

What do you think about climate change?

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Abstract

To answer this question, this paper reviews the huge and growing body of empirical literature on climate change awareness and summarizes insights emerging from a critical review of about 220 papers. It provides (i) a historical overview of climate change awareness worldwide, (ii) a guide to the most widely used datasets, with particular attention to the wording of questions used to measure climate change awareness when the analysis is performed at individual level; (iii) a detailed analysis of the main socio-economic and climatological determinants of climate change awareness, such as age, gender, education, political values, the use of mass media and social media, social and institutional trust, experience of extreme weather conditions and the stage of development of the country where people live; and (iv) a summary of the main implications of these findings in terms of public policy responses.

KEYWORDS

climate change awareness, individual perceptions, question wording, socio-economic determinants, policy implications

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1 | INTRODUCTION

What do you think about climate change? What do you know about it? The answers of a climate scientist to these important and (apparently) simple questions are based on an objective, scientific, and circumstantial description of the main features and effects of the problem. But answers from non-experts are more difficult to pin down. Measuring environmental awareness is a difficult task, as it entails “*an individual’s insight that humans endanger the natural environment combined with the willingness to protect nature*” (Franzen & Vogl, 2013, p. 1002). In this context, emotions, imagery, personal experience, trust, values, and worldviews influence the way in which individuals process their knowledge and experience and are thus very important for perceptions of climate change (Slovic, 2016; Libarkin et al., 2018).

Climate change awareness has been closely investigated worldwide, and documented by Lee et al. (2015), Lorenzoni and Pidgeon (2006); Upham et al. (2009) among others.

Figure 1 shows the geographic distribution of climate change awareness mapped in five different colors. The dark green countries exhibit the highest levels of concern. It is easy to see that climate change awareness widely varies round the world and that it is generally very high in advanced economies such as Australia, Japan, the countries of Europe, and the USA. In a similar manner, Figure 2 highlights that these economies, together with some developing Asian countries, also show the highest levels of carbon dioxide emissions, which are widely held to be mainly

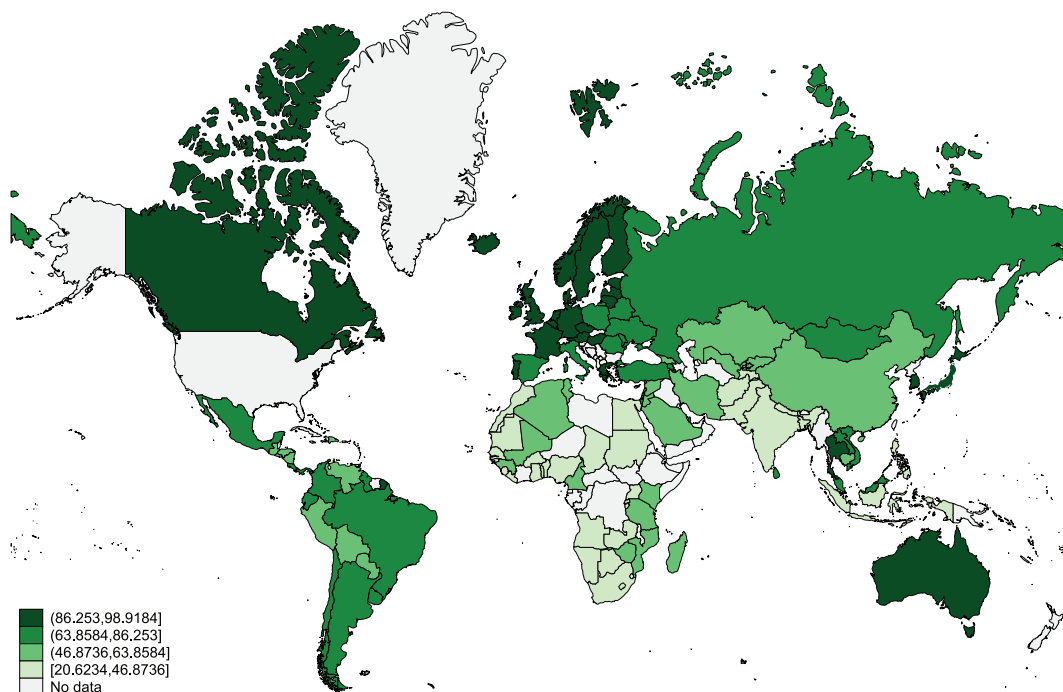


FIGURE 1 Geographic distribution of climate change awareness. Notes: Author’s elaboration on Lee et al. (2015) data retrieved from the Gallup World Poll. Specifically, citizens in 119 countries in 2007–2008 have been asked to answer to the following questions: “How much do you know about global warming or climate change?” and “How serious of a threat is global warming to you and your family?”. [Colour figure can be viewed at wileyonlinelibrary.com]

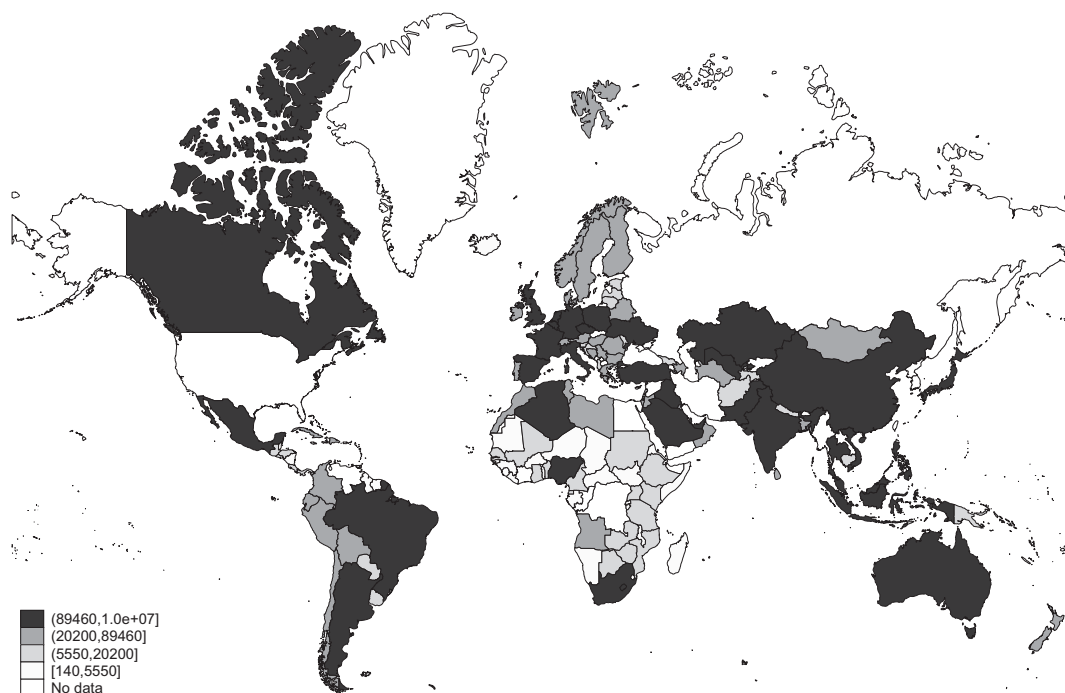


FIGURE 2 Geographic distribution of carbon dioxide emissions. Notes: Author's elaboration on World Bank data. Reference year: 2018.

responsible for global warming and climate change.¹ Furthermore, despite the greater awareness of climate change in developed countries (Franzen & Vogl, 2013; Hidano et al., 2005; Veisten et al., 2004), rich individuals worldwide emit much more than poorer ones. Figure 3 shows that about half of the total growth in absolute emissions came from the richest 10 per cent of the world population, and over a third from the richest 5 percent in the years 1990–2015 (Kartha et al., 2020).

These stylized facts have important consequences in terms policy decisions. On one hand, policymakers require stronger efforts to reduce greenhouse gas emissions and a concrete international coordinated action is a key step to counteract the rise in the global average temperature (IPCC, 2022a, b; UNFCCC, 2015). At the same time, on the other hand, citizen concern about climate change is the driver for the successful realization of this process and is a critical component of the sociopolitical context in which policymakers operate (Leiserowitz, 2005; Leiserowitz et al., 2017).

The aim of this review is to summarize findings and to bring coherence and structure to the growing body of empirical papers analyzing climate change awareness, in order to provide a comprehensive overview of the state of knowledge at the time of writing. The main goal is first to provide a guide to the variables most widely used to measure climate change awareness, with particular attention to the question wording when the analysis is performed at individual level. Second, this review aims to identify factors such as socio-economic conditions, political values, media coverage, trust in institutions, and extreme weather events, which affect public opinion. Extreme weather events are currently particularly worrying, as Fischer et al. (2021) recently show that record-shattering events come in *sharp bursts* and are often totally unexpected, as for example, the devastating floods in Germany and China and the disastrous wildfires in Greece, Italy, Siberia, and Turkey during the summer of 2021. It also asks why, despite the scientific consensus

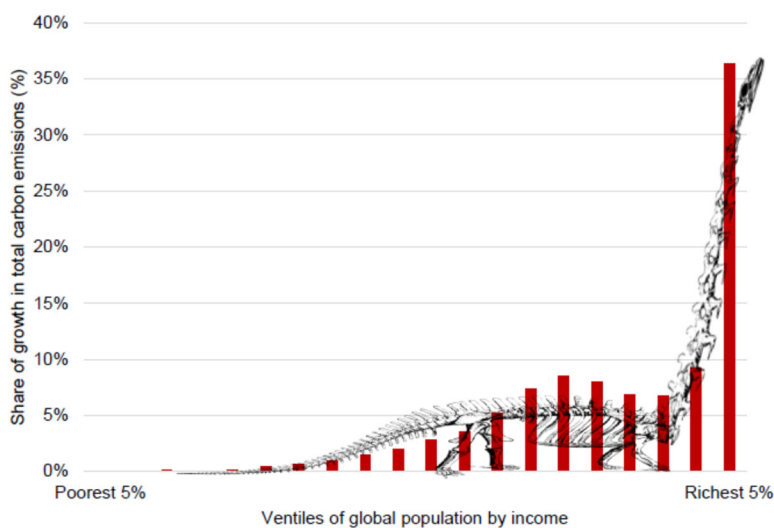


FIGURE 3 The carbon inequality “dinosaur” of emissions growth in the years 1990–2015. Notes: The plot has been retrieved from Kartha et al. (2020, p. 7). The line shows each ventile’s increase in per capita emissions (as a percentage of its 1990 per capita emissions), while the bars show each ventile’s increase in total emissions (as a percentage of total global emissions increase). [Colour figure can be viewed at wileyonlinelibrary.com]

that climate change is a byproduct of human activity and the urgency of stricter regulatory controls for environmentally friendly behaviors, public opinion shows weak support for climate policies, and is sometimes even skeptical of climate change and related risks (Poortinga et al., 2011; Whitmarsh, 2011).

This can have severe repercussions in terms of policy implementation. Climate change awareness is a key driver in taking actions to preserve the environment and heavily influences public support or opposition to climate policies (Leiserowitz, 2005). This is particularly important in the light of the severe obstacles facing climate policies, as their effectiveness is often highly uncertain especially in the long run, and yet they can bring heavy costs in the short run.

This review aims to provide a critical overview of the current state of the art and to identify areas of improvements for raising public awareness of climate change. It addresses various kinds of actor: (i) academia, (ii) policymakers and environmental organizations, (iii) wider audiences. It is organized as follows. After a brief historical overview of the evolution of climate change awareness during the last 50 years (Section 2), it provides academic readers with guidance to the most frequently used datasets and shows how climate change awareness and pro-environmental behaviors are measured in the empirical literature (Section 3). This analysis is particularly useful not only to economists, but also to psychologists, in order to identify the most popular question wordings used to capture the emotional, cognitive and conative components of mind and to identify any possible biases due to the response process. Sections 4 and 5 provide indications to policymakers, scientists, environmental organizations, and climate activists for strengthening environmentally friendly actions. A critical reflection sheds light on personal views, and political, economic, and structural circumstances as well as the main psychological and interpersonal channels and offers suggestions in terms of communication strategies. Fighting climate change also implies the need to enhance international coordination and cooperation, as well as the interaction between national and subnational authorities, including regions, provinces, cities and other

non-state actors, such as the business sector, consumers and investors. It follows that the success of international, national and local mitigation and adaptation policies depends on public opinion, policy support and behaviors at appropriate scales (Howe et al., 2015).

2 | CLIMATE CHANGE AWARENESS: A HISTORICAL OVERVIEW

According to a study on “climatological research as it pertains to intelligence problems” made by the Central Intelligence Agency in the early 1970s, “*the climate change began in 1960, but no one, including the climatologists, recognised it*” (Central Intelligence Agency, 1974, p.1). The world ignored the warning, and intensive investment in energy, technology and medicine were made for many years without the impact on the environment being considered.

Public perception of climate change has received attention only in recent decades, practically since the 1992 Kyoto Protocol, the first global attempt to reduce human impact on the environment. Climate change awareness is influenced by country- and culture-specific issues, which implies that it is in fact difficult to generalize across a geographically, economically and culturally diverse planet (Lee et al., 2015).

