

Cross-pressuring conservative Catholics? Effects of Pope Francis' encyclical on the U.S. public opinion on climate change

Nan Li¹ · Joseph Hilgard² · Dietram A. Scheufele³ ·
Kenneth M. Winneg² · Kathleen Hall Jamieson²

Received: 16 May 2016 / Accepted: 26 September 2016
© Springer Science+Business Media Dordrecht 2016

Abstract In an encyclical released in June of 2015, Pope Francis cast the need to address climate change as a moral imperative. Using nationally-representative surveys with supplemental samples of Catholics, we investigate changes in the U.S. public's post-encyclical attitudes about climate change and the Catholic pontiff. People who were aware of the encyclical held more polarized attitudes toward climate change than those who were unaware of it. Whereas encyclical-aware liberals expressed heightened concerns about climate change, encyclical-aware conservatives expressed lower levels. Cross-pressured by the inconsistency between the pontiff's views and those of their political allies, conservative Catholics devalued the Pope's credibility on climate change. These findings have important implications for communication about climate change in polarized opinion environments.

1 Introduction

Citing the scientific consensus on the existence and human causes of climate change, Pope Francis 2015 encyclical *Laudato si* declared that preventing its negative effects was a moral imperative. The Pope's call for action raised the question whether a religious authority could affect public opinion on a highly polarized topic, either among the U.S. population in general

Electronic supplementary material The online version of this article (doi:10.1007/s10584-016-1821-z) contains supplementary material, which is available to authorized users.

✉ Nan Li
nan.li@ttu.edu

¹ Department of Agricultural Education & Communications, Texas Tech University, Lubbock, TX 79409, USA

² Annenberg Public Policy Center, University of Pennsylvania, Philadelphia, PA 19104, USA

³ Department of Life Sciences Communication, University of Wisconsin-Madison & Morgridge Institute for Research, Madison, WI 53706, USA

or U.S. Catholics in specific. Prior to the encyclical's release, 71 % of American Catholics reported believing in climate change, which is on par with the general public (Pew Research 2015a). Catholics' views on the topic broadly reflect the partisan split that exists within the public. Whereas 62 % of Catholic Democrats believe in climate change and attribute it to human causes, only 24 % of Catholic Republicans hold the same beliefs (Pew Research 2015a). Compared with liberals, conservatives are both more skeptical that anthropogenic climate change exists and less concerned with its adverse effects (Leiserowitz 2006).

Pope Francis' stances on contentious issues do not uniformly align with those of either political party. Republicans generally share his opposition to same-sex marriage, euthanasia, and abortion, and Democrats agree with his opposition to death penalty, support of immigration, and support for the recent U.S.-Iran nuclear agreement (Brekke 2015; Stack 2015). Although elites of both parties sometimes disagree with the Pope, rarely have they publicly spoken against the Catholic pontiff. With respect to climate change, however, conservative leaders criticized Francis' positions (West 2015). A cursory examination of media coverage of the encyclical shows that right-leaning pundits emphasized the uncertainties of climate science and cast doubts on the Pope's competence to speak about it (Noonan 2015; Robbins 2015).

Since Pope Francis' embrace of human-caused climate change contradicts the position taken by most right-leaning politicians and over 70 % of Republicans (Pew Research 2015b), conservative Catholics face cross-pressure between their religious and political identities (Horan 1971). An understanding of how conservative Catholics resolve this incongruity will speak to the relative power of politics and religion in shaping climate change opinions, and to possible effects of the Pope's declaration on the U.S. climate-related conversations.

To investigate the impact of the encyclical on the U.S. public, we conducted nationally-representative surveys with supplemental samples of Catholics both before and after its release. We compared the opinions of those who reported being unaware with those indicating awareness of the encyclical. We also examined its impact on perceived papal credibility on climate change to understand the mechanism through which conservative Catholics might resolve the cross-pressure caused by exposure to the encyclical.

In the following sections, we lay out the sociological and socio-psychological roots of anthropogenic climate change denial in the U.S. and propose hypotheses regarding reactions to the encyclical. After reporting our findings, we discuss the dynamics of climate change opinion formation and the role of religion in mobilizing responsive action.

1.1 Climate denial: an overview

Although belief in anthropogenic climate change is common among liberals, a majority of conservatives, including some conservative Christians and Catholics, question it (Roberts 2011). Particularly between 2001 and 2010, beliefs regarding global warming became increasingly politically polarized (Klein 2015), potentially inspired by the election of Republican president George W. Bush, the awarding of the 2007 Nobel Peace Prize to Democratic presidential candidate Al Gore, and the election of Democrat Barack Obama, who had campaigned on the premise that the planet was in peril.

Rejection of climate change beliefs is sometimes related to a defense of conservative theological principles (Northcott and Scott 2014). As one example, a 2008 survey conducted by the Lutheran World Federation argues that some Christian respondents interpreted climate change as signs of an impending apocalypse, willed by God, which humanity cannot and should not prevent (Bloomquist and Machila 2009). This form of conservative/creationist

theology may undercut scientific perspectives on the issue and dampen individuals' willingness to prevent or mitigate climate change. Consistent with this argument, the PRRI/AAR 2014 Religion, Values, and Climate Change Survey (Jones et al. 2014) reports that evangelical protestants are more likely to attribute natural disasters to the biblical end times (77 %) than to climate change (49 %), whereas Americans in general are more likely to attribute disasters to climate change (62 %) than to biblical end times (49 %).

