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ABSTRACT

Do Europeans Care about Climate Change? An Illustration of the Importance of Data on Human Feelings*

Economists have proposed a variety of sophisticated climate-change interventions. But do our citizens care enough about climate change to enact such policies? This paper provides evidence that suggests they do not. Two kinds of findings are presented. Using data on 40,000 Europeans from the 2016 European Social Survey, the paper shows that only 5% of people say they are extremely worried about climate change. The cooler European countries express particularly low levels of worry. Using data on 30,000 citizens from the 2019 Eurobarometer Surveys, the paper demonstrates that climate change is viewed as a less important problem than parochial issues such as (i) health and social security, (ii) inflation, (iii) unemployment, and (iv) the economic situation. Other results, from regression equations, are provided. This paper's conclusions seem to have exceptionally serious implications for our unborn great grandchildren -- and imply that economic policy should now focus on how to alter feelings rather than upon the design of complicated theoretical interventions. An analogy with successful anti-tobacco policy is discussed.

JEL Classification: Q54, Q58

Keywords: climate change, global warming, feelings, economic policy, welfare

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Do Europeans Care about Climate Change? An Illustration of the Importance of Data on Human Feelings

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Brazilian cigarette pack legally-mandated warning

Introduction

If the world is to make progress in tackling anthropogenic global warming (Benton 1970; Madden and Ramanathan 1980; Chapman and Khanna 2000; Deschenes and Greenstone 2007; Stern 2007; Tol 2008; Deschenes and Kolstad 2011), human beings will have to alter how they live. A range of ingenious policy ideas have been suggested by economists and other social scientists[1]. Yet carefully crafted proposals are of little use if voters oppose them. For innovative economic policies to garner enough support, citizens in democracies have to feel deeply committed to the desirability of action on climate change (because those are likely, in the short run, to be painful for them).

Human feelings are therefore of crucial importance. Yet at the time of writing such data are rarely studied[2] by applied economists.

This paper examines evidence on the feelings and beliefs of modern European citizens about climate change and closely related issues. It draws upon information from two recent data sets – the European Social Survey in 2016 and the Eurobarometer Survey in 2019. As Europe has some of the highest education levels in the world, the continent makes a natural testing ground for an empirical inquiry of this kind. If Europeans are not severely worried, and are unconvinced of an urgent need for change, there is perhaps little reason to have optimism about most other parts of the world.

[1] The modern literature includes Nordhaus 1991; Weitzman 2009; Hepburn et al. 2013; Stern 2015, 2018; Tol 2009, 2018; Heal 2017; Hepburn and Teytelboym 2017; Weitzman 2017; Sachs 2019; Hepburn et al. 2020.

[2] Later sections will study human 'worry', for example, so honourable exceptions should be mentioned – including Ma et al. (2020), Ehlert et al. (2020), and Engelberg and Parsons (2016). See also Bernstein et al. (2019), Baylis (2020), Mullins and White (2019), Powdthavee (2020), Bose et al. (2020), and Gibson and Mullins (2020).

Previous work on Europeans' feelings about the climate-change phenomenon is scant. However, one is Loureiro and Allo (2020) on the study, using Twitter data, of sentiments. It follows in the spirit of a pioneering form of Twitter analysis by Cody et al. (2015). See also, on the measurement of attitudes and feelings, Weber (2010).

This paper's results are troubling. Although they ask slightly different kinds of questions, both of the later data sets seem to tell broadly the same story. The main findings, which could be seen alongside related older work such as by Bord et al. (1998), who at that time concluded that in the eyes of citizens "global warming is not a salient issue", and by Lorenzoni and Pidgeon (2006), are:

(i) *Europeans do not exhibit high levels of worry about climate change* (in the ESS survey, only 1 person in 20 describes themselves as extremely worried, for example).

(ii) *Europe's citizens are more concerned -- in Eurobarometer data -- with parochial economic influences in their lives* (they care more about health and social security, inflation, the general economic situation, and unemployment).

(iii) *Europeans do not have a strong belief -- in ESS data -- that joint action by energy users will help*. On one interpretation of the paper's data, for example, large numbers of citizens may well take the view that the chances of success from even coordinated action is not much better than 50-50.

(iv) *A lack of concern about climate change is most evident -- in both data sets -- among males, the old, and those with low levels of education. The cooler countries are the least concerned.*

(v) *It would be wrong to say that Europeans are entirely complacent about climate change. However, is not easy from these data sets to believe that Europe's citizens care enough to accept painful anti-climate-change actions.*

The paper later considers what kind of policies might help -- given the evidence on underlying beliefs and feelings.

This paper follows in the footsteps of research reviewed in articles such as Heal (2017) and Tol (2018), and is related to important earlier writings such as Poortinga et al. (2019) and Marquart-Pyatt et al. (2019), although the current paper's main focus and key conclusions are different.[3] Oswald and Stern (2019) recently argued that more work by economists remains to be done; it drew attention to the fact that in the case of the distinguished Quarterly Journal of Economics, for example, there was no evidence the journal had ever published a paper on climate change. A more general lack of research on climate change issues by social scientists, and management researchers in particular, was pointed out a decade ago in an article by Goodall (2008). She collected bibliometric data on 60 journals across a wide range of social sciences, including the subject of economics, and drew gloomy conclusions. Goodall and Oswald (2019) made the related point that since the year 2000 the 50 journals in the elite so-called FT Journals list had published only 11 articles on species decline and biodiversity (out of 47,000 articles).

Empirical Approach

The data in this study are drawn from the European Social Survey (ESS) in 2016 and the Eurobarometer Survey in 2019. These are large random-sample surveys that cover the continent of Europe.

The first data set, the European Social Survey (ESS), is a biennial cross-national survey of attitudes and behaviour. It was first established in 2001. The ESS uses cross-sectional, probability samples which are representative of all persons aged 15 and over resident within

[3] At a more general level this paper fits alongside work on environmental economics such as Atkinson et al. 2012, Claborn and Brooks 2019, Levinson 2012, Luechinger 2009, and Maddison et al. 2019.

private households in each country. Through time, the number of countries covered by the ESS has grown, and the 2016 sweep provides information on 29 nations (most of them coming from Western Europe). Funded through the European Commission, the ESS survey is one of the main statistical sources that allows comparable cross-national comparisons for the continent of modern Europe. To ensure that the ESS data can be used to make inferences about the general population, and to minimise the margin of error, each country must achieve a minimum effective sample size of 1500 (after discounting for design effects). For smaller countries (those with a population of less than 2 million), this number is reduced to 800. The ESS fieldwork period typically lasts at least six weeks within a five-month period (usually the period from September of the survey year to January of the following year) in each country. The National Coordinator (NC) is responsible for the national implementation of fieldwork, the monitoring of fieldwork and the deliverables. The Survey Agency conducts the fieldwork according to the ESS specifications, provides information on the progress of fieldwork to make monitoring by the NC and the Core Scientific Team (CST) possible, and plays a supporting role in the preparation of deliverables. More details are available through the official ESS website: https://www.europeansocialsurvey.org/about/faq.html.

The 2016 sweep asked a number of questions about climate change. This provides a total sample size of approximately 40,000 randomly selected men and women. Although, at the time of writing, the ESS recently released another sweep of the data (for calendar year 2018), the climate change questions were not repeated, although apparently they may be in the future. It is conceivable that there have been changes in ESS European attitudes since 2016, but this study must examine the data currently available.

The second data set, the Eurobarometer survey, is one of a series with a cross-national longitudinal design, and was designed to compare and gauge trends within Member States of

the European Union. This survey series began in the early 1970s and is now carried out each autumn and spring.

Although the range of questions has been expanded over the years, the programme aims to keep constant much of the content, so that data are reasonably comparable over time. Starting with Eurobarometer 34 (1990), separate supplementary surveys on special topics have been conducted almost every Eurobarometer wave. Special irregular modules have investigated topics such as agriculture, biotechnology, consumer behaviour, elderly people, energy, environment, family, gender issues, health, immigration, poverty, regional identity, science and technology, urban traffic, working conditions, youth, etc., and all from a European perspective. In the case of the Eurobarometer survey in 2019, various questions were asked -- including a mention of climate -- about the main problems that people thought their own country faced. Sample size is approximately 1000 citizens per nation.

The 2019 survey used in this paper allows a total sample of approximately 29,000 adults. These data sets allow us to examine how randomly selected Europeans respond to questions such as:

"How worried are you about climate change?" [Answers can lie on a one to five scale (denoted from Not At All Worried, Not Very Worried, Somewhat Worried, Very Worried, up to Extremely Worried).]

