

Fear of COVID-19 Reinforces Climate Change Beliefs. Evidence From 28 European Countries

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Research Article

Keywords: stable social legitimacy, long-term nature of climate policy, lower educated Europeans

DOI: <https://doi.org/10.21203/rs.3.rs-366967/v1>

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Abstract

The long-term nature of climate policy measures requires stable social legitimacy, which other types of crises may jeopardize. This article examines the impact of the COVID-19 fear on climate change beliefs based on an autumn 2020 population survey in the Member States of the European Union and the United Kingdom. The results show that deep COVID-19 concerns increase awareness, climate change concerns, and perceived negative impacts of climate change. These effects are more robust among the lower educated Europeans. On the country level, strict governmental measures are also linked to deep climate change concerns. In contrast to the experience following the 2008 recession, the findings show that a secondary crisis can positively impact climate attitudes, which is a promising result for policy actions.

Introduction

The "health versus wealth" dilemma of the COVID-19 pandemic demonstrates that humanity must learn to deal with complex risks and parallel crises [1,2]. The unpredictability caused by unforeseen threats enhances governments' and institutions' ability to adapt; it requires flexible and rapid reactions even when information is lacking [3]. Crisis management can lead to resignations in the short term, so adequate social legitimacy is often essential to make the right government decisions [4]. Therefore, it is becoming increasingly useful to understand how one problem's appreciation affects people's perceptions of another severe difficulty. As climate change is an urgent global challenge, its comparison with the pandemic offers an opportunity to examine cross-effects.

Before the pandemic, many studies have discussed the drivers that influence people's attitudes to climate change. The results show significant regional differences: while in developed countries perceptions were more influenced by social factors (e.g., values, political orientation, cultural identity), in developing regions, education and experiences (e.g., frequency of extreme weather events) were more dominant [5,6,7,8,9,10]. Empirical evidence suggests that an increase in knowledge to a certain level is necessary for understanding the phenomenon of climate change. Still, then, it more politically polarizes the attitudes of respondents [11,12,13].

There are two conflicting behavioural explanations for the effect of social shocks on climate attitudes. One approach is the "finite pool of worry" hypothesis that an increase in fear about one factor reduces concerns about other factors (Americans' climate perceptions before and after the 2008 crisis supported the hypothesis) [14,15]. An alternative explanation is the "affect generalization", according to which an increase in concern about a threat may raise fears about other dangers [16,17].

The European Parliament surveyed its Member States to plan the recovery fund. The results showed that respondents ranked third for climate protection spending (behind health and economic recovery), supporting the "finite pool of worry" idea [18]. However, research on climate change attitudes has shown no decline in risk perception in either the United States or the United Kingdom, showing that the hypotheses were not met or that the two effects are nearly equal [17,19,20]. It is also unclear whether the

potential decline in climate risk perception is due to increased other threats or additional factors. For example, it is conceivable that climate attitudes have changed because people assign lower emissions to decrease their activity [21].

This article provides the first cross-national analysis of the relationship between climate change beliefs and COVID-19 attitudes. We draw on data from a nationally representative survey conducted in autumn 2020, including 28,004 respondents from the 27 countries of the European Union and the United Kingdom. We aimed to discover what drives climate change awareness, attribution scepticism, concerns, and perceived impacts during the pandemic's second wave. Our key individual-level explanatory variable was COVID-19 concerns. Furthermore, we included the number of COVID-19 cases, deaths, and the Oxford COVID-19 government response tracker (OxCGRT) stringency index on the country-level.

Climate change awareness (trend scepticism)

First, we demonstrate the results of the multilevel models predicting climate change awareness (Supplementary Table 1). In the first random intercept model (Model 1), we included the predictors' fixed effects, then added interactions between COVID-19 concerns and climate change belief variables and education in Model 2. We included a random slope for COVID-19 concerns in the final model (Model 3). We found that climate change awareness is positively associated with COVID-19 concerns, whereas neither the number of COVID-19 cases, deaths, nor the country's stringency index affected awareness.

We observed significant interactions between COVID-19 concerns and attribution scepticism, climate change concerns, perceived impact and education (Model 2). As shown in Fig. 1, the impact of COVID-19 concerns on awareness was stronger among individuals with less concerns about climate change ($b = 0.08$, s.e. = 0.02, CI[0.05, 0.11]) and lower belief in the negative impact of climate change ($b = 0.07$, s.e. = 0.02, CI[0.03, 0.11]). The interaction with attribution scepticism and education was weaker and negative. Including a random slope for COVID-19 concerns significantly improved the fit of the model, reinforcing that COVID-19 concerns explain a significant part of the variance of climate change awareness ($\chi^2(2) = 111.64$, $p < 0.001$). To compare the sizes of the effects of the predictors, we refitted the models with standardized predictors. The final model results with standardized predictors show that besides the effect of the other climate change belief related variables, COVID-19 concerns were associated the most with climate change awareness ($B = 0.01$, $p < 0.01$, Supplementary Table 2).