Previous literatures have proposed potential explanations for the causes and mechanisms of climate denial. These range from intra-individual mechanisms such as emotions (e.g., anxiety) to broad, societal forces such as cultural norms and political economy (e.g., Lertzman 2010; Norgaard 2011; Klein 2015). For example, Lertzman (2010) proposes that thinking about the potential consequences of climate change, as well as the seeming difficulty or even impossibility of preventing them, evokes strong feelings of anxiety. To cope with this state, Lertzmann argues, individuals may prefer to doubt, or at least avoid thinking about, climate change. In addition, Norgaard proposes a sociological and socio-psychological model that views anthropogenic climate change denial and climate apathy as social and cultural processes (Norgaard 2011). In this model, denial positions are developed in order to dismiss the need for a less comfortable standard of living, and then these positions are justified through cultural processes that maintain the status quo and absolve feelings of guilt or responsibility. In short, the anxiety caused by climate change is felt "at the individual level as identity threats, at the institutional level as challenges to social cohesion, and at the societal level as legitimation threats" (Revkin 2011). These denial and avoidance behaviors are socially reinforced by group norms, as well as the messages people receive from the mass media and the political elite (Hmielowski et al. 2014).

1.2 The U.S. public and Catholics' response to the encyclical

Papal concern for the environment dates at least to Pope Paul VI's 1971 apostolic letter, *Octogesima adveniens*, which listed environmental degradation as a social problem (Francis 2015). Pope Francis' environmental message also has roots in earlier teachings about human ecology and environmental stewardship (Thorsen 2015). The encyclical cites scientific consensus on the existence of climate change and notes that probable consequences include reduced agricultural productivity, rising sea levels, and more extreme weather events. The document also highlights the disproportionate risks climate change poses to developing countries and socially-disadvantaged populations; these concerns are consistent with the Catholic Church's dedication to poverty reduction and social justice (Northcott and Scott 2014).

The encyclical elicited public support from environmental, social justice and public health groups, climate scientists, and Democrats. Left-leaning editorial pages, such as the *New York Times*, said it "packed an unexpectedly authoritative and confidence punch" (The Editorial Board 2015). However, the encyclical's arguments met with opposition from conservative pundits. After its release, *Wall Street Journal* editorialist Peggy Noonan wrote that the Pope "acts on unsettled science" (Noonan 2015). Conservative radio hosts Rush Limbaugh, Michael Savage, and Alex Jones described the Pope's critique of "unfettered capitalism" as sympathy for Marxism, socialism and advocacy for a redistribution of global wealth (Wills 2015).

This partisan response can be explained by cultural cognition theory (Kahan et al. 2011) which posits that individuals selectively credit or dismiss risk-related information according to their in-group's cultural values (Kahan et al. 2011). Because the Pope's concern with

environmental justice is consistent with liberals' egalitarian/communitarian values and resentment of possessive individualism and unregulated industry (Kahan et al. 2011; Pelletier 2010), liberals who learned of the document should be more likely to embrace the moral dimensions of climate risk asserted by the pontiff and express greater concerns of climate change, compared to liberals who had not heard about it.

In contrast, Pope Francis' pro-climate positions conflict with conservatives' skeptical views of climate change. When people are exposed to a message that threatens their beliefs or preexisting values, they avoid dissonance and protect social standing by engaging in identity protection, a process that aligns beliefs with those endorsed by their in-group (Cohen 2003; Kahan et al. 2007). As a result, compared to their counterparts who had not heard about the encyclical, conservatives who had heard about it should be more likely to deny the scientific reality of climate change and to downplay the seriousness and adverse impact of climate change. Accordingly, we hypothesize that the relationships between political leaning and opinions on climate change, including (1) overall acknowledgement of and concerns about climate change and (2) perceived climate change risks to the poor, would vary as a function of encyclical awareness, such that:

H1: Encyclical awareness is positively related to overall acknowledgement of and concerns with climate change among liberals and negatively related to them among conservatives.

H2: Encyclical awareness is positively related to perceived climate change risk to the poor among liberals and negatively related to it among conservatives.

Although one might expect greater acceptance of the Pope's message among Catholics, their responses to the Pope's call varied. Some Catholic leaders, including heads of the U.S. Conference of Catholic Bishops and the Catholic Climate Covenant, expected it to add urgency to environmental measures in the Obama administration's climate plan (Goldenberg 2015). The U.S. Conference of Catholic Bishops acknowledged its pro-climate position in 2001, saying "Climate change is about the future of God's creation and the one human family" and, foreshadowing Francis' message, emphasizing that the poor and powerless would suffer disproportionately from climate alterations (U.S. Conference of Catholic Bishops 2001).

However, many Catholics on the religious right doubt that human-caused climate change exists or oppose political action to prevent it (Roberts 2011). After the release of the encyclical, some rejected the Pope's call to phase out fossil fuels (Goodstein 2015). Moreover, few priests used their pulpits to communicate the Pope's message (Goodstein 2015). In the months after the encyclical's promulgation, many priests remained muted on the message (Vyawahare 2015). A survey conducted in mid-July found 40 % of American Catholics reporting awareness of the encyclical, and among this group only 23 % reported hearing about it at Mass (NORC 2015). These responses invite a research question (RQ) that asks:

RQ1: Did liberal and conservative Catholics react to the Pope's message in the same way as their non-Catholic counterparts?

