

Socioeconomic Roots of Climate Change Denial and Uncertainty among the European Population

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Abstract

Despite the overwhelming scientific consensus, in many Western countries, there appears to be a considerable share of people questioning the existence and anthropogenic cause of climate change. Climate change disbelief includes the absolute rejection of the existence of anthropogenic climate change (climate change denial) as well as a lack of sureness about the anthropogenic cause of climate change (climate change uncertainty). Although considerable research on this phenomenon has been conducted, the roots of climate change disbelief are not yet fully understood. In this article, data from Round 8 of the European Social Survey are used to study the possible socioeconomic roots of climate change disbelief at the individual, regional, and country level. Results show that climate change denial is a marginal phenomenon among European populations but that a great share of people attributes climate change equally to human influences and natural processes. Thereby, it appears that the level of climate change disbelief varies between countries, and even more so between regions within countries. Results of various three-level multilevel models show that socioeconomic factors can partly explain this variation. Individuals who feel insecure about their economic future are significantly more likely to reject the existence of anthropogenic climate change. Furthermore, climate change denial and uncertainty are more common in more rural and less prosperous regions and in countries more economically dependent on fossil fuels. The results contribute to a deeper understanding of climate change disbelief among the European population and have important implications for climate change mitigation efforts.

Introduction

Despite the overwhelming scientific consensus on the existence and anthropogenic causes of climate change (IPCC, 2018), climate change disbelief has penetrated into public perceptions in many Western countries. A significant number of people persistently claim that the global climate is not changing at all, or that climate change is caused by natural processes rather than by human activities (McCrigh and Dunlap, 2011a; Poortinga *et al.*,

2019). While considerable research on this phenomenon has been conducted, several open questions still remain. These include the lack of clear understanding of the causes and the considerable cross-national variation of climate change disbelief. In this article, I seek to fill these gaps by discussing and examining the socioeconomic roots of different types of climate change disbelief among European populations at the individual, regional, and national levels.

There is clear evidence that climate change disbelief is not just the result of a lack of awareness or understanding (Whitmarsh, 2011; Lockwood, 2018). Instead, climate change disbelief appears to be part of a broader, cross-national ideology that is characterized by opposing what is called ‘the mainstream’ and challenges basic human rights, scientific facts, and democratic principles (Lockwood, 2018; Huber, 2020). Evidence of such an anti-mainstream ideology has also been observed on issues other than the environment, such as immigration, globalization, and pluralism. The spread of this ideology has been held responsible for the increasing popularity of populist radical right parties (Inglehart and Norris, 2017; De Vries, 2018). Explanations for this development typically refer to a backlash against modernization (Inglehart and Norris, 2016; McCright *et al.*, 2016; De Vries, 2018; Gidron and Hall, 2020). Climate change disbelief is assumed to be an ideological counter-reaction among some social groups, especially those who hold conservative values and support populist radical right parties (Poortinga *et al.*, 2011; Whitmarsh, 2011; Lockwood, 2018; Krange, Kaltenborn and Hultman, 2019). It is, however, unclear whether the spread of climate change disbelief is also linked with factors other than ideological worldviews. In this article, I seek to fill this gap in the research by discussing and examining the socioeconomic roots of climate change disbelief among European populations.

Previous research has also shown that the level of climate change disbelief greatly varies between countries. This is most apparent in comparing the United States and Europe, whereas the level of climate change disbelief is much higher in the United States than in European countries (McCright and Dunlap, 2011a). Cross-European studies, however, also documented a great variation in the level of climate change disbelief across European countries (McCright, Dunlap and Marquart-Pyatt, 2015; Poortinga *et al.*, 2019). Despite the increasing number of studies on that issue, the reasons for these cross-national variations are still not understood. Most existing studies on this topic have focused on single countries, such as Great Britain (Poortinga *et al.*, 2011), Germany (Engels *et al.*, 2013), or Norway (Krange, Kaltenborn and Hultman, 2019); or did not adopt a multilevel approach to disentangle the contextual factors that shape climate change disbelief (Poortinga *et al.*, 2019). In this study, I will focus on socioeconomic factors as potential explanations of these cross-national variations within Europe. In addition to previous studies, I will extend the analysis to the economic conditions at the regional level, assuming that economic development of the region where people live might shape

people’s climate change belief, as they determine the actual opportunities and constraints that individuals face more than national averages. Using individual-level data from the European Social Survey (ESS) and contextual data provided by EUROSTAT, a series of multilevel logistic regressions are estimated that include factors on the individual, regional, and national level (three-level models with random effects at the regional and country levels).

By focusing on socioeconomic explanations for climate change disbelief, this study contributes to understanding the roots of climate change disbelief in Europe. This is crucial for understanding the opportunities and challenges governments face in establishing efficient and widely accepted policies for mitigating climate change. Together with many other countries around the globe, the European countries have signed the Paris agreement on limiting the temperature increase to below two degrees Celsius above pre-industrial levels (UNFCCC, 2015). The substantial reduction in greenhouse gas emissions needed to meet this target requires fundamental shifts in many areas of the economy, and of daily life. Efforts to implement such changes can only succeed if people are aware of the existence and the human causes of climate change. Studying climate change disbelief also contributes to the ongoing debate about on the roots of populism in many Western countries. Despite the plethora of research on the topic, the drivers of the increasing popularity of populist ideas are still not fully understood. Studying the roots of climate change denial and uncertainty will help us better understand the increasing popularity of populist ideas and parties in general.

Climate Change Disbelief and Its Potential Roots

The term *climate change disbelief* is used to describe the public rejection of the realities of global warming. It covers very different forms and dimensions, including the disbelief of the existence of climate change (called trend disbelief) and its human causes (attribution disbelief) (Whitmarsh, 2011; Engels *et al.*, 2013; van Rensburg, 2015; Poortinga *et al.*, 2019). Recent surveys have shown that the share of people who completely reject the existence of climate change is very low in Europe, but that there is a substantial share of people who question the anthropogenic causes of climate change (Poortinga *et al.*, 2018). The latter includes people who completely reject the human influence and those who do not fully realize the great extent of the human causes of climate change (van Rensburg, 2015; Björnberg *et al.*, 2017). However, recognizing the

anthropogenic causes of climate change in full is essential to supporting actions to mitigate climate change. Therefore, I use the term *climate change denial*¹ to refer to individuals who either state that the climate is not changing or that there is no anthropogenic climate change source. Furthermore, I use the term *climate change uncertainty* to refer to individuals who are uncertain and claim that natural processes and human activities about equally cause climate change.