Attribution scepticism

We examined peoples' beliefs on whether or not climate change is caused by natural processes or human activity (attribution scepticism). The coefficient for COVID-19 concerns is significant and negative, indicating that those highly concerned about COVID-19, were less likely to believe that climate change is human-caused (Supplementary Table 3). The number of COVID cases or deaths in a country were unrelated to attribution scepticism. In contrast, people were more willing to believe that climate change is human-caused in countries where governmental measures to tackle the pandemic were more stringent (higher stringency index score).

The interactive effects shown in Fig. 2 indicate that the impact of COVID-19 concerns on attribution scepticism largely depends on the individual's climate change beliefs and educational level. The negative association between COVID-19 concerns and attribution scepticism is only present when concerns are high ($b = -0.04$, s.e. = 0.01, CI[-0.07, -0.01]), and turns positive when concerns are low ($b = 0.04$, s.e. = 0.02, CI[0.01, 0.07]). Similarly, we found that low belief in climate change's negative impact moderates the negative effect of COVID-19 concerns on attribution scepticism. However, the interactive effect of awareness was positive and significant. The regression slopes are largely different depending on education. COVID-19 concerns have a negative effect on attribution scepticism among lower educated individuals ($b = -0.05$, s.e. = 0.01, CI[-0.08, -0.03]), and a positive effect among highly educated individuals ($b = 0.04$, s.e. = 0.02, CI[0.01, 0.07]). Here, including a random slope for COVID-19 concerns improved model fit as well ($\chi^2(2) = 144.06$, $p < 0.001$). The impact of COVID-19 concerns on attribution scepticism with standardized predictors was not significant in the final model (Supplementary Table 4).

Climate change concerns

The third dependent variable was climate change concerns. Deep COVID-19 concerns are strongly associated with serious concerns on climate change (Supplementary Table 5). This relationship is endorsed by the finding that climate change concerns were greater in the countries where the pandemic affected people's life more severely (higher stringency index score).

The results shown in Fig 3. indicate that COVID-19 concerns have a more substantial impact on climate change concerns among individuals with higher attribution scepticism ($b = 0.21$, s.e. = 0.02, CI[0.18, 0.24]) lower belief in the negative impact of climate change ($b = 0.20$, s.e. = 0.02, CI[0.17, 0.23]) and lower educational level ($b = 0.21$, s.e. = 0.01, CI[0.18, 0.23]). On the other hand, high awareness reinforced the impact of COVID-19 concerns on climate change concerns. The improvement in model fit in Model 3 indicates that COVID-19 concerns account for significant variation in climate change concerns ($\chi^2(2) = 61.92$, $p < 0.001$). The models involving standardized predictors show that the most important predictor of climate change concerns is climate change awareness ($B = 0.10$, $p < 0.001$), the second is COVID-19 concerns ($B = 0.05$, $p < 0.001$) and the third is the stringency index ($B = 0.04$, $p < 0.001$, (Supplementary Table 6).

Perceived impact of climate change

The last predicted variable was the views on the impact of climate change. Here, we obtained a positive association with COVID-19, meaning that people with deeper COVID-19 concerns were more likely to believe that climate change impacts will be negative (Supplementary Table 7). The country-level COVID related variables did not have a significant impact on this question.

We found weaker interactive effects compared to the previous questions (Model 2). However, the regression slope of COVID-19 varied with attribution scepticism (see Fig 4a). Deep COVID-19 concerns reinforce people's views on climate change's negative impacts when attribution scepticism is low ($b = 0.06$, s.e. = 0.02, CI[0.02, 0.10]). This effect is weaker when attribution scepticism is high ($b = 0.01$, s.e. =

0.02, CI[-0.04, 0.05]). The positive effect of COVID-19 concerns on people's beliefs in the negative impacts of climate change was more pronounced among individuals with a lower level of education ($b = 0.06$, s.e. = 0.02, CI[0.01, 0.10]), compared to highly educated individuals ($b = -0.02$, s.e. = 0.02, CI[-0.03, 0.06], see Fig 4b). Here, similarly to the previous models, including a random slope for COVID-19 concerns improved model fit ($\chi^2(2) = 221.98$, $p < 0.001$), but the fixed effect of COVID-19 concerns was insignificant both in Model 3, and in the final model with standardized predictors (Supplementary Table 8).

