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RESEARCH ARTICLE

Understanding public concern about climate change in Europe, 2008–2017: the influence of economic factors and right-wing populism

Sem Duijndam ⓘ and Pieter van Beukering ⓘ

Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

ABSTRACT

European survey data shows strong temporal fluctuations in climate change concern within European countries and large differences in concern between these countries. However, there is as yet no comprehensive understanding of what drives these longitudinal and cross-sectional patterns. To fill this knowledge gap, this study analyzes data of over 155,000 survey respondents from 28 European countries over the period 2008–2017. This study is the first to apply within-between random effects models to simultaneously analyze longitudinal and cross-sectional determinants of climate change concern, and examine if and how the influence of these determinants has changed over time. Substantively, it researches the nexus between climate change and two other crises that have captured the imagination of European publics over the studied period: the liberal democracy crisis and the economic crisis. The former is characterized by the rise of right-wing populist parties in Europe. Right-wing populism is often at odds with climate change policies, and its rise in popularity could have undermined public concern about climate change. We find only a weak negative longitudinal relationship between such concern and the popularity of right-wing populist parties, and no significant cross-sectional relationship. We find that economic performance is strongly positively associated with concern, with GDP per capita being most important for explaining cross-country differences in concern, and deviations in unemployment being most important for explaining longitudinal within-country change. However, this negative longitudinal relationship with unemployment weakens considerably over time, illustrating the importance of including dynamic effects in modeling efforts to generate more reliable results.

Key policy insights

- The percentage of European respondents mentioning climate change as one of the most serious world problems declined from 65% in 2008 to 43% in 2017.
- This study does not find a strong direct relationship between the rise of climate skeptic right-wing populist parties and public concern about climate change.
- Economic factors are important predictors of climate change concern, with GDP per capita being the dominant driver of between-country differences, and unemployment the dominant within-country predictor.
- The marginal impact of unemployment was much stronger during, rather than after, the economic crisis.

CONTACT Sem Duijndam ✉ sem.duijndam@vu.nl ⊡ Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, De Boelelaan 1085, Amsterdam 1081HV, The Netherlands

1. Introduction

Although climate scientists warn us that climate change presents one of the greatest threats to our common future, this alarming message has not fully trickled down to the European public. Whereas in 2008, the first year of the Special Eurobarometer on climate change, 65% of the respondents mentioned climate change as one of the most serious world problems, this steadily declined to 43% in 2017 (European Commission, 2008, 2017). The survey data also reveal large differences in concern between European countries. This is important to understand, because concern about climate change is in at least two ways strongly related to our ability to successfully combat the problem. First, people who are more concerned about climate change are more likely to support mitigation policies (Bouman et al., 2020; Hagen et al., 2016; Lorenzoni & Pidgeon, 2006). Second, concerned individuals are more likely to show personal climate mitigation behaviours (Bouman et al., 2020; Capstick et al., 2015; Hagen et al., 2016). Therefore, it is of high policy relevance to know what drives public concern about climate change.

This study provides the first large-scale longitudinal and cross-sectional analysis of determinants of climate change concern in Europe. It analyzes a dataset including more than 155,000 respondents from 28 European countries by pooling survey data collected over the period 2008–2017. These survey data are obtained from the Special Eurobarometer on climate change series. To date, such a comprehensive assessment of country-level determinants of climate change concern is lacking in the literature. Although several studies on climate change attitudes in Europe have been conducted, these studies either solely analyzed data from single survey waves (Mayer & Smith, 2019; McCright et al., 2016; Sohlberg, 2016) or applied within-country (fixed effects) analyses covering a short time period of only two years (Scruggs & Benegal, 2012; Shum, 2012). The data analyses applied in these studies were either of an exclusive cross-sectional or of a longitudinal character. The problem of pure cross-sectional analyses is that they suffer from few degrees of freedom at the country level due to a low number of countries present in the data, which could possibly yield imprecise estimates of country-level effects (Schmidt-Catran et al., 2019). The limitation of the pure longitudinal approach is that it controls away relevant country-level information (Bell & Jones, 2015). The comparative longitudinal structure of the dataset employed in this study allows for the application of within-between random effects (REWB) models to conduct a simultaneous but separate analysis of longitudinal and cross-sectional relationships (Christmann, 2018; Fairbrother, 2014; Schmidt-Catran et al., 2019). These REWB models have been found to lead to increased statistical power, result in less biased estimates, and allow richer and more complete explorations of the dependent variable (Bell & Jones, 2015; Fairbrother, 2014; Schmidt-Catran et al., 2019).

With the use of this innovative data and methodology, this paper aims to provide a better explanation of what drives fluctuations in climate change concern over time within European countries; what explains differences in concern between these countries; and the extent to which the influence of determinants changes over time. To do this, the study researches how economic factors and the rise of right-wing populism have shaped public concern about climate change in Europe over the period 2008–2017. As Forchtner (2019) states, two crises have captured the imagination of publics in recent years: the environmental crisis with climate change as the key protagonist, and the liberal democracy crisis embodied by the rise of right-wing populism. We would like to add to this a third crisis, namely the economic crisis. The Great Recession of 2008 and 2009 and the Euro crisis that followed have led to sharp declines in economic activity and rising unemployment levels creating widespread societal unrest in many parts of Europe. This study researches the nexus between these three crises; in particular, how economic factors and right-wing populism have influenced public concern about climate change in Europe.