The rejection of the realities of climate change has been described as a symptom of a broader anti-mainstream ideology that is characterized by opposing ongoing societal changes of modernization (McCright, 2016; McCright *et al.*, 2016; see also Boström, Lidskog and Ugglä, 2017). Explanations for this development typically refer to a backlash against modernization (Inglehart and Norris, 2016; McCright *et al.*, 2016; De Vries, 2018; Gidron and Hall, 2020). The Anti-Reflexivity thesis describes climate change denial as a counter-movement against achievements of reflexive modernization (McCright, 2016). Reflexivity refers to the idea that late-modern societies increasingly become aware of the ecological, technological, and social risks generated by their own technic-economic development and thus start to demand actions to tackle these problems (Beck, Giddens and Lash, 1994; see also Boström, Lidskog and Ugglä, 2017). This process is mainly driven by scientific progress and social movements (McCright, 2016). However, certain individuals and groups of society are unwilling to accept these insights and attempt to defend the status quo and the existing system against scientific evidence and widespread social movements (McCright *et al.*, 2016). As the societal self-reflection process also includes the recognition of climate change as global problem, these groups are also unwilling to accept that there is a need to change in order to tackle climate change and question the existence and anthropogenic cause of climate change.

Ideological Explanations of Climate Change Disbelief

According to McCright (2016), this anti-reflexive counter-reaction is motivated by both ideological and economic considerations. Ideological (also called cultural) explanations often refer to conservative values that make people unwilling to accept climate change mitigation changes. Climate change denial might thus be motivated by the wish to maintain or regain traditional social structures. This explanation has been called the ‘conservative white male effect’ (McCright and Dunlap, 2011b; Poortinga *et al.*, 2018; Krange, Kaltenborn and

Hultman, 2019). Others have attributed climate change disbelief to a loss of trust in institutions such as political parties, the media, and science, and to the tendency to take an opposing stance towards all those they perceive as representing ‘the mainstream’ or the cosmopolitan elite (Inglehart and Norris, 2016; Lockwood, 2018; Huber, 2020).

These ideological explanations are supported by the consistent findings that politically conservative men report higher levels of climate change denial than their liberal counterparts (McCright and Dunlap, 2011a; Krange, Kaltenborn and Hultman, 2019; Poortinga *et al.*, 2019, 2011). This divide becomes most obvious in the large partisan polarization on climate change belief in the United States, whereby Republicans are much more likely than Democrats to express doubt about climate change (McCright and Dunlap, 2011a). Political orientation also appears to be an important predictor of climate change denial outside the United States, as shown by studies using data from single countries such as Australia (Tranter, 2013), Great Britain (Poortinga *et al.*, 2011), Germany (Engels *et al.*, 2013), or Norway (Krange, Kaltenborn and Hultman, 2019) as well as studies examining cross-national data (McCright, Dunlap and Marquart-Pyatt, 2015; Tranter and Booth, 2015; Poortinga *et al.*, 2019). Focusing on individuals’ left-right ideology in the European context, studies have shown that individuals who place themselves on the right side of the political spectrum were less likely to believe in anthropogenic climate change and to perceive climate change to be a serious problem compared to individuals who place themselves on the left side (Poortinga *et al.*, 2011; Whitmarsh, 2011).

Socioeconomic Explanations of Climate Change Disbelief

In addition to ideological roots, the resistance to societal changes and thus the tendency to disbelieve in climate change might also be caused by socioeconomic factors (McCright *et al.*, 2016). It is often assumed that there is a tradeoff between economic considerations and the importance people place on environmental issues such as climate change (Scruggs and Benegal, 2012; Kachi, Bernauer and Gampfer, 2015). In particular, individuals are believed to have a ‘finite pool of worries’ (Whitmarsh, 2011). This describes the phenomenon that people can only pay attention to a small number of developments and perceive them as threats. Anything that is not part of this simply is outside of their perception. Individuals concerned about the current economic situation or the future economic outlook might thus not

be able to pay attention to climate change and thus ignore or even reject any information on the existence and human cause of climate change.

This explanation has been used to describe the relationship between economic wealth and climate change awareness in a cross-sectional perspective. It has often been assumed that individuals living in more economically advanced countries are more likely to be concerned about climate change because they ‘have no other worries’ (in this context also called the prosperity hypothesis, see [Franzen and Meyer, 2010](#)). Empirical findings on this, however, yielded mixed results. While some studies found a significant correlation between national economic conditions and climate change concern ([Scruggs and Benegal, 2012](#); [Knight, 2018](#)), others studies found little if any evidence of such a correlation ([Kachi, Bernauer and Gampfer, 2015](#); [Mildenberger and Leiserowitz, 2017](#)). One reason for these mixed results could be the way economic conditions are operationalized. Most studies rely on contextual information such as the country’s unemployment levels or GDP rates to capture economic worries. It is assumed that a high unemployment rate is perceived as a threat to individuals’ economic security and thus increases economic worries. While this approach is appropriate, it nevertheless overlooks two important points: first, the national average does not necessarily equal the situation in the region where a person lives. Individuals are probably more likely to react to conditions in the region where they live rather than to the average conditions in their country as they determine the real opportunities and constraints that individuals face.

Second, previous research hardly considers socioeconomic factors at the individual level. Research, however, has shown that in particular subjective worries about current economic situation and future economic outlook shape individuals’ preferences and worldviews. There is, for example, a rich literature on the political effects of self-perceived job insecurity showing that subjective insecurities in particular reduce trust in political institutions ([Wroe, 2016](#); [Nguyen, 2017](#)), and give rise to anti-immigrant attitudes ([Billiet, Meuleman and De Witte, 2014](#)). Based on these considerations, the following hypotheses about the socioeconomic roots of climate change denial will be examined:

H1: Individuals who live in economically disadvantaged regions or countries are more likely to disbelieve the existence of anthropogenic climate change.

H2: Individuals who subjectify perceive economic hardship or feel insecure about their economic future are

more likely to disbelieve the existence of anthropogenic climate change.