Country differences and other predictors

The null models' ICCs indicated that 2–8 % of the total variance in individual-level climate change beliefs is attributable to variation between countries. We plotted the per-country average intercepts and slopes of COVID-19 concerns on the four dependent variables in Fig. 5. and in Supplementary Extended Data Figs. 1–8. These comparisons show that in most countries, the effects' direction is the same, although with considerable variation in its size. Nevertheless, the results do not offer a clear regional pattern. COVID-19 concerns have the highest impact on peoples' concerns in Western European countries, such as the United Kingdom, France or Germany, and Eastern European countries (e.g. Romania, Bulgaria, Poland). The results are similarly mixed regarding the other dependent variables. Altogether, the effect of COVID-19 concerns on climate change beliefs is the strongest in the United Kingdom.

Including fixed effects of individual and country-level predictors vastly improved the models' fit for all the four dependent variables (see Supplementary Tables). Lastly, we present some of the most important findings of the control variables. On the individual level, females were less aware of climate change, but had a more vital perception of the human cause of climate change and were more concerned about climate change. Interestingly, awareness was lower among young individuals, and attribution scepticism was higher, although they had deeper climate change concerns. As expected, educated individuals were more aware that climate change is occurring and they were more likely to believe that climate change is human-caused. Still, concerns and beliefs on the negative impact of climate change were deeper among lower educated respondents. The effect of left-right identification is strong and consistent. People show less scepticism and higher awareness, concerns, and belief in climate change's negative impact on the political left.

Concerning the country-level variables, we found lower climate change concerns in the more developed countries (high HDI), whereas HDI did not affect other climate change beliefs. In countries where the Climate Change Index (CRI) was high, individuals were more aware that climate change is occurring, and they were less concerned about climate change. Neither green party support nor right-wing party support was associated with climate change beliefs.

Conclusions

This study contributed to understanding how perceptions of the COVID-19 pandemic may have affected people's climate change beliefs. Based on cross-national survey data from 28 European countries, we

found that COVID-19 fears positively affect climate change awareness, concerns and the perceived negative impact of climate change. Besides the individual attitudes, on the country level, strict government measures tackling the pandemic (high stringency scores) were also associated with deep climate change concerns. In contrast, the effect was reversed by attribution scepticism: those who considered the human contribution to climate change to be lower were more likely to have a lower fear of COVID-19. Interestingly, government measures to prevent the spread of the virus have had a much more substantial impact on people's climate attitudes than infection or mortality data. We also found that the effect of COVID-19 concerns on climate change concerns was more significant among lower educated individuals and respondents with lower climate change awareness or higher attribution scepticism. These interactive effects were mixed for the other dependent variables.

In contrast to the experience of the 2008 crisis, our findings yielded evidence in support of the "affect generalization" bias and no proof of the "finite pool of worry" hypothesis. There are several possible explanations for the difference, which are promising future research directions. One possible reason is that while the economic crisis of 2008 was socially endogenous, COVID-19, like the threats posed by climate change, is more exogenous. Besides, individuals can develop control strategies for the economy's existential threat, but they are entirely vulnerable to natural warnings to the virus's health and climate change. Finally, humanity has a closer economic crisis experience than with uncertain consequences of pandemics and climate change.

Our study was the first to explore the relationship between COVID-19 and climate change perceptions. Given the explorative nature of our study, further research is needed to understand some of our conclusions. One such field is the observed differences in educational level. A possible explanation for the fact that lower educated individuals were more sensitive to the pandemic's effect is that attitude strength and attitude certainty [22] may be lower among these groups. Similarly, more research is needed to understand the different patterns shown by attribution scepticism and why various aspects of climate change beliefs were associated somewhat differently with COVID-19 concerns.

The results of this study have a significant policy message. According to previous empirical results, high climate change concerns can raise individuals' support of climate policies and play an essential role in climate action engagement [23]. Thus, the positive association we found between COVID-19 and climate change concerns suggests that the pandemic, as a secondary crisis, may indirectly reinforce peoples' motivation to tackle climate change. Moreover, the virus's impact is more robust in the lower educated groups, which have traditionally been less supportive of climate policy, as well as among more sceptical and less concerned individuals. Thus, COVID-19 offers a promising opportunity for European governments to step up their climate protection efforts in terms of social legitimacy.

Methods

Data. This study used data from a nationally representative survey conducted by Kantar in 27 member states of the European Union, and the United Kingdom during September–October 2020. One thousand

respondents were sampled in each country, with a total of 28,004 interviews. The 28 countries represent approximately 69% of the European population. The project was financed by the Hungarian Ministry of Innovation and Technology and Századvég Foundation.

Data was collected via computer-assisted telephone interviews (CATI). In most countries, a mobile/landline sampling frame was used. The household samples were drawn with a geographically stratified random sampling procedure, whereas the last birthday method [24] was used for sampling individuals. The samples are representative of the population aged 18 or older in age, sex, and region.