However, it is possible to identify common patterns in the evolution of climate change awareness all over the world, and they can be summarized into three phases as follows:

- (i) Awareness (1980s and 1990s);
- (ii) Scepticism (2000s – first part of the 2010s);
- (iii) Opinion leader influence (2016 – to today).

During the 1980s, few opinions or statements appeared (Dunlap & Scarce, 1991; Nisbet & Myers, 2007; Whitmarsh & Capstick, 2018). Only after the Kyoto Protocol in 1992 was public awareness observed (Lorenzoni & Pidgeon, 2006; Upham et al., 2009). In those years, scientific evidence that climate change is a by-product of human activities began to be reported by mainstream media, and there was more public attention to this topic (Boykoff & Yulsman, 2013). However, national policymakers reacted differently to the Kyoto guidelines: on one hand, the European Union supported and promoted them while the on the other, the USA often did not (Leiserowitz, 2005).

The phase of scepticism started during the 2000s in the USA, where the debate on climate change was particularly politicized and polarized (Guber, 2013; Dunlap et al., 2016), and then spread to the rest of the world. The majority of scientists in the climate research community stated that there had been an increase in temperatures due to human activities, but others disagreed: the disagreement of the Nongovernmental International Panel on Climate Change (NIPCC) with the assessments of the Intergovernmental Panel on Climate Change (IPCC) is probably the best-known international example of the fairly widespread scepticism.² Public scepticism about the severity of climate change was also fomented by uncertainty among scientists about how much temperatures would rise and the potential impact on human systems. For example, the IPCC Fourth Assessment Report read: “*Effects of climate changes on human and some natural systems are difficult to detect due to adaptation and non-climatic drivers*” (IPCC, 2007, p. 72) and “*Projections of climate change and its impacts beyond about 2050 are strongly scenario- and model-dependent, and improved projections would require improved understanding of sources of uncertainty and enhancements in systematic observation networks*” (IPCC, 2007, p. 73). As noted by Whitmarsh (2011), the analysis of mass media and internet communication of climate change reveals denial, doubt and apathy towards the existence and causes of climate change and how

to tackle it. This tendency was further emphasized by the *climategate controversy* in 2009, which reflected the politicization of climate change in Western European countries (Hart & Nisbet, 2012; McCright et al., 2016).

In the third phase, the use of social media has recently proved to be crucial in shaping people's perceptions of environmental issues. Social media are important in creating an open space for organizations, climate activists, and scientists to share information during specific environmental campaigns and in connecting people locally and cross-nationally (Boulianne et al., 2020). This can be seen in the cases of Mr. Beast and Greta Thunberg, who have successfully built-up widespread awareness of environmentally friendly behaviors thanks to their use of this rapid and dynamic format to publicize warnings about climate change.

Mr. Beast is an American youtuber, who in October 2019 organized the #TeamTrees campaign to plant 20 million trees around the world by 2022. After only 2 months, this goal was achieved and, by the end of May 2020, the project had collected more than 22 million dollars. Greta Thunberg is a global eco-celebrity, 2019 "Person of the Year" for Time Magazine (Alter et al., 2019), who uses her celebrity status to push for radical and immediate actions to fight global warming, thanks to the attention of the international media around the world (Murphy, 2021). She leads the "Fridays for Future" movement, which held the largest, youth-based, environmental demonstrations in human history, involving about 3.6 million people across 169 countries in August 2019. She has also been criticized on Twitter by well-known figures such as Australian columnist Andrew Bolt and former US President Donald Trump (Jung et al., 2020). Trump in fact to date has tweeted his scepticism of climate change at least 115 times,³ stating for example that it is "mythical", "non-existent" and "an expensive hoax" perpetrated by the enemies of the USA, peddling chaos and fear rather than facts (Tollefson, 2020). This posits a role for these two as opinion leaders, Greta Thunberg as a "green" leader and Donald Trump as a "brown" leader,⁴ and demonstrates that opinion leaders matter for shaping environmentally friendly choices (Baiardi & Morana, 2021). It opens up the third phase in the evolution of climate change awareness, characterized by new and dynamic ways of communication.

3 | MEASURING CLIMATE CHANGE AWARENESS

3.1 | Climate change awareness at individual level

Psychologists classify individual reactions to problems into three different but complementary components of mind: affect, cognition, and conation. Affect refers to the emotions associated with knowledge, in this case, about climate change. Cognition is the process of thinking rationally and understanding the phenomenon through the acquisition and processing of information. Conation refers to the personal actions taken (Tallon, 1997). The literature on environmental attitudes has explored all three components, including a focus on mass media, which are fundamental to the cognition process (Whitmarsh, 2011). The main topics investigated are principally perceptions and opinions of:

- (i) the seriousness of climate change, its threats and perceived danger, and severity compared to other global problems;
- (ii) the prioritization of economic growth versus environmental protection;
- (iii) the responsibility of international and national governments and business and industry in fighting climate change;

TABLE 1 The main dimensions of climate change awareness investigated in the most popular databases

Topic	Reference
(i) <i>The seriousness of climate change, its threats and perceived danger, and severity compared to other global problems</i>	Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change Gallup World Poll
(ii) <i>Prioritization of economic growth versus environmental protection</i>	Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change Gallup World Poll ISSP The World Value Survey
(iii) <i>The responsibility of international and national governments and business and industry in fighting climate change</i>	Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change Gallup World Poll ISSP The World Value Survey PEW Institute
(iv) <i>Personal actions taken in order to mitigate climate change or, more generally, improve the environment</i>	Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change ISSP
(v) <i>The willingness to pay (including in terms of higher taxes) for fighting climate change</i>	ISSP Life in Transition Study

(iv) personal actions taken in order to mitigate climate change or, more generally, improve the environment;

(v) the willingness to pay (including in terms of higher taxes) for fighting climate change.

Note that point (i) refers to affect, points (ii) and (iii) to cognition and points (iv) and (v) to conation.

The most frequently used datasets, covering a large set of countries, are the Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change, the Gallup World Poll, the International Social Survey Programme (ISSP), the Life in Transition Study, the World Value Survey, and the surveys provided by the PEW Institute.

As shown by Table 1, the two most complete databases, which cover all the above points with the sole exception of (v), are the Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change and the Gallup World Poll, together with the ISSP, which omits only climate change awareness (point i). Some datasets, like the World Value Survey, Life in Transition Study and the surveys provided by the PEW Institute, focus only on specific issues such as topics (ii), (iii) and (v). A description of the three most complete surveys (the Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change, the Gallup World Poll and the ISSP) is provided in Appendix A.

In the case of the USA, data have often been retrieved from the Gallup World Poll, the General Social Survey, a nationally representative survey of adults in the United States conducted since 1972, or from the New Hampshire Granite State Poll, quarterly telephone interviews with random samples of about 500 New Hampshire residents. Some other papers analyze climate change attitudes using data from ad hoc surveys commissioned from private research companies.

Techniques for measuring climate change attitudes are principally based on qualitative approaches, such as face-to face or telephone interviews, through either pen-and-paper (PAPI) or computer-assisted personal interviewing (CAPI) or with open-ended questions, and/or, multiple-choice, true-false, or Likert-type questions (see also Libarkin et al., 2018).

These various sources of data make it possible to carry out empirical research using pooled cross-sectional as well as country-specific cross-sectional datasets, and to analyze trends in attitudes by exploiting the time dimension of the data.

Lastly, it is worth noting that new and unconventional approaches for polling will probably revolutionize interview techniques in the future. An example is the Peoples' Climate Vote, launched in 2020 by the United Nations Development Programme and conducted at world level, where poll questions are distributed through adverts on popular mobile gaming apps. This innovative approach has made it possible to obtain a random sample of 1.22 million people of all ages, genders and educational backgrounds, including individuals who are typically difficult to contact using standard techniques.

3.2 | The most frequently investigated questions for each component of mind

Empirical analyses are generally made on samples of either a wide range of countries or specific countries or groups of countries. Advanced economies, such as the European countries, the USA and Australia, are the most widely investigated. However, given their crucial role in curbing greenhouse gases and reaching a cleaner energy era globally, policymakers and public opinion are currently shifting attention to developing countries, such as China and the Middle East.⁵

In the following subsections we review the most frequently investigated questions by considering “*the various kinds of stuff that goes on in one’s head and in one’s behavior and in dealing with other people*” (Bateson, 1991, p. 24), under the assumption that ideas are interdependent, interacting, and that they can live and die.⁶ In the case of awareness of climate change, individuals mainly react in three distinct ways to environmental problems, corresponding to the three components of mind affect, cognition and conation. In other words, it is assumed that they are emotionally affected by climate change, they have rational insight into the problem, and they are willing to act.

3.2.1 | Being emotionally affected by climate change

In this subsection we review the questions most frequently used to capture the emotional component of individual perceptions of climate change, that is, how far the problem is perceived as serious and dangerous, its severity compared to other global problems, and its threats.

The extent to which climate change is serious, including in comparison to other global problems and other environmental issues, is the core question in many empirical analyses. Sandvik (2008) analyses a cross-national dataset, based on data collected by an online global survey on consumer

attitudes towards global warming in 46 countries in 2007. Individuals were asked to express their perception of the seriousness of climate change on a scale from 1 to 5. The question used was “*Have you heard or read anything about the issue of global warming?*” and the author considers only those respondents who define global warming to be either “*a fairly serious problem*” or “*a very serious problem*”. A similar approach is adopted by Diekkman and Franzen (1999) who collected data from face-to-face or telephone interviews in 24 countries in 1993, and by Shao et al. (2014), who used answers to the question “*Do you think global warming is an environmental problem that is causing a serious impact now, or do you think the impact of global warming won’t happen until sometime in the future, or do you think global warming won’t have a serious impact at all?*”. Responses were retrieved from the CBS News and CBS News/New York Times surveys and from the Pew Research Centre in the years 2001–2010 in the USA.

Lee et al. (2015) analyze data collected by the Gallup World Poll in 2007–2008 in 119 countries, which is currently the most representative sample analyzed in the empirical literature. In order to identify the relative influence of socio-demographic characteristics, geography, perceived well-being, and beliefs on public climate change awareness and risk perceptions on a national scale, they use this question as a measure climate change awareness: “*How much do you know about global warming or climate change?*”. Individual responses “*I know something about it*” and “*I know a great deal about it*” are classified as “*aware*”, and responses “*I have never heard of it*” or “*Don’t know*” as “*unaware*”.⁷ Moreover, *aware* participants were also asked: “*How serious a threat is global warming to you and your family?*”, and the response used as a measure of risk perception.⁸ A similar question wording was used by Leiserowitz in various surveys of risk perception of climate change in the USA, for example: “*Which of the following are you most concerned about? The impacts of global warming on (1) you and your family; (2) your local community; (3) the U.S. as a whole; (4) people all over the world; (5) non-human nature; or (6) not at all concerned*” (Leiserowitz, 2005).

Skogen et al. (2018) consider a sample of Norwegian respondents aged 18–87 selected from the nationally representative TNS Gallup Panel. The respondents express concern on 16 distinct environmental problems, summarized as follows: climate change in general and global warming, biodiversity loss, changes in weather and extreme weather conditions, pollution of air and water, destruction of nature due to construction, roads, logging and second homes as well as fragmenting of pristine areas, increased precipitation, radiation from mobile towers and high voltage grids, toxins in food, loss of habitat for animals and plants and invasive species, hydroelectric development and modern forest. The response options vary from “*Very concerned*” to “*Not at all concerned*”.

Lo and Chow (2015) note that it is important to distinguish *the perception of the importance* of climate change compared to other problems, from the *perception of danger*, which is correlated with the sense of insecurity and risk associated to climate change. Starting from the publicly available dataset “Environment Module” managed by the ISSP Research Group (2012) which covers 34 countries worldwide, the perceived *importance* of climate change is obtained by means of a dummy variable which codes as “1” (otherwise “0”) those respondents indicating climate change as the most important of nine distinct environmental problems. This is a *relative* rather than an *absolute* measure, since these individuals recognize climate change as a priority compared to other environmental problems. The second variable capturing the perception of risk associated with climate change relates to the belief that rising temperature is a result of the dangers of climate change and is measured on a five-point scale, ranging from “*Not dangerous at all*” to “*Extremely dangerous*”.

Other papers analyze this issue using data provided by ad hoc surveys commissioned from private research companies. Andor et al. (2018) use all survey waves conducted in 2012 and 2015 by the German institute *forsa*.⁹ Their sample accounts include over 6000 respondents (6404 households

in 2012, 6522 in 2013, 6602 in 2014 and 7077 in 2015), which are representative of the population aged 14 and above of German speaking households. The surveys are updated regularly. Interviewees are asked to complete the questionnaire at home using either a television or the internet. The key variable is the following: *“There are plenty of challenges that people all around the world are faced with. Please indicate how important combating climate change is to you”*, with response options ranging from (1) *“Very unimportant”* to (5) *“Very important”*.

Looking at China, Dai et al. (2015) use data from a survey run by the Horizon Research Consultancy Group, one of the leading market research companies in the country. A total of 1054 Chinese adults aged 18–60 were interviewed in December 2012 in the five cities of Beijing, Guangzhou, Chengdu, Wuhan, and Shenyang. The questionnaire consists of various parts, and Dai et al. (2015) examine respondent’s experience of extreme weather events and their assessments of global warming, as well as their socio-demographic and socioeconomic characteristics. They then build a binary dependent variable, the key variable of their empirical analysis, which takes the value of 1 (otherwise zero) if respondents believe that global climate change is already taking place today or will take place in the future.