In addition, Catholic Republican politicians tried to discredit the Pope's message even before it was released. These attacks stressed the boundaries of papal credibility, acknowledging his authority on theological but not on scientific matters (Rockström 2015). These attacks underscored the counter-frame of climate change not as a moral but as an economic, political,

or scientific issue, a line of argument used by Republican Catholic presidential candidate Jeb Bush who said, “I don’t get economic policy from my [pope.] [...] I think religion ought to be about making us better as people, less about things [that] end up getting into the political realm” (Lavender 2015). Another Catholic, former senator Rick Santorum noted “The church has gotten it wrong a few times on science, and I think that we probably are better off leaving science to scientists...” (Beasley 2015).

These prominent Republican Catholics reduced the dissonance invited by the encyclical by holding to their preexisting opinions and questioning the Pope’s credibility on climate change. The avenue was open for lay conservative Catholics to do the same. Previous studies show that it is easier to dismiss a message from a low-credibility source than from a high-credibility one (Hovland and Weiss 1951; Kelly-Woessner and Woessner 2006; Kleinhesselink and Edwards 1975). Relief from dissonance can be achieved by disparaging the source’s credibility in a specific domain (Festinger 1962). In other words, compared to their counterparts who had not heard about the encyclical, Catholics who had heard should be more likely to adjust the credibility ascribed to the pope based on political leaning as a way to resolve cross-pressure. In short, for Catholics, the relationship between political leaning and perceived papal credibility on climate change should vary as a function of encyclical awareness. We hence hypothesize that:

H3: Encyclical awareness is negatively related to perceived papal credibility on climate change among conservative Catholics and positively related to it among liberal Catholics.

2 Method

2.1 Data

Our data come from phone interviews with two nationally representative samples plus supplemental samples of Catholics (Total $N=2755$). Catholic oversamples¹ ($N=711$) were recruited from households with a respondent who had identified as Catholic in a previous national representative survey. Data were collected between June 12 and July 2, 2015; 1381 respondents took the survey one week before and 1374 respondents took it two weeks after the encyclical was released on June 18. Interviews of approximately 20 min were conducted in both English and Spanish. The two data sets were combined into a single data file for analysis.

Both surveys used an overlapping dual-frame random digit dial (RDD) sample design. To improve coverage among subgroups (e.g., young adults, Hispanics), cell phone interviews were conducted in conjunction with the landline survey. Both samples were drawn by Survey Sampling International, LLC according to Abt SRBI specifications. In the pre-encyclical survey, response rates were 7.24, 7.94, and 29.86 % for the landline RDD, cell phone RDD, and Catholic oversample, respectively. These response rates were 6.45, 7.08, and 27.74 % respectively for the post-encyclical survey (AAPOR 2015). All responses were weighted using

¹ Oversampling is a survey technique that allows researchers to obtain more reliable estimates for subgroups in the population by adding to a national random sample an additional random selection of more individuals from a group of special interest (in this case Catholics) than would typically occur if those in that group had the same chance of being chosen as those in the population at large (Groves 1989).

the weights adjusted for sex, age, education level, race, geography, household telephone usage, and urban residence.

2.2 Measures

Overall acknowledgement of and concerns about climate change While previous researchers have specified constructs capturing beliefs and concerns regarding climate change, these are generally indicative of one's *overall acknowledgement of and concerns about climate change*, which largely manifests fundamental cultural values and ideological leanings (Kahan et al. 2011; Norgaard 2011). To examine how liberals and conservatives would respond to the encyclical differently as it minimized or elicited their expression of cultural identities, we defined an index of overall attitudes toward climate change. A multi-item measure was developed, combining respondents' (1) belief in anthropogenic climate change, (2) perceived seriousness of climate change, and (3) belief in scientific consensus on climate change. An analysis of the index's construct validity can be found in online Appendix I.

We first asked respondents to assess the seriousness of the issue of climate change confronting the nation on a four-point scale (1 = "not at all serious," 4 = "very serious;" $M = 3$, $SD = 1.03$). We then measured individuals' beliefs in anthropogenic climate change using a five-point scale derived from a drill-down questioning procedure. Respondents were first asked whether there was solid evidence of global warming. Respondents who answered yes were asked whether the warming was caused by human activity or natural patterns. Respondents who answered no to the first question were asked whether there was insufficient evidence or climate change was not happening. Responses were coded into five categories: 0 ("just not happening," 8.2 %), 1 ("not happening but don't know enough yet," 16.1 %), 2 ("not sure whether getting warmer or not," 5 %), 3 ("getting warmer because of natural patterns," 23.6 %), and 4 ("getting warmer because of human activity," 47 %). We finally asked whether respondents thought most *scientists* believe that global warming "is occurring" (coded as 3; 66.3 %), "not occurring" (coded as 1; 7.9 %), or "most scientists are unsure whether global warming is occurring or not" (coded as 2; 20.2 %). The three items were standardized and averaged to form an index to measure individuals' *overall acknowledge of and concerns with climate change* (Cronbach's $\alpha^2 = .74$, $M = 0$, $SD = .82$).

Perceived climate risks to the poor This variable was measured by a single item asking "how accurate is it to say that climate change will have a greater effect on the poor than on those in better economic circumstances" on a four-point scale (1 = "not accurate at all," 4 = "very accurate;" $M = 2.91$, $SD = 1.09$).

Perceived papal credibility on climate change Respondents also indicated on a five-point scale (1 = "not credible at all," 5 = "very credible;" $M = 2.95$, $SD = 1.49$) how credible Pope Francis was when he spoke about "moral obligations to address climate change".

² Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. Generally speaking, a value of 0.7-0.8 is an acceptable value for Cronbach's alpha, indicating reasonable reliability of the measure.

Encyclical awareness Respondents answering the survey after the encyclical's release were asked whether they had heard or read anything about Pope Francis "issuing an official church document, known as an encyclical, on climate change and other environmental issues" (29 % answered yes). Because the earliest media report on the planned release of encyclical occurred on June 7 (Beasley 2015), about one week before our survey was fielded, we also asked respondents who took the survey before the encyclical release whether they had heard anything about "Pope Francis' plan" to issue an encyclical" (16 % answered yes).

Political leaning Two items on party identification and political ideology were standardized and combined to measure one's political leaning (Pearson $r = .4$, $M = 0$, $SD = .85$). *Party identification* was measured on a seven-point scale (1 = "strong Democrat", 4 = "Independent," 7 = "strong Republican") ($M = 3.55$, $SD = 2.12$). *Political ideology* was measured by a five-point scale (1 = "very liberal," 3 = "moderate," 5 = "very conservative") ($M = 3.16$, $SD = 1.22$).

News media use The *conservative news media* scale ($M = .48$, $SD = .65$, range 0–3) summed one point for watching any amount of FOX news, plus one point for any amount of conservative talk radio (e.g., Rush Limbaugh, Glen Beck), plus one point for the use of any conservative news websites (e.g., Drudge Report, FoxNews.com, TownHall.com) in the past week. Similarly, the *liberal news media* scale ($M = .75$, $SD = .91$, range 0–4) was constructed as the sum of one point for any amount of CNN use, one point for any amount of MSNBC use, one point for any liberal talk radio (e.g., NPR's Talk of the Nation), and one point for any liberal news website in the past week (e.g., Huffington Post, Talking Points Memo).

Demographics Collected demographics included gender (48.7 % males), age ($M = 47$, $SD = 18.4$), Hispanic ethnicity (15.3 % Hispanics), race (11.6 % Black), education (41.6 % High School or less, 28.7 % some college, 29.7 % college and more). Respondents were also asked their specific religious preference (21.1 % Catholic, 37.9 % non-Catholic Christians, 24.3 % no religious denomination, 5.6 % atheist or agnostic). A dummy variable was used to indicate Catholic status.

2.3 Analytical framework

According to H1 and H2, the relationships between political leaning and opinions on climate change should vary as a function of encyclical awareness. Additionally, RQ1 asks whether the interactive effect of political leaning and encyclical exposure differed between Catholics and non-Catholics. Thus, we fitted a series of multiple regression models embodying the *Encyclical Awareness* \times *Political Leaning* \times *Catholic* interaction and all of its lower-order items to two outcome variables - *overall acknowledgement of and concerns about climate change* and *perceived climate risks to the poor*. In order to test H3, the same model was also fitted to examine *perceived papal credibility on climate change*. To account for other sources of variance, including age, gender, race, Hispanic ethnicity, education, liberal and conservative media use,³ several other variables were included.

³ The news media variables were not excessively correlated with political leaning, all Pearson $r < .4$, and hence presented no multicollinearity problem for the analysis.

3 Results

As Table 1 indicates, the model explains 32.5 and 15.4 % of variance in *overall acknowledgement of and concerns about climate change* and *perceived climate risks to the poor*, respectively. In general, Hispanics and heavy users of liberal media are more likely to be concerned with climate change. In contrast, conservatives and conservative news media users are less likely to report concern. Similarly, liberal media users are more likely to believe climate change will disproportionately affect the poor, whereas conservatives, and heavy users of conservative media are less likely to do so.

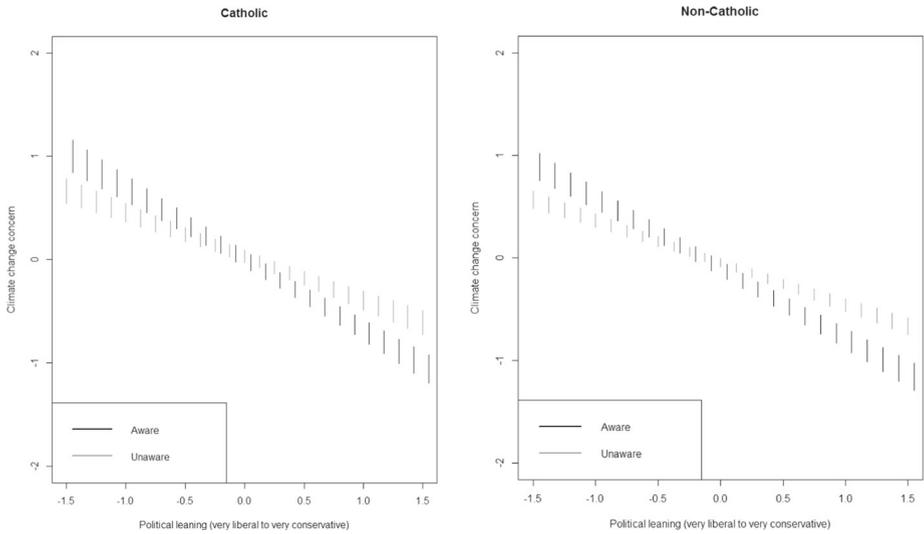
H1 and H2 hypothesize that conservatives and liberals would react differently to the encyclical, with awareness negatively related to acknowledgement of and concerns about climate change and perceived climate risks to the poor among conservatives while the opposite would be the case for liberals. These hypotheses were supported by the significant interactions between encyclical awareness and political leaning when predicting the overall acknowledgement of and concerns about climate change ($\beta = -.11, p < .001$) and perceived climate risks to the poor ($\beta = -.09, p < .001$) (see Table 1).