In our weighting procedures, we followed a similar approach to the European Social Survey (ESS) [25]. Post-stratification weights were applied to correct for over- or underrepresentation, nonresponse, and sampling error. Post-stratification weights were calculated by age group, gender, education, and region. Our main source for population distributions was the European Union Labour Force Survey and the ESS. Additionally, population size weights were calculated to account for population size differences. Similarly, to the ESS, we calculated 'analysis weights', which combines post-stratification weights with population size weights.

The questionnaire covered several topics. Respondents were asked about general political attitudes and preferences, economic expectations, their attitudes towards the European Union, the coronavirus pandemic, migration, family, antisemitism, and media. Questions about climate change beliefs were placed in the middle of the questionnaire. The mean total duration of the interviews was 25 minutes.

Individual-level variables. Climate change beliefs. To assess climate change beliefs (our dependent variables), we used four questions from Round 8 of ESS, which contained a module on 'Climate Change and Energy'. Climate change awareness was measured with the question 'You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing?'. A four-graded scale was used for this question. We recoded the values so that the highest value indicates that the climate is 'definitely changing' and the lowest value indicates that it is 'definitely not changing'. To assess attribution scepticism, the following question was used: 'Do you think that climate change is caused by natural processes, human activity, or both?', with a five-grade scale from 1 ('entirely by natural processes') to 5 ('entirely by human activity'). We recoded 'I don't think climate change is happening' responses to 0. Respondents were also asked about their climate change concerns with the question "How worried are you about climate change?" with responses from 1 ('Not at all worried') to 5 ('Extremely worried'). The fourth question about climate change beliefs aimed to capture perceptions of its impact by asking respondents 'How good or bad do you think the impact of climate change will be on people across the world?'. The response scale ranged from 0 ('Extremely bad') to 10 ('Extremely good'). The responses were reverse coded, so that high values indicate negative perceived impact, to unify the four dependent variables in terms of scale direction. We set all 'Don't know' answers to missing (see Supplementary Table 9. for descriptive statistics). All variables were then scaled from 0 to 1. When climate change beliefs were used as predictors in our models, we used the grand-mean centred version of these variables. We

preferred grand-mean centring above standardization because this only affects the intercepts [26]. Nevertheless, we applied standardization in additional models.

COVID-19 concerns. Our key individual-level predictor was concerns on the COVID-19 pandemic. Respondents were asked 'How concerning do you think the problem of the spread of coronavirus pandemic is?' A four-grade scale was applied with 1 'Highly concerning' to 4 'Not concerning at all'. We reverse coded the responses so that higher values indicate deeper concerns.

Political orientation. Left-right identification was measured by asking 'Which one is closer to your general political outlook, would you say you are...?'. Respondents were able to choose from 1 'Left of centre', 2 'Centre' 3 'Right of centre'.

Education. At the educational level, country-specific coding was applied during the data collection to capture the different levels of the countries' educational systems. The country-specific educational level codes were then allocated to the three basic International Standard Classification of Education categories (ISCED) [27]. These categories were: less than primary, primary and lower secondary education (levels 0-2); upper secondary and post-secondary non-tertiary education (levels 3 and 4) and tertiary education (levels 5-8). This unified variable of the educational level was used for weighting and analytical purposes.

Age. Age was measured in seven categories: 18–22 years old, 23–30 years old, 31–40 years old, 41–50 years old, 51–60 years old, 61–65 years old, older than 65 years.

All individual-level variables were scaled from 0 to 1 and centred around their grand mean.

Country-level variables.COVID-19 cases and COVID-19 deaths. Our first key country-level predictors were the reported average number of total COVID-19 cases and total COVID-19 deaths in the countries. Our daily data source was the dashboard of Johns Hopkins University, Center for Systems Science and Engineering Coronavirus Resource Center [28]. We extracted the averages of the total per million COVID-19 cases and total per million COVID-19 related deaths respectively during September 7, 2020, to October 15, 2020, in each country. The variables were then scaled from 0 to 1 and grand-mean centred.

Stringency index. The other COVID-related country-level predictor was the Oxford COVID-19 government response tracker (OxCGRT) stringency index [29]. The University of Oxford developed the stringency index. The indicator aimed at capturing the stringency of government responses to the pandemic all over the world systematically. The index is based on nine indicators of responses, including school closing, workplace closing, cancelling public events, restrictions on gathering size, public transport closing, home confinement orders, restrictions on domestic or internal movement, international travel controls, and public information campaigns. The index is ranged from 0 to 100, where a higher score indicates stricter measures. We computed each country's average score from September 7, 2020, to October 15, 2020. The index was scaled from 0 to 1 and grand-mean centred.

HDI. The Human Development Index (HDI) was included as a control country-level variable, as previous research found an association between country development and climate change beliefs [7, 13, 30, 31].

The HDI is a composite index of three dimensions: health (life expectancy), education (expected years of schooling, mean years of schooling) and standard of living (gross national income per capita) [32]. The index is the geometrical mean of the three-dimension indices. HDI is measured on a scale of 0 to 1. We extracted the HDI scores of the countries of interest from 2020 and grand-mean centred the scores.