"What do you think are the two most important issues facing (THIS COUNTRY) at the moment?" [Maximum 2 answers from the list: Crime; economic situation; inflation; taxation; unemployment; terrorism; housing; government debt; immigration; health and social security; the education system; pensions; the environment, climate and energy issues].

Principal Findings from the European Social Survey

We begin with patterns in the ESS data. Human beings' feelings and beliefs do not, of course, come with cardinal units of measurement. It is therefore necessary to use survey responses with care.[4]

Figure 1 is one simple illustration of the nature of the continent's, and indeed the world's, problem. Only a small percentage (5%) of European citizens report extreme worry about the changing climate (namely, the level coded as the fifth column in Figure 1). Moreover, only approximately one quarter of Europeans put themselves in either of the two top categories of concern. Instead, in answering the question *How worried are you about climate change?*, Europeans arrange themselves fairly smoothly across all the feasible answers. There is little sign of skewness in the distribution (an environmentalist would hope to see strong negative skew). Treating the answers cardinally, for expositional simplicity in tables, produces a mean worry score of 3.028 on a one-to-five scale in appendix Table A2, and the modal answer is 'somewhat worried'.

Here we have paid attention to the words that humans use. Yet might it be appropriate to take a more sanguine view of these survey responses?

An optimist might argue in the following way. Large numbers of citizens say they are somewhat concerned about the changing climate. When people say 'I am somewhat worried about climate change', an optimist might propose that they are actually expressing a really strong level of concern -- one strong enough to mean a potentially painful climate-change policy could successfully be pushed through in western democracies. On this interpretation, Europe might be severely worried about the changing climate but its citizens could simply be using mild language to describe the problem. That possibility deserves to be taken scientifically seriously.

[4] An extreme view might be that such information should be eschewed entirely. However, that would mean turning our backs, as social scientists, on the crucial role of human feelings and beliefs. Policymakers are not able to do that. They have to fit around humans -- because in a democracy it is, of course, votes by citizens that ultimately determine action.

However, the second data set, the Eurobarometer Survey that is discussed later, helps us to adjudicate on, and throws some direct doubt upon, that type of optimistic interpretation. But even with the ESS data set itself, there are reasons to be doubtful of a sanguine account.

First, it might be expected that the proportions of individuals who claim they care about climate change are over-estimates. It is known that when humans respond to surveys they feel under pressure to give politically correct answers. This is the famous problem of 'social desirability bias', Fisher (1993). As the questions in the ESS survey data set may thus be interpreted by people as encouraging socially responsible answers (a form of so-called priming effect, where respondents are aware they are 'meant' to give a particular answer), the fact that there is no evidence of high levels of concern about the climate is suggestive of, below the surface, a potentially larger and hidden problem of climate-change complacency within the European population.

Second, when faced with the pattern in Figure 1, an analyst who wanted to be optimistic might react in another way. He or she might argue that humans are intrinsically reluctant in survey answers (i) to use the word 'extremely' or indeed (ii) to approach the upper end of any response scale.

Again, there are reasons to be doubtful of that. For example, the Appendix gives data on people's responses in this same 2016 ESS survey about their feelings of satisfaction with life. Here there is a much longer scale than the 5-point used for climate change. On an integer band from zero to ten, where 10 is 'I am extremely satisfied with my life', ten percent of Europeans give the topmost score and say 'extremely' satisfied. That is double the proportion of Europeans who report themselves 'extremely' worried about climate change. Moreover, if we think of compressing the long 0-10 scale into quintiles similar to the worry scale of Figure 1, it can be seen in the appendix that approximately 25% of all Europeans put themselves into

the top fifth of potential life-satisfaction answer (compared to the tiny 5% of Europeans who put themselves in the top fifth of answers about the changing climate).

Nevertheless, an optimistic sceptic might still refuse to accept the apparently dark implications of these worry-data patterns. Hence we return to this topic in a different and complementary way, with Eurobarometer data, in a later section.

Do Europeans Think That Coordinated Action Would Work?

A closely related issue is whether Europe's citizens believe in the value of climate-change policy.

Figure 2 reports ESS data on people's feelings about action. It illustrates a further difficulty, and perhaps an ever deeper one, for modern society.

Here the key survey question is *'Imagine that large numbers of people limited their energy use. How likely do you think it is that this would reduce climate change?*' It can be seen in Figure 2 that many Europeans are unconvinced that cooperative reductions in everyone's use of energy would help – even though modern science would itself be clear that coordinated action on carbon emissions would slow the rise in global temperatures.

In Figure 2's pattern there is slightly more skewness than in Figure 1. Even so, it appears to be much less than might be wished for by an environmentalist who was hoping to reverse climate change. The mean score is 5.603 on a zero-to-ten cardinal scale (see Table A2 in the Appendix), which is not reassuring from an environmentalist's standpoint.

Is there a way to calibrate the objective size of this phenomenon? On the surface it is not possible to be certain how individuals view the answer scaling that they give in Figure 2. Yet one interpretation is numerical in spirit. It comes in two parts. First, survey respondents are asked about the likelihood of something (namely, their perception of the chance of reducing climate change through joint cuts in society's use of energy). In this case, the word 'likelihood'

can presumably be reasonably taken as synonymous with 'probability'. Second, ESS respondents are presented with a cardinal scale from 0 (not at all likely) to 10 (extremely likely) along which they had to answer. Responses close to 10 can presumably be taken as a signal that the person believes the event is close to being a certainty. Answers close to zero are the reverse signal, namely, that the person thinks the event is virtually certain not to occur.

On this quasi-cardinal interpretation, those respondents who mark around the middle of the x-axis on likelihood -- in the histogram in Figure 2 -- are presumably trying to signal that they view it as around a 0.5 probability that if large numbers of individuals limit their energy use then climate change will be reduced. The answer 5 out of 10, as the stated likelihood, is the modal answer in Europe. That might be termed a 50-50 likelihood in common language. Unfortunately, a 50-50 figure might be viewed as troublingly low if the hope is to get large number of Europe's citizens to sign up to substantial, and coordinated, action on anthropogenic climate change.

Might Concern Have Risen More Recently?

Could the fact that the ESS data are from a few years ago be of some comfort? An optimistic commentator could hope that the level of worry about climate change may have increased since then.

We examine 2019 Eurobarometer data shortly. However, the Pew Research Centre, at www.pewresearch.org, carries out a Global Attitudes Survey in a large number of countries (not only European) where respondents are asked each year whether climate change is "a major threat, minor threat or not a threat" to their countries (on Pew data, see also Lewis et al. 2019). Through the years 2016-2018, the proportion of people answering 'major threat' has increased (there are no full data currently for calendar year 2019). This trend rise in the numbers is noticeable but of moderate size. It is an increase of approximately 5.3 percentage

points of the population between 2016 and 2018 (from 62.99% to 68.52%). The proportion of individuals thinking that it is no threat at all has remained roughly constant at approximately 10%. In terms of levels of concern about the changing climate, it is not easy to be certain how the different wordings in the Pew and ESS questions might be interpreted in a way completely consistent between the two data sets. Citizens may feel that climate change is a potential threat without believing that anything needs currently be done. There is also, as ever, the problem of 'social desirability bias' in Pew answers. Overall, however, we think it is reasonable to believe that future ESS surveys will show greater numbers of worried Europeans.

Even if that turns out to be true, it would itself not solve the problem apparent in the paper's Figure 2. That figure provides information about belief in the usefulness of action. It is not about citizens' levels of underlying worry. Even worried voters will resist carbon cuts if they think that coordinated behaviour will not work.

Principal Findings from the Eurobarometer Survey

We now turn to the second data set -- the Eurobarometer of 2019. This asks respondents to choose among societal issues that they view as important. For our purpose, the data set has a special advantage. It asks respondents about their ranking of different kinds of problems in society. A long list -- of 13 possibilities -- is offered in the survey. Survey respondents have to state the two issues they see as of particular importance.

As might be anticipated, different individuals stress different topics. There is considerable heterogeneity. Table 1 gives an overview of the data. It reports the mean values for how many times each topic is mentioned by respondents. The single most-mentioned

national problem is that of Health and Social Security: 25.8% of Europeans emphasize this. The least-mentioned national problem is that of Terrorism: 4.4% of Europeans emphasize this.