Compared to those who had not heard about the encyclical, those who had hold more polarized attitudes toward climate change (see Fig. 1). Figure 2 shows a similar polarization trend for individuals' perception of climate-caused risks to the poor. In general, conservatives who had heard about the encyclical were less likely to think climate change is risky for economically disadvantaged populations than were those who had not heard about it. Liberals

Table 1 Regression predicting overall acknowledgement of and concerns with climate change, perceived climate risks to the poor, and perception of papal credibility on climate change

	Overall acknowledgement of and concerns about climate change	Perceived climate risks to the poor	Perception of papal credibility on climate change
Age	-.03	.01	.11***
Gender (Female = 1)	.06***	.08***	.05*
Education	.04*	-.03	-.02
Race (Black = 1)	.02	-.02	-.02
Hispanic	.1***	.08***	.17***
Catholic	.01	-.02	.19***
Political leaning (conservative = high)	-.32***	-.21***	-.19***
Liberal news media use	.14***	.1***	.12***
Conservative news media use	-.29***	-.19***	-.16***
Encyclical awareness	.01	.06**	.1***
Awareness * Catholic	-.04*	0	-.06**
Awareness * Political leaning	-.11***	-.09***	-.14***
Catholic * Political leaning	-.01	0	.01
Awareness * Catholic * Political leaning	0	.03	.08**
Total R ²	32.5 %***	15.4 %***	19.3 %***

Notes: Total $N = 2755$. Standardized coefficients (β) were reported for main effects. Before entry-betas were reported for all interaction terms. * $p < .05$, ** $p < .01$, *** $p < .001$

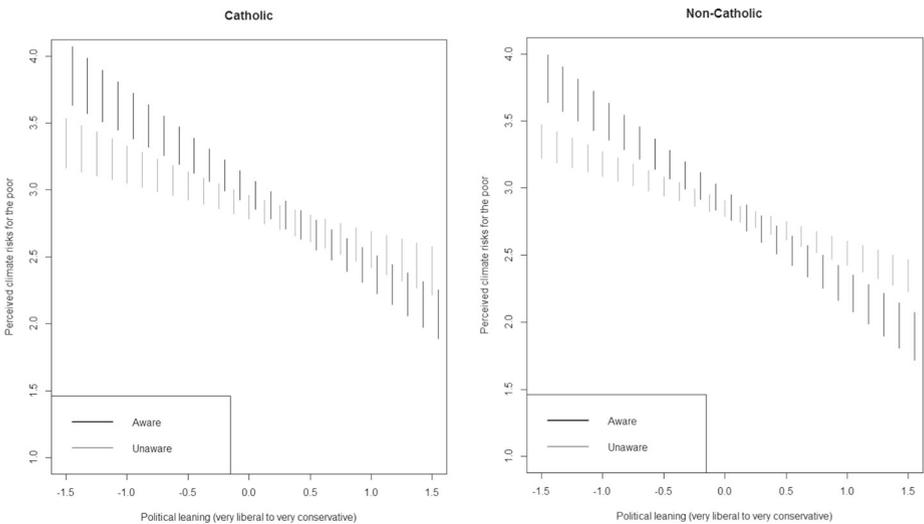


Notes: Vertical bars represent 95% confidence interval.

Fig. 1 Interactive effects between encyclical awareness, Catholicism, and political leaning on overall acknowledgement of and concerns with climate change

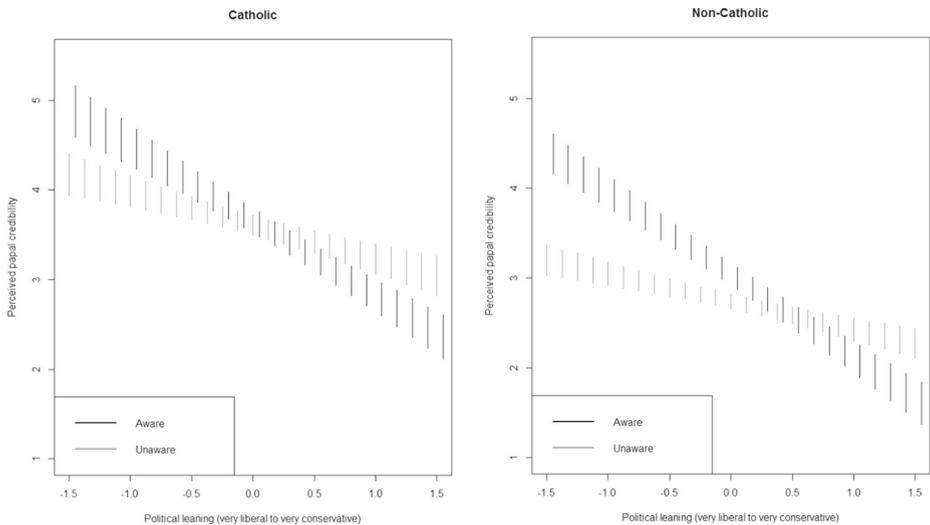
who had heard about the encyclical perceived more risks of climate change to the poor than their ideological kin who were unaware.