In addition, climate change disbelief might also be shaped by economic self-interests. Mitigation of climate change requires a substantial rebuild of the current economic system and might thus be perceived as a threat to the current socioeconomic security. Individuals employed in sectors dependent on fossil fuels, for example, might be concerned about the stability of their current jobs. This might be particularly the case in countries highly dependent on fossil fuel production and consumption ([Tranter and Booth, 2015](#); [Knight, 2018](#)). It is argued that individuals living in areas where the economy is highly dependent on the fossil fuel industry may perceive climate change mitigation as an economic threat to what is seen as the basis of economic prosperity. Denying climate change might thus be motivated by a desire to protect one’s economic interests and maintain the status quo. In favour of this line of argumentation, [Tranter and Booth \(2015\)](#) indeed found that individuals in countries with greater carbon emissions per capita were more likely to dismiss climate change. [Knight \(2018\)](#) confirmed this finding by showing that a country’s dependency on fossil fuel production was significant and negatively related to the share of its population who acknowledged the human causes of climate change. However, these studies neither controlled for individual data nor focused on Europe. Nevertheless, I expect that:

H3: Individuals who live in regions or countries more dependent on fossil fuels are more likely to deny the existence of anthropogenic climate change.

Data, Measures, and Method

Data

Individual-level data were drawn from Round 8 of the ESS, a population-representative cross-national survey that has been conducted every 2 years across Europe since 2002. Round 8 was collected in 2016/2017, and included questions designed to assess people’s perceptions of global warming, including their belief in the existence and anthropogenic causes of climate change ([Poortinga et al., 2018](#)). The analysis covers 25,230 individuals living in 165 regions across 20 European countries, which are Austria (AT), Belgium (BE), Switzerland (CH), Czechia (CZ), Germany (DE), Estonia (EE), Spain (ES), Finland (FI), France (FR), United Kingdom (UK), Hungary (HU), Ireland (IE), Iceland (IS), Italy (IT), Lithuania (LT), the Netherlands (NL), Norway (NO),

Poland (PL), Portugal (PT), and Sweden (SE). Israel, the Russian Federation, and Slovenia are excluded from the analyses due to missing context data.

The regions within the countries were defined using the Nomenclature of Territorial Units for Statistics (NUTS) established by Eurostat. The NUTS classification determines three regional levels, mostly along administrative boundaries, with a minimum and a maximum population size for each level. NUTS 1 captures major socioeconomic regions with a minimum population of three million to a maximum population of seven million. NUTS 2 refers to basic regions with a minimum population of 800,000. NUTS 3 refers to small regions with a minimum population of 150,000 (Eurostat, 2020). I followed the recommendations of the ESS Documentation (ESS Round 8: European Social Survey, 2020) and used a mix of all NUTS units, depending on the sample size and data availability. Regions with fewer than 50 respondents were clustered within a higher NUTS level or summarized with neighbouring regions. The number of regions per country varied from two (Iceland) to 18 (France). Table A1 in the Appendix shows the total number of valid observations, the NUTS level used, and the number of resulting regions for each country. Country- and regional-specific context data were derived from Eurostat (see also Table A2 in the Appendix).

Measures

The outcome variables refer to different forms of climate change disbelief, namely climate change denial and climate change uncertainty. *Climate change denial* refers to individuals holding the position that the climate is definitely or probably not changing, or that climate change is mainly or entirely due to natural processes. Individuals stating that the climate is probably or definitely changing, and that that climate change is at least partly caused by human activity formed the reference group. In addition, *climate change uncertainty* refers to individuals stating that the climate is probably or definitely changing, but that climate change is about equally caused by human activity and natural processes. The reference group was those who do not only believe in climate change but also attributed it mainly to human activities.

The following analyses included several control variables. Gender is a dummy variable with the value 0 for women and 1 for men. Age is operationalized as metric variables ranging from 18 to 80 years. Education is recoded into a variable with three categories, based on

the international classification scheme ISCED: no or only primary education (used as the reference category), secondary education, and tertiary education. Furthermore, individuals' social class is controlled for based on the class scheme proposed by Oesch (2006). Social class was distinguished into five groups: 'higher-grade service class' (1), 'lower-grade service class' (2), 'small business owners' (3), 'skilled worker' (4), and 'unskilled worker' (5). All individuals who reported being unemployed were included in the category 'unemployed' (6), and all individuals who were not employed for any other reason (such as those who were in education or retired) were included in the category 'others' (7).

Ideological factors of climate change denial and uncertainty were captured by conservation values and political orientation. Using the well-established Schwartz scale of human values, the analysis includes a metric variable capturing an individual's conservation values (vs. openness-to-change). The political orientation was introduced as a metric variable based on the standard left-right self-placement. Respondents are asked to position themselves on an 11-point scale from 0 (far left) to 10 (far right). Economic factors were first captured by perceived current economic hardship, distinguishing between individuals who find it difficult or very difficult to live on their present income (1), and those living comfortably or coping with their present income (0). Second, I measured individuals' self-reported economic outlook. I distinguished between individuals who considered it very likely or likely that their 'household income will not be enough for necessities in the next 12 months' (1) and those who considered that situation very unlikely or unlikely (0). Descriptive statistics of variables at the individual level are displayed in Table A3 in Appendix.

Several regional and country-level variables were used to operationalize socioeconomic situation at the contextual level: first, I considered the unemployment rate (as a share of the unemployed within the labour force) and short-term changes therein at the regional and country level to capture current labour market situation. Second, countries and regional economic prosperity were measured using GDP at current market prices (PPP, per capita) and again recent changes therein. Third, I considered CO₂ emissions per GDP to indicate countries' economic dependency on fossil fuels. At the regional level, I further controlled for population density and total population change. All of the contextual variables were provided by EUROSTAT standardized to have a zero mean and a unit standard deviation across countries or regions.

Method

Multilevel logistic regression analysis (also called random coefficient regression) was applied, as this facilitates accounting for the hierarchical structure of the data used (Snijders and Bosker, 2012; Stegmueller, 2013; Hox, Moerbeek and van de Schoot, 2017). Contrary to many other studies employing multilevel analysis, I chose to use regions as a further contextual level in addition to countries. This has the advantage of enabling me to more precisely describe the socioeconomic and cultural context of the region in which a person actually lives. Second, using within-country regions as a further contextual level increases the number of contextual units, and enables me to obtain more reliable results (Bryan and Jenkins, 2016). Thus, I estimated three-level models with random effects at the regional and the country level. This modelling approach allows me to highlight the existing variance in climate change disbelief across and within European countries, and to separate compositional effects from ‘true’ structural effects based on differences between regions and countries (Hox, Moerbeek and van de Schoot, 2017).