Most previous studies find that deteriorating economic conditions can decrease concern about climate change (Brulle et al., 2012; Scruggs & Benegal, 2012; Shum, 2012), although some studies doubt this relationship (Mildenberger & Leiserowitz, 2017). Cross-sectional studies on the relationship between economic performance and climate change concern also find mixed results (Kenny, 2019; Mayer & Smith, 2019). By simultaneously analyzing longitudinal and cross-sectional effects over an extensive time period, this study provides a more rigorous and comprehensive picture of the impact of economic factors than does the existing literature, and it is the first to assess its dynamism over time. This contributes to Capstick et al's. (2015) call for more research on how climate change attitudes are dynamically shaped.

Over the past decade, right-wing populist parties have been rising in electoral popularity in many countries in Europe and anti-climate positions and rhetoric have become an increasingly important engine for their political activities (Forchtner, 2019; Fraune & Knodt, 2018). Climate change portrayed as an abstract, technical, and uncertain issue of primary interest to a cosmopolitan elite, far away from the everyday needs of ordinary people and threatening national sovereignty, provides an ideal target for right-wing populist parties. This increased anti-climate rhetoric might have influenced public opinion. Although previous literature suggests that political factors play an important role in climate change attitudes (Brulle et al., 2012; Mildenberger & Leiserowitz, 2017), only few studies have assessed the role of (right-wing) populism (Huber, 2020; Huber et al., 2020), and these studies focused solely on individual-level indicators. Our study adds to these seminal individual-level studies, by providing the first aggregate country-level assessment on the role of right-wing populism in explaining climate change attitudes. This is of important added value, as it is aggregate levels of climate change attitudes that best help predict how societies and politics will respond to climate change (Brulle et al., 2012; Capstick et al., 2015).

The structure of this paper is as follows. Section 2 discusses the theory, hypotheses and empirical literature. Section 3 presents the data and methodology. Section 4 gives the results. Section 5 provides a discussion of the results and Section 6 ends with a conclusion.

2. Theoretical background

2.1. Economic factors and climate change concern

The relationship between economic factors and climate change concern is often attributed to the 'finite pool of worry' hypothesis, a theory that originates from psychological research. It hypothesizes that when concern about one issue goes up, concerns about other issues go down because people only have a limited pool of emotional resources (Hansen et al., 2004; Linville & Fischer, 1991). Simply stated, people cannot worry about too many things at the same time. Economic issues are generally of high salience to the public and possibly occupy a higher rank in people's finite 'pool of worry' than climate change, given their immediate impacts on household wellbeing (Capstick et al., 2015; van der Linden, 2017; Whitmarsh, 2011). Hence, when economic worries increase, worry about climate change is expected to decrease. Therefore, it is hypothesized that there is a positive cross-sectional and longitudinal relationship between economic performance and climate change concern. The former postulates an influence of differences in economic performance between countries, and the latter an influence of within-country changes in economic performance. Over the studied period 2008–2017, the impact of the economic situation on people's lives was most evident during the economic crisis in the earlier years of this period, as it involved severe financial and societal turmoil. Therefore, it is expected that the influence of within-country changes in economic conditions on climate change concern has declined in strength over time. These expectations lead to the following three hypotheses:

H1: There is a positive cross-sectional relationship between country-level economic performance and climate change concern

H2: There is a positive longitudinal relationship between country-level economic performance and climate change concern

H3: The positive longitudinal relationship between country-level economic performance and climate change concern has decreased over time

In previous studies, economic factors have been researched both as determinants for cross-country differences and for within-country fluctuations in climate change concern. Several cross-sectional studies have been conducted at the European level. Using Eurobarometer data from 2009, Sohlberg (2016) finds that both GDP per capita and unemployment are negatively related to the perceived threat of climate change. Mayer and Smith (2019) use data from two separate surveys held in 2009 and 2010 and find GDP per capita to be positively related to pro-climate behaviour. McCright et al. (2016) use 2008 Eurobarometer data and find no significant relationship between GDP per capita on the one hand, and acceptance of anthropogenic climate change and perceived seriousness of the problem on the other. The findings of these studies illustrate that there is no consistent picture of the influence of economic factors. Besides the use of different indicators for public

perceptions of climate change, an important reason for this could be that these studies conduct analyses on data covering one survey wave, making the results a snapshot of that survey year and sample of respondents. The strength of this study is that it combines data from six survey waves, strongly increasing the number of cases and making results much less dependent on specific survey wave peculiarities (Schmidt-Catran et al., 2019).

There are also several studies that have analyzed the longitudinal relationship between economic factors and climate change concern. Brulle et al. (2012) apply a time-series analysis with US data from 2002 to 2010 and find that improved economic conditions are significantly associated with increased concern. In contrast, Mildenberger and Leiserowitz (2017), using US data from 2008 and 2011, find that the decline in climate change concern observed over that period is not so much due to economic factors but rather due to political cues. At the European level, both Shum (2012) and Scruggs and Benegal (2012) analyze data from 2008 and 2009 and find that declining GDP per capita and increasing unemployment account for a large part of the decrease in climate change concern witnessed over this period. The large time span of the data in this study allows for an assessment of the influence of within-country economic changes also beyond 2009, as well as the extent to which this influence has changed over time.