In answer to RQ1, liberal and conservative Catholics reacted to the encyclical in a pattern similar to that of their non-Catholic counterparts; *Encyclical Awareness* × *Political Leaning* × *Catholic* interactions were not significant when predicting the two outcome



Notes: Vertical bars represent 95% confidence interval.

Fig. 2 Interactive effects between encyclical awareness, Catholicism, and political leaning on perceived climate risks to the poor



Notes: Vertical bars represent 95% confidence interval.

Fig. 3 Interactive effects between encyclical awareness, Catholicism, and political leaning on perceived papal credibility on climate change

variables. As was the case with non-Catholics, conservative Catholics who had heard about the encyclical were less accepting of the reality and risks of climate change than were their encyclical-unaware counterparts. However, liberal Catholics aware of the document reported higher levels of concern and perceived risks.

H3 proposes that compared to their counterparts who had not heard about the encyclical, Catholics who had should be more likely to adjust the credibility ascribed to the Pope based on political leaning as a way to resolve potential cross-pressure. This hypothesis was supported by the significant three-way interaction among Catholicism, political leaning, and encyclical awareness. As shown in Fig. 3, conservative Catholics who had heard about the encyclical assigned the Pope less credibility than those who had not, whereas the opposite was true for liberal Catholics.

4 Discussion

Laudato Si' is the first encyclical devoted to environmental issues. Its release focused additional media attention on the climate change issue debated for decades. Acknowledging the scientific consensus regarding global warming, Pope Francis highlighted the disproportionate risks to the world's poor and declared addressing the issue to be a moral imperative. Although the encyclical did not have broad effects on overall acknowledgement of and concerns about climate change, people who had heard about the encyclical appeared to be more polarized than those unaware of the document. Among liberals, those who had heard about it were more concerned about climate change and perceived more risks than those indicating no awareness; the opposite was true for conservatives.

Although Catholics did not appear to be more influenced by the encyclical than non-Catholics, they did attribute higher credibility to the Pope on climate change than non-

Catholics, suggesting that Catholics may be more receptive to the Pope's message. However, among Catholics who had not heard of the encyclical, political leaning was strongly associated with climate change beliefs and perception of papal credibility. Catholics' attitudes toward climate change and the Pope were even more polarized among those aware of the papal document. In sum, while Pope's environmental call may have increased some individuals' concerns about climate change, it backfired with conservative Catholics and non-Catholics, who not only resisted the message but defended their preexisting beliefs by devaluing the pope's credibility on climate change.

These results suggest that the worldviews, political identities, and group norms that lead conservative Catholics to deny climate change override their deference to religious authority when judging the reality and risks of this phenomenon. Because conservatives tend to expect individual societies to secure their own well-being without assistance or interference from others (Kahan et al. 2011), the pope's justification for action holds limited moral authority for conservatives. As a result, many Catholics with conservative political views were either ambivalent or opposed to the Pope's message. The ambivalence and opposition motivated conservative Catholics to devalue the pope's credibility on the issue.

Before discussing the domestic and international implications of these findings, we should note a number of limitations of our study. First, the observed effects, although statistically significant ($p < .001$), are often small ($\beta \sim .1$). Second, although we hypothesized that the encyclical would receive distinct responses from liberals and conservatives as it either prompted or minimized an expression of cultural identity, it is possible that the encyclical did not cause the attitudinal shifts we found, but instead that respondents who had more extreme attitudes about climate change were more likely to learn of the encyclical, perhaps as part of their politicized media diet. To rule out this possibility, we examined attitude change using a subset of 602 respondents who were surveyed twice, once before and once after the encyclical's release (see online Appendix II for details).

The results replicated some, but not all, of the polarization effects observed in cross-sectional analysis. For example, there was a small, not-quite-significant interaction between encyclical awareness and political leaning for climate change acknowledgement and concerns. The panel respondents ($N = 175$) who did not hear about encyclical at Time 1 did not become significantly more polarized regarding climate change after hearing about it at Time 2. In fact, climate change acknowledgement and concerns were highly stable from pre-encyclical to post-encyclical, as demonstrated by the large effect of pre-encyclical concern on post-encyclical concern, $\beta = .70$. This indicates that climate change concern is resistant to change across time. Nonetheless, we again observed that respondents appeared to adjust the Pope's credibility on climate change according to whether his message fit their political leaning. Consistent with our cross-sectional analyses, conservatives tended to maintain preexisting beliefs while devaluing the Pope's credibility and counter-arguing his message. Nonetheless, the panel analyses suggest that conservative Catholics may be less willing to denigrate the Pope's credibility on climate change than conservative non-Catholics.

The panel study had its own limitations, including attrition, a comparatively small number able to be re-contacted, and a lack of demographical representativeness. In particular, the cross-sectional surveys had 1904 encyclical-unaware and 851 encyclical-aware respondents. In contrast, the panel had 270 unaware-controls and just 175 participants who learned of the encyclical between surveys. Causal effects of the encyclical may be too small to detect at this scale.

Third, encyclical exposure is operationalized as self-reported awareness of the encyclical in this study, which is closely related to one's news media use and interests in public affairs. The polarizing responses from liberals and conservatives, therefore, may not be attributed to one's reading of the actual content, but to their broad exposure to mediated communications surrounding the release of the encyclical. As American Catholics' concerns about climate change appeared to increase four months after the encyclical release when the pope visited the US (Maibach et al. 2015), it is possible that public opinion may be moved as the overall news narrative became less contentious. Additional studies are needed to isolate the relationship between news coverage and public responses to the Pope's call for environmental action. Experimental research is needed to separate the relative effects of encyclical exposure from that of the news narrative.