Climate change awareness has also been widely investigated in advanced economies such as the USA. Often individual perceptions are identified by questions such as: *“Recently, you may have noticed that global warming has been getting some attention in the news. Global warming refers to the idea that the world’s average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world’s climate may change as a result. What do you think? Do you think that global warming is happening?”* (See Leiserowitz et al., 2010). Similarly, Zaval et al. (2014) proxy climate change concerns by considering to what extent American respondents are convinced *“that global warming (climate change) is happening”* and to what extent they are *“personally worried about global warming (climate change)”*. Zaval et al. (2014) recruited respondents from the website Amazon Mechanical Turk and from Columbia University’s Center for Decision Sciences national panel. Hamilton and Saito (2015) use data collected from the Granite State Poll. They proxy climate change concerns using responses to the question: *“Which of the following three statements do you personally believe?”*. Response options are: *“Climate change is happening now, caused mainly by human activities”*; *“Climate change is happening now, but caused mainly by natural forces”*; *“Climate change is not happening now”*. Konisky et al. (2016) consider the following question, retrieved from the CCES, a web-based survey conducted by YouGov in the USA since 2006: *“From what you know about global climate change or global warming, which one of the following statements comes closest to your opinion?”* The response categories are on a 5-point scale, ranging from *“Global climate change is not occurring”*; *“This is not a real issue”* to *“Global climate change has been established as a serious problem, and immediate action is necessary”*.

3.2.2 | Rational insight into climate change problems

In this subsection we review the questions most frequently used to identify the cognition component of mind, which corresponds to rational insight into climate change problems. In this context, public debate focuses on the controversial relationship between economic growth and environmental protection, that is, on preferences for prioritizing environmental protection or economic growth when the two interests are in conflict. However, the empirical literature shows that attitudes on this topic are inconsistent and contradictory, and question wording and format can lead to significantly different responses. Moreover, increasing attention is also being given to the

responsibilities of international and national governments, and business and industry in fighting climate change.

Looking at the prioritization of economic growth versus environmental protection, Drews et al. (2018) use data from three Special Eurobarometer surveys (2008, 2011, and 2014 Editions) on European citizen attitudes to the environment to study how public perception of environmental problems affects the growth debate. They also analyze the case of the USA, using data from the International Social Public Program, the World Value Survey and surveys by the PEW Institute and Gallup World Poll. They first analyze whether the aims of economic growth and environmental protection are compatible, using the following statements: “*Economic growth always harms the environment*”, and “*In order to protect the environment, [COUNTRY] needs economic growth*”. These data, related to the 2010 and 2011, are retrieved from the International Social Survey Program. Respondents can express agreement or disagreement on a 5-point Likert scale. For the Eurobarometer surveys, respondents were divided into two groups, each of them receiving one of the following two statements: “*The protection of the environment can boost economic growth in the European Union*” or “*Protecting the environment is an obstacle to economic growth in the European Union*”. Drews et al. (2018) then investigate whether economic growth or environmental protection are the priority for respondents, using answers to the single question: “*Here are two statements people sometimes make when discussing the environment and economic growth. Which of them comes closer to your own point of view? Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs OR Economic growth and creating jobs should be the top priority, even if the environment suffers to some extent*”, which is retrieved from the World Value Survey (2010 Edition).

Similar questions are used in the PEW Research Center surveys and the Gallup World Poll, and in the periodical surveys by the Yale Program on Climate Change Communication, which have been widely used to analyze the evolution of this debate especially in the USA. For example, Leiserowitz et al. (2012) and Kaplowitz et al. (2013) consider the binary variable obtained from the answers to the following question: “*When there is a conflict between environmental protection and economic growth, which do you think is more important?*”.

However, respondents do not always realize that the two issues conflict, and question wording can bias their answers. Some studies thus employ different options. For example, Drews and van den Bergh (2016) use the phrases: “*considering economic growth as compatible with environmental sustainability*”, “*ignoring economic growth as a policy aim*”, “*stopping pursuing economic growth*” and “*pursuing economic growth in spite of its environmental impacts*”, while Jagers (2009) looks at opinions on “*working towards an environmentally friendly society even if it means low or no economic growth*”.

The responsibility of international and national governments and business and industry in fighting climate change is investigated by both the Eurobarometer Special Survey on Climate Change and by the Gallup World Poll. In the Eurobarometer survey, participants are asked the following question: “*In your opinion, who within the EU is responsible for tackling climate change?*” with possible answers “*National governments*”, “*the European Union*”, “*Regional and local authorities*”, “*Business and industry*”, “*You personally*”, “*Environmental groups*”, “*Others*” or “*All of these possibilities*” (Liobikienė & Minelgaitė, 2021; Jakučionytė-Skodienė & Liobikienė, 2022). In the Gallup World Poll, on the other hand, the question wording is more closely focused on the responsibility of national government: “*Do you think that [COUNTRY] government is doing too much, too little, or about the right amount in terms of protecting the environment?*”. Using the European Social Survey (ESS 8) conducted in 2016 and 2017, Boto-García and Buccioli (2020), Bouman et al. (2020) and Weko (2022) measure a sense of personal responsibility for reducing climate change with the

following question: “*To what extent do you feel a personal responsibility to try to reduce climate change?*”. Answers are given on an 11-point scale from 0 (“*not at all*”) to 10 (“*a great deal*”).

Such surveys have provided food for thought especially in the USA since 1992. Often advocating more action by elected officials, corporations and citizens themselves, empirical studies reveal that Americans perceive that their government is doing too little to protect the environment and that global warming and clean energy should be among the nation’s priorities (Leiserowitz et al., 2012). The issue is particularly divisive between Republicans and Democrats, since perceptions are sometimes in turn influenced by respondents’ expectations of the Presidents’ performance on the environment. These latter are investigated by means of this question “*Do you think [INCUMBENT PRESIDENT] will do a good job or a poor job in handling each of the following issues as president?*”, with the issues including: “*Protecting the nation’s environment*”, “*Improving the nation’s energy policy*” and “*Making America prosperous*”.

3.2.3 | Willingness to act to fight climate change

This subsection focuses on the conative component of the mind. It refers to: (1) personal actions to fight climate change, (2) the willingness to pay in order to ameliorate environmental conditions, and (3) individual attitude toward climate policies. Before going into detail on these behaviors, note that some authors consider these three aspects jointly with the other features of environmental concern analyzed in the previous subsections.

For example, Xiao et al. (2013) include in their empirical analysis the perceived seriousness of local environmental problems (local problems), the perceived seriousness of national environmental problems (national problems), the economic-environmental trade-off, and a measure of environmental worldview as well as more general variables capturing environmental activism and the willingness to pay for environmental protection. Wicker and Becken (2013) consider individuals indicating climate change as the most serious problem facing the world as a whole, together with their concerns regarding energy availability and the economic situation. Boto-García and Bucciol (2020), Liobikienė and Minelgaitė (2021) and Jakučionytė-Skodienė and Liobikienė (2021, 2022) analyze changes in climate change awareness, personal responsibility and climate-friendly behaviors since the 2015 Paris Agreement, which has positively influenced green behaviors (Bauer & Menrad, 2019). Bouman et al. (2020) consider personal worry and feelings of responsibility for climate change together with personal savings behaviors and climate policy support (“*increasing taxes on fossil fuels, such as oil, gas and coal*”, “*using public money to subsidise renewable energy such as wind and solar power*” and “*a law banning the sale of the least energy efficient household appliances*”).¹⁰ Weko (2022) analyses the effectiveness of personal responsibility together with personal and collective efforts to limit energy use.

Personal actions to fight climate change

Wicker and Becken (2013) perform a cross-sectional analysis based on a final sample of 26,840 respondents. Data are retrieved from Eurobarometer 75.4, reporting a survey conducted from 4 to 19 June in 2011 (GESIS, 2012). They also study actions among eleven listed possibilities personally taken by each respondent in order to fight climate change during the 6 months before the interview. Respondents are asked whether they have, for example, bought a new low fuel consumption car or a low-energy home, whether they buy locally produced and seasonal food, whether they walk, bike or take public transport or car-share instead of using private cars, whether they have insulated their home to reduce energy consumption or have installed solar panels, and whether

they separate waste for collection, etc. The same set of variables are analyzed by Meyer (2015) in investigating the influence of education on pro-environmental behaviors. In Meyer (2015), data are retrieved from Eurobarometer 68.2 in the period November 2007–January 2008 and Eurobarometer 75.2 April–May 2011.

In the same way, D'Amato et al. (2019) analyze the impact of different sources of information, and trust in information, on the following behaviors: waste reduction, waste recycling, water saving and energy saving. Data are collected from three Special Eurobarometer surveys on attitudes of European citizens towards the environment in the years 2008, 2011, and 2014. Respondents are asked: “Have you done any of the following actions for environmental reasons in the past month? 1. Reduced the consumption of disposable items (for example, plastic bags, certain kind of packaging, etc.); 2. Separated most of your waste for recycling; 3. Cut down your water consumption (for example not leaving water running when washing the dishes or taking a shower, etc.); 4. Cut down your energy consumption (for example, turning down air conditioning or heating, not leaving appliances on stand-by, buying energy saving light bulbs, buying energy efficient appliances, etc.)”.

Jakučionytė-Skodienė & Liobikienė (2021, 2022) measure climate-friendly behaviors in 2019 and 2015–2019, respectively,¹¹ by means of dichotomous variables derived from the answers to the following options: “Which of the following actions have you taken, if any? 1. You try to reduce your waste and you regularly separate it for recycling; 2. When buying a new household appliance e.g. washing machine, fridge or TV, you choose it mainly because it was more energy efficient than other models; 3. You regularly use environmentally friendly alternatives to using your private car such as walking, biking, taking public transport or car-sharing; 4. You have insulated your home better to reduce your energy consumption; 5. You have switched to an energy supplier which offers a greater share of energy from renewable sources than your previous one; 6. You have bought a new car and its low-fuel consumption was an important factor in your choice; 7. You have bought a low-energy home.” A similar set of questions is analyzed by Boto-García and Bucciol (2020), Liobikienė and Minelgaitė (2021) and Weko (2022). In particular, Liobikienė and Minelgaitė (2021) use the 2017 Eurobarometer survey “Attitudes of European citizens towards the environment”. In this survey, respondents are invited to choose between “none”, “few” or “all” of different energy saving behaviors suggested in the questionnaire. The survey focused particularly on the impact of plastic on the environment, healthy food habits and water saving behaviors.

Willingness to pay in order to ameliorate environmental conditions

Smith and Mayer (2018) consider the role of risk perception and social and institutional trust in encouraging actions to fight climate change. Data from 35 countries are supplied by the Life in Transition II Study, conducted by the World Bank and the European Bank for Reconstruction and Development in 2010. Face-to-face interviews were performed in the respondent's home, utilizing either computer assisted or pen-and-paper interview techniques. Different variables are examined. Personal actions taken to fight climate change are first captured by the question “Have you personally taken any action aimed at helping to fight climate change?”, and the willingness to pay variable is derived from the question: “Would you be willing to give part of your income, or pay more taxes, if you were sure the extra money was used to combat climate change?”. Risk perception related to climate change is derived using the following question: “As a result of climate change, do you think people in our country will be better off, worse off, or about the same?”. Lastly, variables capturing how much respondents know about the causes of climate change, the consequences of climate change, ways to slow down climate change, and ways to adapt to climate change are used as control variables.

The question of how climate change attitudes influence personal efforts to do something about it is also studied in terms of willingness to pay for ameliorating environmental quality. Household data from the 2010 Life in Transition Survey across 35 countries are investigated by Dienes (2015). Various dependent variables are considered in order to study the relationship between individual concern about climate change and the actions and intentions to pay for mitigating it. The variable capturing the intention to pay to fight climate change is a dummy taking the value of one if the individual intends to pay, and zero otherwise. Individual actions taken against climate change are similarly captured by a dummy equal to one if the respondent has taken such actions, and zero otherwise. Torgler and García-Valiñas (2007) consider the following item: “*I would agree to an increase in taxes if the extra money were used to prevent environmental damage (0 = strongly disagree, 3 = strongly agree)*” retrieved from the World Values Survey for years 1990, 1995, 2000 and the 1999 European Values Survey, with a specific focus on the case of Spain. Franzen and Vogl (2013) base their empirical analysis on the following items: “*I do what is right for the environment, even when it costs more money or takes more time*”, “*How willing would you be to accept cuts in your standard of living in order to protect the environment?*”, “*How willing would you be to pay much higher prices in order to protect the environment?*” and “*How willing would you be to pay much higher taxes in order to protect the environment?*”. Data are collected from three waves of the ISSP environmental module for the years 1993, 2000, and 2010 on a sample of 33 countries.

The main shortcoming of questions of this type is that they do not specify the level of improvement or the amount of tax increase, and they provide no information about the type of tax to apply. This may give a misleading picture of willingness to pay (Hidano et al., 2005). In order to overcome this problem, Meyer and Liebe (2010) consider not only the answer to the usual question “*It is not normally possible to increase environmental protection for free. Would you be prepared to pay higher taxes or duties for improved environmental protection?*” but they also follow it up with a request for detail: “*Could you please tell me the amount in Swiss francs that you would be prepared to pay per month in addition to your taxes for improved environmental protection in Switzerland?*”, in order to capture the appropriate willingness to accept an increase in taxes.