In Table 1, the topic Environment, Climate and Energy Issues is fifth in the ranking of societal importance. It is mentioned by 16.3% of Europeans. In other words, approximately one in seven Europeans think of climate change as one of the two most important problems facing society. Therefore climate-change concerns are lower than those about Health and Social Security, Inflation, the Economic Situation, and Unemployment. For policy-makers and environmentalists, this implies that although climate-change concerns are not negligible it is parochial economic considerations that matter to people noticeably more than the climate issue.

When viewed in this way, the results from the European Social Survey and the results from the Eurobarometer Survey paint an apparently consistent story. There is, in the general population, some concern over the climate. A small percentage of citizens really do put high weight on that issue. But the typical citizen does not. The typical citizen is instead focused on narrow economic interests.

Regression Results

What sort of individuals and nations are, and are not, concerned about climate change? To examine that, we estimate regression equations in which the dependent variable is a measure of concern.

Using ESS data, Table 2 defines 'substantially worried' as meaning the person gave the survey answer Extremely or Very. Table 3 depicts a linear probability equation. People's characteristics are listed vertically on the left hand side of Table 3. Positive coefficients in the vertical list imply a greater amount of significant worry. The dependent variable in Table 3 is thus unity for those people -- just over a quarter of the ESS sample -- who report being either

extremely worried or very worried. The base category (the people who are then zeroes) is for all other lower levels of worry.

In Table 3, the key estimated results are that worry about climate change is greater among females (for example, the coefficient is 0.037 with a standard error of 0.005), the unemployed, those in good health, the young, ethnic minorities, the highly educated (with an especially large coefficient of 0.126 on higher tertiary education), those who are left-wing in their politics, and citizens of large cities.

Table 4 is a similar kind of regression equation but now with 2019 Eurobarometer data. Women tend to put slightly greater weight on climate change as a major societal problem (the coefficient is 0.009 with a standard error of 0.004). The old care far less than the young (for example, the coefficient on over-75-years-in-age is -0.051 with a standard error of 0.013). The highly educated care more than those with little education (for example, the coefficient on educated-beyond-the-age-of-20 is 0.067 with a standard error of 0.007).

Table 5 is an equivalent regression equation on people's belief that coordinated cutting of energy use would be beneficial to climate change. Many similar patterns of coefficient signs are found as in Table 3.

Figure 3 turns from data on different kinds of people to data on different kinds of countries. It reveals a potentially noteworthy pattern across nations. Warmer places have citizens who worry more about climate change. Here we use the regression in Table 3 to create what can be thought of as an adjusted country-worry coefficient. That estimated coefficient is positively correlated with the average temperature in 2016 (the year of interview) in the country. This finding is reminiscent of Donner and McDaniels (2013), who showed that, within the United States, people's worry about climate change is influenced by recent temperatures that they have experienced in their local area. See also Zander et al. (2019).

We checked that our result is not simply because Eastern Europe is colder than Western Europe. The same scatter plot, about worry and temperature, holds in the subsample for Western Europe alone (see the estimate in the footnotes for the Figure).

There is also an upward sloping pattern in Figure 3. However, there is an important caveat here. In this case the positive gradient disappears when Eastern Europe is excluded. A higher temperature -- even though it signals greater worry about global warming -- apparently does not truly make people more likely to believe in the success of cooperative action on climate change.

One further fact should be recorded, because it may be relevant to the likely returns on an investment in altering voters' attitudes.

Using the ESS data set, it is possible to calculate the number of people who are both worried about climate change and who do not believe that the problem will be reduced by us all jointly restricting our use of energy. The reason this group is particularly interesting is that these individuals might be viewed as fertile possibilities -- namely as potential switchers -- in a voting campaign for green policies. The number of those in our data set is 3,764 men and women, which is a little below 10% of our sample. To calculate the number, we used the 'Imagine large numbers of people reduced energy use, how likely to reduce CC' question and assumed anyone with a value of 5 or less (out of ten) would think it is 'unlikely'. Substantial worry is defined as answering in the top-2 categories out of five. For the overlap group (substantial worry + not convinced of joint action's effectiveness), a policymaker's campaign would need only to change their perception of the effectiveness of everyone limiting their energy use.

Finally, on those who think that collective action would be likely to work, but are not greatly worried (that is, not in the top-2 worry categories), there are 15,832 such people in the sample.

Conclusions

The evidence in this paper suggests that Europeans do not greatly care about climate change. The calculations draw on two recent sources that cover 70,000 randomly sampled males and females.

It would be wrong to argue that Europe's citizens are wholly complacent. It should also be emphasized that there exists a small percentage of citizens who put very high weight on the issue of climate change.[5] Nevertheless, the majority of the continent's citizens are instead focused upon parochial economic matters that might affect their immediate lives:

- Only 5% of European citizens, for example, say they are extremely worried about climate change.
- Climate change is rated fifth in a ranking of societal problems.
- Large numbers of Europeans say they do not believe that coordinated reductions in energy use would slow the rate of climate change.
- Colder European countries tend to be the least concerned about climate change.

How should economic policy-makers react to these troubling findings? One approach to a solution might be -- although economists are little-used to thinking this way -- to exploit public-information programmes as a key policy instrument (as advocated in Weiss and Tschirhart 1994 and studies since). This was, in part, the approach taken by the health authorities of the world on the issue of smoking, and there is randomized-controlled-trial evidence of its success in the domain of cigarette smoking cessation (for example, Brewer et al. 2016, Noar et al. 2016; Hall et al. 2020). In that case, governments produced large amounts of public information on the dangers of smoking. They provided their countries -- and still do

[5] It would be useful if future research could ascertain whether this proportion rises when there is newspaper publicity about natural disasters like the Australian bush fires of 2019.

-- with fierce warnings about the need to quit cigarettes. That kind of public-information programme was coupled with fiscal incentives. Yet arguably it was the information programme that first changed people's feelings and beliefs, and thereby, indirectly, allowed politicians eventually to push through the tax schemes on cigarette smoking.

The findings in this study appear to present economists, the world, and especially our unborn great grandchildren, with a fundamental difficulty. In a democracy, policy proposals have to build upon a platform of generalized assent in society. There is little point in designing sophisticated economic policies for combatting climate change until voters feel that climate change is a deeply disturbing problem. Currently, those voters do not.

REFERENCES

Atkinson, G., Bateman, I., Mourato, S. (2012). Recent advances in the valuation of ecosystem services and biodiversity. Oxford Review of Economic Policy, 28, 22-47.

Baylis, P. (2020). Temperature and temperament: Evidence from Twitter. Journal of Public Economics, 184, article number 101461.

Benton, G.S. (1970). Carbon dioxide and its role in climate change. Proceedings of the National Academy of Science of the USA, 67, 898-891.

Bernstein, A., Gustafson, M.T., Lewis, R. (2019). Disaster on the horizon: The price effect of sea level rise. Journal of Financial Economics, 134, 253-272.

Bord, R.J., Fisher, A., O'Connor, R.E. (1998). Public perceptions of global warming: United States and international perspectives. Climate Research, 11, 75-84.

Bose, N., Hills, T., Sgroi, D. (2020). Climate change and diet. IZA Discussion Paper 13426.

Brewer, N.T., Hall, M.G., Noar, S.M., Parada, H., Al S-S, Bach, L.E., Hanley, S., Ribisl, K.M. (2016). Effect of pictorial cigarette pack warnings on changes in smoking behaviour: A randomized clinical trial, JAMA Internal Medicine, 176, 905-912.

Chapman, D., Khanna, N. (2000). Crying no wolf: Why economists don't worry about climate change, and should. Climatic Change, 47, 225-232.

Claborn, K.A., Brooks, J.S. (2019). Can we consume less and gain more? Environmental efficiency of wellbeing at the individual level. Ecological Economics, 156, 110-120.

Cody, E.M., Reagan, A.J., Mitchell, L., Dodds, P.S., Danforth, C.M. (2015). Climate change sentiment on Twitter: An unsolicited public opinion poll. PLOS ONE, 10, 8, article number e0136092.

Deschenes, O., Greenstone, M. (2007). The economic impacts of climate change: Evidence from agricultural output and random fluctuations in weather. American Economic Review, 97, 354-385.

Deschenes, O., Kolstad, C. (2011). Economic impacts of climate change on California agriculture. Climatic Change, 109, 365-386.

Donner, S.D., McDaniels, J. (2013). The influence of national temperature fluctuations on opinions about climate change in the US since 1990. Climatic Change, 118, 537-550.