As the current study mainly focuses on the U.S. public's response to the Pope's environmental message, the observed patterns in public opinion may not be generalizable to other countries, especially where people share more positive or negative views of Pope Francis and show higher or lower deference to religious authority over social and political issues. For example, in Panama, 73 % believe religious leaders should have at least some influence on political matters, compared to only 38–45 % in the US (Pew Research 2014). Future research should investigate the potential interaction between citizens' acceptance of religious figures' teaching on environmental justice and their support for the separation between religion and state. Also of note is the fact that the world's religions are engaging the idea of climate change in various ways for a various set of reasons (see Veldman et al. 2013 for a review). Whereas many Christian denominations have declared climate change to be an urgent moral matter, many non-Christian traditions have engaged this issue in a much less active manner if at all (Veldman et al. 2013). Further research should investigate the roles of different religious traditions in encouraging or discouraging collective actions against climate change and explore how, if at all, each religion interacts with political identities to influence climate change opinion.

In past years, a number of organizations, including religious bodies, have framed climate change as a moral issue that involves considerations of personal responsibility, stewardship for the Earth and the disadvantaged (Markowitz and Shariff 2012). However, few studies have empirically examined the effectiveness of such messages. In this study, we use individuals' awareness of the encyclical as a quasi-experimental treatment and examine how it affects individuals' concerns regarding climate change and perceived climate-related risks to the poor.

In conclusion, highlighting the harms and injustices associated with climate change did not activate immediate moral intuitions even when the message came from a high-profile and respectful religious leader. To increase climate change concerns, other moral foundations should be recognized. For example, prior scholarship shows that framing climate change as an issue of religiously required stewardship has increased the salience of the subject among some traditionally skeptical audiences (Markowitz and Shariff 2012). Also, strategically developed messages that leverage the credibility of scientific organizations respected by both parties (i.e. NASA) persuaded even conservatives to reject a message suggesting the recovery of Arctic ice (Jamieson and Hardy 2014). Empirical evidence also reveals potential opportunities for non-political leaders and scientists to leverage their credibility by conveying comprehensible facts while framing messages that directly speak to audiences' ideologies and value-driven concerns (Nisbet and Scheufele 2009). Communication efforts should therefore provide diverse pathway by which individuals with different cultural values and political views can come to a shared belief regarding the need for action.

References

- AAPOR (2015) Standard definitions: final dispositions of case codes and outcome rates for surveys
- Beasley A (2015) Rick Santorum: turn to me, not the Pope, on climate change. MSNBC Publishing MSNBC.com. <http://www.msnbc.com/msnbc/rick-santorum-turn-me-not-the-pope-climate-change>. Accessed 06 May 2016
- Bloomquist KL, Machila R (2009) God, creation and climate change. The Lutheran World Federation, Geneva
- Brekke K (2015) The Pope doesn't belong in any political category, and here's why. In: Huffingt. Post. http://www.huffingtonpost.com/entry/pope-politics_us_5602ad92e4b0fde8b0d08255. Accessed 3 Aug 2016
- Cohen GL (2003) Party over policy: the dominating impact of group influence on political beliefs. *J Pers Soc Psychol* 85:808–822
- Festinger L (1962) A theory of cognitive dissonance. Stanford university press
- Francis (2015) On the care for our common home - LAUDATO SI'
- Goldenberg S (2015) US Catholics ready to follow Pope's 'marching orders' on climate change. The Guardian Publishing theguardian.com. <http://www.theguardian.com/world/2015/jun/18/pope-encyclical-climate-change-catholics-us-response>. Accessed 06 May 2016
- Goodstein L (2015) Few echo Pope's environmental plea in Sunday sermons. The New York Times Publishing nytimes.com. <http://www.nytimes.com/2015/06/22/world/few-echo-popes-environment-plea-in-sunday-sermons.html>. Accessed 06 May 2016
- Groves R (1989) Survey errors and survey costs. Wiley, New York
- Hmielowski JD, Feldman L, Myers TA et al (2014) An attack on science? media use, trust in scientists, and perceptions of global warming. *Public Underst Sci* 23:866–883. doi:10.1177/0963662513480091
- Horan PM (1971) Social positions and political cross-pressures: a re-examination. *Am Sociol Rev* 36:650–660
- Hovland CI, Weiss W (1951) The influence of source credibility on communication effectiveness. *Publ Opin Quart* 15:635–650
- Jamieson KH, Hardy BW (2014) Leveraging scientific credibility about Arctic sea ice trends in a polarized political environment. *Proc Natl Acad Sci* 111:13598–13605. doi:10.1073/pnas.1320868111
- Jones RP, Cox D, Navarro-Rivera J (2014) Believers, sympathizers, & skeptics: Why Americans are conflicted about climate change, environmental policy, and science: Findings from the PRRI/AAR Religion, Values, and Climate Change Survey
- Kahan DM, Braman D, Gastil J, Slovic P, Mertz CK (2007) Culture and identity-protective cognition: explaining the white-male effect in risk perception. *J Empir Leg Stud* 4:465–505
- Kahan DM, Jenkins-Smith H, Braman D (2011) Cultural cognition of scientific consensus. *J Risk Res* 14:147
- Kelly-Woessner A, Woessner MC (2006) My professor is a partisan hack: how perceptions of a professor's political views affect student course evaluations. *PS: Pol Sci Pol* 39:495–501
- Klein N (2015) This changes everything: capitalism vs. the climate. Simon and Schuster
- Kleinhesselink RR, Edwards RE (1975) Seeking and avoiding belief-discrepant information as a function of its perceived refutability. *J Pers Soc Psychol* 31:787–790
- Lavender P (2015) Jeb Bush among conservatives criticizing Pope for climate change encyclical. The Huffington Post Publishing huffingtonpost.com. http://www.huffingtonpost.com/2015/06/17/jeb-bush-pope-climate-change_n_7603160.html. Accessed 06 May 2016
- Leiserowitz A (2006) Climate change risk perception and policy preferences: the role of affect, imagery, and values. *Clim Chang* 77:45–72
- Lertzman RA (2010) The myth of apathy: psychosocial dimensions of environmental degradation. Cardiff University
- Maibach E, Leiserowitz A, Roser-Renouf C, Myers T, Rosenthal S, Feinberg G (2015) The Francis effect: how Pope Francis changed the conversation about global warming. George Mason University Center for Climate Change Communication, Fairfax, p 93, http://environment.yale.edu/climate-communication-OFF/files/The_Francis_Effect.pdf. Accessed 06 May 2016
- Markowitz EM, Shariff AF (2012) Climate change and moral judgement. *Nat Clim Chang* 2:243–247
- Nisbet MC, Scheufele DA (2009) What's next for science communication? promising directions and lingering distractions. *Am J Bot* 96:1767–1778. doi:10.3732/ajb.0900041
- Noonan P (2015) Scenes from a young papacy. the Wall Street Journal Publishing wsj.com. <http://www.wsj.com/articles/scenes-from-a-young-papacy-1434065038>. Accessed 06 May 2016
- NORC (2015) New survey on Americans' views on papal encyclical on climate change. NORC Publishing norc.org. <http://www.norc.org/NewsEvents/Publications/PressReleases/Pages/new-survey-on-americans-views-on-papal-encyclical-on-climate-change.aspx>. Accessed 06 May 2016
- Norgaard KM (2011) Living in denial: Climate change, emotions, and everyday life. MIT Press
- Northcott MS, Scott PM (2014) Systematic theology and climate change: ecumenical perspectives. Routledge
- Pelletier N (2010) Environmental sustainability as the first principle of distributive justice: towards an ecological communitarian normative foundation for ecological economics. *Ecol Econ* 69:1887–1894