Global Climate Risk Index. Several previous studies exploring climate change attitudes used the Global Climate Risk Index (CRI) [10, 29, 33, 34]. The index developed by Germanwatch aims to quantify the impacts of extreme meteorological events, including the fatalities and the economic consequences. Four indicators are included in the index: the number of deaths, the number of deaths per 100 000 inhabitants, the sum of losses in US\$ in purchasing power parity (PPP) and losses per unit of gross domestic product (GDP) [35]. The score is calculated based on the countries' rankings (relative score); a higher CRI score means low vulnerability to climate change. We extracted the score of the countries of interest for 2019, as data for 2020 is not yet available. The index was scaled from 0 to 1 and grand-mean centred.

Green and right-wing party support. We further included green and right-wing party support to control for local political environment. We used an updated list of green parties in Europe, developed by Pearson and Rüdig [36]. For right-wing parties, we based our research on the list of Down and Han [37]. The list of green and right-wing parties used in this study is available in Supplementary Table 10. Our two sources for party support were the general election results of 2020 and Politico's "poll of polls" [38], a site that aggregates poll results throughout Europe. If general elections were held in a country in 2020, both green and right-wing support was extracted from election results. If elections were not held in a country in 2020, we extracted the average support of both green and right-wing parties from the polls conducted between September and October 2020. In case there were no green or right-wing parties in a country, support was set to zero. Both green and right-wing party support were scaled from 0 to 1 and grand-mean centred.

Statistical Analysis. We fitted four random intercept multilevel models (MLM) for each dependent variable, with individuals (Level 1) nested within countries (Level 2). After starting with the Null-models, we included the fixed effects of both the individual- and country-level predictors in Model 1. Our key individual-level predictor was COVID-19 concerns. We further added individual-level control predictors, such as gender, age, and education, as previous studies have found links between these variables and climate change beliefs [7, 8, 9, 13, 39]. The country-level predictors were COVID-19 cases, death counts, and the Oxford stringency index. Other country-level predictors were also added for controlling purposes, namely the HDI, the countries' CRI, and the support for green and right-wing parties, respectively. These models were fitted to estimate the general impact of the predictors, while the coefficients were held at constant across countries. Two-way interactions between COVID-19 concerns and each climate change belief variables and education were then added in Model 2. On the one hand, the choice of the interaction pairs was motivated by our aim to assess the effect of COVID-19 concerns on climate change beliefs in the condition of the individuals' other climate change beliefs, to get a more in-depth understanding of this relationship. On the other hand, as previous studies [7, 8, 9, 13] reported a strong tie between education and climate change attitudes, we further examined if education moderates the above relationship. In our

final models (Model 3), we included a random slope for COVID-19 concerns, as its relationship with climate change beliefs, was expected to vary cross-nationally.

Following Czarnek et al. [13], all variables in the models were scaled between 0-1, and the predictors were centred around their grand mean. We re-run our models with standardized versions of the predictors to estimate and compare the predictors' effect sizes. Both marginal and conditional r-squared, intraclass correlation coefficient (ICC) was computed for all models. Computation was based on Nakagawa et al. [40]. For each model, we ran likelihood ratio tests to confirm improvement in model fit. Data were weighted by using 'analysis weight' that combines post-stratification weights and population-size weights. Maximum likelihood estimation was used, interactions were probed at ± 1 s.d. We used SPSS version 24 [41] for data cleaning and preparation, and RStudio [42] for analytical purposes with haven [43], tidyverse [44], scales [45], lmer [46], lmerTest [47], optimx [48], emmeans [49], effects [50], multcomp [51],ggeffects [52], sjPlot [53], psych [54], interactions [55], and texreg [56] packages.

Declarations

Data and code availability

The merged dataset and the R-code for the analyses are openly available at:
<https://szazadveg.hu/en/project-europe/database>