Ehlert, A., Seidel, J., Weisenfeld, U. (2020). Trouble on my mind: the effect of catastrophic events on people's worries. Empirical Economics, 59, 951-975.

Engelberg, J., Parsons, C.A. (2016). Worrying about the stock market: Evidence from hospital admissions. Journal of Finance, 71, 1227-1250.

Fisher, R.J. (1993). Social desirability bias and the validity of indirect questioning. Journal of Consumer Research, 20, 303-315.

Gibson, M., Mullins, J. (2020). Climate risk and beliefs in New York floodplains. IZA Discussion Paper 13553.

Goodall, A.H. (2008). Why have the leading journals in management (and other social sciences) failed to respond to climate change? Journal of Management Inquiry, 17, 408-420.

Goodall, A.H., Oswald, A.J. (2019). Researchers obsessed with FT Journals list are failing to tackle today's problems. Financial Times, 8 May.

Hall, M.G., Grummon, A.H., Lazard, A.J., et al. (2020). Reactions to graphic and text health warnings for cigarettes, sugar-sweetened beverages, and alcohol: An online randomized experiment of US adults. Preventive Medicine, 137, article number 106120.

Heal, G. (2017). The economics of the climate. Journal of Economic Literature, 55, 1046-1063.

Hepburn, C.J., Quah, J.K.H., Ritz, R.A. (2013). Emissions trading with profit-neutral permit allocations. Journal of Public Economics, 98, 85-99.

Hepburn, C.J., Teytelboym, A. (2017). Climate change policy after Brexit. Oxford Review of Economic Policy, 33, S144-S154.

Hepburn, C., Stern, N., Stiglitz, J.E. (2020). 'Carbon pricing' special issue in the European Economic Review. European Economic Review, 127, article number 103440.

Levinson, A. (2012). Valuing public goods using happiness data: The case of air quality. Journal of Public Economics, 96, 869-880.

Lewis, G.B., Palm, R., Feng, B. (2019). Cross-national variation in determinants of climate change concern. Environmental Politics, 28, 793-821.

Lorenzoni, I., Pidgeon, N.F. (2006). Public views on climate change: European and USA perspectives. Climatic Change, 77, 73-95.

Loureiro, M.L., Allo, M. (2020). Sensing climate change and energy issues: Sentiment and emotion analysis with social media in the UK and Spain. Energy Policy, 143, article number 111490.

Luechinger, S. (2009). Valuing air quality using the life satisfaction approach. Economic Journal, 119, 482-515.

Ma, Y., Nolan, A., Smith, J.P. (2020). Free GP care and psychological health: Quasi-experimental evidence from Ireland. Journal of Health Economics, 72, article number 102351.

Madden, R.A., Ramanathan, V. (1980). Detecting climate change due to increasing carbon-dioxide. Science, 209, 763-768.

Maddison, D., Rehdanz, K., Welsch, H. (eds.) (2019). Handbook on wellbeing, happiness and the environment, Edward Elgar, London.

Marquart-Pyatt, S.T., Qian, H., Houser, M.K., McCright, A.M. (2019). Climate change views, energy policy preferences, and intended actions across welfare state regimes: Evidence from the European Social Survey, International Journal of Sociology, 49, 1-26,

Mullins, J., White, C. (2019). Temperature and mental health: Evidence from the spectrum of mental health outcomes. IZA Discussion Paper 12603.

Noar, S.M., Hall, M.G., Francis, D.B., Ribisl, K.M., Pepper, J.K., Brewer, N.T. (2016). Pictorial cigarette pack warnings: a meta-analysis of experimental studies. Tobacco Control, 25, 341-354.

Nordhaus, W.D. (1991). To slow or not to slow: the economics of the greenhouse effect. Economic Journal, 101, 920-937.

Oswald, A.J., Stern, N. (2019). Why are economists letting down the world on climate change? VoxEU.

Poortinga, W., Whitmarsh, L., Steg, L., Bohm, G., Fisher, S. (2019). Climate change perceptions and their individual-level determinants: A cross-European analysis. Global Environmental Change – Human and Policy Dimensions, 55, 25-35.

Powdthavee, N. (2020). The causal effect of education on climate literacy and pro-environmental behaviours: Evidence from a nationwide natural experiment. IZA Discussion Paper 13210.

Sachs, J.D. (2019). Getting to a carbon-free economy. American Prospect December 5.

Stern, N. (2007). The economics of climate change. Cambridge University Press, Cambridge, UK

Stern, N. (2015). Why are we waiting? The logic, urgency, and promise of tackling climate change, MIT Press.

Stern, N. (2018). Public economics as if time matters: Climate change and the dynamics of policy. Journal of Public Economics, 162, S.I., 4-17.

Tol, R.S.J. (2008). Why worry about climate change? A research agenda. Environmental Values, 17, 437-470.

Tol, R.S.J. (2009). The economic effects of climate change. Journal of Economic Perspectives, 23, 29-51.

Tol, R.S.J. (2018). The economic impacts of climate change. Review of Environmental Economics and Policy, 12, 4-25.

Weber, E.U. (2010). What shapes perceptions of climate change? Wiley Interdisciplinary Reviews – Climate Change. 1, 332-342.

Weiss, J.A., Tschirhart, M. (1994). Public information campaigns as policy instruments. Journal of Policy Analysis and Management, 13, 82-119.

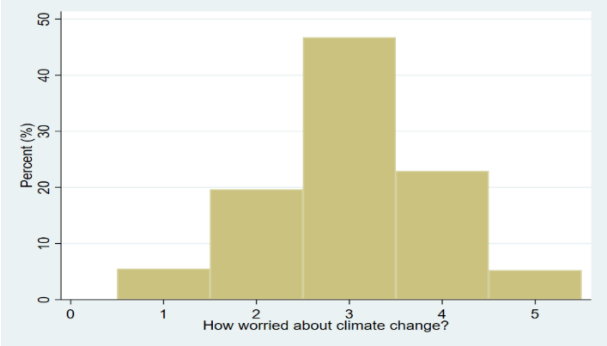
Weitzman, M.L. (2009). On modelling and interpreting the economics of catastrophic climate change. Review of Economics and Statistics, 91, 1-19.

Weitzman, M. L. (2017). On a World Climate Assembly and the social cost of carbon. Economica, 84, 82-119.

Zander, K.K., Moss, S., Garnett, S.T. (2019). Climate change-related heat stress and subjective well-being in Australia. Weather Climate and Society, 11, 505-520.

Figure 1. Europeans Do Not Exhibit High Levels of Worry About Climate Change. ESS Data

[This figure uses the full European sample of approximately 40,000 adults]

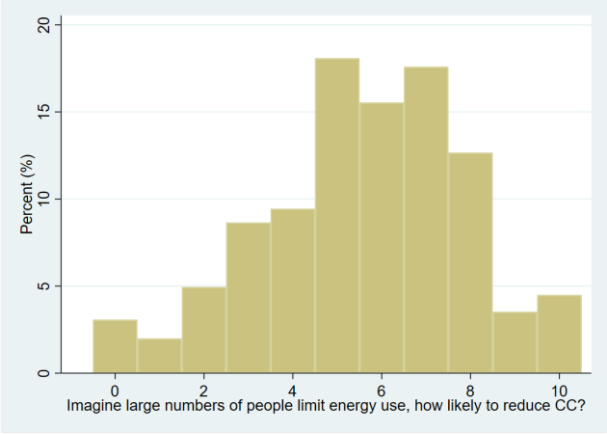


Notes

The vertical axis is in percentages of the population. It draws on answers given in the 2016 European Social Survey to the question *'How worried are you about climate change?'* Answers can lie on a one to five scale (marked from Not At All Worried, Not Very Worried, Somewhat Worried, Very Worried, up to Extremely Worried).