Results

Descriptive Results

Figure 1 shows the mean level of climate change denial and climate change uncertainty across 20 European countries covered by the present analyses. Starting with climate change denial, it appears that the share of population in each country who denied the existence and

anthropogenic causes of climate change entirely was rather low (dark bars). The highest level of climate denial by far was observed in Lithuania, where about 26 per cent of respondents denied the reality of anthropogenic climate change. The level of climate change denial was much lower in the other countries, ranging from about 15 per cent in Czechia to 6 per cent in Iceland, and Spain. The level of climate change uncertainty appears to be much higher across European countries (grey bars). The share of people who felt uncertain about the cause of climate change and attributed it equally to natural processes and human activity ranges from 29 per cent in Austria to 55 per cent in Poland. Thus, the great majority of Europeans acknowledged the existence of climate change, but in many countries large parts of the population did not appear fully aware of the dominant anthropogenic cause of climate change.

In addition to these variations between countries, my analysis further revealed a considerable variation of climate change denial and climate change uncertainty between regions within countries. Figure 2 maps this regional distribution of climate change denial, whereby a darker colour indicates a higher share of climate change denial. Considerable variation in the level of climate change denial between regions can be observed in most countries. This variation was strongest in Lithuania, where the level of climate change denial ranges from 9 per cent to about 48 per cent (see Table A4 in Appendix for highest and the lowest values, as well as the standard deviation of climate change denial of the regions within each country). The variation was also quite strong in Estonia, Austria, Ireland, France,

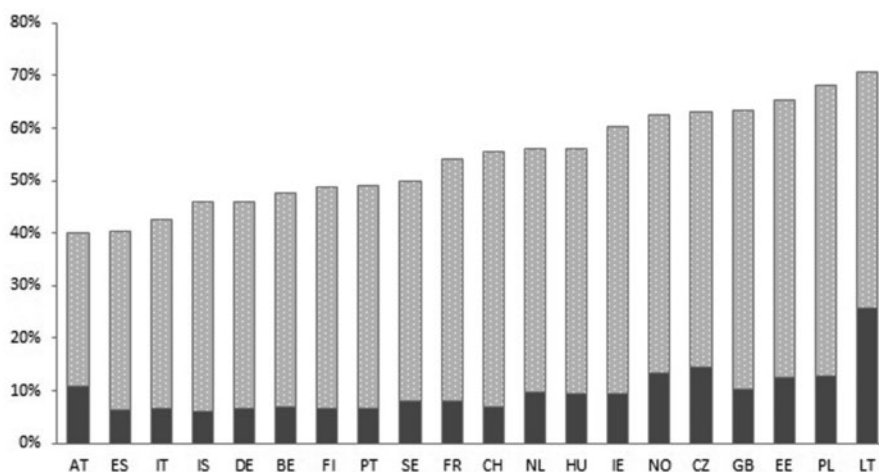


Figure 1. Level of climate change denial and uncertainty across European countries
Source: ESS Round 8, own calculations (weighted using design and population weights).

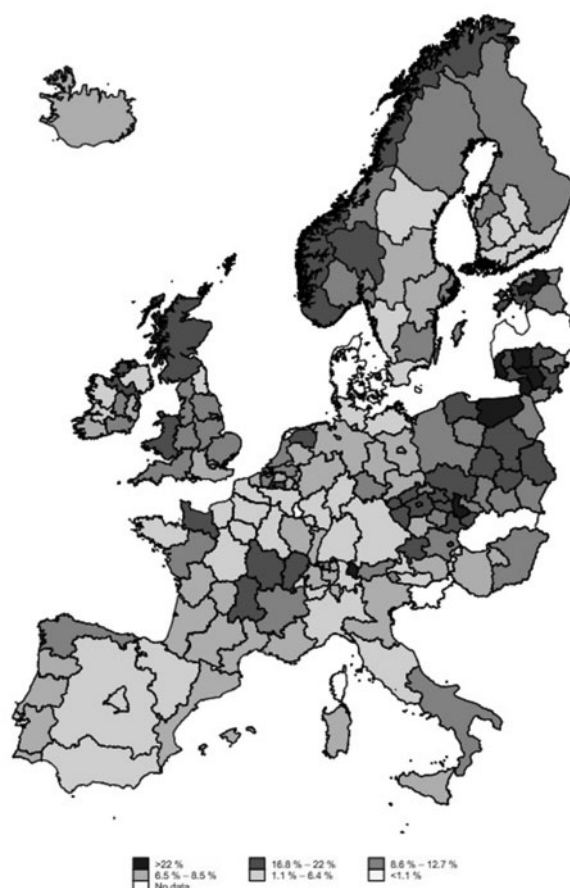


Figure 2. Regional variation in the level of climate change denial

Source: ESS Round 8, own calculations and presentation based on shapefiles of NUTS 2013 provided by Eurostat GISCO. Intervals are obtained by the boxplot method.

and Norway. As illustrated in [Figure 3](#), the level of climate change uncertainty similarly varies between regions and ranges from 22 per cent to about 74 per cent (see again also [Table A4](#) in the Appendix). This variation was particularly high in Hungary, Poland, and Czechia. It appears that climate change disbelief is not concentrated in a few countries, but are spread throughout Europe, and emerged as an issue in certain regions of many European countries. However, no clear geographical pattern of climate change denial and uncertainty appears at first sight.