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Figures

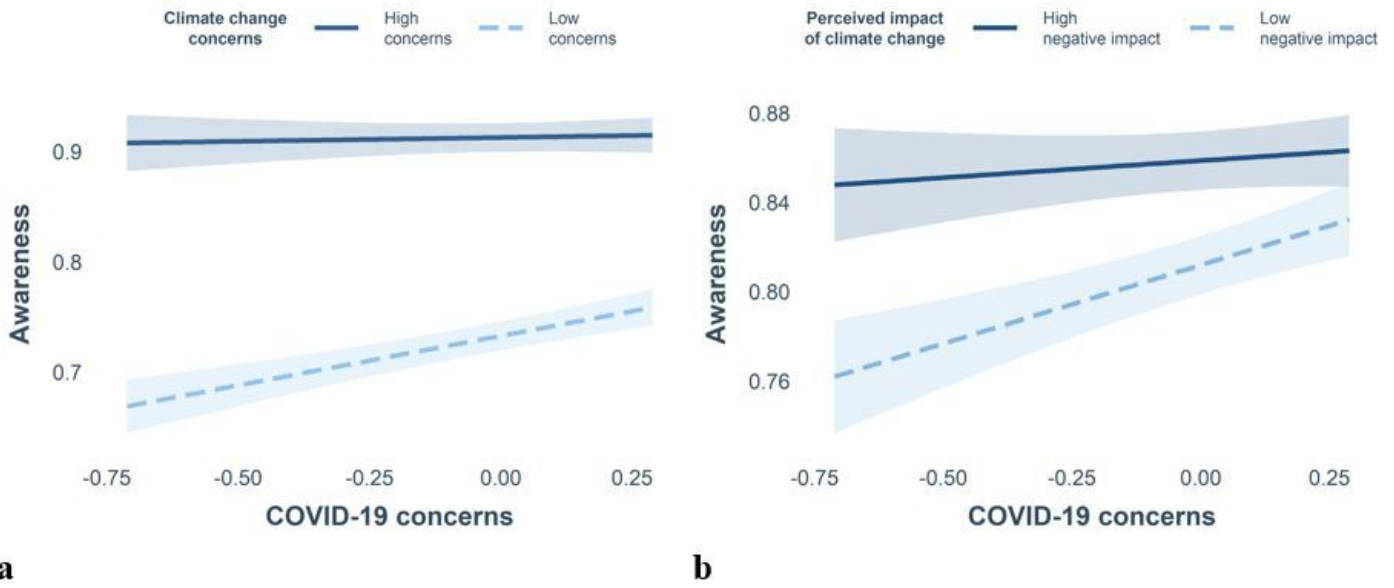


Figure 1

The effect of COVID-19 concerns climate change awareness for individuals with low and high climate change concerns (a) and low and high perceived negative impact of climate change (b). Note: Estimates with 95 % confidence intervals.

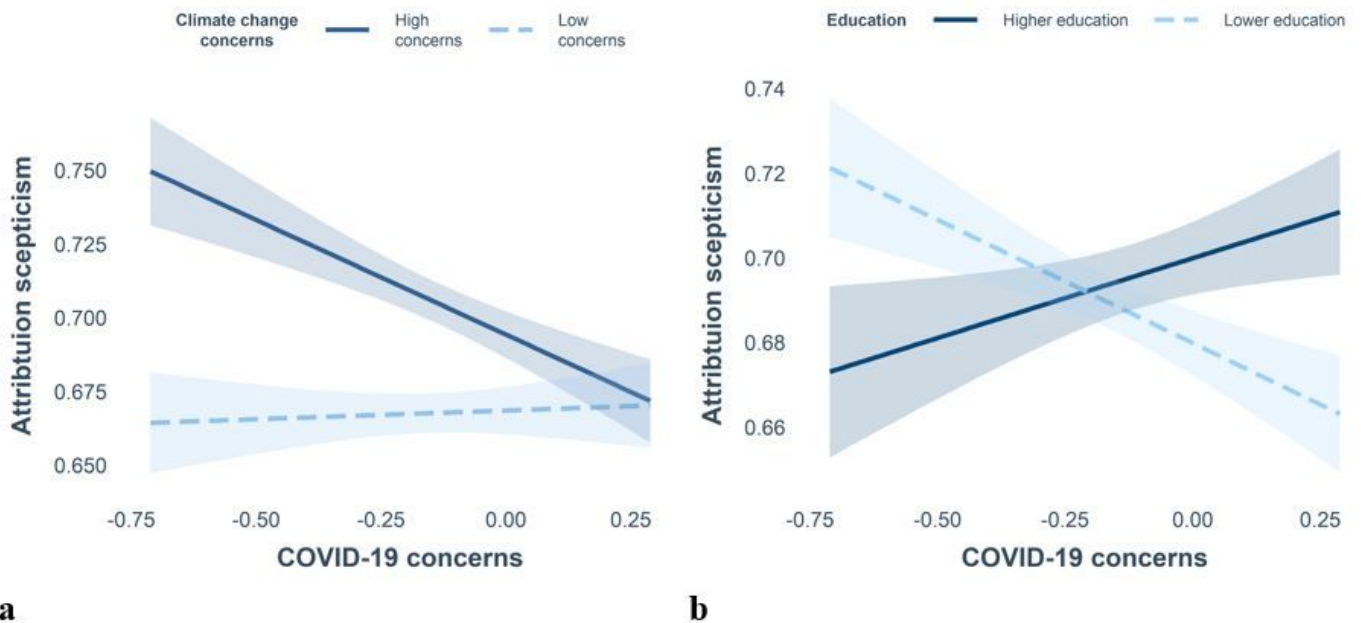


Figure 2

The effect of COVID-19 concerns attribution scepticism for individuals with low and high climate change concerns (a) and with the low and high level of education (b). Note: Estimates with 95 % confidence

intervals.

