago Mercantile Exchange (CME) has operated a market in weather derivatives since 1999, in addition to its more conventional commodity futures contracts (e.g., future prices for gold). It has recently added a new climate option product; participants can buy and sell contracts predicting the number of heavy precipitation events in the future.

The CME is the world's largest and most diverse market for futures and derivatives. It provides a world-wide exchange where buyers and sellers can transact in products that help them manage risk, or profit from accepting risk. Every year it handles around 3 billion contracts, worth around \$1 quadrillion.

Trading in the new climate option indicates that participants in the market think it is very likely there will be an increase in heavy precipitation events, e.g., an increase in the frequency/intensity, and/or amount of heavy precipitation events by the end of this century.

The price at which contracts are trading indicates that the market predicts that there is a 90%–100% probability that this change in earth's climate will occur.

### **Climate Change and Temperature Extremes [IPCC Condition]**

One of the potential effects of changes in earth's climate system is an increase in the number of heavy precipitation events.

The United Nations' Inter-governmental Panel on Climate Change (IPCC) has recently released its Fifth Report, *Climate Change 2013: The Physical Science Basis*.

The IPCC is a scientific body associated with the United Nations. It does not do research itself, but reviews the most recent work from scientists around the world. Thousands of scientists voluntarily participate in its work. The governments of all UN member countries can also participate in the IPCC process to review, adopt, and approve its reports. Currently 195 countries are members.

The IPCC's report indicates that it is likely that there will be warmer/fewer colder days and warmer/more frequent hot days over most land areas by the middle of this century.

The IPCC predicts that there is a 66%–100% probability that this change in the earth's climate will occur.

### **Climate Change and Temperature Extremes [CME Condition]**

One of the potential effects of changes in earth's climate system is an increase in the number of heavy precipitation events.

The Chicago Mercantile Exchange (CME) has operated a market in weather derivatives since 1999, in addition to its more conventional commodity futures contracts (e.g., future prices for gold). It has recently added a new climate option product; participants can buy and sell contracts predicting the number of heavy precipitation events in the future.

The CME is the world's largest and most diverse market for futures and derivatives. It provides a worldwide exchange where buyers and sellers can transact in products that help them manage risk, or profit from accepting risk. Every year it handles around 3 billion contracts, worth around \$1 quadrillion.

Trading in the new climate option indicates that participants in the market think it is likely that there will be warmer/fewer colder days and warmer/more frequent hot days over most land areas by the middle of this century.

The price at which contracts are trading indicates that the market predicts that there is a 66%–100% probability that this change in the earth's climate will occur.