Figure 2. Europeans Do Not Think Climate Change Would Be Greatly Reduced if Everyone Limited Their Energy Use. ESS Data

[This figure uses the full European sample of approximately 40,000 adults]

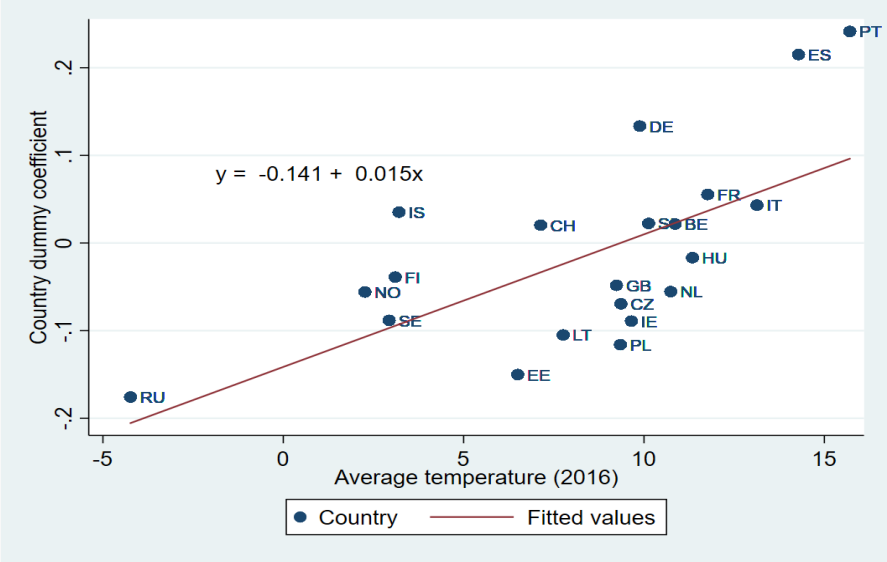


Notes

The vertical axis is in percentages of the population. It draws on answers given in the 2016 European Social Survey to the question *'Imagine that large numbers of people limited their energy use. How likely do you think it is that this would reduce climate change?*' Answers can lie on a zero to 10 scale (marked from Not At All Likely up to Extremely Likely).

Figure 3. A Positive Correlation Between the Level of Worry About Climate Change and the Average Temperature in a Country. ESS Data

[This figure uses the full European sample of approximately 40,000 adults]



Notes

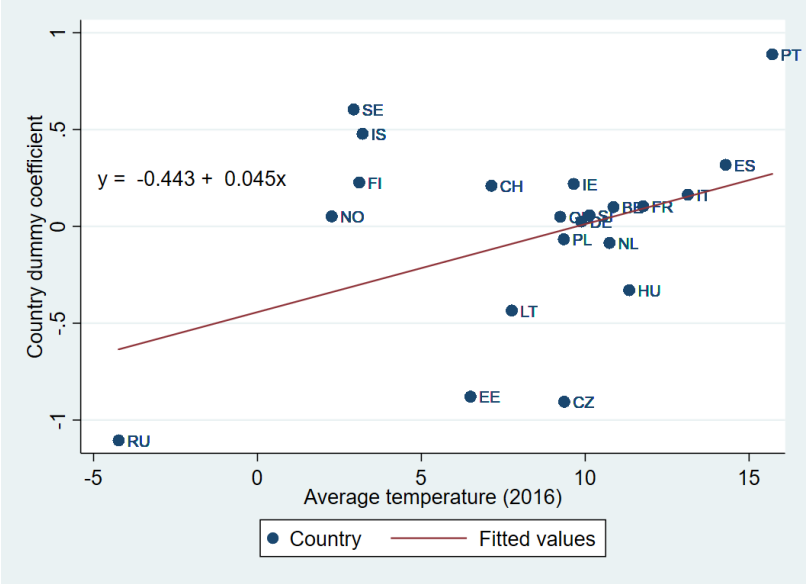
The vertical axis draws on answers in the European Social Survey to the question *'How worried are you about climate change?'* Answers can lie on a one to five scale (marked from Not At All Worried up to Extremely Worried).

The dots in the figure are country-dummy coefficients calculated using a regression-equation specification as in Table 3. The average temperature is from https://climateknowledgeportal.worldbank.org/download-data.

If the East European nations are excluded here, the slope of the fitted line remains almost unchanged at y = -0.122 + 0.016x. If Russia alone is excluded, the above gradient increases a little but the paper's results are not greatly affected.

Figure 4. A Positive Correlation Between the Belief in the Likelihood of Reduced Climate Change after Collective Limits and the Average Temperature in the Country. ESS Data

[This figure uses the full European sample of approximately 40,000 adults]



Notes

The vertical axis draws on answers in the European Social Survey to the question *'Imagine that large numbers of people limited their energy use. How likely do you think it is that this would reduce climate change?'* Answers can lie on a zero to 10 scale (marked from Not At All Likely up to Extremely Likely).

The dots in the figure are country-dummy coefficients calculated using a regression-equation specification as in Table 5. The average temperature is from https://climateknowledgeportal.worldbank.org/download-data.

If the Eastern European nations are excluded here, the slope of the fitted line flattens considerably to y = 0.191 + 0.001x.

Table 1.

Measuring Europeans' Feelings About Societal Issues: Ranked by Perceived Importance. Eurobarometer Data

Variable	Mean	SD	Mentioned	Not mentioned
Health and social security	.258	.437	7,447	21,452
Rising prices / inflation / cost of living	.236	.425	6.833	22,066
Economic situation	.184	.388	5,330	23,569
Unemployment	.183	.386	5,276	23,632
The environment, climate and energy issues	.163	.369	4,720	24,179
Immigration	.155	.362	4,468	24,431
Pensions	.144	.352	4,173	24,726
Crime	.113	.317	3,264	25,635
The education system	.11	.313	3,192	25,707
Housing	.104	.306	3,019	25,880
Government debt	.0952	.293	2,751	26,148
Taxation	.0812	.273	2,348	26,551
Terrorism	.0435	.203	1,256	27,643

Notes

The sample size (N) is 28,899. The answers are ordered according to frequency of being mentioned in response to the question: "What do you think are the two most important issues facing (OUR COUNTRY) at the moment? (Max. 2 answers)".

Some answers are omitted from the above table: Don't know 'DK', 'Other (SPONTANEOUS)' and 'None (SPONTANEOUS)'.

Table 2.

2a. Dependent-Variable Descriptions. ESS Data

Variable	Definition	Coding in the Regression
Substantially worried	How worried are you about climate change?	1 = "Extremely worried" and "Very worried", 0 = "Somewhat worried", "Not very worried", and "Not at all worried"
Collective limit's likely effect	Now imagine that large numbers of people limited their energy use. How likely do you think it is that this would reduce climate change?	0 "Not at all likely" up to 10 "Extremely likely"

2b. Dependent-Variables: Summary Statistics. ESS Data

Variable	N	Mean	SD	Min	Max
Substantially worried*	41448	.274	.446	0	1
Collective limit's likely effect	39048	5.603	2.301	0	10

*Here 'substantially worried' is again coded as answering in the top-two categories out of five.

Table 3.

Regression Equation for Substantially Worried About Climate Change. ESS Data 2016.

	Substantially Worried
Female	0.037***
	(0.005)
Unemployed	0.069***
	(0.011)
Good health	-0.004
	(0.007)
Fair health	0.001
	(0.008)
Bad health	0.052***
	(0.011)
Very bad health	0.075***
	(0.022)
20-24	-0.040***
	(0.013)
25-29	-0.045***
	(0.013)
30-34	-0.039***
	(0.013)
35-39	-0.041***
	(0.013)
40-44	-0.056***
	(0.013)
45-49	-0.056***
	(0.013)
50-54	-0.048***
	(0.013)
55-59	-0.009
	(0.013)
60+	-0.058***
	(0.011)
Child home	-0.007
	(0.006)
Ethnic minority	0.024***
	(0.009)
Married	-0.003
	(0.005)
Lower secondary educ.	0.037***
	(0.010)
Lower tier upper sec. educ.	0.055***
	(0.010)
Upper tier upper sec. educ.	0.082***
	(0.010)
Advanced vocational, sub-deg.	0.074***
	(0.011)
Lower tertiary educ.	0.127***
	(0.012)
Higher tertiary educ.	0.126***
	(0.011)
Ideology right-leaning	-0.017***
	(0.001)
Suburbs or outskirts of big city	0.008
	(0.009)

Town or small city	-0.029***
	(0.007)
Country village	-0.033***
	(0.007)
Farm or home in countryside	-0.047***
	(0.013)
Observations	35,819
R-squared	0.089
Prob > F	<0.001
Country Dummies	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes

The dependent variable 'Substantially worried' is coded as 1 if the respondent gives either of the top-two worry categories ('extremely' or 'very') out of five categories. See Table 2a, b.

For simplicity, this is a linear-probability equation (a probit equation gives equivalent results).

The regression sample excludes the 348 people who say that climate change is not happening. The Appendix gives background information on their characteristics.

Table 4.

Regression Equation for Who Considers Environment, Climate and Energy An Important Issue. Eurobarometer Data 2019.