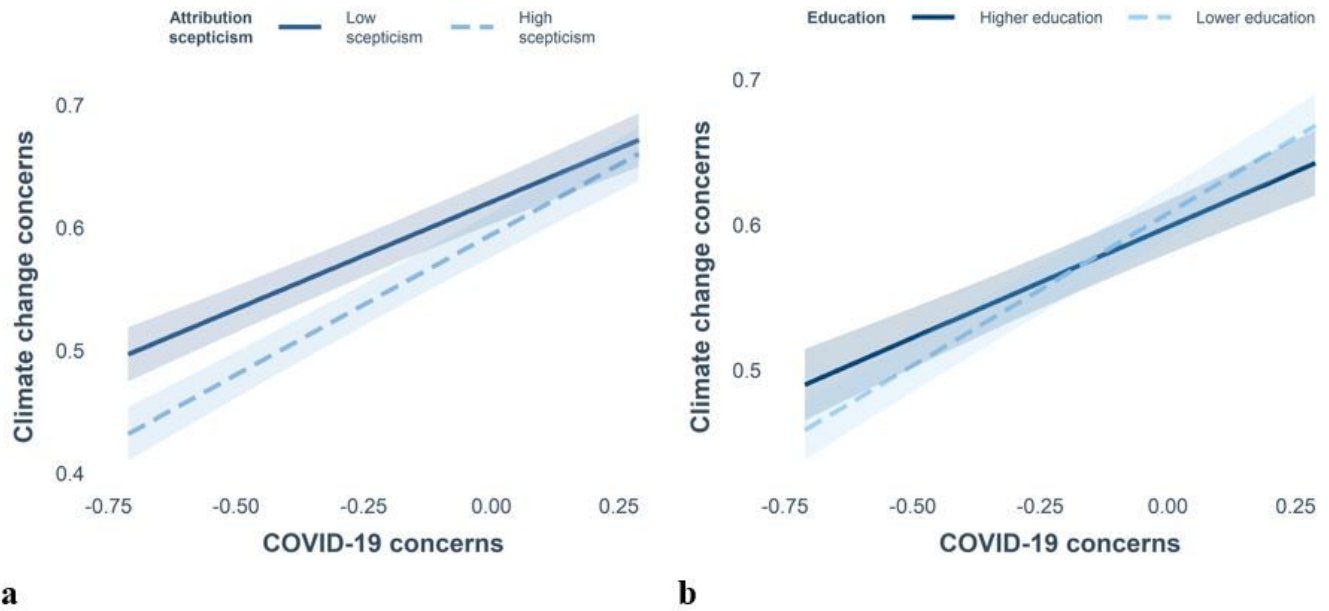


Figure 3

The effect of COVID-19 concerns on climate change concerns for individuals with low and high attribution scepticism (a), and with the low and high level of education (b). Note: Estimates with 95 % confidence intervals.