2.2. Right-wing populism and climate change concern

It is important to note that right-wing populism consists of two main dimensions: right-wing politics and populism. Although still a contested concept, most approaches to populism agree that its main feature is the division of society into 'the people' versus 'the corrupt elite', contending that politics should be an expression of the general will of the people (Hawkins & Rovira Kaltwasser, 2018; Mudde, 2004; Rooduijn, 2014). Populism can be defined as a thin-centered ideology with only a few core concepts, which allows it to easily appear in combination with other political ideologies (Freeden, 1996; Mudde, 2004). This is why populism can be observed at both the left and the right (and centre) of the political spectrum. The central focus of right-wing populism is on culture and nativism aiming to protect the 'native people' from 'dangerous others'. Left-wing populism, on the other hand, lacks this element and portrays the struggle between the elite and the people mainly as a class struggle where the former economically exploits the latter (Huber, 2020; Huber & Schimpf, 2017; Mudde & Rovira Kaltwasser, 2013; Zulianello, 2020). Some of the core tenets of right-wing populism, in particular its tendency towards authoritarianism, relate negatively to liberal democratic quality (Mudde, 2007), which is why the rise of right-wing populism is often depicted as an unfolding crisis of liberal democracy (Forchtner, 2019).

From a theoretical point of view, both the 'right-wing' and the 'populism' component of right-wing populism generate a fertile ground for climate skepticism and hostility to climate policy. It is the abstract and technical nature of climate change, and its typically elite-driven top down discourse, that makes it easy for populists to portray the problem as illustrating the chasm between the elite and the people (Huber, 2020). The right-wing component adds authoritarianism and nationalism to the equation, whereas left-wing populism tends to express more universalist values (Lockwood, 2018; Mudde, 2007). The international, cosmopolitan nature of climate change (negotiations) is directly at odds with right-wing populists' values (Lockwood, 2018). It has also empirically been found that a large majority of European right-wing populist parties are skeptical about climate change, revealing different motivations for their climate skepticism (Forchtner, 2019; Hess & Renner, 2019; Lockwood, 2018; Schaller & Carius, 2019). Climate skepticism is manifested as trend skepticism (the climate is not changing), attribution skepticism (climate change exists but is not anthropogenic), and/or impact skepticism (climate change exists but does not lead to significant impacts; Lockwood, 2018; Poortinga et al., 2011). Mass publics have been found to be generally opinion followers instead of leaders. (Lenz, 2012; Mildenberger & Leiserowitz, 2017). Hence, even though populist voters might not have voted for populist parties because of their climate profile, the climate skeptic positions of these parties could have trickled down to this public. This effect is amplified by populist media where skeptic, and often misleading, communications on climate change are frequent (Hameleers et al., 2017; Waisbord, 2018). A greater political platform for populist parties to communicate their views could also increase their influence on non-populist voters. Therefore, it is hypothesized that a negative cross-sectional and longitudinal relationship exists between the

popularity of right-wing populist parties in a country and climate change concern. Concern is thus expected to be lower in countries with a higher popularity of right-wing populist parties (cross-sectional relationship), and an increase in the popularity of right-wing populist parties is expected to decrease concern within countries (longitudinal relationship). Although trend skepticism and impact skepticism are more strongly related to concern than attribute skepticism, it has been found that the three types of skepticism are strongly interlinked with each other at the individual level (Poortinga et al., 2011). In general, a strong association between skepticism and concern has been found in the literature (Capstick & Pidgeon, 2014; Tranter & Booth, 2015).

> H4: There is a negative cross-sectional relationship between the popularity of right-wing populist parties in a country and concern about climate change

> H5: There is a negative longitudinal relationship between the popularity of right-wing populist parties in a country and concern about climate change

As climate change has become a more prominent (and sometimes polarized) topic in public debate over the years, public exposure to climate skeptic views of right-wing populist parties has increased over time (Fraune & Knodt, 2018; Hoffarth & Hodson, 2016). This leads to the following expectation:

> H6: The negative longitudinal relationship between the popularity of right-wing populist parties in a country and climate change concern has intensified over time

Previous empirical studies have identified that political factors can be pivotal in explaining climate change concern. Brulle et al. (2012) find that US climate change concern dropped significantly and considerably when Congressional Republicans released public statements that opposed climate change action. Mildenberger and Leiserowitz (2017) find shifting political cues – shifting from voting Democratic to voting Republican – to be the most plausible explanation for the decline in US climate opinion over the period 2008–2011. Other studies find that climate change concern and policy support strongly depend on political ideology and are lower among people on the right than on the left (McCright et al., 2016; van der Linden, 2017), although research by Harring et al. (2019) suggests that the strength of this relationship is dependent on the political culture of the country. Populism as another dimension of political ideology has been addressed by only few studies. Huber et al. (2020) using US data find that populist attitudes enhance the effects of political ideology; populist Republicans oppose climate policies more than non-populist Republicans, while the opposite holds for Democrats. On the other hand, Huber (2020) using UK data finds that populist individuals are more likely to be climate skeptic irrespective of their political ideology.

3. Data and methods

3.1. Data

This article uses data from six survey waves of the Eurobarometer series on climate change over the period 2008–2017. These include Eurobarometer 69.2 (2008), 71.1 (2009), 75.4 (2011), 80.2 (2013), 83.4 (2015), and 87.1 (2017). Each Eurobarometer survey typically involves 25,000–30,000 respondents from all 28 European Union (EU) member states (including the United Kingdom).[1] Pooling the six survey waves results in a dataset of over 155,000 respondents. The selection of respondents in the Eurobarometer takes place on the basis of a multi-stage random probability design, and respondents are interviewed face-to-face. Around 1000 respondents are interviewed for each member state (GESIS, 2020).