VARIABLES	***Climate is important***
Female	0.009**
	(0.004)
Unemployed	-0.022**
	(0.009)
25-34	-0.002
	(0.011)
35-44	-0.010
	(0.012)
45-54	-0.018
	(0.012)
55-64	-0.013
	(0.012)
65-74	-0.032***
	(0.012)
75+	-0.051***
	(0.013)
Child home	-0.003
	(0.005)
Married	0.012**
	(0.005)
16-19 Educ. Years	0.009
	(0.007)
20+ Educ. Years	0.067***
	(0.007)
Still studying	0.096***
	(0.014)
No full-time education	-0.035
	(0.023)
Ideology right-leaning	-0.010***
	(0.001)
Observations	26,536
R-squared	0.162
Prob > F	<0.001
Country Fixed Effects	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes

(i) The dependent variable is coded as a dummy variable. It takes the value of 1 when an individual mentioned "The environment, climate and energy issues" when being asked about what they considered the two most important issues facing their country at the moment.

(ii) For simplicity, this is a linear-probability equation (a probit equation gives equivalent results).

Table 5.

Regression Equation for Beliefs About Whether Collective Limits Would Be Effective. ESS Data 2016.

	Collective limit's likely effectiveness
Female	0.269***
	(0.024)
Unemployed	-0.090
	(0.059)
Good health	-0.211***
	(0.034)
Fair health	-0.268***
	(0.039)
Bad health	-0.363***
	(0.058)
Very bad health	-0.660***
	(0.120)
20-24	-0.319***
	(0.067)
25-29	-0.620***
	(0.068)
30-34	-0.595***
	(0.068)
35-39	-0.499***
	(0.070)
40-44	-0.413***
	(0.070)
45-49	-0.545***
	(0.069)
50-54	-0.595***
	(0.067)
55-59	-0.388***
	(0.070)
60+	-0.608***
	(0.058)
Child home	0.078**
	(0.031)
Ethnic minority	-0.012
	(0.050)
Married	-0.038
	(0.029)
Lower secondary educ.	0.139***
	(0.051)
Lower tier upper sec. educ.	0.055
	(0.055)
Upper tier upper sec. educ.	0.138***
	(0.053)
Advanced vocational, sub-deg.	0.186***
	(0.056)
Lower tertiary educ.	0.306***
	(0.063)
Higher tertiary educ.	0.366***

	(0.056)
Ideology	-0.027***
	(0.006)
Suburbs or outskirts of big city	-0.012
	(0.048)
Town or small city	-0.021
	(0.035)
Country village	-0.063*
	(0.036)
Farm or home in countryside	-0.133*
	(0.068)
Observations	34,235
R-squared	0.061
Prob > F	<0.001
Country Dummies	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes

The dependent variable is coded cardinally from 0 up to 10.

For simplicity, this is a linear-probability equation (a probit equation gives equivalent results).

The regression sample excludes the 348 people who say that climate change is not happening.

Appendix
(for online publication only)

APPENDIX TABLES FOR THE EUROPEAN SOCIAL SURVEY

Table A1.

Measuring Europeans' Beliefs About Climate Change: The ESS Questions

[In the ESS data set, the questions below are asked of respondents in the same order as below. Hence that ordering is maintained in later tables, even though the focus of the paper is on particular questions, as marked in italics.]

Variable	Definition	Coding
I think climate is not changing	You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing?	1 "Definitely changing"; 2 "Probably changing"; 3 "Probably not changing"; 4 "Definitely not changing"
Cause of CC	Do you think that climate change is caused by natural processes, human activity, or both?	1 "Entirely by natural processes" up to 5 "Entirely by human activity" (55 – "I don't think climate change is happening)
Personal responsibility	To what extent do you feel a personal responsibility to try to reduce climate change?	0 "Not at all" up to 10 "A great deal"
Level of worry	*How worried are you about climate change?*	*1 "Not worried at all" up to 5 "Extremely worried"*
Collective limit's likely effectiveness	*Now imagine that large numbers of people limited their energy use. How likely do you think it is that this would reduce climate change?*	*0 "Not at all likely" up to 10 "Extremely likely"*
Government enough	And how likely do you think it is that governments in enough countries will take action that reduces climate change?	0 "Not at all likely" up to 10 "Extremely likely"
Own limit energy	How likely do you think it is that limiting your own energy use would help reduce climate change?	0 "Not at all likely" up to 10 "Extremely likely"

Table A2. Overall Sample: Summary Statistics on Europeans' Beliefs. ESS Data

Variable	N	Mean	SD	Min	Max
I think climate is not changing	40746	1.511	.674	1	4
Cause of CC	39743	3.422	.789	1	5
Personal responsibility	39679	5.597	2.698	0	10
Level of worry	*40271*	*3.028*	*.924*	*1*	*5*
Collective limit's likely effect	*39048*	*5.603*	*2.301*	*0*	*10*
Government enough	38962	4.588	2.194	0	10
Own limit energy	39508	4.356	2.631	0	10

Table A3. By Gender: Summary Statistics on Europeans' Beliefs. ESS Data

	Males			**Females**		
Variable	N	Mean	SD	N	Mean	SD
I think climate is not changing	19299	1.537	.697	21447	1.488	.651
Cause of CC	18788	3.424	.812	20955	3.42	.769
Personal responsibility	18813	5.521	2.695	20866	5.666	2.699
Level of worry	*19007*	*2.973*	*.932*	*21264*	*3.077*	*.914*
Collective limit's likely effect	*18570*	*5.482*	*2.373*	*20478*	*5.713*	*2.227*
Government enough	18586	4.589	2.24	20376	4.587	2.151
Own limit energy	18776	4.263	2.669	20732	4.441	2.592

Table A4. By Region: Summary Statistics on Europeans' Beliefs. ESS Data

	West			**East**		
Variable	N	Mean	SD	N	Mean	SD
I think climate not changing	29186	1.431	.613	11560	1.712	.771
Cause of CC	28746	3.474	.766	10997	3.285	.832
Personal responsibility	28764	6.088	2.52	10915	4.305	2.725
Level of worry	*29083*	*3.118*	*.898*	*11188*	*2.793*	*.949*
Collective limit's likely effect	*28360*	*5.833*	*2.246*	*10688*	*4.993*	*2.333*
Government enough	28336	4.519	2.175	10626	4.773	2.235
Own limit energy	28632	4.515	2.626	10876	3.939	2.597

Table A5. By Age (30 or Under vs Above 30): Summary Statistics on Europeans' Beliefs. ESS Data

	Young (30 or under)			Old (Above 30)		
Variable	N	Mean	SD	N	Mean	SD
I think climate not changing	7936	1.493	.674	32810	1.515	.674
Cause of CC	7746	3.527	.787	31997	3.396	.788
Personal responsibility	7751	5.568	2.567	31928	5.605	2.729
Level of worry	*7817*	*3.046*	*.936*	*32454*	*3.024*	*.921*
Collective limit's likely effect	*7656*	*5.761*	*2.221*	*31392*	*5.565*	*2.318*
Government enough	7653	4.621	2.148	31309	4.58	2.205
Own limit energy	7722	4.35	2.553	31786	4.358	2.649

Table A6. By Age (Under 25 vs Above 50): Summary Statistics on Europeans' Beliefs. ESS Data

	Young (25 or under)			Old (50 or above)		
Variable	N	Mean	SD	N	Mean	SD
I think climate not changing	5039	1.481	.67	20403	1.536	.671
Cause of CC	4944	3.549	.778	19872	3.347	.79
Personal responsibility	4935	5.567	2.509	19803	5.468	2.793
Level of worry	*4977*	*3.076*	*.935*	*20219*	*3.002*	*.928*
Collective limit's likely effect	*4871*	*5.856*	*2.183*	*19385*	*5.504*	*2.32*
Government enough	4860	4.673	2.131	19353	4.613	2.212
Own limit energy	4909	4.383	2.517	19691	4.313	2.67

Table A7. Young Educated Women (30 or under) vs Old Uneducated Men (50 or above): Summary Statistics on Europeans' Beliefs. ESS Data

	Young Women (Under 30, degree)			Old Men (50 or above, no degree)		
Variable	N	Mean	SD	N	Mean	SD
I think climate not changing	968	1.415	.629	7495	1.576	.7
Cause of CC	947	3.58	.76	7279	3.345	.825
Personal responsibility	942	6.32	2.339	7289	5.31	2.786
Level of worry	*953*	*3.239*	*.915*	*7405*	*2.93*	*.941*
Collective limit's likely effect	*938*	*6.108*	*2.102*	*7155*	*5.379*	*2.373*
Government enough	945	4.613	2.068	7171	4.59	2.262
Own limit energy	946	4.667	2.534	7266	4.252	2.673