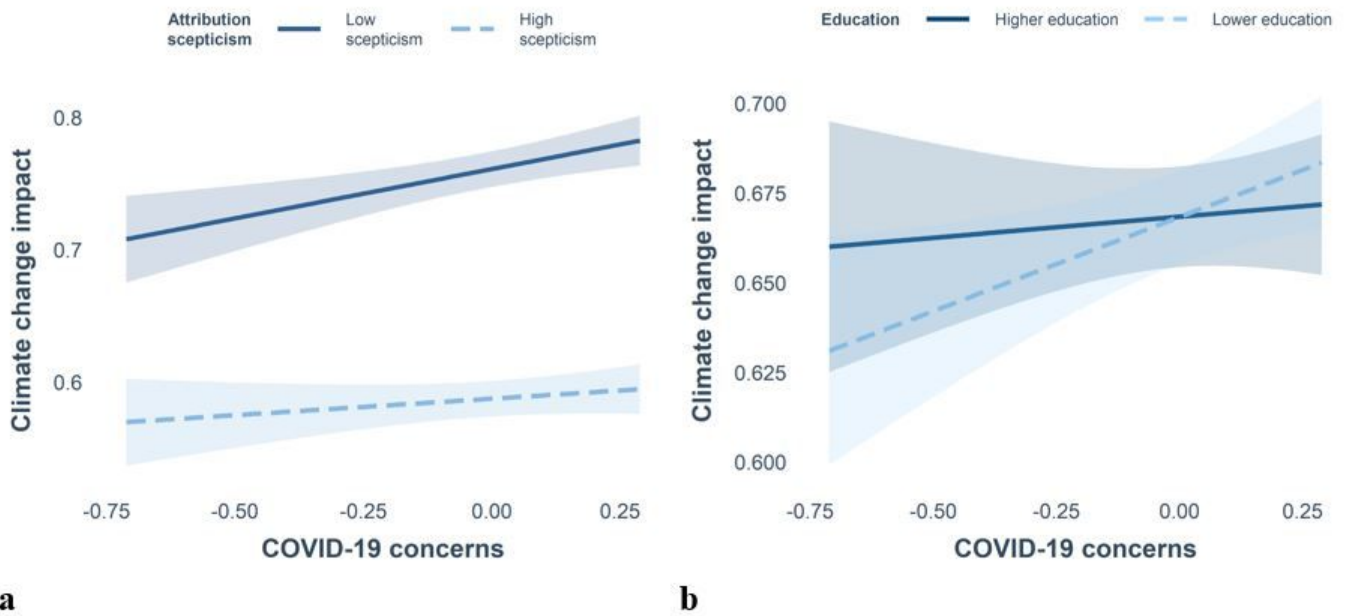


Figure 4

The effect of COVID-19 concerns the perceived impact of climate change with low and high attribution scepticism (a) and with the low and high level of education (b). Note: Estimates with 95 % confidence intervals.

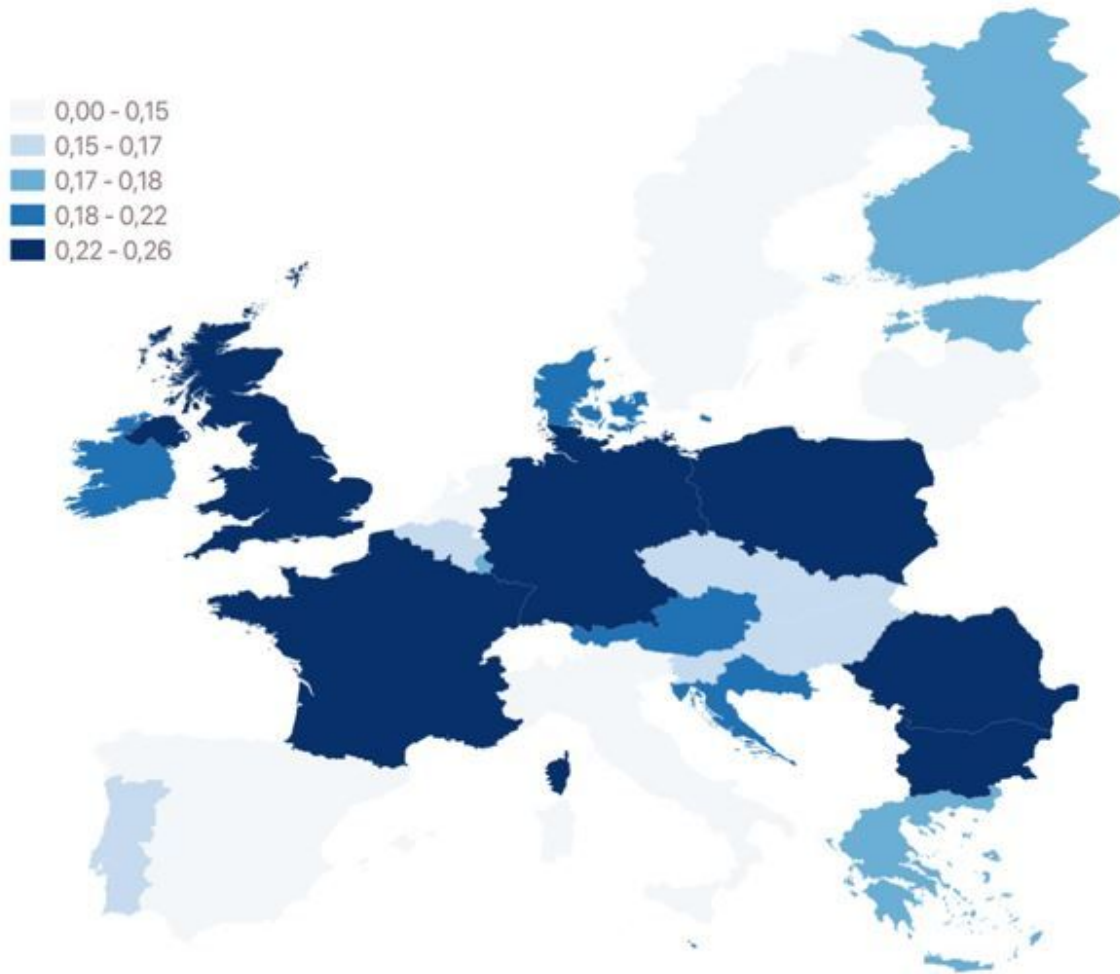


Figure 5

Predicted per-country average slopes of COVID-19 concerns on climate change concerns with per-country random intercepts. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

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