3.2. Dependent variable

Table 1 provides a description of all the variables used in the analyses and their coding. Climate change concern is measured with the use of the following question from the Eurobarometer surveys 'Which of the following do you consider to be the single most serious problem facing the world as a whole, and which others do you consider to be serious problems?' Respondents can choose from a variety of issues, including climate change, and they can state up to four problems.[2] The dependent variable is a binary variable and is coded as 1 if climate change is mentioned as a serious problem, and as 0 if not. 'Don't know' responses are omitted from the analysis.

Table 1. Variable description and coding.

Variable	Description and coding
Dependent variable	
Climate change concern	If respondents mention climate change as one of the most serious world problems. '0' climate change is not mentioned as a serious world problem, '1' climate change is mentioned as a serious world problem
Independent variables	
Log GDP/capita	Real GDP per capita in logarithm, ranging from 8.52 to 11.32
Unemployment	Unemployment (% of active population), ranging from 2.9 to 27.5
Right-wing populism	Vote share of right-wing populist parties (in %), ranging from 0 to 69.2
Control variables	
Age	Age of the respondent, ranging from 15 to 99
Gender (1=female)	Gender of the respondent, '0' male '1' female'
Education	Age when finishing full-time education, from '1' <15 years to '9' >22 years. If still studying, current age is used.
Unemployed	Unemployment status of the respondent. '0' employed, '1' unemployed
Life satisfaction	Self-declared satisfaction with life. '0' not at all or not very satisfied with life, '1' fairly or very satisfied with life
Young children	If respondent has children younger than 15 years old in their household. '0' no, '1' yes
Location (rural-urban)	Location of residence. '1' rural area or village, '2' small or middle-sized town, '3' large town
Political ideology	Political ideology from (1) left to (10) right
CO_2/capita	Tons of CO_2 equivalent per capita, ranging from 5.40 to 29.70
Time	Linear time trend for survey years, ranging from 0 (2008) to 5 (2017)

Sources: Eurobarometer, Eurostat and TIMBRO.

Letting respondents prioritize their concerns reduces the problem of 'cheap talk' responses which can occur when simply asking respondents how concerned they are about climate change. Furthermore, as climate change is just one of the answer options and not explicitly highlighted in the question itself, the survey question also suffers less from value-laden question framing (Sinkowitz-Cochran, 2013). This survey question has also been used in previous studies to measure climate change concern (e.g. Ćetković & Hagemann, 2020; Ricart et al., 2018; Villar & Krosnick, 2011) and is actively used by the European Commission (European Commission, 2017).

3.3. Independent variables

To capture the economic situation of a country, data on GDP per capita and unemployment are collected from Eurostat (European Commission, 2020) for each survey year. To assess the popularity of right-wing populist parties, country-level data on the vote share of right-wing populist parties in the most recent national elections are collected from the TIMBRO Authoritarian Populism Index (Johansson Heinö, 2019). The index is specifically tailored towards European political parties and labels parties to be right-wing populist parties based on expert assessments, election manifestos, and party programmes. Indicators that are used in this index to categorize right-wing populist parties include strong anti-establishment rhetoric and positions on immigration, minority views and multiculturalism (Johansson Heinö, 2019; Rohac et al., 2017). Strong anti-establishment rhetoric follows from populism's main feature of the 'people' versus the 'corrupt elite', whereas positions on immigration, minority views and multiculturalism reflect the right-wing part of the measure.

3.4. Control variables

Several control variables are included in the analysis. All models include the following individual-level variables collected from the Eurobarometer survey waves: age, gender, education, location of residence, employment status, life satisfaction, and having young children. Most studies find that younger people, females, higher educated people, people with a higher life satisfaction and people living in urban areas are more concerned about climate change (Poortinga et al., 2019; Sohlberg, 2016; van der Linden, 2017). Findings are mixed for employment status and having young children (Ekholm, 2020; Kahn & Kotchen, 2011; Norton & Leaman, 2004; Sohlberg, 2016). Another important determinant of climate change concern at the individual level is political ideology (Beiser-McGrath & Huber, 2018; McCright et al., 2016). Political ideology was not asked in the Eurobarometer surveys of 2011 and 2013, and hence results for this variable are only presented in some of the models.

At the country level, CO_2 emissions per capita, which is collected from Eurostat, is included as a control variable. Several studies find a negative cross-sectional relationship between CO_2 emissions per capita and climate change concern (Brody et al., 2008; Sandvik, 2008). A suggested reason for this is that the economic burdens of climate change policy are higher in countries with higher emissions. Overall, the unique data and methodology used in this study can shed a new light on the influence of all the included control variables.

3.5. Methodology

The data used in this study are characterized as comparative longitudinal survey data. There are non-repeated observations on a large sample of micro-level units (i.e. individuals), and repeated observations on a small sample of macro-level units (i.e. 28 European countries). The micro-level units are nested within the macro-level units. This data structure makes it possible to analyze both the within and between effects of time-varying country-level variables. This simultaneous but separate analysis of longitudinal and cross-sectional relationships can be done by employing REWB models (Christmann, 2018; Fairbrother, 2014; Schmidt-Catran et al., 2019). The decomposition into within and between effects is an important improvement to conventional random effects modelling where this decomposition does not take place. After all, there is no reason to assume that the within and between effects are the same and not decomposing would make it impossible to tell if estimated effects are due to differences between countries, changes within countries, or a combination of both (Christmann, 2018; Fairbrother, 2014; Hedman et al., 2015). Mathematically, the REWB model can be represented as:

$$y_{itc} = \beta_0 + \beta_1 x_{itc} + \beta_2 x_{tcM} + \beta_3 \bar{x}_c + \beta_4 time + v_c + u_{tc} + e_{itc}. \tag{1}$$