Table A8. The Variables Used as Controls in the Regressions. ESS Data

Variable	N	Mean	SD	Min	Max
Female	41448	.527	.499	0	1
Unemployed	41448	.04	.197	0	1
Health	41395	2.22	.909	1	5
Age	41325	49.268	18.543	15	100
Child home	41448	.342	.474	0	1
Ethnic minority	41448	.055	.228	0	1
Married	41448	.482	.5	0	1
Education	41325	3.986	1.853	1	7
Ideology	35952	5.118	2.182	0	10
Domicile	41398	2.94	1.213	1	5

Table A9. Descriptions of Control Variables. ESS Data

Variable	Definition	Coding
Female	Respondent's gender	1 = "Female" – 0 "Male"
Unemployed	Doing last 7 days: unemployed, actively looking for job	1 "Unemployed" – 0 "Employed"
Health	Respondent's subjective health	1 = "Very good" up to 6 = "Very bad"
Age	Respondent's age category	1 = "15-20" up to 10 = "60+"
Child home	Children living at home or not	1 = "Respondent lives with children at household grid" – 0 "Does not"
Ethnic minority	Respondent belonging to a minority ethnic group	1 = "Yes" – 0 = "No"
Married	Marital status	1 = "Married", 0 = "Other"
Education	Generated variable: Highest level of education, ES - ISCED	1 = "ES-ISCED I, less than lower secondary" – 7 = "ES-ISCED V2, higher tertiary education, >= MA level"
Ideology	Left-Right self-placement on the ideological scale	0 = "Left" up to 10 = "Right"
Domicile	Domicile, respondent's description.	1 = "Big city"; 2 = "Suburbs/ outskirts of a big city"; 3 = "Town or small city"; 4 = "Country Village"; 5 = "Farm or home in countryside"

Further Notes on the ESS Data

The appendix lays out the answers to a number of other questions asked in the European Social Survey (and in the order of asking). There could reasonably be different interpretations of these patterns, but one reading is as follows.

First, there seems to be fairly considerable support in Europe for the broad idea that the climate is changing (see the mean of 1.511, and standard deviation of 0.674) in Table A2. Perhaps this is to be expected as many citizens have themselves lived through demonstrably warm recent summers. Second, there is mild support for the view that climate change is anthropogenic and that people have some personal responsibility to do something about it in their own lives (see the means of 3.422 and 5.597 respectively). Third, there is less support for the idea that governments will do enough, or that an individual, on his or her own, can contribute in any substantive way (see the means of 4.588 and 4.356 respectively). Nevertheless, the imputed cardinality here should be kept in mind as a potential weakness in any firmly held conclusions of this particular sort.

Tables A3-A7 divide the data into a large number of sub-categories. Broadly, these cross-tabulations show that concern about climate change is lower in Eastern Europe, among older people, among less-educated citizens, and among males when compared to females.

Similar results are produced in a more formal way, for the two variables (worry and a belief in joint action) of particular interest in the current paper, in the regression equations of Tables 3-5. The variables are defined and explained in the Appendix.

Table A10: An Example of the Use of 'Extremely'…in Life Satisfaction Data

Life Satisfaction	Frequency	Percent (%)	Cumulative %
Extremely dissatisfied	435	1.05	1.05
1	286	0.69	1.75
2	688	1.67	3.41
3	1,374	3.33	6.74
4	1,634	3.96	10.70
5	4,161	10.08	20.78
6	3,936	9.54	30.32
7	7,571	18.34	48.66
8	10, 694	25.91	74.56
9	6,240	15.12	89.68
Extremely satisfied	4,260	10.32	100.00

Notes

The question of interest above draws on the answers given in the European Social Survey to the question '*All things considered, how satisfied are you with your life as a whole nowadays?*' Answers lie on a 0 to 10 scale (marked from Extremely dissatisfied up to Extremely satisfied). The sample size used to produce the above table is 41,279 individuals.

Table A11: The Characteristics of Those Who Say Climate Change is Not Happening

Climate-change deniers: summary statistics

Variable	N	Mean	SD	Min	Max
Female	348	.511	.501	0	1
Unemployed	348	.023	.15	0	1
Health	347	2.427	.987	1	5
Age	344	49.067	18.977	15	93
Child home	348	.319	.467	0	1
Ethnic minority	348	.164	.371	0	1
Married	348	.46	.499	0	1
Education	348	3.882	1.857	1	7
Ideology	246	5.354	2.476	0	10
Domicile	348	2.586	1.28	1	5

APPENDIX TABLES FOR THE EUROBAROMETER SURVEY

Table A12. Measuring European's Preferences About Climate Change: The Eurobarometer Questions

Variable	Definition	Coding
Climate important	What do you think are the two most important issues facing (OUR COUNTRY) at the moment? (Max. 2 answers)	1 "The environment, climate and energy issues"; 0 "Not mentioned"
Climate personal issue	And personally, what are the two most important issues you are facing at the moment? (Max. 2 answers)	1 "The environment, climate and energy issues"; 0 "Not mentioned"
Energy Union Priority: [X]	In your opinion, which of the following objectives should be given top priority In a European Union energy union? (max 3 answers). Three answers considered, defined as [X], are: "Environmental protection", "Fighting global warming", and "Renewable energy". Separate dummy variables constructed for each answer.	1 "[X] mentioned in answer"; 0 "Not mentioned".
[X] important: EU	What do you think are the two most important issues facing the EU at the moment? Answers considered ([X]) are "The environment" and "Climate change". Two separate dummy variables.	1 "[X] mentioned in answer"; 0 "Not mentioned"
EU-level decisions: climate	For each of the following areas, please tell me if you believe that more decision-making should take place at a European level or on the contrary that less decision-making should take place at a European level. The answer considered is "Protecting the environment".	1 "More decision-making at European level"; 2 "Less decision-making at European Level"; 3 "No change is needed (SPONTANEOUS)"
Voting reason: climate	Which are the issues which made you vote in the recent European Parliament elections? Firstly? Answer considered: "Combating climate change and protecting the environment"	1 "Combating climate change and protecting the environment"; 0 "Other"
Issue dev. countries: climate	Which of the following challenges do you consider the most pressing for the future of developing countries? The answer considered is "Environmental protection and climate change"	1 "Environmental protection and climate change"; 0 "Other"

Table A13. The Variables Used as Controls in the Regressions: Eurobarometer

Variable	N	Mean	SD	Min	Max
Female	29,304	.534	.499	0	1
Unemployed	29,304	.044	.246	0	1
Age	29,304	50.0	18.1	15	98
Child home	29,304	.378	.485	0	1
Married	29,304	.530	.499	0	1
Education	29,304	2.37	.839	1	5
Ideology	26,536	5.27	2.36	1	10

Note: Age is presented in its uncategorized version, i.e. in the regression equation we use a 7-level version of age dummies.

Table A14. Descriptions of Control Variables: Eurobarometer

Variable	Definition	Coding
Female	Respondent's gender	1 = "Female" – 0 "Male"
Unemployed	Respondent's current occupation: unemployed or currently not working.	1 "Unemployed" – 0 "Employed"
Age	Respondent's age category	1 = "15-24" up to 7 = "75+"
Child home	Respondent part of single household with children or multiple household with children.	1 = "Respondent lives with children at household grid" – 0 "Does not"
Married	Marital status (Married or Re-married)	1 = "Married", 0 = "Other"
Education	Respondent's age when stopped full-time education, recoded into 5 categories.	1 = "Up to 15"; 2 = "16-19"; 3 = "20+"; 4 = "Still studying", 5= "No full-time education";
Ideology	Left-Right self-placement on the ideological scale	1 = "Left" up to 10 = "Right"

Table A15. Overall Sample: Summary Statistics on Europeans' Beliefs: Eurobarometer

Variable	N	Mean	SD	Min	Max
Climate important	28,899	.163	.369	0	1
Climate personal issue	28,899	.117	.322	0	1
Energy union: env. prot.	24,707	.402	.49	0	1
Energy union: glob. warm.	24,707	.353	.48	0	1
Energy union: ren. energy	24,707	.449	.49	0	1
Environment important: EU	24,707	.123	.33	0	1
Climate change important: EU	24,707	.220	.414	0	1
EU-level decisions: climate	23,806	1.23	.48	1	3
Voting reason: climate	29,304	0.067	.25	0	1
Issue dev. countries: climate	24,707	.122	.33	0	1

The above table examines climate change and environment-related variables in the Eurobarometer, as defined by the previous table.