Multilevel Results on the Individual and Contextual Determinants of Climate Change Disbelief

In the following, individual, regional-level and country-specific determinants of climate change denial and climate

change uncertainty are successively explored. [Table 1](#) shows the results of various multilevel logistic regression models concerning climate change denial, and [Table 2](#) the corresponding results concerning climate change uncertainty. The analyses start with three-level multilevel models without any covariable (so-called ‘empty model’) to gauge the variance at the country and regional level. The variance at the country level was highly statistically significant, and the interclass correlation (ICC) was 0.04 for climate change denial and 0.03 for climate change uncertainty. The ICC indicates the size of variance that is explained by differences between context levels ([Snijders and Bosker, 2012](#)). Here, it indicated that 4 per cent of the variation in climate change denial and 3 per cent of climate change uncertainty is attributable to differences at the country level. Furthermore, there were also significant variations at the regional level. The ICCs of 0.07 and of

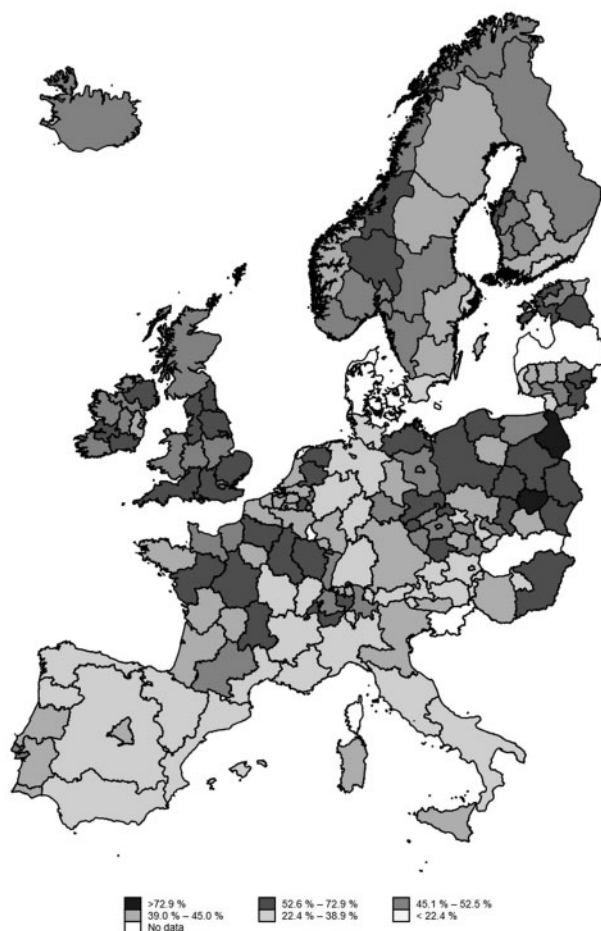


Figure 3. Regional variation in the level of climate change uncertainty

Source: ESS Round 8, own calculations and presentation based on shapefiles of NUTS 2013 provided by Eurostat GISCO. Intervals are obtained by the boxplot method.

0.05, respectively indicated that 7 per cent of the variation in climate change denial and 5 per cent of climate change uncertainty were attributable to differences at the regional level. The estimates of the variance components did not change considerably when individual level variables were included. These results indicated that there is considerable variation between countries, and even greater variation between regions within Europe. Thus, these findings highlight the need for a multilevel model that accounts both country and regional level variance.

Before I turn to contextual factors that might explain these variations, I present results concerning individual-level variables. First, results concerning the individual-level correlates of climate change denial are presented in Table 1. These results confirm previous research showing that men are more likely than women to reject the

realities of global warming (e.g. Engels *et al.*, 2013; Poortinga *et al.*, 2019) and further indicate that climate change denial increases with age. Furthermore, significant educational differences appeared. Individuals with secondary or tertiary education were much less likely to deny climate change than those with primary level of education. There were hardly any significant differences between socioeconomic groups. Only unskilled workers were significantly more likely than members of the higher-grade service class to deny climate change.

In addition to these socio-demographic and socioeconomic variables, Model 3 included variables capturing ideological worldviews and Model 4 variables capturing subjective economic situation. It appears that political orientation, but not conservative values were significantly linked with climate change. Individuals who described

Table 1. Individual level determinants of climate change denial

	Model 1	Model 2	Model 3	Model 4	Model 5
Age of respondent (in years)		0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
Gender: male (ref.: female)		0.34*** (0.04)	0.35*** (0.04)	0.35*** (0.04)	0.35*** (0.04)
Level of education (ref.: primary)					
Secondary education		−0.34*** (0.05)	−0.32*** (0.05)	−0.33*** (0.05)	−0.31*** (0.05)
Tertiary education		−0.49*** (0.06)	−0.46*** (0.06)	−0.47*** (0.06)	−0.44*** (0.06)
Socio-economic status (ref.: higher-grade service class)					
Lower-grade service class		−0.03 (0.11)	−0.03 (0.11)	−0.03 (0.11)	−0.03 (0.11)
Small business owners		0.20 (0.10)	0.18 (0.10)	0.19 (0.10)	0.18 (0.10)
Skilled worker		0.14 (0.10)	0.15 (0.10)	0.13 (0.10)	0.14 (0.10)
Unskilled worker		0.29** (0.11)	0.30** (0.11)	0.27* (0.11)	0.28** (0.11)
Unemployed		0.20 (0.11)	0.21 (0.11)	0.13 (0.12)	0.15 (0.12)
Other		0.07 (0.08)	0.07 (0.08)	0.05 (0.08)	0.06 (0.08)
Conservative values (vs. openness to change)			−0.02 (0.05)		−0.02 (0.05)
Political orientation (left/ right)			0.11*** (0.01)		0.11*** (0.01)
Perceived current economic hardship				0.00 (0.06)	0.01 (0.06)
Expected economic hardship in next 12 month				0.16*** (0.04)	0.16*** (0.04)
Variance statistic					
Country variance	0.38*** (0.07)	0.41*** (0.07)	0.40*** (0.07)	0.40*** (0.07)	0.39*** (0.7)
Regional variance	0.30*** (0.03)	0.30*** (0.03)	0.30*** (0.03)	0.30*** (0.03)	0.29*** (0.03)
ICC country	0.04	0.05	0.04	0.05	0.04
ICC region	0.07	0.07	0.07	0.07	0.07

Notes: Average marginal effects (AME) from multi-level logistic regression models on climate change denial, standard error in parentheses. N = 28,044 individuals, 165 regions, 20 countries.