The model is a hierarchical three-level model with individuals (i) nested in country-years (t) which are in turn nested in countries (c). The individual-level variables are captured in the vector x_{itc}. The time-varying country-level variables x_{tc} are decomposed and enter the equation twice in the form of $\bar{x}_c$ and x_{tcM}. The between component is represented by $\bar{x}_c$, which is the mean of x_{tc}. and captures persistent cross-country differences. The within (longitudinal) component is depicted by x_{tcM}. This within component is obtained by group-mean centering, which entails calculating the mean ($\bar{x}_c$) and subtracting this mean from the time-varying variable x_{tc}. The resulting variable x_{tcM} is a country-year level variable and captures variation around the mean for each country-year. Due to the orthogonality of x_{tcM} to $\bar{x}_c$ their coefficients β_2 and β_3, respectively reflecting within and between effects, can be estimated separately. A linear variable for time is also included in the model to account for the possibility of spurious correlations between the within-country estimates and common time trends inherent in the data (Fairbrother, 2014).

Table 2. Descriptive statistics of dependent, independent, and control variables.

Variable	2008–2017		Means per survey year					
	Mean	S.D.	2008	2009	2011	2013	2015	2017
Dependent variable								
Climate change concern	0.52	0.50	0.65	0.53	0.52	0.50	0.47	0.43
Independent variables								
Log GDP/capita	9.92	0.62	9.92	9.86	9.92	9.89	9.94	10.00
Unemployment	8.97	4.40	6.52	9.08	10.09	11.11	9.53	7.52
Right-wing populism	12.20	13.45	10.45	10.81	12.22	12.17	13.14	14.40
Control variables								
Age	49.21	18.23	48.29	48.31	47.79	49.44	49.97	51.38
Gender (1 = female)	0.55	0.50	0.55	0.54	0.54	0.55	0.56	0.55
Education	5.34	2.72	5.06	5.14	5.18	5.42	5.59	5.65
Unemployed	0.07	0.26	0.05	0.07	0.08	0.08	0.07	0.07
Life satisfaction	0.76	0.42	0.64	0.74	0.78	0.78	0.82	0.82
Young children	0.26	0.44	0.27	0.27	0.27	0.25	0.25	0.25
Location (rural-urban)	1.93	0.78	1.90	1.90	1.92	1.94	1.98	1.95
Political ideology	5.31	2.28	5.41	5.29	–	–	5.26	5.28
CO_2/capita	9.78	3.35	11.12	9.92	10.04	9.41	9.03	9.19

Sources: Eurobarometer, Eurostat and TIMBRO.

4. Results

4.1. Descriptive statistics

Table 2 provides descriptive statistics for all the variables used in the analyses. Means and standard deviations are provided for the whole data sample, while means are also shown for each survey year separately to visualize trends over time. To illustrate variation between countries, Table A.1 in the Supplementary Online Material shows country averages for all country-level variables, with averages calculated over the sample period 2008–2017. The data show that average climate change concern has dropped considerably over time. While in 2008, 65% of the respondents mentioned climate change as one of the most serious world problems, this steadily declined to 43% in 2017. There is also much variation between countries, with country averages ranging between 32% and 76%. Average GDP per capita (log transformed) decreased from 2008 to 2009, increased from 2009 to 2011, and then again decreased from 2011 to 2013 before increasing again until 2017. Unemployment levels increased each year from 2008 to 2013 and decreased afterwards. Country averages for log GDP and unemployment range between 8.6 and 11.3, and 5% and 19%, respectively. Table 2 also clearly shows the rise in the vote share of right-wing populist parties in Europe. While in 2008 an average of 10.5% of votes were cast for right-wing populist parties, this increased to 14.4% in 2017. Also here, there is much variation between countries, with country averages ranging between 0% and 60%. Average CO_2 emissions per capita have dropped over time, and country averages range between 6 and 24 tons. The individual-level data are generally consistent with recent socio-demographic trends.

4.2. Model results

Model 1 and Model 2 in Table 3 display results of random effects models that do not decompose the country-level variables into their between and within components. The same model estimations including political ideology are presented separately in Model I and Model II in Table A.2 of the Supplementary Online Material, as this indicator was not measured in the 2011 and 2013 survey waves. Model 1 only includes individual-level variables. Several of the individual-level variables are significantly related to climate change concern. Education, life satisfaction, and living in an urban area are significantly positively associated with concern. Age, being unemployed, and having a right-wing political ideology are significantly negatively related to concern. Gender and having young children are not significant. Model 2 includes the country-level variables. GDP per capita (log transformed) is positively associated with climate change concern and the result is significant at the 1% level. Unemployment is negatively associated with concern and this result is also significant at the 1% level. The effect of the vote share of right-wing populist parties is not significant. CO_2 emissions per capita is significantly negatively associated with concern. Although these findings provide an indication of the influence of these country-level variables on climate change concern, the results are a combination of between and within effects. These effects are not necessarily the same and, therefore, distinguishing between them is essential for proper understanding and policy relevance.