Attitude toward climate policies

It is worth noting that there is currently increasing attention to attitudes towards different climate policies, such as adopting alternative energy sources, saving energy and reusing and recycling natural resources. For example, the 2020 Peoples’ Climate Vote, the most recent and largest ever survey of public opinion on climate change across 50 countries, focuses on 18 different climate policies in the following fields: Energy, Economy, Transportations, Farm and Food, Protecting People and Nature.¹²

Schwirplies (2018) in her study introduces the problem of climate change using the statement: “*Climate change is understood to be a rise in the average global temperature over the past 150 years or in the future, resulting in weather and climate changes*”. On a scale with five categories ranging from “very weakly” to “very strongly”, respondents are then asked to indicate their acceptance of “*mitigation of climate change*” (e.g., advancement of renewable energy or energy-efficient technologies) and “*adaptation measures relating to the consequences of climate change*” (e.g., protection against natural events like the building of dams, safeguarding of traffic routes etc.). Data are obtained from almost identical web-based surveys conducted simultaneously in three countries. In Germany and the USA, about 1000 respondents were invited via email to complete a self-administered questionnaire in a web-based online environment, while in China, respondents were invited to centrally located test studios because of the lack of internet access in many rural areas of the country.

Cologna and Siegrist (2020) consider a broad set of environmentally friendly behaviors, corresponding to the definition of mitigation and adaptation measures provided by IPCC (2018). They classify as mitigation behaviors the implementation of carbon dioxide taxes and climate-related policies, reductions in emission intensive consumption and the support and funding for mitigation technologies such as solar radiation management and carbon capture and storage. The willingness to pay for insurances and home protection, the support for adaptation policies and the intention to adopt protective behaviors are considered as adaptation behaviors.

3.3 | Climate change awareness at the aggregate level

All the studies reviewed in the previous subsections use data disaggregated at individual level, but there are some recent studies which use quantitative and qualitative data to proxy climate change awareness at *aggregate* level.

3.3.1 | Quantitative aggregate data

A basic proxy of climate change at the aggregate level is the emission of carbon dioxide (CO₂), which, together with methane (CH₄) and nitrous oxides (N₂O), is the major component of overall greenhouse gas emissions and thus the main cause of global warming. This explains why many industrial and developing countries, from the Kyoto Protocol to the recent Paris Agreement, emphasize curbing CO₂ emissions globally. Data are principally available at national level and retrieved from free datasets like World Bank Development Indicators, OECD Statistics, the Paris Reality Check: PRIMAP-hist and the Climate Data Explorer.

CO₂ emissions are widely used in the environmental economic literature as a proxy of the level of pollution in a specific geographic area (generally a country or a region), that is, as a proxy of the negative externality due to human activities on the environment (see, among others, Wang, 2012; Muhammad & Long, 2021). In a broader sense, they have also been considered as an indirect or implicit proxy of climate change concern at the aggregate level (Sandvik, 2008; Lo & Chow, 2015; Bu et al., 2016). However, it is important to note that the use of this variable to proxy climate change *concern* is improper, as CO₂ emissions represent the *objective* level of this greenhouse gas in a specific geographic area and only implicitly refer to the *subjective* attitudes and perceptions of citizens of a country on climate issues.

The Notre-Dame Global Adaptation Index (ND-GAIN) is used to measure the ability and the preparedness of a country to face climate change (Lo & Chow, 2015). This annual indicator is computed by the University of Notre-Dame, within the Notre-Dame Global Adaptation Initiative, on a scale from 0 to 100. It measures the difference of an index of country's *readiness* to mobilize financial resources to mitigate its exposition to climate change and an index of country's *vulnerability* or *inability* to face the potential adverse effects of climate change.

Lastly, the Climate Change Performance Index is an annual composite indicator which evaluates and compares the climate protection performance of 57 countries and the European Union. The index is built using fourteen distinct variables from four different categories: Greenhouse Gas Emissions, Renewable Energy, Energy Use and Climate Policy. Quantitative data, retrieved from the International Energy Agency, the Paris Reality Check: PRIMAP-hist, the Food and Agriculture Organization and the national GHG inventories, refer to the first three categories, while climate policy data are based on qualitative measures indicating government decisions relating to climate.

However, both the ND-GAIN and the Climate Change Performance indicators are affected by the same shortcomings as the proxies of air pollution.

3.3.2 | Qualitative aggregate data

The Eurobarometer Special Surveys on Climate Change also provide aggregate figures indicating perceptions on climate change on a national scale for European countries. These data are contained in Volume C (Country/Socio-Demographics). To the best of our knowledge, only Baiardi and Morana (2021) use these aggregate data by considering the Special Eurobarometer surveys 322, 372, 409, 435, 459 and 490, collected in the years 2009, 2011, 2013, 2015 and 2019, respectively.

Witzke and Urfei (2001), using individual data from a survey on Environmental Consciousness and Behavior run by the Federal Environmental Agency, apply a two-step procedure to estimate an indicator of environmental willingness to pay for Germany at regional level (NUTS3). They first estimate an order probit model in order to identify the main socio-economic determinants of environmental preferences at an individual level. They then combine this model with regional data in order to obtain an indicator of regional willingness to pay for conserving the environment.

For the USA, Brulle et al. (2012) and Carmichael and Brulle (2016) compute a time-series measure of public opinion on climate change by pooling data on climate change perceptions between 2002 and 2010 and 2001 and 2013, respectively.¹³ These data are retrieved from 74 different surveys, administered to 84,086 respondents, and the attention is focused on 14 distinct questions related to the emotional component of mind of climate change. They thus build an aggregate measure capturing how much the interviewees worry about this problem, to what extent the issue is serious and important for them, whether they are personally affected by climate change and consider global warming as a threat to themselves or to their way of life. Similarly, Bergquist and Warshaw (2019) put forward a comprehensive index of latent public concern about climate change for each of the fifty states of the USA in the years 1999–2017. Qualitative data, collected from all publicly available survey data on climate change in the USA (about 400,000 survey respondents in 170 polls), are aggregated by the general framework of Item-Response Theory, which is commonly used for pooling responses to different survey questions about an issue of interest. The index captures responses to questions about the belief that climate change is occurring and/or caused by human activities, concern about global warming, and support for prioritizing policies to address climate change, and thus focuses on the cognitive and conative components of mind.

Lastly, with the continuous growth of internet usage, Google Trend has emerged as a powerful tool to monitor and evaluate the dynamics of public interest and social trends (Nghiem et al., 2016). Consequently, some recent papers analyze Google search data to measure a country's level of environmental awareness. Vergis and Chen (2015) and Austmann and Vigne (2021), for example, use the expressions “*climate change*” or “*global warming*” as search term translated in the corresponding domestic languages of the countries of interest.

4 | DETERMINANTS OF CLIMATE CHANGE AWARENESS

In 1972, Gregory Bateson's influential book, *Steps to an Ecology of Mind*, introduced the revolutionary idea that individuals are a part of a system, defined as an “*integrated whole whose essential properties arise from the relationships between its parts*” (Pettini & Mazzocco, 2022). It entails that all humans are components of multiple and complex interconnected relationships and networks

featuring specific formal characteristics. This implies that Darwin's theory of evolution, which focuses on the idea of "self", is subject to an epistemological error and that climate change, or more generally environmental degradation, is the consequence of this. In other words, individuals are a part of economic, social and environmental systems, which can be perceived as dynamic inseparable processes co-evolving within each other. Climate change is a systemic stress, and causes disequilibrium in the system. It can be seen as an opportunity for agents to look for new ways of adapting to the environment, by involving government decisions, economic structure, and educational programs.

The way an individual reacts to the systemic stress of climate change depends on his/her knowledge of the environment and ability to store and exchange information through complex forms of cooperation and communication. Bateson notes that when studying cultural elements such as climate change awareness, it is a fallacy to classify the traits of a culture only in terms of "(a) economic profit or political dominance; (b) desirability of bringing about conformity to values of donor group; and (c) ethical and religious considerations" (Bateson, 1972, p. 72).¹⁴ It is instead important to realize that individual actions depend on the interaction between socio-economic features of a country as well as individual characteristics, beliefs, ethics, values and preferences. In this, communication plays a crucial role, in that individuals learn and share experiences with others.

In empirical models, this complexity is mainly treated by means of multivariate regressions, structural equation modelling and 2SLS regressions, in order to guard against the omission of relevant variables and problems of endogeneity (Tables 2–6). To provide a structured overview of existing studies, the following subsections review the literature based on variables often included in model specifications.

4.1 | Gender, age, education, and personal income

Gender, age, race (mainly in the USA), education, and personal income are the most widely investigated determinants of climate change attitudes. According to literature on risk perception, women are generally more risk averse than men, and thus they show greater environmental awareness (Skogen et al., 2018). This is consistent with their traditional role of caregiver and nurturer in the household. Moreover, as shown by Hunter et al. (2004), the fact that they traditionally work at home is an implicit incentive to engage privately in behaviors aiming at environmental conservation. Nevertheless, the literature on the relationship between environmental attitudes and gender is inconsistent (Mohai, 1997; Zelezny et al., 2000).¹⁵

On the other hand, men present higher risk acceptance, probably due to their dominant role in society, and are thus less concerned about climate change (Andor et al., 2018; Hamilton & Keim, 2009). Similar conclusions also hold for elderly people. Specifically, Franzen and Vogl (2013) find that American women show slightly higher environmental concern than men and that the age effect is concave, that is, environmental concern first increases and then decreases with increasing age, which suggests that younger people have more positive attitudes toward climate actions (Weko, 2022). In line with these findings, Wicker and Becken (2013) and Meyer (2015) show that women and young people exhibit a higher willingness to act in environmental protection than men and older people,¹⁶ while Andor et al. (2018) find that older people are not likely to take personal action or support policy measures for fighting climate change. This appears to be because they are more concerned about other global challenges, such as stabilizing the financial system and fighting terrorism, and that the existence of children or grandchildren does not alter their perception on environmental problems. In the USA, race is an additional factor to take into

TABLE 2 Socio-economic determinants of climate change awareness reviewed in Subsection 4.1, by country

Country	Data sources	Socio-economic determinant	Methodology	Author(s)
119 countries	Gallup World Poll	Education, Income	Recursive partitioning methods and non-metric multidimensional scaling	Lee et al. (2015)
35 countries	Life in Transition II study (LITS II, 2010)	Education	Multilevel binary logistic regressions	Smith and Mayer (2018)
33 countries	World Value Survey	Income	International contingent valuation study	Israel and Levinson (2004)
33 countries	ISSP (2010 Edition)	Gender, Age, Education, GDP	OLS regressions	Franzen and Vogl (2013)
27 European Member States	Eurobarometer #75.4 (2011 Edition)	Gender, Age, Education	Logistic regression analyses	Wicker and Becken (2013)
27 European Member States	Eurobarometer #68.2 and #75.2 (2008 and 2011 Editions)	Gender, Age, Education	OLS and 2SLS regressions	Meyer (2015)
27 European Member States	Eurobarometer #295, #365 and #416 (2008, 2011 and 2014 Editions)	Education	Multivariate linear regression model	D'Amato et al. (2019)
27 European Member States	Eurobarometer #322, #372 (2011), #409, #435, #459 and #490 (2009, 2011, 2013, 2015, 2017 and 2019 Editions) and different databases	Education	OLS regressions	Baiardi and Morana (2021)
European countries	European Social Survey (Round 8, in 2016)	Age, Education, Income	OLS regressions	Weko (2022)
26 countries	ISSP (2010 Edition)	Wealth	Descriptive statistics	Franzen (2003)
20 countries	ISSP (2010 Edition)	Gender	OLS regressions	Hunter et al. (2004)
Canada	Ad-hoc survey	Gender, Age, Education	Spearman's correlation analysis	Rowlands et al. (2003)
China	Chinese General Social Survey	Gender, Age, Education, Income	Structural equation model	Xiao et al. (2013)
China	Ad-hoc survey	Gender, Age, Education	Probit regression analyses	Dai et al. (2015)
China, Germany, and the USA	Ad-hoc survey	Education, Income	Bivariate ordered probit models and multinomial logit models	Schwirplies (2018)

(Continues)

TABLE 2 (Continued)

Country	Data sources	Socio-economic determinant	Methodology	Author(s)
Germany	Forsa	Gender, Age	OLS multivariate regression model	Andor et al. (2018)
Japan	Ad-hoc survey	Income, Information sources of global warming	Logistic regression models	Hidano et al. (2005)
Netherlands	Ad-hoc survey	Education	OLS and quantile regressions	De Silva and Pownall (2014)
Norway	Ad-hoc survey	Income	Contingent valuation study	Veisten et al. (2004)
Norway	Ad-hoc survey conducted by the Norwegian Institute for Nature Research	Gender, Age, Education, Social class, occupational status	OLS regressions and factor analysis	Skogen et al. (2018)
Spain	World Values Survey and European Values Survey	Education, Income	Order probit regression	Torgler and García-Vallina (2007)
Sweden	Ad-hoc survey	Gender, Age, Education	Random effects binary probit model	Ek and Söderholm (2008)
Switzerland	Ad-hoc survey	Gender, Education	Principal component analysis and multivariate regression model	Tobler et al. (2012)
USA (California)	Telephone survey of households in the Los Angeles area by UCLA's Center for the Study of the Environment and Society	Education	Descriptive statistics	Berk et al. (1993)
USA (California) and 14 countries	Ad-hoc survey	Gender	Descriptive analysis	Zelezny et al. (2000)
USA (Michigan)	University of Michigan's 1990 Detroit Area Study	Gender	Descriptive statistics	Mohai (1997)