*P < 0.05;

**P < 0.01;

***P < 0.001.

themselves as more politically right-wing were more likely to deny the existence of anthropogenic climate change. Holding conservative values was, like in the study recently conducted by Poortinga (2019), not significantly related to climate change denial. It further appears that individual economic outlook is an important predictor of climate change denial. Individuals who reported they believe that their economic situation will be worse in the future were significantly more likely to deny climate change than those who were optimistic about their economic future. In contrast, people who perceived their economic situation as bad were not more likely to reject climate change. This suggests that it is not an individual's current level of economic hardship, but his or her fear of losing economic security in the near future, that influences climate change belief or disbelief. Model 5 in Table 1 included variables of both ideological worldview and subjective economic situation

simultaneously. Effects of both political orientation and subjective economic outlook remained significant, suggesting that ideological and economic explanations of climate change denial are distinct.

Results concerning individual-level determinants of climate change uncertainty are presented in Table 2. As outlined above, climate change uncertainty refers to individuals' feeling unsure about the anthropogenic cause of climate change and attributing climate change about equally to natural processes and human activities. The reference group here consists of those who reported that they attribute climate change mainly or entirely to human activities. Climate change uncertainty was observed to increase with age, but, contrary to climate change denial, was more common among women than men. There was again a significant association with education, indicating that individuals with tertiary education were less likely to feel uncertain about the causes of

Table 2. Individual level determinants of climate change uncertainty

	Model 6	Model 7	Model 8	Model 9	Model 10
Age of respondent (in years)		0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
Gender: male (ref.: female)		−0.12*** (0.03)	−0.12*** (0.03)	−0.12*** (0.03)	−0.12*** (0.03)
Level of education (ref.: primary)					
Secondary education		0.01 (0.03)	0.03 (0.03)	0.02 (0.03)	0.04 (0.04)
Tertiary education		−0.17*** (0.04)	−0.13** (0.04)	−0.17*** (0.04)	−0.13** (0.04)
Socio-economic status (ref.: higher-grade service class)					
Lower-grade service class		0.13* (0.06)	0.13* (0.06)	0.13* (0.06)	0.12* (0.06)
Small business owners		0.26*** (0.06)	0.25*** (0.06)	0.26*** (0.06)	0.25*** (0.06)
Skilled worker		0.20** (0.06)	0.19** (0.06)	0.20** (0.06)	0.19** (0.06)
Unskilled worker		0.23*** (0.07)	0.23*** (0.07)	0.23*** (0.07)	0.22*** (0.07)
Unemployed		0.20** (0.07)	0.20** (0.07)	0.20** (0.07)	0.20** (0.07)
Other		0.09 (0.05)	0.08 (0.05)	0.09 (0.05)	0.08 (0.05)
Conservative values (vs. openness to change)			0.13*** (0.03)		0.13*** (0.03)
Political orientation (left/right)			0.08*** (0.01)		0.08*** (0.01)
Perceived current economic hardship				−0.04 (0.04)	−0.04 (0.04)
Expected economic hardship in next 12 month				0.05 (0.03)	0.05 (0.03)
Variance statistic					
Country variance	0.36*** (0.06)	0.35*** (0.06)	0.34*** (0.06)	0.36*** (0.06)	0.35*** (0.06)
Regional variance	0.28*** (0.03)	0.38*** (0.03)	0.27*** (0.03)	0.28*** (0.03)	0.28*** (0.02)
ICC country	0.03	0.04	0.03	0.04	0.03
ICC region	0.05	0.06	0.05	0.06	0.06

Note: Average marginal effects (AME) from multi-level logistic regression models on climate change uncertainty, standard error in parentheses.

N = 25,230 individuals, 165 regions, 20 countries.

* $P < 0.05$;

** $P < 0.01$;

*** $P < 0.001$.

climate change. Individuals with secondary education, however, did not differ from those with primary education. In contrast to climate change denial, socioeconomic status appeared to be an important determinant of climate change uncertainty. Individuals with lower socioeconomic status such as skilled workers, unskilled workers, and people who were unemployed were more likely to attribute climate change equally to natural processes and human activities. Members of lower-grade service class and in particular small business owners were more likely to feel unsure about the cause of climate change compared to members of the higher-grade service class.

Analogue to Table 1, Table 2 also contains indicators of individuals' ideological worldview and subjective economic situation. It appears that again ideological variables were significantly linked with climate change uncertainty. Those holding conservative values and placing themselves more on the right

sight of the political spectrum were more likely to be uncertain about the cause of climate change. Individuals' subjective economic situation, however, was not significantly linked with climate change uncertainty.

In the next step, the effects of several contextual variables at both the regional and the national level were tested. At the regional level, I considered population density, population growth, the unemployment rate and GDP per capita, and the changes in unemployment and GDP in recent years. At the country level, I again introduced the unemployment rate, GDP per capita, and the respective changes. Furthermore, the CO₂ emissions per GDP (the current rate as well as reductions in recent years) were introduced at the country level as a measure of economic dependency on fossil fuels. Table 3 displays results from three-level logistic regressions in which I included one macro variable at a time.

Table 3. Effects of contextual variables on climate change denial and uncertainty

	Climate change denial	Climate change uncertainty
Regional level		
Population density 2016	−0.04 (0.04)	−0.05 (0.03)*
Population growth 2016 vs. 2015	−0.02 (0.05)	−0.03 (0.04)
Unemployment		
Unemployment rate 2016	−0.11 (0.06)	−0.05 (0.05)
Change 2016 vs. 2015	0.05 (0.06)	−0.04 (0.04)
Change 2016 vs. 2012	−0.06 (0.08)	−0.07 (0.06)
GDP per capita (PPP)		
GDP per capita 2016	−0.05 (0.04)	−0.09* (0.04)
Change 2016 vs. 2015	−0.06 (0.04)	−0.04 (0.04)
Change 2016 vs. 2012	−0.00 (0.05)	0.02 (0.04)
Country level		
Unemployment rate		
Unemployment rate 2016	−0.19* (0.08)	−0.16* (0.07)
Change 2016 vs. 2015	0.06 (0.09)	0.01 (0.08)
Change 2016 vs. 2012	−0.10 (0.09)	−0.10 (0.08)
GDP per capita (PPP)		
GDP per capita 2016	−0.08 (0.09)	−0.01 (0.08)
Change 2016 vs. 2015	0.11 (0.08)	0.04 (0.08)
Change 2016 vs. 2012	0.07 (0.10)	0.11 (0.09)
CO₂ emissions per GDP		
Emissions 2016	0.17** (0.9)	0.12 (0.08)
Reduction 2016 vs. 2006 ²	−0.20** (0.08)	−0.19** (0.07)

Note: Average marginal effects (AMEs) from multi-level models on climate change denial and uncertainty, standard error in parentheses. The effects are obtained from different multi-level models controlling for individual-level variables mentioned in Tables 2 and 3, which are age, gender, level of education, socio-economic status, conservative values, political orientation, perceived current economic hardship, and expected economic hardship.