Models 3–6 in Table 3 are REWB models and decompose the overall effects of the country-level variables into their cross-sectional (i.e. between) and longitudinal (i.e. within) parts. In these models, the individual-level results are nearly identical to those of Models 1 and 2. Political ideology is excluded from these model specifications because of missing observations in 2011 and 2013. Model 3 shows the results when the two economic indicators, log GDP/capita and unemployment, are decomposed into their cross-sectional and longitudinal parts. The longitudinal components of both variables are interacted with time to test if the influence of these indicators has changed over time. The odds ratio for log GDP/capita (between) is higher than 1 and significant at the 1% level. Hence, there is a significant positive cross-sectional relationship between GDP per capita (log) and climate change concern. The longitudinal relationship between GDP per capita (log) and concern is also positive, but insignificant. The odds ratio for the cross-sectional component of unemployment is lower than 1 but insignificant. However, there is a significant (1% level) negative longitudinal relationship between unemployment and concern. The odds ratio of the interaction between the longitudinal component

Table 3. Random effects and within-between random effects (REWB) models of climate change concern.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Individual level						
Age	0.995***	0.995***	0.995***	0.995***	0.995***	0.995***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gender (1 = female)	1.000	1.000	1.000	1.000	1.000	1.000
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Education	1.066***	1.066***	1.066***	1.066***	1.066***	1.066***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Unemployed	0.952**	0.953**	0.953**	0.952**	0.953**	0.953**
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Life satisfaction	1.139***	1.139***	1.139***	1.139***	1.138***	1.138***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Young children	1.004	1.004	1.004	1.004	1.004	1.004
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Location (rural-urban)						
Small-middle sized town	1.052***	1.051***	1.051***	1.052***	1.051***	1.051***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Large town	1.073***	1.073***	1.073***	1.073***	1.073***	1.073***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Country/country-year level						
Log GDP/capita		1.694***				
		(0.201)				
Log GDP/capita (Between)			1.423***		1.721***	1.714***
			(0.153)		(0.190)	(0.200)
Log GDP/capita (Within)			3.492		4.144	
			(3.702)		(4.522)	
Log GDP/capita (Within)*Time			0.741		0.717	
			(0.256)		(0.247)	
Unemployment		0.970***				
		(0.009)				
Unemployment (Between)			0.981		0.980	
			(0.019)		(0.018)	
Unemployment (Within)			0.913***		0.913***	0.900***
			(0.022)		(0.022)	(0.016)
Unemployment (Within)*Time			1.028***		1.027***	1.031***
			(0.010)		(0.010)	(0.007)
Right-wing populism		0.999				
		(0.004)				
Right-wing populism (Between)				1.004	1.007	
				(0.007)	(0.005)	
Right-wing populism (Within)				0.978*	0.980*	0.990*
				(0.012)	(0.011)	(0.006)
Right-wing populism (Within)*				1.005	1.005	
Time				(0.004)	(0.004)	
CO_2/capita		0.953***				
		(0.017)				
CO_2/capita (Between)					0.953**	0.956**
					(0.018)	(0.019)
CO_2/capita (Within)					0.973	
					(0.028)	
Time	0.832***	0.815***	0.865***	0.837***	0.860***	0.878***
	(0.013)	(0.014)	(0.018)	(0.013)	(0.023)	(0.014)
Constant	1.366***	0.017***	0.044***	1.277***	0.010***	0.009***
	(0.131)	(0.019)	(0.049)	(0.159)	(0.011)	(0.009)
Variance country level	0.178	0.099	0.104	0.178	0.073	0.089
Variance country-year level	0.110	0.096	0.085	0.107	0.081	0.084
N countries	28	28	28	28	28	28
N country-years	167	167	167	167	167	167
N individuals	157,666	157,666	157,666	157,666	157,666	157,666
AIC	204,161	204,136	204,124	204,163	204,120	204,116
BIC	204,281	204,295	204,303	204,312	204,349	204,286
Log-Likelihood	−102,068	−102,052	−102,044	−102,066	−102,037	−102,041

Note: Results are displayed in odds ratios. Standard errors in parentheses. The levels of significance are: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

of unemployment and time is higher than 1 and also significant at the 1% level, illustrating that the negative longitudinal effect of unemployment has decreased in strength over time.

Model 4 shows the results when solely the vote share of right-wing populist parties is included in the model, decomposed into its longitudinal and cross-sectional component. The results are mostly insignificant. Only the odds ratio of the longitudinal component is lower than 1 and significant at the 10% level. The results for the cross-sectional component and the interaction between the longitudinal component and time are insignificant. Model 5 includes the decompositions of both the economic variables and the vote share of right-wing populist parties, as well as CO_2 emissions per capita as a control variable. The significance levels of the variables remain the same as in Models 3 and 4. Model 6 only includes variables that have been found to be significant at the 10% level in Models 3–5. This model has the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) scores of models 3–6 and a Variance Inflation Factor (VIF) test reveals no problematic multi-collinearity issues (all VIFs < 5). The signs of the odds ratios and the significance levels also do not change in this model, illustrating the robustness of the results to different model specifications.[3]