(Continues)

TABLE 2 (Continued)

Country	Data sources	Socio-economic determinant	Methodology	Author(s)
USA (Texas)	Texas Environmental Survey	Gender, Race, Education	Logistic regression models	Klineberg et al. (1998)
USA	Email survey	Gender, Race, Education	Multivariate regression models	O'Connor et al. (1999)
USA	Ad-hoc survey	Gender, Race	Descriptive statistics and OLS regressions	Leiserowitz (2006)
USA	Ad-hoc surveys	Gender, Political ideology	Ordered logistic model	Malka et al. (2009)
USA	Ad-hoc survey	Gender, Race	Descriptive statistics	Wood and Vedlitz (2007)
USA	Ad-hoc survey	Gender, Race	Descriptive statistics	Brody et al. (2008)
USA	Ad-hoc survey	Gender	Descriptive statistics	Hamilton (2008)
USA	Community and Environment in Rural America	Gender, Education	OLS regressions	Hamilton and Keim (2009)
USA	Gallup World Poll	Gender, Age, Race	Logistic regression models	McCright and Dunlap (2011)
USA	Gallup World Poll	Gender, Race, Education, Political ideology, Income	OLS regressions	McCright (2010)
USA	Ad-hoc survey	Gender, Age, Education	Probit estimates	Reschovsky and Stone (1994)
USA	1993 General Social Survey	Education	Probit estimates	Smith (1995)
USA	Ad-hoc survey	Education	Multinomial logistic regression analyses	Kahan et al. (2011)
USA	Ad-hoc survey	Education, Cultural values, Information	OLS regressions	Kahan et al. (2012)

TABLE 3 Political values reviewed in Subsection 4.2, by country

Country	Data sources	Political values	Methodology	Author(s)
119 countries	Gallup World Poll	Political ideology	Recursive partitioning methods and non-metric multidimensional scaling	Lee et al. (2015)
47 countries	World Values Survey	Political interest	Linear regressions analysis	Kvaløy et al. (2012)
35 countries	Life in Transition Study (2010 Edition)	External political factors (2008 economic and financial crises)	Probit estimations	Dienes (2015)
33 countries	ISSP 2010	Party affiliation	OLS Multivariate Regression Model	Franzen and Vogl (2013)
26 countries	International Social Survey (2000 Edition)	Liberal political views	Descriptive Statistics and Probit regressions	Tjernström and Tietenberg (2008)
25 European countries	Eurobarometer #69.2 survey (2008)	Political ideology	OLS regressions	McCrigh et al. (2016)
European countries	European Social Survey (Round 8, in 2016)	Political ideology and values	OLS regressions	Weko (2022)
14 countries	International Social Survey Programme (2010 Edition)	Political affiliation	Ordered logit models	Tranter and Booth (2015)
Australia	Australian Survey of Social Attitudes	Political ideology	Ordered logistic model	Tranter (2011)
Australia	Australian Election Study	Political ideology	Multivariate analyses	Tranter (2013)
Canada and USA	Different databases	Political affiliation	Descriptive statistics	Lachapelle et al. (2012)
China	Ad-hoc survey	-	Descriptive statistics and maximum likelihood estimates in binary probit models,	Dai et al. (2015)
Germany	Ad-hoc survey	Income distribution	Ordered probit model	Witzke and Urfei (2001)
Great Britain	Ad-hoc survey	Party affiliation	Logistic and linear regressions	Poortinga et al. (2011)

(Continues)

TABLE 3 (Continued)

Country	Data sources	Political values	Methodology	Author(s)
Great Britain	Ad-hoc postal survey	Political affiliation	Linear regressions analysis	Whitmarsh (2011)
Great Britain	Eurobarometer #71.1 (2009); Department for Environment, Food and Rural Affairs (DEFRA) Survey 2009; British Social Attitudes Survey 2009	Political affiliation and discussion	Linear regressions analysis	Clements (2012a)
Great Britain	British Household Panel Survey 2008—2009	Political affiliation	Linear regressions analysis	Clements (2012b)
Post-Communist European countries	ISSP (1993, 2000, and 2010 Editions)	Political parties	OLS regressions	Chaisty and Whitefield (2015)
Spain	World Values Survey and European Values Survey	Environmental organizations, Political ideology	Order probit regression	Torgler and García-Valiñas (2007)
Sweden	Ad-hoc survey	Environmental organizations	Contingent valuation method	Carlsson and Johansson-Stenman (2000)
Sweden	Ad-hoc survey	Political distrust, Party support	Regression analyses	Jylhä et al. (2020)
United Kingdom	Ad-hoc survey	Voting preference	Descriptive statistics and linear regressions	Corner et al. (2011)
USA	Mail survey	Environmental interest group behavior	Contingent Valuation Method	Whitehead (1991)
USA	Email survey by the University of Kentucky Survey Research Center	Environmental organization	Logistic regression models	Blomquist and Whitehead (1998)
USA	Different databases	External political factors (Military conflicts)	Multivariate analyses	Gelpi et al. (2009)
USA	Ad-hoc surveys	Party affiliation, Trust in scientists	Ordered logistic model	Malka et al. (2009)
USA	Ad-hoc survey	Party affiliation	Descriptive statistics and ordered logistical model	Borick and Rabe (2010)

(Continues)

TABLE 3 (Continued)

Country	Data sources	Political values	Methodology	Author(s)
USA	Gallup World Poll	Political ideology	Multivariate logistic regression model	McCrigh and Dunlap (2011)
USA	Different databases	Elite Cues, Scientific information, Media advocacy, External political factors (business cycles, oil price shocks, arm conflicts)	Time-series regression estimates	Brulle et al. (2012)
USA	Gallup World Poll	Party affiliation, Party sorting, Elite cues	Descriptive statistics and OLS regression model	Guber (2013)
USA	Various national and rural surveys	Party affiliation	Descriptive statistics and logistic regression model	Hamilton et al. (2015)
USA	Granite State Poll	Political ideology, scientific information	Descriptive statistics and weighted logistic regressions	Hamilton and Saito (2015)
USA	Different databases	Elite cues, social movement efforts on climate change, Availability of scientific information, and mass media coverage, External political factors (business cycle)	SEM model	Carmichael and Brulle (2016)
USA (Oklahoma)	Meso-Scale Integrated Socio-geographic Network	Political ideology,	Multivariate analyses	Ripberger et al. (2017)
USA	-	Person's worldviews and ideology	-	Whitmarsh and Capstick (2018)
USA	Floor speeches published in the <i>Congressional Record</i> between 1996 and 2015	Political ideology	Quantitative text analysis	Guber et al. (2021)

TABLE 4 Media coverage of climate reviewed in Subsection 4.3, by country e/o type of user

Country/User	Data sources	Media coverage of climate	Methodology	Author(s)
27 countries	-	Newspaper articles that explicitly mentioned "climate change", "global warming", or "greenhouse effect"	Descriptive statistics	Schmidt et al. (2013)
China	Ad-hoc online survey	Mass media (newspapers, magazines, radio, television, and the Internet), social media (WeChat, Weibo, Douyin, Kuaishou, QQ, BaiduTieba, Zhihu, Douban, Facebook, Twitter, and Instagram) and interpersonal communication	Multiple regression analysis	Han and Xu (2020)
India	Ad-hoc online survey	Television, newspapers and magazines use	Confirmatory factor analysis and structural equation modeling	Trivedi et al. (2018)
Japan	25,532 newspaper articles	Newspaper articles about "climate change" and "global warming"	Time series analysis and cross-correlation	Sampeai and Aoyagi-Usui (2009)
Singapore	Ad-hoc computer-assisted telephone interview survey	Six media channels (television, newspapers, the Internet, magazines, outdoor media, and radio) and perceived media exposure of others (like family members, friends, colleagues, and the general public)	Structural equation modeling	Liao et al. (2016)
Taiwan	A national telephone survey from September 19 to October 5, 2014.	Television, newspapers and the Internet use	Descriptive statistics and structural model	Huang (2016)
USA	1993 General Social Survey	Environmental knowledge	Multivariate regressions	Blocker and Eckberg (1997)
USA	Ad-hoc mail survey	Television use (public affairs, nature documentaries, situation comedies, progressive dramas, traditional dramas)	OLS regressions	Holbert et al. (2003)
USA	-	Newspaper articles about "climate change" in <i>The New York Times</i> , <i>The Wall Street Journal</i> , <i>The Washington Post</i> , and <i>USA Today</i>	A quantitative content analysis	Feldman et al. (2015)

(Continues)

TABLE 4 (Continued)

Country/User	Data sources	Media coverage of climate	Methodology	Author(s)
USA	Different databases	Television, newspapers and magazines use	Structural equation modeling	Carmichael and Brulle (2016)
USA	Different databases	Newspaper articles about “climate change” in The New York Times and Wall Street Journal, television coverage in various channels (ABC, CBS, NBC, PBS, CNN, MSNBC, FOX, The Colbert Report and The Daily Show), and radio coverage	Multivariate regressions	Carmichael et al. (2017)
USA	2012 American National Elections Studies survey	Television, newspapers, radio, magazines and online data sources	Logistic regressions	Carmichael and Brulle (2018)
USA	A national paid opt-in online survey panel of U.S. adults through Qualtrics Panels	–	Online news browsing experiments	Feldman and Hart (2018)
USA	Online qualitative survey	–	A qualitative approach	Klas et al. (2019)
USA	Online longitudinal study	Social media	Logistic regression models	Latkin et al. (2022)
Facebook users	Ad hoc survey	Hot Dish Facebook application users	Descriptive statistics	Robelia et al. (2011)
Twitter users	Twitter trace data (993 tweets)	Social media: Twitter, with the following hashtags: #YouthClimateStrike (10.5K Tweets); #ClimateActionNow (7K Tweets), and #SchoolStrike4Climate (86.6K Tweets)	A combination of qualitative and quantitative analysis	Boulianne et al. (2020)
Twitter users	Twitter trace data (1,744,446 tweets)	Social media (Twitter)	Descriptive statistics	Jung et al. (2020)

TABLE 5 Different kinds of trust reviewed in Subsection 4.4, by country

Country	Data sources	Trust	Methodology	Author(s)
60 countries	Different databases	Social trust	Descriptive statistics and OLS regressions	Delhey and Newton (2005)
35 countries	Life in Transition Study (LITS II, 2010)	Social trust; Institutional trust	Multilevel binary logistic regressions	Smith and Mayer (2018)
33 countries	ISSP (2010 Edition)	General trust in people; General trust in government	OLS regressions	Franzen and Vogl (2013)
27 European Member States	Eurobarometer 68.2 (2008)	Corruption	Multilevel logistic regression:	Harring (2014)
27 European Member States	Eurobarometer #295, #365 and #416 (2008, 2011 and 2014 Editions)	Trust in information providers	Multivariate linear regression model	D'Amato et al. (2019)
27 European Member States	Different databases	Institutional trust	OLS regressions	Baiardi and Morana (2021)
Great Britain	Ad-hoc postal survey	Trust and distrust in information sources	Linear regressions analysis	Whitmarsh (2011)
Iran	Ad-hoc online survey	Trust in social media	Structural equation modeling	Zobeidi et al. (2022)
Israel	Ad-hoc online survey	Trust in journalists	Hierarchical regression analysis	Livio and Cohen (2018)
Spain	World Values Survey and European Values Survey	Generalized trust	Order probit regression	Torgler and Garcia-Valiñas (2007)
Switzerland	Swiss Environmental Survey (2007 Edition)	Generalized trust	Multivariate analyses	Meyer and Liebe (2010)
–	Data are retrieved from 51 studies available on Web of Science and Scopus databases	General trust, trust in institutions, trust in environmental groups, trust in industry and trust in scientists	Meta-regression analysis	Cologna and Siegrist (2020)
–	–	Interpersonal trust, membership in voluntary associations, and norms of reciprocity	Qualitative analysis	Sullivan and Transue (1999)

TABLE 6 Perceptions and personal experience about weather conditions reviewed in Subsection 4.5, by country