N = 28,044/25,230 individuals, 165 regions, 20 countries.

¹No data available for Spain.

* $P < 0.05$;

** $P < 0.01$;

*** $P < 0.001$.

At the regional level, the present analysis found no significant association between climate change denial and indicators of current economic conditions. Notably, this is in contrast to the initial analysis, which uncovered substantial variation attributed to differences at the regional level (see again Table 2). There were, however, two significant effects for climate change uncertainty. Climate change uncertainty was less likely in regions with a higher population density and a higher GDP per capita. This suggests that individuals living in prosperous urban areas are more likely to accept the anthropogenic cause of climate change than those living in more rural and less affluent regions within Europe. This effect, however, is rather small and only significant at 5 per cent level.

At the country level, there was a significant relationship between unemployment rate and climate

change disbelief, which, contradicts the assumed direction. It appears that both climate change denial and climate change uncertainty were more likely in countries with a lower unemployment rate. Recent changes in unemployment, however, were not significantly linked with climate change disbelief. There was also no significant with the GDP and its recent changes. There was, however, a significant relationship between climate change denial and a country's CO₂ emissions per GDP. That means that individuals living in countries where the economy is more dependent on fossil fuels, and where the transition to a low-carbon economy is thus more costly, were less likely to report acceptance of the realities of global warming. In addition, levels of climate change denial were also higher in countries that have recently reduced their CO₂ emissions per GDP.

Summary and Conclusion

In this article, I used data from Round 8 of the ESS to investigate the socioeconomic roots of climate change disbelief among the European population. Different forms of climate change disbelief were distinguished: climate change denial and climate change uncertainty. Climate change denial was defined as the absolute rejection of the existence of and the anthropogenic causes of climate change. Climate change uncertainty refers to the lack of sureness about the anthropogenic cause of climate change and is used to describe individuals who attribute climate change equally to both natural processes and human activities.

The results of this study confirm that climate change denial is a marginal phenomenon among European populations, and that a great majority of Europeans acknowledge the reality of climate change and attribute it at least partly to human activities (see also [Poortinga et al., 2018](#)). There is, however, great uncertainty concerning its anthropogenic cause as a considerable share of people is not aware of the great importance human activities have for climate change. It further appeared that the level of climate change denial and uncertainty varies between countries, and to an even greater extent between regions within countries. These regional variations have so far been mostly hidden behind national averages, but surely need to be explored further. They show that climate change disbelief accumulates in certain regions across Europe, even in countries where the average level of disbelief is relatively small. Studying these regional variations can further enhance our understanding of the roots of climate change denial and uncertainty.

This article focused on socioeconomic roots of climate change disbelief, which have so far been widely overlooked in previous research. The results of the presented analysis showed that climate change disbelief is not only linked with certain ideological worldviews but also with economic factors at the individual, regional and national level. Climate change disbelief was much more common among members of social classes who are strongly exposed to labour market risks (such as unskilled workers and small business owners), as well as among those who reported feeling insecure about their economic situation in the future. In contrast, people who reported currently experiencing economic hardship were not more or less likely to deny climate change. This finding confirms previous research arguing that it is not economic hardship or deprivation *per se*, but the fear of losing one's social status that makes people more prone to support populist ideas and parties ([Gidron and Hall,](#)

[2020](#)). Furthermore, in the present study, climate change denial and uncertainty were more common in more rural and less prosperous regions and countries more economically dependent on fossil fuels. These results indicate that climate change disbelief is not only shaped by ideological factors but also by economic context.

All in all, the results suggest that socioeconomic factors also shape an individual's climate change belief, and that they may work in addition to or in conjunction with cultural factors. In the present analysis, they appeared to be distinct determinates. However, much more research is needed to understand the causes and the considerable cross-national variation of climate change disbelief in more detail and discover the interrelation between economic and ideological factors. Thus, future research on climate change denial should strive to include economic factors, particularly those at the contextual level. The great regional variation that remained after controlling for socioeconomic conditions may, however, also point to the importance of long-term structural changes that go beyond the time horizon of this study. In addition, it could suggest that there are long-term cultural differences between regions that may, for example, affect people's trust in institutions. There might be persistent, long-term cultural differences between regions and countries that are hard to measure, but that shape people's reactions to socioeconomic insecurity, and, thus, their attitudes and beliefs ([Cantoni, Hagemester and Westcott, 2019](#)). Analysing such cultural differences could considerably enhance our understanding of the rising support for populist ideas in general. Future attempts to explain the roots of climate change denial should go beyond measuring economic and cultural factors at the individual level to consider contextual factors. Studying such regional differences might help us better understand the roots of climate change denial and populist ideas.

The findings of this study have to be seen in the light of some limitations. A major limitation is that because only cross-sectional data were analysed, no causal associations could be detected. Another limitation is that the study focused only on ideological and socioeconomic explanations of climate change disbelief. In addition, there are certainly other factors that might also affect climate change perception, such as experience with severe weather or the kind of media coverage (see for example [Scruggs and Benegal, 2012](#)). There is an emerging research strand that shows that individuals' climate change belief is also shaped by different experiences with weather anomalies and severe weather events, which can make people more aware of climate change and serve as a kind of evidence of its existence ([Whitmarsh, 2008](#); [McCright,](#)

Dunlap and Xiao, 2014; Cutler *et al.*, 2018). The revealed regional variations of climate change denial and climate change uncertainty might thus also be attributed to different exposure to extreme weather so far.

Despite these limitations, this article contributes to our understanding of the roots of climate change disbelief, and, thus, to the more general understanding of the rising anti-reflexivity in many Western countries. This also includes the success of mostly extreme right-wing populist parties who deny climate change in many places. Climate change denial appears to be part of a broader, cross-national populist ideology that opposes what is called ‘the mainstream’, and that also includes extreme positions on issues other than the environment, such as immigration, globalization, and pluralism.