- Pew Research Center (2014) Pope Francis' image positive in much of world
- Pew Research Center (2015a) Catholics divided over global warming
- Pew Research Center (2015b) Partisans differ sharply on power plant emissions limits, climate change
- Revkin A (2011) On birth certificates, climate risk and an inconvenient mind. In: New York Times. <http://dotearth.blogs.nytimes.com/2011/04/28/on-birth-certificates-climate-risk-and-an-inconvenient-mind/>. Accessed 3 Aug 2016
- Robbins D (2015) Conservative media vs. the Pope: the worst reactions to Pope Francis' climate change encyclical. Media Matters for America Publishing [mediamatters.org](http://mediamatters.org/research/2015/06/18/conservative-media-vs-the-pope-the-worst-react/204037). <http://mediamatters.org/research/2015/06/18/conservative-media-vs-the-pope-the-worst-react/204037>. Accessed 06 May 2016
- Roberts M (2011) Evangelicals and climate change. In: Gerten D, Bergmann S (eds) Religion in environmental and climate change: Suffering, values, lifestyles. Bloomsbury Publishing, pp 107–131
- Rockström J (2015) Why the Pope's embrace of science matters. In: TED.COM. <http://ideas.ted.com/why-the-popes-embrace-of-science-matters/>. Accessed 3 Aug 2016
- Stack L (2015) Pope Francis on abortion and other issues. In: New York Times. http://www.nytimes.com/interactive/2015/09/21/us/pope-francis-issues-catholics.html?_r=0. Accessed 3 Aug 2016
- The Editorial Board (2015) The Pope and climate change. New York Times Publishing [nytimes.com](http://www.nytimes.com/2015/06/19/opinion/the-pope-and-climate-change.html). <http://www.nytimes.com/2015/06/19/opinion/the-pope-and-climate-change.html>. Accessed 06 May 2016
- Thorsen JE (2015) Trends in global Catholicism. Handbook of Global Contemporary Christianity: Themes and Developments in Culture, Politics, and Society, p. 29
- U.S. Conference of Catholic Bishops (2001) Global climate change: a plea for dialogue, prudence and the common good
- Veldman RG, Szasz A, Haluza-DeLay R (2013) How the world's religions are responding to climate change: Social scientific investigations. Routledge
- Vyawahare M (2015) How will American Catholics respond to Pope's message on climate change? Scientific American. <http://www.scientificamerican.com/article/how-will-american-catholics-respond-to-pope-s-message-on-climate-change/>. Accessed 06 May 2016
- West J (2015) A lot of American Catholics have never heard of Pope Francis' most important new message. Mother Jones. <http://www.motherjones.com/environment/2015/08/pope-francis-climate-american-polls>. Accessed 06 May 2016
- Wills O (2015) A "Marxist" who should "stay home": the worst of conservative media's war on Pope Francis. [mediamatters.org](http://mediamatters.org/research/2015/09/21/a-marxist-who-should-stay-home-the-worst-of-con/205680). <http://mediamatters.org/research/2015/09/21/a-marxist-who-should-stay-home-the-worst-of-con/205680>. Accessed 06 May 2016