Country	Data sources	Perceptions and personal experience about weather conditions	Methodology	Author(s)
89 countries	Gallup World Poll	Temperature anomalies	Kruskal–Wallis one-way analysis of variance and multilevel binary logistic regressions	Howe et al. (2013)
27 European Member States	Eurobarometer #322, #372 (2011), #409, #435, #459 and #490 (2009, 2011, 2013, 2015, 2017 and 2019 Editions) and different databases	Extreme weather events (monetary loss and cooling degree days)	OLS regressions	Baiardi and Morana (2021)
Australia and USA	Ad-hoc survey and different databases	Perceived local temperature changes	2SLS regressions	Li et al. (2011)
China	Ad-hoc survey	Physical or financial damages due to extreme weather events (heatwaves, heavy rainfalls or floods, droughts, sandstorms, windstorms, and avalanches)	Descriptive statistics and maximum likelihood estimates in binary probit models,	Dai et al. (2015)
Germany	Ad-hoc survey	Perceptions about three kinds of natural hazards: heat waves, storms, and floods	Ordered logit regressions	Frondel et al. (2017)
Switzerland	Ad-hoc survey	Perception and personal experience with floods	Descriptive statistics	Keller et al. (2006)
Switzerland	Ad-hoc mail survey	Perceptions and personal experience with flood risks	Descriptive statistics	Siegrist and Gutscher (2006)
United Kingdom	Ad-hoc surveys	Personal experiences of flooding	Qualitative analysis	Whitmarsh (2008a)
United Kingdom	Ad-hoc survey	Extreme weather events (floods)	Product-of-coefficients approach	Spence et al. (2011)
USA	Ad-hoc survey	Local temperature changes and extreme weather events (hurricanes)	Descriptive statistics and ordered logistical model	Borick and Rabe (2010)

(Continues)

TABLE 6 (Continued)

Country	Data sources	Perceptions and personal experience about weather conditions	Methodology	Author(s)
USA	Few Research Center (June, July, and August 2006, January 2007, and April 2008)	Extreme weather events (local weather)	Ordered logit regressions	Egan and Mullin (2012)
USA	Different databases	Perceived changes in local temperatures, floods and droughts	Ordered logit regressions	Goebbert et al. (2012)
USA	Gallup World Poll	Local temperature abnormality	Bayesian and heuristics updating	Deryugina (2013)
USA	Granite State Poll	Perceived temperature changes (Arctic/weather question) and two temperature indicators	Logit regression model	Hamilton and Lemcke-Stampone (2014)
USA	Different databases	Perceived temperature and temperature abnormalities	OLS, 2SLS and hierarchical multiple regressions	Zaval et al. (2014)
USA	Various national and rural surveys	Temperature anomaly	Descriptive statistics and logistic regression model	Hamilton et al. (2015)
USA	Different databases	Extreme Weather Events (excessive hot and cold temperature, droughts, flooding, storms and hurricanes)	SEM model	Carmichael and Brulle (2016)
USA	NOAA's Storm Events Database and Cooperative Congressional Election Study	Extreme weather events (excessive heat, droughts, flooding, and hurricanes)	OLS and logistic regression models	Konisky et al. (2016)
USA	Different databases	Local temperature changes and temperature abnormalities	OLS and spatial regression models	Kaufmann et al. (2017)
USA	–	Weather condition and weather events	–	Whitmarsh and Capstick (2018)

consideration. Findings show that non-white females are more concerned about climate change than white males (Brody et al., 2008; Hamilton, 2008; Leiserowitz, 2006; Malka et al., 2009; McCright, 2010; McCright & Dunlap, 2011; O'Connor et al., 1999; Wood & Vedlitz, 2007;).

Lee et al. (2015) demonstrate that education is the strongest predictor of climate change awareness. It is generally positively correlated with the respondent's knowledge about environmental problems, and better educated individuals are expected to be more willing to engage in pro-environmental behaviors and to exhibit stronger climate change beliefs (Klineberg et al., 1998; O'Connor et al., 1999; Tobler et al., 2012). The literature shows that formal education is effective (Israel & Levinson, 2004; Veisten et al., 2004), but also that informal education is important in terms of higher preferences in environmental protection (Torgler & García-Valiñas, 2007).

Reschovsky and Stone (1994) find a positive relationship between different indicators of the level of education (i.e., below high school, school-leaving diploma, bachelor's degree, and graduate or professional degree) and five distinct household recycling behaviors by running an experiment in the Finger Lakes region of upstate New York. Similar results are discussed by Rowlands et al. (2003) and Krström and Kiran (2014), who show a positive association between education and the individual willingness to pay premium for green electricity in Canada and in the OECD countries, respectively.¹⁷ Wicker and Becken (2013) and Meyer (2015) estimate a logistic regression model and an instrumental variable analysis, respectively, in order to capture the effect of education on pro-environmental actions. Their findings demonstrate that education may increase respondents' perceptions of environmental issues. Similar results are obtained by Franzen and Vogl (2013), who measure education by the highest schooling achievement for each respondent in the USA, by De Silva and Pownall (2014) using a survey of over 1400 households in the Netherlands, and by Smith and Mayer (2018) in a sample from 35 countries. Xiao et al. (2013) and Dai et al. (2015) show that higher education is also positively associated with climate change concern in China.

However, as highlighted by Smith (1995) and Torgler and García-Valiñas (2007), the empirical literature casts some doubt on the robustness of this positive evidence in relation to individual attitudes towards collective environmental conservation and damage prevention initiatives. Berk et al. (1993) and Grafton (2014) find mixed results about the role of education in various water saving behaviors, while D'Amato et al. (2019) find that lower education reduces the propensity towards recycling and water saving, but that education has no effect on other pro-environmental actions. Ek and Söderholm (2008) analyze the main determinants of Swedish households' choice to pay a price premium for "green" electricity and find that it does not seem to be affected by education or gender. Kahan et al. (2011, 2012) identify in cultural polarization and conflict of interests, together with cognitive bias, elitist cultural worldviews and self-denial campaigns, the reason for a negative link between higher education and climate change awareness. In line with this evidence, Baiardi and Morana (2021) find a positive link between secondary education and climate change awareness, but a negative effect when tertiary education is considered, thus suggesting that the higher the percentage of citizens with tertiary education, the higher the national level of scepticism on climate change.

Lastly, among the social demographic characteristics linked to individuals' environmental awareness, personal income, or more generally, the economic situation of an individual, are an additional significant factor. In fact, wealthier people are expected to have a higher demand for a cleaner environment and for less environmental damage, although they are responsible for higher emissions than poorer individuals worldwide, as shown by Figure 3. As described by Franzen and Vogl (2013), two mechanisms are at work in this context: firstly, wealthier individuals have fewer economic problems and are therefore freer to consider other issues, and secondly, their

willingness to pay for better public goods is higher (Franzen, 2003). This implies that personal income is expected to positively affect climate change awareness, that is, that a higher personal income is correlated with a higher willingness to prevent environmental damage (Torgler & García-Valiñas, 2007). This hypothesis is generally verified, among others, by Franzen and Vogl (2013), Hidano et al. (2005), Israel and Levinson (2004), Schwirplies (2018), and Veisten et al. (2004).

It is worth noting that it is very difficult to capture the overall economic situation of each respondent. Personal income is an incomplete and partial measure of personal wealth, because respondents tend to underreport personal income in surveys, and inherited wealth or other properties are often not declared (Franzen & Vogl, 2013). For this reason, the inclusion in the empirical analysis of a macroeconomic variable measuring the stage of development of the country where the respondent lives would be crucial. Richer countries tend to provide more and better-quality public goods, and this sort of GDP effect contributes to individuals' wealth in addition to their personal incomes (See also Subsection 4.6).

To conclude, Table 2 provides a detailed summary of the literature related to the socio-economic determinants of climate change awareness reviewed in this subsection. It indicates data sources, the countries investigated, and the methodology used in the empirical analysis.

4.2 | Political interest and political orientation

Political interest and political orientation are significant individual level predictors of environmental awareness. With regard to political interest, it is assumed that politically interested people are also well-informed and have the objectivity to understand environmental issues. Their willingness to act to conserve the environment is expected to be very high. This is investigated by Torgler and García-Valiñas (2007), using three survey questions “*When you get together with your friends, would you say you discuss political matters frequently, occasionally or never?*”, “*How interested would you say you are in politics?*” and “*How important is politics in your life?*”. These questions capture whether the respondent discusses politics, her/his interests on the topic and to what extent the issue is important for her/him.

Membership of a voluntary environmental organization is also a significant factor. As underlined by Blomquist and Whitehead (1998), Carlsson and Johansson-Stenman (2000), Torgler and García-Valiñas (2007), and Whitehead (1991), members of this type of association tend to be more aware of environmental problems and exhibit stronger preferences for reducing environmental harm and fighting climate change.

Political orientation is another aspect analyzed frequently in the literature. Proxies of political orientation are generally obtained by means of specific survey questions where participants are asked to self-identify their ideology or political party. For example, the Eurobarometer survey invites respondents to express their political views on a Likert scale, where 1 is “*Being on the left*” and 10 “*Being on the right*”. Findings show that, in developed countries, people with more accentuated right-wing ideology are less interested in protecting the environment than left-wing voters (Franzen & Vogl, 2013), perhaps reflecting their stronger preference for economic development (Witzke & Urfei, 2001).

Literature on the role of political ideology in belief in anthropogenic climate change has flourished especially in the USA. Surveys generally ask individuals to express their political views as Democrat, Independent or Republican, sometimes with the additional qualification of “*strong Democrat*” or “*strong Republican*”, or alternatively “*extremely liberal*” or “*extremely conservative*”. Empirical evidence shows that political ideology is more important than other individual

characteristics in determining environmental views in the USA (Borick & Rabe, 2010; Hamilton et al., 2015). Liberals and Democrats are more likely to express concern about climate change than Conservatives and Republicans (Brulle et al., 2012; Lee et al., 2015; Malka et al., 2009), who are more sceptical about the phenomenon and its features (Dunlap, 2014). Guber et al. (2021) make a textual analysis of speeches published in the Congressional Record between 1996 and 2015 and show that the two main political parties differ in terms of the language they use. Democrats base their communications on scientific evidence, while Republicans prefer a narrative based on anecdotes and storytelling.¹⁸ McCright and Dunlap (2011), using data from the Gallup World Poll and by means of a multivariate logistic regression model, demonstrate that being a conservative white male is crucial in terms of climate change denialism and in terms of the defense of the current socio-economic system in the USA.

Recent political divisions in the USA have taken on new significance to environmental issues in the USA. Hamilton and Saito (2015) examine the case of the Tea Party movement which started in 2009, where supporters are more likely to be older, middle-class, male, and more educated than mainstream Republicans. Using an ad hoc survey question inserted into the Granite State Poll aiming to identify Tea Party supporters, they find that these supporters are less likely than other Republicans to trust scientists for information about environmental issues, to believe in Darwinian evolution, or believe either the physical reality or the scientific consensus on anthropogenic climate change. They show greater (misplaced) confidence in their own understanding of climate change.

Political ideology can also interact with education. The empirical literature shows that more educated people develop stronger arguments to support their views on climate problems, as in the case of Liberals and Democrats in the USA (Lee et al., 2015; Whitmarsh & Capstick, 2018). This evidence is generally explained by *elite cues* and *party sorting*, by which people's preferences align with the views of politicians and media that they follow (Guber, 2013). Moreover, more educated and informed individuals exhibit a higher capability to collect information supporting their beliefs and prejudices in what have been termed, as demonstrated by the *assimilation* and *motivated skepticism biases* (Borick & Rabe, 2010; Corner et al., 2011; Hamilton & Saito, 2015; McCright & Dunlap, 2011). The consequence is that people believe that they are well informed about climate change, but their knowledge is biased by their political ideology and may not be based on scientific evidence (Hamilton et al., 2015). This also implies that elite views impact more strongly on public opinion than do scientific research and mass media coverage (Brulle et al., 2012; Carmichael & Brulle, 2016).¹⁹

Similar evidence is found in many other developed countries, in other words, left-identifying individuals are more concerned about climate change than their right-identifying counterparts. This is the case of Australia, where Tranter (2011, 2013) analyzes the issue using data from the Australian Survey of Social Attitudes and from the Australian Election Study for the years 2007, 2010, and 2011. Tranter (2011) also shows that supporters of the Labor Party and the Greens exhibit a higher willingness to pay for renewable energy. Looking at climate change skepticism in Great Britain, Poortinga et al. (2011), Whitmarsh (2011) and Clements (2012 a,b) find that political affiliation is a very important predictor, and Conservative Party voters are more skeptical than Labor, Liberal Democrat or other party voters. A similar conclusion is reached by Lachapelle et al. (2012) in Canada, by Jylhä et al. (2020) in Sweden and by Kvaløy et al. (2012), Tjernström and Tietenberg (2008), Tranter and Booth (2015) and McCright et al. (2016) in other different samples of countries. However, it is worth noting that the evidence is weaker in less advanced countries. Dai et al. (2015), when testing whether education interacts with ideological and political beliefs, find that political factors do not seem to be crucial in terms of climate change attitudes in China. Moreover,

McCright et al. (2016), in line with Chaisty and Whitefield (2015), find that there is no clear-cut ideological divide on climate change awareness in the former Communist countries of Eastern Europe. Weko (2022) finds that political ideology is the key determinant of individual attitude in Europe, and that energy security is the reason for the differences in attitude between Eastern and Western Europe.

Table 3 provides a summary of the literature on political values influencing climate change awareness reviewed in this subsection, showing the countries investigated, data sources and the estimation methods used.

It is worth noting that Table 3 also reports some other *external* political factors, independent of individual ideology and political will, which can affect environmental views, and which should thus be included in the analysis. Such factors include armed conflicts (like war deaths in Iraq and Afghanistan), terrorist attacks, greater attention to foreign than to internal affairs, oil price shocks and the 2008 financial and economic crisis (Brulle et al., 2012; Carmichael & Brulle, 2016; Dienes, 2015; Gelpi et al., 2009).