Note

- 1 The term *climate change skepticism* is often used synonymously to describe disbelief in anthropogenic climate change. Skepticism (or doubt) is, however, an integral part of the scientific process, and thus the usage of climate change skepticism is misleading in the sense that it suggests that disbelief in climate change is a legitimate debate. Denial, in contrast, describes the automatic refusal of climate change regardless of any evidence (Lewandowsky *et al.*, 2016). I therefore prefer to use the term climate change denial to capture individual motivated disbelief in the existence and the anthropogenic causes of climate change.

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Appendix

Table A1. Overview of countries and regions included in analysis

Country	Valid observations	NUTS level	Number of regions
Austria	1,474	2	9
Belgium	1,446	2	7
Switzerland	1,166	2	7
Czechia	1,674	3	14
Germany	2,214	1	13
Estonia	1,568	3	5
Spain	1,334	1	7
Finland	1,537	3	8
France	1,585	2	18
Great Britain	1,426	1	12
Hungary	1,003	1	3
Ireland	1,950	3	2
Iceland	594	3	8
Italy	1,869	1	5
Lithuania	1,383	3	10
Netherlands	1,318	3	5
Norway	1,190	2	7
Poland	1,239	2	13
Portugal	966	2	4
Sweden	1,108	2	8
Overall	28,044	–	165

Source: ESS Round 8, own calculations.

Table A2. Descriptive statistics of contextual variables

	Mean	SD	Min.	Max.
Regional level (N = 165)				
Population density 2016	364.92	884.57	1.20	7,454.60
Population growth 2016 vs. 2015	3.46	7.96	–27.40	21.30
Unemployment rate 2016	7.60	4.29	2.50	27.50
Change 2016 vs. 2015	–0.69	0.82	–3.00	1.60
Change 2016 vs. 2012	–2.00	2.80	–7.10	3.20
GDP per capita (PPP) 2016	29.68	10.82	12.10	71.00
Change 2016 vs. 2012	0.35	8.23	–41.00	30.00
Change 2016 vs. 2015	24.73	27.22	–38.00	17.90
Country level (N = 20)				
Unemployment rate 2016	7.51	3.57	3.00	19.60
Change 2016 vs. 2015	–0.68	0.74	–2.50	0.60
Change 2016 vs. 2012	–1.96	2.71	–7.10	1.60
GDP per capita (PPP) 2016	32.52	8.76	19.94	51.30
Change 2016 vs. 2015	0.21	0.99	–0.98	4.29
Change 2016 vs. 2012	3.71	3.64	1.21	16.32
CO ₂ emissions per GDP				
Emissions 2016	0.26	0.10	0.11	0.55
Reduction 2016 vs. 2006 ²	–0.07	0.04	–0.16	–0.03

Source: ESS Round 8, own calculations (unweighted, unstandardized).

Table A3. Descriptive statistics of variables at individual level (*N* = 28,044)

	Mean/Prop.	Freq.	SD	Min.	Max.
Age of respondent (in years)	50.20		19.05	15	98
Gender: male (ref.: female)	0.49		0.50	0	1
Level of education					
Primary education	0.26	7,221			
Secondary education	0.45	12,528			
Tertiary education	0.30	8,295			
Socio-economic status					
Higher-grade service class	0.12	3,261			
Lower-grade service class	0.08	2,251			
Small business owners	0.07	2,086			
Skilled worker	0.10	2,795			
Unskilled worker	0.07	1,908			
Unemployed	0.06	1,679			
Other	0.50	14,064			
Conservative values (vs. openness to change)	−0.24		0.46	−2.03	1.79
Political orientation (left/right)	3.38		1.44	1	6
Perceived current economic hardship	0.19		0.39	0	1
Expected economic hardship in next 12 month	0.38		0.63	0	1

Source: ESS Round 8, own calculations (unweighted).

Table A4. Distribution of climate change denial and uncertainty across Europe

Country		Climate change denial (in %)				Climate change uncertainty (in %)			
		Overall level	Regional variability			Overall level	Regional variability		
			Min	Max	SD		Min	Max	SD
Austria	AT	10.9	4.1	31.1	8.2	29.3	22.5	43.0	6.8
Belgium	BE	6.9	1.1	12.8	3.8	40.6	22.4	55.1	9.6
Switzerland	CH	7.0	5.0	9.6	1.4	48.6	32.1	54.4	7.5
Czechia	CZ	14.6	7.5	23.3	4.3	48.4	33.6	70.8	10.2
Germany	DE	6.6	4.0	9.5	1.6	39.5	28.9	54.2	7.9
Estonia	EE	12.5	9.2	23.8	6.7	52.8	41.2	56.7	6.4
Spain	ES	6.3	3.7	11.1	2.5	34.0	28.7	40.5	3.9
Finland	FI	6.8	4.1	10.3	2.1	42.1	36.0	52.7	5.5
France	FR	8.1	3.5	19.0	4.3	45.9	35.2	60.3	8.2
United Kingdom	UK	10.2	2.2	13.1	3.5	53.4	46.1	70.8	6.8
Hungary	HU	9.6	6.9	12.2	2.8	46.6	36.0	58.8	12.1
Ireland	IE	9.4	5.3	19.6	4.6	50.8	42.1	61.6	5.4
Iceland	IS	6.1	5.4	7.1	1.2	39.9	36.1	46.1	7.1
Italy	IT	6.7	4.8	9.4	2.0	35.9	30.3	44.8	5.8
Lithuania	LI	25.6	8.7	48.0	13.7	45.1	31.2	61.1	8.9
Netherlands	NL	9.8	7.3	13.4	2.8	46.1	42.0	52.7	4.9
Norway	NO	13.4	8.9	20.7	4.9	49.0	42.8	55.3	4.6
Poland	PL	12.7	8.6	22.3	4.8	55.5	41.1	75.4	10.9
Portugal	PT	6.5	4.5	7.9	1.5	42.6	37.1	48.1	4.6
Sweden	SE	8.1	5.0	12.0	2.6	41.8	36.9	49.9	4.6
Overall		8,5	1.1	48,0	6,4	43,6	22.4	75.4	10,0

Source: ESS Round 8, own calculations (weighted using design and population weights).