4.3. Probability analysis

To assess the magnitude of the effects of the significant variables related to H1–H6, a predicted probability analysis was conducted. Figure 1 shows that the size of the effect of the negative longitudinal relationship between unemployment and climate change concern is substantial, but that its strength has weakened over time, as illustrated by its significant positive interaction with time. In 2008, the probability of mentioning climate change as a serious world problem for a respondent living in a country witnessing a one standard deviation decrease in unemployment is 0.13 higher than for a respondent living in a country witnessing a one standard deviation increase in unemployment. In 2013, this difference is only 0.02, and for 2015 and 2017 the effect is even slightly reversed. If we would have ignored the interaction with time, the results would have depicted a time-independent significant difference in probability of 0.05. Disregarding the temporal heterogeneity of the influence of unemployment shocks would clearly provide a distorted picture of reality.
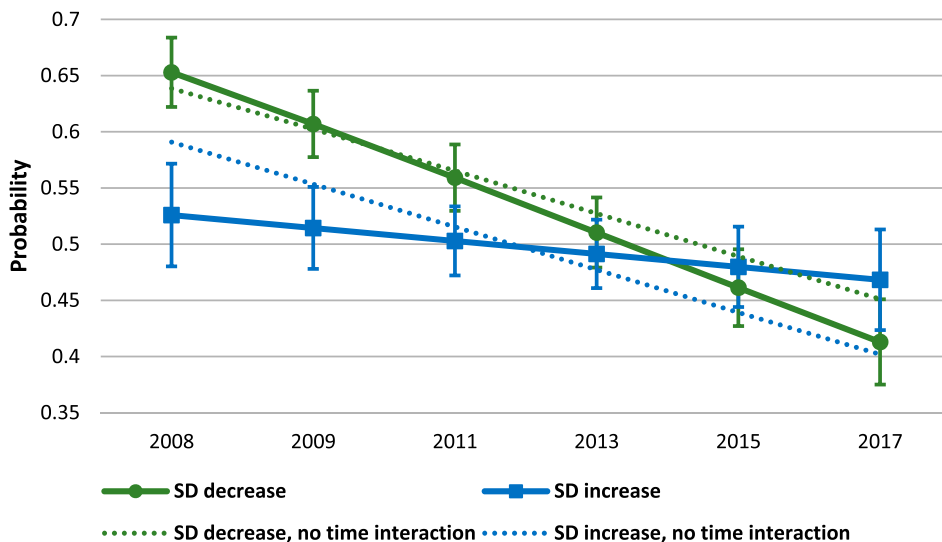

Figure 1. Conditional effects of time on the relationship between unemployment (within) and climate change concern. Note: Predicted probabilities of mentioning climate change as a serious world problem, for a standard deviation (SD) decrease (−2.68) and increase (+2.68) in unemployment. Results are shown for when interaction 'unemployment (Within)*Time' is taken into account (solid line) and when not (dashed line). When the interaction is omitted, unemployment (Within) is still significant at the 1% level. Whiskers show 95% confidence interval. Predictions based on model 6 in Table 3. All other predictors held at observed values.

Figure B.1 in the Supplementary Online Material shows that the significant positive cross-sectional relationship between GDP per capita (log) and climate change concern is also of substantial magnitude. A one standard deviation higher average GDP per capita (log) increases the probability of a respondent mentioning climate change as a serious world problem by around 0.08. Figure B.2 depicts a small substantive impact of deviations in the vote share of right-wing populist parties.

5. Discussion

The results provide important novel insights on individual-level, cross-country and longitudinal determinants of climate change concern in Europe and allow us to reflect on the hypotheses formulated earlier in this paper. The signs of the odds ratios for the economic indicators are all in accordance with the expectations of H1–H3, even though not all are significant. H1 and H2 expected, respectively, a positive cross-sectional and longitudinal relationship between economic performance at the country level and climate change concern. The results of this study show that, at the cross-sectional level, GDP per capita is the strongest economic predictor of concern whereas at the longitudinal level this is unemployment. The former finding might be explained by the fact that the impact of GDP per capita on economic well-being has more of a long-term nature due to sluggish trickle down effects. This finding is also consistent with theories contending that post-materialist concerns, such as on the environment, only emerge when in the long-term a certain level of economic prosperity is reached (Mayer & Smith, 2017). In contrast, within-country changes in unemployment can be immediately felt by those who themselves or whose close relatives have become unemployed or through fears of unemployment (Scruggs & Benegal, 2012). The probability analysis revealed that the effects for both findings are also of a substantial magnitude, with standard deviation differences for these indicators being associated with potentially tens of percentage points differences in concern. The cross-sectional findings add important new evidence to the hitherto mixed results found at the European level (Mayer & Smith, 2019; McCright et al., 2016; Sohlberg, 2016). The results on the strong negative longitudinal relationship between unemployment and climate change concern correspond with several previous American (Brulle et al., 2012; Carmichael & Brulle, 2017) and European (Scruggs & Benegal, 2012; Shum, 2012) studies, although the latter research covers a much shorter time frame (2008–2009) than the study presented here.

We also find evidence that the positive longitudinal relationship between a country's economic performance and climate change concern has decreased in strength over time (H3). Although results for GDP are insignificant, unemployment shocks had more of an influence in the earlier years of the examined period, which correspond with the period of the financial and economic crisis (2008–2009). Results from the probability analysis showed that this effect is also substantive; the large negative impact of unemployment in the earlier years quickly decreases over time, and in 2015 and 2017 the sign of the effect is even reversed. Shocks in unemployment thus seem to be influential mainly in dire economic conditions. These are important findings as they show that the influence of variables on climate change concern can vary significantly over time. If we would just rely on the findings of the random effects model presented in Model 2 in Table 3 without decomposing the effects, we could falsely assume that these results hold in the cross-sectional and longitudinal domain and are stable over time. This could seriously undermine effective understanding and subsequent policymaking.