Table A16. By Gender: Summary Statistics on Europeans' Beliefs: Eurobarometer

	Males			**Females**		
Variable	N	Mean	SD	N	Mean	SD
Climate important	13,663	.164	.37	15,641	.159	.37
Climate personal issue	13,464	.122	.33	15,435	.113	.32
Energy union: env. prot.	11,337	.372	.48	13,370	.429	.49
Energy union: glob. warm.	11,337	.336	.47	13,370	.366	.48
Energy union: ren. energy	11,337	.468	.49	13,370	.433	.49
Environment important: EU	13,663	.102	.30	15,641	.105	.31
Climate change important: EU	13,663	.177	.38	15,641	.193	.39
EU-level decisions: climate	11,013	1.24	.48	12,793	1.23	.48
Voting reason: climate	13,663	.0651	.25	15,641	.0687	.25
Issue dev. countries: climate	11,337	.124	.33	13,370	.120	.33

The above table examines climate change and environment-related variables in the Eurobarometer, as defined by the previous table, summarizing them by gender.

Table A17. By Region: Summary Statistics on Europeans' Beliefs: Eurobarometer

	West			East		
Variable	N	Mean	SD	N	Mean	SD
Climate important	19,647	.191	.39	9,657	.0998	.29
Climate personal issue	19,242	.144	.35	9,657	.0646	.24
Energy union: env. prot.	16,015	.434	.49	8,692	.345	.48
Energy union: glob. warm.	16,015	.399	.49	8,692	.267	.44
Energy union: ren. energy	16,015	.514	.49	8,692	.329	.47
Environment important: EU	19,647	.116	.32	9,657	.077	.27
Climate change important: EU	19,647	.206	.40	9,657	.143	.35
EU-level decisions: climate	15,542	1.19	.44	8,264	1.31	.53
Voting reason: climate	19,647	.087	.29	9,657	.026	.35
Issue dev. countries: climate	16,015	.125	.33	8,692	.117	.32

The above table examines climate change and environment-related variables in the Eurobarometer, as defined by the previous table, summarizing them by European region. East: Czech Republic, East Germany, Estonia, Slovakia, Hungary, Albania, Lithuania, Poland, Romania, Slovenia, Bulgaria, Latvia.

Table A18. By Age (30 or Under vs Above 30): Summary Statistics on Europeans' Beliefs - Eurobarometer

	Young (30 or under)			Old (30 or above)		
Variable	N	Mean	SD	N	Mean	SD
Climate important	5,301	.168	.37	24,003	.159	.37
Climate personal issue	5,139	.123	.33	23,760	.116	.32
Energy union: env. prot.	3,891	.46	.49	20,816	.392	.49
Energy union: glob. warm.	5,891	.408	.49	20,816	.342	.47
Energy union: ren. energy	5,891	.479	.49	20,816	.444	.49
Environment important: EU	5,301	.111	.31	24,003	.102	.30
Climate change important: EU	5,301	.179	.38	24,003	.187	.39
EU-level decisions: climate	3,734	1.19	.45	20,072	1.24	.48
Voting reason: climate	5,301	.058	.23	24,003	.0689	.25
Issue dev. countries: climate	3,891	.119	.35	20,816	.119	.32

The above table examines climate change and environment-related variables in the Eurobarometer, as defined by the previous table, summarizing them by age classification (under and equal to 30 are compared with over and above 30).

Table A19. By Age (25 or Under vs 50 or Above): Summary Statistics on Europeans' Beliefs: Eurobarometer

	Young (25 or under)			Old (50 or above)		
Variable	N	Mean	SD	N	Mean	SD
Climate important	3,238	.176	.38	15,241	.166	.37
Climate personal issue	3,131	.133	.34	15,127	.118	.32
Energy union: env. prot.	2,422	.474	.49	13.802	.393	.49
Energy union: glob. warm.	2,422	.420	.49	13,802	.337	.47
Energy union: ren. energy	2,422	.476	.49	13,802	.433	.49
Environment important: EU	3,238	.123	.33	15,241	.101	.30
Climate change important: EU	3,238	.187	.39	15,241	.195	.39
EU-level decisions: climate	2,309	1.18	.44	13,251	1.25	.48
Voting reason: climate	3,238	.0565	.23	15,241	.071	.26
Issue dev. countries: climate	2,422	.139	.35	13,802	.110	.31

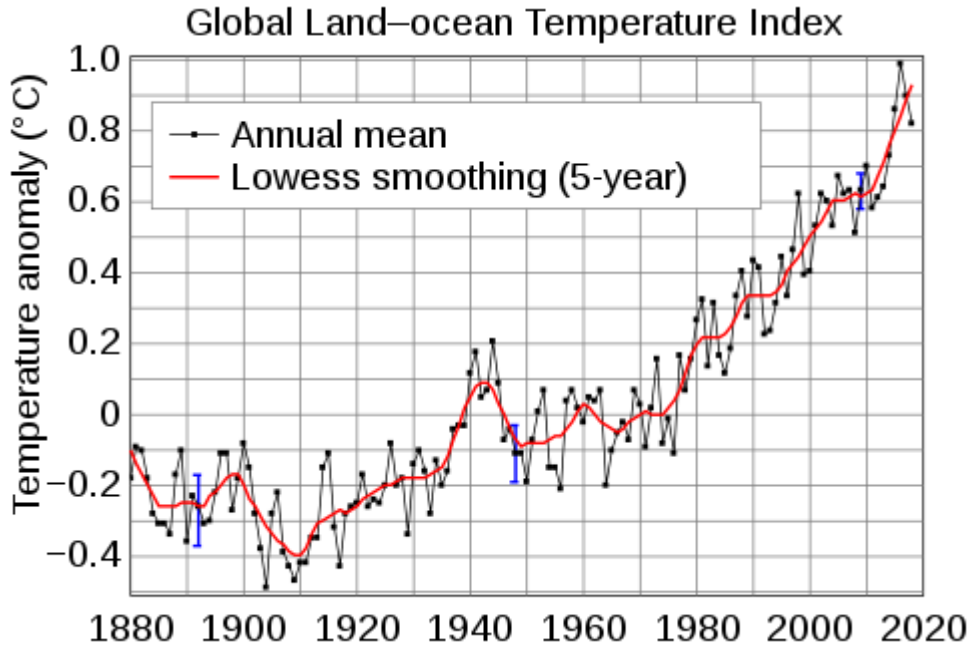
The above table examines climate change and environment-related variables in the Eurobarometer, as summarizing them by age classification (under and equal 25 compared to over or equal to 50 years of age).

Table A20. Young Educated Women (30 or Under) vs Old Uneducated Men (50 or Above): Summary Statistics on Europeans' Beliefs: Eurobarometer

	Young Women (Under 30, university)			Old (50 or above, no university)		
Variable	N	Mean	SD	N	Mean	SD
Climate important	5,505	.223	.42	8,874	.124	.33
Climate personal issue	5,424	.168	.37	8,758	.090	.29
Energy union: env. prot.	4,883	.458	.49	7,155	.368	.48
Energy union: glob. warm.	4,883	.417	.49	7,155	.321	.47
Energy union: ren. energy	4,883	.523	.49	7,155	.430	.49
Environment important: EU	5,505	.133	.34	8,874	.092	.29
Climate change important: EU	5,505	.259	.44	8,874	.151	.36
EU-level decisions: climate	4,755	1.19	.45	6,893	1.27	.49
Voting reason: climate	5,505	.113	.32	8,874	.039	.20
Issue dev. countries: climate	4,883	.138	.35	7,155	.112	.31

The above table examines climate change and environment-related variables in the Eurobarometer, summarizing them on a three-dimensional basis considering the age, education and the gender of the respondent. "University" is defined as an individual having finished their formal education at an age of above 20, whereas no university is attributed otherwise (still studying or having finished before the age of 20).

Supplementary Figure: Temperature Over 140 Years



Global mean surface temperature from 1880 to 2018, relative to the 1951-1980 mean. The black line is the global annual mean, and the red line is the five-year local regression line. The blue bars show a 95% confidence interval. Source: Oswald and Stern (2019)