4.3 | Media coverage of climate

An extensive body of papers has also focused on the extent, frequency, framing and prominence of media coverage of individual perceptions of certain issues (Dumitrescu & Mughan, 2010; McCombs, 2004). We consider two types of information dissemination about climate change, mass media and social media. The main findings are briefly summarized in Table 4.

4.3.1 | The use of mass media

Several types of mass media, including newspapers, television and radio, have been considered in the literature as primary sources of *environmental knowledge* (Slovic, 2016). Blocker and Eckberg (1997) find that there are no consistent gender differences in engagement in environmentally friendly actions when knowledge and trust in science are strong. This suggests that the use of mass media is a key factor in terms of pro-environmental behaviors, even though media attention to environmental stories tends to be short-lived and cyclical (Brossard et al., 2004; Driedger, 2007; McComas & Shanahan, 1999; Schmidt et al., 2013).

Schmidt et al. (2013) analyze media attention to climate change in 27 countries in the years 1996–2010. They consider the leading print media in each country and select articles which explicitly mention “climate change”, “global warming”, or “greenhouse effect”. Their findings are that climate change coverage has increased over time, especially in countries which signed the Kyoto Protocol. Similar conclusions are also reached by Sampei and Aoyagi-Usui (2009) in Japan,²⁰ who also observe a strong and robust increase in climate change awareness after the launch in 2005 of a national campaign to reduce greenhouse gas emissions.

Considering a sample of Indian consumers, Trivedi et al. (2018) find that those using television, newspapers and magazines exhibit higher environmental concern and are more likely to have green purchasing intentions. Similar conclusions are reached by Liao et al. (2016) for a nationally representative sample of 1144 Singaporeans. Similarly, reporting a 2014 national survey in Taiwan of 1074 respondents, Huang (2016) finds that the use of television, newspapers and the Internet positively affect several types of pro-environmental efforts, including searching for additional information, civic engagement and following environmental practices in everyday life

(proactive behaviors). Schmidt et al. (2013) underline that most of the literature uses different time frames and media, data and methods, and is based on single-case studies.

Lastly, many papers analyze the role of mass media in shaping public opinion on climate change in the USA. Holbert et al. (2003) use data collected in an annual ad-hoc mail survey of more than 3100 respondents in the years 1999 and 2000.²¹ They suggest that of four main types of television program, only public affairs broadcasts and nature documentaries increase environmental concern and affect pro-environmental behaviors, especially in the case of women, and older and well-educated people. Taking the following keywords to investigate media exposure “climate change”, “global warming”, “greenhouse” and “atmospheric carbon dioxide”, Robert Brulle, Jason Carmichael and colleagues find that television viewing, newspaper readership, radio programs and online data sources influence climate awareness (Carmichael & Brulle, 2016; Carmichael et al., 2017; Carmichael & Brulle, 2018), especially among Liberals and Democrats (Feldman & Hart, 2018). Their conclusions are also in line with Feldman et al. (2015), who find that partisan media affects this perception, and that American people are more likely to consume media nearer to their values and beliefs in the years 2006–2011. This in turn implies that mass media tends to provide coverage of topics which interest their audience (Yin, 1999).

4.3.2 | The advent of social media

Social media are interactive internet-based technologies which have spread spectacularly during the last 20 years. The use of social media has completely revolutionized the information environment, enabling people to communicate, and share videos and photos freely on the internet, and thus to experience new ways of entertainment, doing business, learning and understanding (Li & Sakamoto, 2014; Siddiqui & Singh, 2016). Social media have opened up new channels for organizations, climate activists, influencers, scientists and policymakers to raise climate change awareness and affect pro-environmental behaviors worldwide.

The activism of Greta Thunberg is perhaps the best-known example (Boulianne et al., 2020; Murphy, 2021). Her criticism of past actions of older generations as too weak to preserve the environment garnered global consensus at the end of 2019. The phenomenon became known as the “Greta Effect” and 2019 is widely recognized as the year when public opinion woke up to climate change. Since the Internet traffic is seen as the proxy of the public interest, Figure 4 shows that the search words “*What is climate change?*” increased considerably, with a consistent acceleration (and some spikes) at the end of 2019, on the occasion of Greta’s speech “How dare you?” at the United Nations Climate Action Summit (21–28 September 2019). This demonstrates that online social networks are an essential communication tool and especially stimulate young people to take action to reduce greenhouse gas emissions and join environmental movements (Jung et al., 2020; Robelia et al., 2011).

Moreover, social media influences environmentally friendly efforts through multiple mechanisms. Communication is favored by the fact that social and mass medias have certain features in common. Social media also benefits from interpersonal influence (Wählberg & Sjöberg, 2000; Liao et al., 2016), which affects the perceived truthfulness rating associated with the messages shared (Li & Sakamoto, 2014). Han and Xu (2020) jointly consider the influence of traditional media, social media and interpersonal communication on pro-environmental behavior in a sample of 550 Chinese respondents in 2019. They find that although traditional media are having a declining impact on environmental efforts, social media and interpersonal communication are significantly affecting perceptions of environmental risk and thus playing a key role in green behaviors.

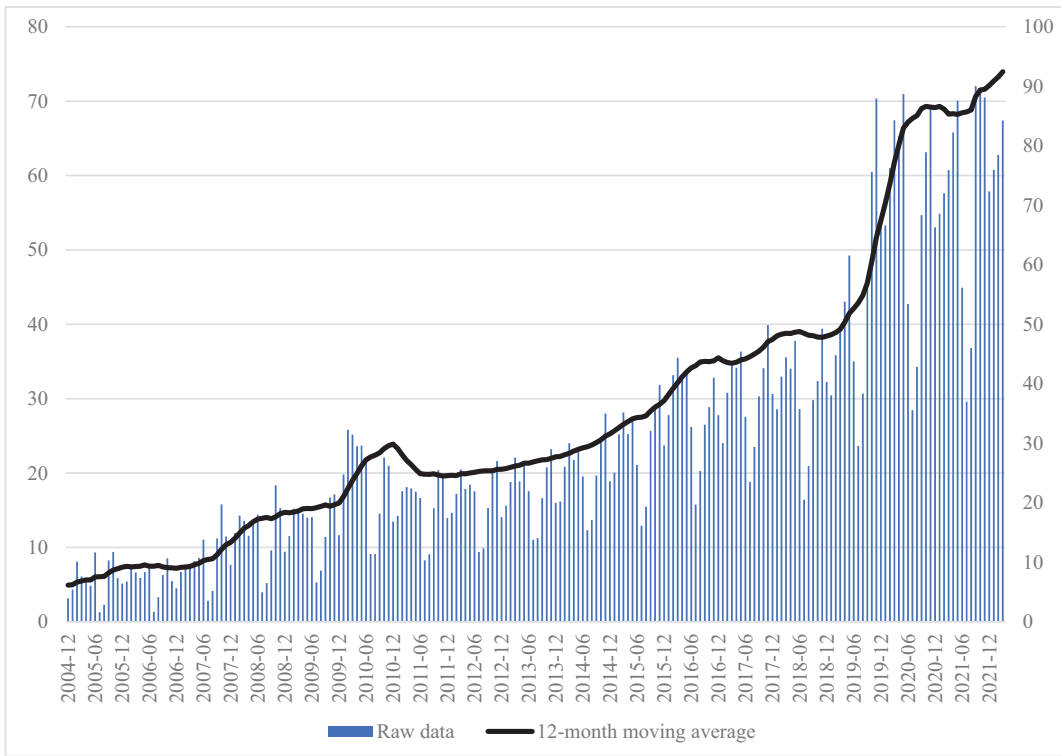


FIGURE 4 Google Trend results on “*What is climate change?*” in the period 2004–2022. *Source:* Author’s elaboration on Google Trend data (monthly frequency). The keyword is “*What is climate change?*” and the sample covers “The World” in the years 2004M1–2022M3. Bars indicate raw data, while the black line is the related 12-month moving average series. [Colour figure can be viewed at wileyonlinelibrary.com]

This close connection between social media and interpersonal communication is also crucial in the light of the relational limitations and social distancing imposed by the COVID-19 pandemic, which made electronic devices the main source of information. Latkin et al. (2022) in fact find that new forms of communication of compelling content, channeled through informal and personal networks, more easily reaches individuals who generally distrust information on these issues. Social media could thus bring the opportunity to stop seeing environmentalists negatively when they are engaged in collective action in the public sphere (Klas et al., 2019).

However, it is necessary to be careful with the use of social media. Free access to content can increase the viral spread of hoaxes and inaccurate news. According to the World Economic Forum,²² this information bias can also be exacerbated by the proliferation of unconnected platforms. Moreover, although individual environmental activism is facilitated by social media, there is the risk that supporters only participate through “clicktivism”, without taking any steps to fight climate change in the real world.

4.4 | Trust

Trust is a particularly important issue in climate change awareness because the information about risks relating to climate change cannot usually be verified. This is increasingly true in the age of

social media, where it has been shown that trust in information sources is dynamic and time variant and can differ across various groups of individuals, and from one technology platform to another (Cologna & Siegrist, 2020; Zobeidi et al., 2022). There are various definitions of trust, but it can generally be defined as the assumption that “*other people, or institutions, are acting in a mutually beneficial manner informed by broadly shared social norms*” (Smith & Mayer, 2018, p. 141). However, trust may also constitute a “social trap”, since higher it may amplify the effect of risk perception (Rothstein, 2014).

The level of trust that citizens place in their institutions is very important in the discussion of climate change awareness (Baiardi & Morana, 2021). Trust in government is particularly important, since it has a key role in the development of institutions and implementation of public policy (Sullivan & Transue, 1999). As a consequence, lack of trust in government, because of corruption, for example, can be detrimental in terms of pro-environmental efforts. Furthermore, the environment can be interpreted as a public good, which is characterized by non-excludability and non-rivalry of consumption, and environmental conservation may offer potential opportunities for “free riding” behavior (Kollock, 1998). This implies that greater trust in others indicates greater concern for public goods, and thus incentivizes pro-environmental behaviors (Franzen & Vogl, 2013; Harring, 2014; Smith & Mayer, 2018).

Meyer and Liebe (2010) study the impact of generalized trust, measured by means of an additive index derived from the answers to the following three questions “*Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?*”, “*Do you think that most people would try to take advantage of you if they had the chance, or would they try to be fair?*” and “*Would you say that most of the time people try to be helpful or that they are mostly looking out for themselves?*”, which are taken from the 2007 Swiss Environmental Survey, a nationwide general population survey of 3369 individuals. In this way, they analyzed the effectiveness of perceived trustworthiness, opportunism, and helpfulness as a determinant of individuals’ willingness to pay for public environmental goods. They find that generalized trust is associated with a stronger willingness to contribute, including in terms of higher taxes, to environmental protection, and this suggests that trust in other people encourages more effort toward environmental protection. Similar conclusions are reached by Torgler and García-Valiñas (2007), who show that the more citizens trust their society, the higher their willingness to conserve the environment, which also favors membership of environmental organizations.

Franzen and Vogl (2013) investigate two dimensions of trust: trust in people and trust in governmental institutions. General trust in people is measured by means of the following question, taken from the ISSP survey: “*Generally speaking, would you say that most people can be trusted, or that you can’t be too careful in dealing with people?*”, and the possible five responses range from “*You cannot be too careful*” to “*Most people can be trusted*”. General trust in the government is measured by the item “*Most of the time we can trust people in government to do what is right*”. Franzen and Vogl (2013) find that while trust in other people has a positive impact on environmental awareness, trust in institutions has no significant effect.

Smith and Mayer (2018) distinguish three different dimensions of trust: social trust, particular trust and trust in institutions. Social trust is the most general definition, involving trust in others within a society, linking individuals with other people (Delhey & Newton, 2005). Particular trust is that between members of an individual’s in-group. Trust in institutions, such as the government, the legal system, labor unions, business or organized religion, is a predictor of the individual’s propensity to provide policy support. Smith and Mayer (2018) build two variables: the first proxies social trust, and respondents are asked to express their trust in the following groups: neighborhood, people you meet for the first time, people of another religion, and people of another

nationality. The second variable captures institutional trust and respondents are asked about their trust in the following institutions: the presidency/monarchy, the government/cabinet ministers, local government, the parliament, courts and political parties.²³ By means of a multilevel binary logistic regression analysis, they find that individual-level social trust is positively correlated with climate behavior, and that its estimated effects are stronger and more consistent than those of institutional trust.

A similar conclusion is reached by D'Amato et al. (2019), who find that institutions such as governmental agencies do not affect pro-environmental behaviors, with the sole exception of water saving. This suggests that public campaigns play a key role in water consumption. D'Amato et al. (2019) also analyze the role of eco-information sources and trust in environmentally relevant behaviors and find that internet access can be considered as an effective source of eco-information in stimulating specific pro-environmental actions, while traditional media are an important source of information only in the case of decisions on energy saving and, less significantly, waste reduction.²⁴

Cologna and Siegrist (2020) perform a meta-analysis of 51 studies, and investigate how general trust and trust in institutions, environmental groups, scientists and industry influence different climate-friendly behaviors. Their results generally confirm the importance of trust in pro-environmental efforts, but also highlight the importance of environmental groups and scientists in encouraging individual engagement in mitigation and adaptation behaviors. This implies that scientists “*must learn to see themselves as public figures and honest brokers*”, in order to be “*as persuasive as they are trusted — which means that preserving and cultivating the public's trust must be the scientific community's top priority*” (Nature, 2010, p. 466).