The results do not much support H4–H6 on the influence of right-wing populism on climate change concern. Only a weak significant (10% level) negative longitudinal relationship between the vote share of right-wing populist parties and concern has been found, which provides some modest support for H5. Nevertheless, the approach used in this article has some limitations. First, the data do not consider heterogeneity between parties. Although the majority of right-wing populist parties are climate skeptic, the degree of skepticism varies between them (Forchtner, 2019). Second, the vote share of these parties gives a rather static representation of their popularity, as for each country-year the vote share of the most recent national election is used, whereas popularity can also change in between national elections. Third, the influence of populist parties can be different depending on whether they are in the opposition or in government. In the latter case, populists exercise direct control over power and generally have a larger influence on the political agenda and policy making (Huber & Schimpf, 2016; Mudde & Rovira Kaltwasser, 2012). To address these shortcomings, three robustness checks that aimed to reduce these flaws have been performed and the results were not notably

different; only the negative longitudinal effect is sometimes significant (explanations and results of these robustness checks are available in Annex C of the Supplementary Online Material). In addition, although researching the links between right-wing populism and climate change has been done previously in the literature (Ćetković & Hagemann, 2020; Lockwood, 2018), one could criticize the conflation of populism and political ideology from an analytical point of view, because results could be due to either the populism component, the ideological component, or a combination of both (Huber, 2020). In response to this, this study has attempted to also assess the influence of populism and political ideology separately, and results were insignificant (see Annex C). What this shows overall is that, although political ideology and populist attitudes are strong predictors of climate change attitudes at the individual level (Huber, 2020; Huber et al., 2020; McCright et al., 2016), we do not see that country-level shifts to the (populist) right are so strongly associated with decreased concern both between and within countries. A reason for this could be that climate skeptic stances of right-wing populist parties are counteracted by a stronger mobilization of pro-climate movements influencing public attitudes (Caniglia et al., 2015; Hagedorn et al., 2019), but researching this is beyond the scope of this study and should provide fruitful inspiration for future research.

The findings for the control variables also provide some interesting insights. In line with most of the literature, this study finds that younger and higher educated people, people with a more left-wing political ideology, as well as people living in urban areas are more concerned about climate change (McCright et al., 2016; Poortinga et al., 2019; van der Linden, 2017). The same holds for people with a higher life satisfaction. Unemployed people are significantly less likely to be concerned about climate change, showing that unemployment as a personal hardship measure also significantly negatively influences concern. No evidence is found that females are more concerned than males, even though this is generally referred to in the literature (van der Linden, 2017). There is also no significant association between having young children and climate change concern. Similar to other cross-sectional inquiries in the literature, the findings of this study show that concern is significantly higher in countries with lower CO_2 emissions per capita (Brody et al., 2008; Sandvik, 2008). The longitudinal relationship between changes in CO_2 emissions per capita and concern is insignificant.

6. Conclusion

Applying a comprehensive statistical approach, this study has analyzed the influence of economic factors and right-wing populism on climate change concern using a dataset covering more than 155,000 individuals from 28 European countries over the period 2008–2017. The comparative longitudinal structure of the survey data allowed for the unique application of REWB models that decompose effects into their cross-sectional and longitudinal components. The results of this study have generated novel scientific insights and provide important guidance to climate policies.

Several concrete policy implications can be stipulated for policymakers trying to understand dynamics in public opinion about climate change and for those trying to limit strong declines in concern (especially during times of economic recession). Regarding right-wing populism, this study does not find a strong direct relationship between the rise of climate skeptic right-wing populist parties and public concern about climate change in Europe. We do not find lower levels of concern for countries with a higher vote share of right-wing populist parties, and increasing vote shares for these parties within countries have only a minor substantive influence on concern. Nevertheless, engaging on climate change with those sections of the population that have been, or who feel, 'left behind' through inclusive climate policies and communications could help them increase their support for climate policies.

Although previous studies have emphasized the important role of economic factors (e.g. Scruggs & Benegal, 2012; Shum, 2012), this study provides a much more nuanced picture. Whereas differences in concern between countries can best be explained by different levels of GDP per capita, within-country changes are strongly influenced by changes in unemployment. The potential magnitude of these effects has proved to be substantial. The importance of economic factors in explaining climate change concern predicts serious consequences should another economic crisis hit Europe. However, this perceived economy/climate trade-off could be overcome if climate policies were deployed and communicated as a way to enhance economic growth and generate employment. Another important finding of this study is that within-country changes in unemployment had

a much stronger effect on concern during the period of the financial and economic crisis, rather than during the period thereafter. Policy recommendations in the literature of public perceptions of climate change are sometimes, implicitly, based on a static view of society. However, societies are dynamic and this study illustrates that there is not necessarily a temporally stable blueprint for what explains climate change concern.

Future studies are encouraged to further exploit the benefits of REWB models in providing richer and less biased estimates in the many other domains of the thriving literature of public perceptions of climate change. Of particular interest will be the impact of the COVID-19 pandemic, which through its health and economic impacts might shift concern away from climate change.

Notes

1. For Eurobarometer 75.4 (2011), no residents of Croatia were interviewed.
2. Other answer options include: (1) international terrorism (2) poverty, hunger and lack of drinking water, (3) spread of infectious diseases, (4) the economic situation, (5) proliferation of nuclear weapons, (6) armed conflicts, (7) the increasing global population, (8) other, (9) none, (10) don't know.
3. Following the suggestion of an anonymous reviewer, we looked at the influence of reconstructing the dependent variable into measuring only people's perceived number one most serious world issue, instead of looking at their up to four most serious issues. The results of this analysis are presented in table A.3 in the Appendix. Reconstructing the dependent variable in this way does not affect the main findings (except for the cross-sectional effect of unemployment now also being significant).

ORCID

Sem Duijndam http://orcid.org/0000-0001-6826-1563
Pieter van Beukering http://orcid.org/0000-0001-7146-4409

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