The acquisition and processing of information are crucial, as climate change attitudes and actions are influenced by how people interpret and understand the available information (Franzen & Vogl, 2013; Smith & Mayer, 2018). It is, however, the case that individuals tend to use only information which confirms their beliefs, ignoring news which conflicts with them (Kunda, 1990). Education plays a key role in the fruition of printed and online media, magazines and newspapers, blogs, etc. The media have sometimes in fact been guilty of providing biased information, even denying the existence of climate change, showing doubt and encouraging apathy (Whitmarsh, 2011) and highlighting declining levels in public trust in journalists (Livio & Cohen, 2018).

Table 5 provides a list of the papers related to the different types of trust investigated in the empirical literature reviewed in this subsection. It shows data sources, countries analyzed and the methodological framework.

4.5 | Experience of extreme weather events and weather conditions

The literature indicates *direct experience* of climate change as direct experience of heatwaves, heavy rainfall or floods, drought, sandstorms, windstorms and avalanches or the damage and/or financial loss due to extreme weather episodes (Baiardi & Morana, 2021; Konisky et al., 2016). Such extreme weather events are becoming more frequent: in 2019, in just 1 year, there were at least 15 climate-related disasters round the world including wildfires in the USA, typhoons in China and Japan, and huge floods in Australia and Spain, leading to overall losses of 124.1 billion dollars. In general, people experiencing extreme weather are more concerned about global warming (Borick & Rabe, 2010; Dai et al., 2015; Howe et al., 2013; Whitmarsh & Capstick, 2018).

Spence et al. (2011) use data from a 2010 national survey of 1822 participants in the UK and show that individuals with personal experience of flooding are more aware of climate change,

and also exhibit greater willingness to save energy to mitigate climate change. Dai et al. (2015) find that climate change awareness is stronger for people who experience extreme weather events like heatwaves, heavy rainfall or floods, droughts, sandstorms, windstorms, or avalanches, independently of the occurrence of physical or financial damage. The relationship is very strong in the case of physical and financial damage caused by extreme weather events. Moreover, heatwaves are more strongly associated with climate change than floods or droughts. Similar conclusions are reached by Frondel et al. (2017), considering personal risk perception of three adverse natural events in Germany: heat waves, storms, and floods. In this survey, the key item in the empirical analysis is: “*With respect to the next few decades, how likely is an increase in future personal financial or physical damages caused by ...*”, and the blank is completed with one of the following events: heat waves, storms, or floods (Frondel et al., 2017, p. 174).²⁵ Explanatory variables indicate respondents’ experience of such natural events as well as financial or physical damage caused. Using a generalized ordered logit approach, they find that risk perception is positively related to personal experience with adverse natural events, and if this experience involves personal damage, the effect on risk perception is even stronger. These results confirm findings in the literature from different countries. See, for example, Keller et al. (2006) and Siegrist & Gutscher (2006) for Switzerland and Whitmarsh (2008a) for the UK. Baiardi and Morana (2021) use two variables for the monetary impact of climate change together with a measure of the intensity of the use of cooling facilities and the negative component of the Southern Oscillation Index, corresponding to El Niño episodes.

The incidence of *local weather conditions*, especially rising temperatures, on climate change awareness has been also studied. Recent papers in fact show that *current* temperature increases amplify the perception that climate change is happening, since individual perceptions are generally the result of personal experience (Egan & Mullin, 2012; Zaval et al., 2014; Kaufmann et al., 2017). Zaval et al. (2014) investigate how local temperature abnormalities influence global warming attitudes in the USA and find that they lead to an overestimation of the frequency of similar past events, thereby increasing belief in and concern about global warming. This sort of “local warming effect” depends on the fact that local temperature changes, as well as perceived temperature changes, are easily interpreted by individuals as evidence of climate change, although they provide little information about global warming from a scientific point of view (Li et al., 2011; Hamilton & Lemcke-Stampone, 2014).

However, conflicting results have been found in the empirical literature on this issue. Some papers, especially focusing on the USA, state that only fluctuations in temperature induce higher salience in climate change in the long run (Deryugina, 2013) and that they do not have any effects on climate change awareness (Carmichael & Brulle, 2016). Konisky et al. (2016) consider micro-level geospatial data on extreme weather events from NOAA’s Storm Events Database and analyze extreme weather events that are predicted to increase in frequency and severity because of climate change, such as warmer temperatures, more heat waves and drought, higher rainfall, more serious tropical storms, and rise in sea-level (IPCC, 2013). They conclude that there is little evidence of a positive relationship between experiencing extreme weather and climate change awareness, especially if these weather events occurred recently. Carmichael and Brulle (2016) also find a weak result investigating five distinct measures of extreme weather events (extremes in high and low temperature, extremes in 1-day precipitation, drought levels, and land-falling hurricanes and major storms) as did Hamilton et al. (2015) with regard to daily temperature and weather disasters.

Goebbert et al. (2012) combine observed data on weather conditions with individual perceptions. Using an ordered logit model, they investigate to what extent and whether observed deviations in local temperatures and precipitation from long term averages affect individual

perceptions of local weather changes. They ask three questions related to temperature, drought and floods: “*In your personal experience, over the past few years have average temperatures where you live been rising, falling, or staying about the same as previous years?*”, “*In your personal experience, over the past few years has drought where you live been more frequent, less frequent, or stayed about the same as previous years?*” and “*In your personal experience, over the past few years has flooding where you live been more frequent, less frequent, or stayed about the same as previous years?*”.²⁶ Their findings show that the relationship between perceptions of weather changes and actual changes in local weather is affected by cultural and political biases.

Table 6 provides a summary of the literature related to the perceptions and personal experience of weather conditions affecting climate change attitude reviewed in this subsection. It shows data sources, the countries investigated, and the empirical methodology used.

4.6 | The stage of development of the country

Climate change awareness is closely connected to the stage of development of the country where people live (Brulle et al., 2012; Carmichael & Brulle, 2016). Sandvik (2008) makes an analysis of covariance between climate change awareness, two proxies of economic wealth (2005 per capita GDP based on purchasing power parity in 1000 USD and its annual growth rate in the years 2000–2004) and a variable capturing the responsibility for global warming (2003 national per capita emission of carbon dioxide from fossil fuels in metric tons of carbon). Countries are grouped into different geographical areas (Africa, Asia, Europe, Latin America, North America and Oceania), and also according to their stage of development. Sandvik (2008) finds that climate change awareness is negatively, or perhaps non-linearly, correlated with GDP.

Kim & Wolinsky-Nahmias (2014) reach a similar conclusion on this correlation using a comprehensive cross-national dataset of data retrieved from the 2007 Pew Global Attitude Project, the 2005 World Values Survey, the 2008 HSBC Climate Change Confidence Monitor, and the BBC World Service Poll on Climate Change for the years 2006 and 2007. The finding implies that individuals more exposed to adverse local climate conditions, like farmers in developing countries, may be much more concerned about climate change than people in advanced economies (Basannagari & Kala, 2013; Whitmarsh & Capstick, 2018).

This suggests that, although climate change is a well-recognized threat to human wellbeing, the richest economies are “*better equipped and more capable of mitigating risks and coping with its consequences than the rest of the world*” (Lo & Chow, 2015, p. 346). People living in advanced economies are thus less concerned about the risks of climate change and tend to see it as an important but not very dangerous threat. Moreover, from a temporal and spatial perspective, they perceive climate change as distant, with negative consequences only in the long run (Frondel et al., 2017).

However, the debate about the relationship between climate change awareness and GDP is still open. Lo and Chow (2015) use per capita GDP (constant 2005 prices in USD) and tons of per capita CO₂ emissions as generic indicators of national wealth and of responsibility for climate change, respectively. They also include in their estimates energy consumption, as a robust alternative to CO₂ emissions, and the Notre Dame Global Adaptation Index as an indicator of preparedness for global climate change. Their results, obtained by means of a bivariate correlation coefficient analysis and a generalized linear regression model, show that per capita GDP, like all the other variables described here, correlates negatively with the perceived *risk* associated with climate change. Unlike Sandvik (2008), however, they find that it correlates positively with climate change *concern*. Baiardi and Morana (2021), Franzen and Vogl (2013), and Smith and Mayer

(2018) all reach the same conclusions, showing the existence of a positive relationship between per capita GDP and climate change awareness in different time periods and in different samples of countries.

This positive relationship is also found when other sets of variables are used. For example, Lo and Chow (2015) show that empirical estimations obtained by models using the ND-GAIN index are statistically more robust than models using GDP per capita. Similar conclusions are reached by Diekkman and Franzen (1999), who perform a correlation analysis using data from the 1992 Health-of-Planet Survey on 21 countries and per capita GNP, and by Franzen and Vogl (2013), who find that the positive effect of national wealth on environmental concern holds using cross-sectional data for the years 1993 and 2000, and also when fixed effects panel regressions are computed.

5 | CLIMATE CHANGE AWARENESS AND POLICY RESPONSES

Climate change is a negative international externality which has severe impacts in terms of wealth depletion, higher income inequality between regions and countries, trade redirection, and asset valuation. The 13th Sustainable Development Goals (SDGs) of 2015 express the need for a global partnership to take urgent action to tackle it and enable ambitious policy challenges in terms of climate change mitigation, adaptation and resilience to be set. As noted by IPCC (2022a), such intervention is crucial for reducing loss and damage caused by climate change in the short run, even if they cannot be eliminated. It is also crucial for limiting the magnitude and rate of loss and damage in the long run.

Greater concern about global warming is a determinant factor in achieving these goals, which require fundamental changes in lifestyles, technologies and business models (Carraro & L  v  que, 2013; EEA, 2016a; Esposito et al., 2017). Intervention will be successful only if there is an unprecedented level of global policy coordination. Advanced and developing economies are characterized by different vulnerabilities and exposures to climate change, in order also to capture interlinkages between resource users (Bleischwitz et al., 2018).

This section thus aims to identify which are the heterogeneous channels through which climate change awareness can support the desirable design of these types of interventions: responsibility and perceived risks, costs and benefits of climate policies, the quality of political institutions, communication strategy and cross-country cooperation and coordination (Subsections 5.1–5.5).

5.1 | Felt responsibility and risk perception

There are many psychological obstacles to personal support of mitigation and adaptation measures, even when people are aware of environmental problems (Gifford, 2011),²⁷ and proactive behaviors when enacted are generally spurred by a strong sense of responsibility (Fuller et al., 2006). Public awareness and a sense of responsibility are vital components for the effectiveness of climate policies. The concept of felt responsibility in fact indicates “*the extent to which individuals feel capable of and compelled to take useful action toward a desired result, and it prompts a willing, proactive engagement in an issue that can generate progress and future accomplishment*” (Jaku  cionyt  -Skodien   & Liobikien  , 2022, p. 3).

Feeling responsible implies that aware people feel they have to do something in order to preserve the environment (Austin et al., 2020; Skogen et al., 2018; Van der Linden et al., 2017). Women

tend to have a greater sense of responsibility than men, and in general, age, education, political orientation, religiosity and income are the most important factors in a sense of responsibility (Bateman & O'Connor, 2016; Boto-García & Bucciol, 2020).

Bouman et al. (2020) emphasize that personal responsibility and worry about climate change are key drivers of energy-saving behaviors (i.e., energy efficiency and energy curtailment) and climate policy support (i.e., applying a tax on fossil fuels, subsidizing renewables and banning unsustainable appliances). They also find that this positive relationship is significant in Northern and Western European countries, and weaker in Southern and Eastern European economies. Boto-García and Bucciol (2020) state that responsibility, self-transcendence (i.e., feeling oneself as an integral part of the universe) and openness (i.e., having broad intellectual interests and emotional range) are positively associated, whereas individual tendencies to promote personal interests and not to change one's personal environment are negatively related to environmentally friendly behaviors.

This is only part of the story. Climate change is an abstract phenomenon, with an impact on human wellbeing perceived as distant in time and space. This means that individuals often believe that they are powerless and their everyday actions irrelevant to fighting climate change (Burke et al., 2018; Van der Linden et al., 2015; Weber, 2015). The same type of myopia is also identified in behavioral economics literature (Thaler & Benartzi, 2004), and means that risks of climate change are often underestimated, with negative consequences in terms of public support for climate policies. Higher individual risk perceptions of climate change generally go hand in hand with personal experience of adverse natural events. When personal loss or damage is involved, risk perception is even higher (Frondel et al., 2017; Zaalberg et al., 2009).²⁸

Generally, respondents more aware of climate change show a higher willingness to pay for mitigation policies and are more likely to take action to preserve the environment (Dienes, 2015; Wicker & Becken, 2013). In line with this evidence, Jakučionytė-Skodiėnė and Liobikienė (2022) emphasize that the main challenge for policymakers is not only to make people concerned about the environment, but to make them aware that their actions and choices are pivotal for climate change mitigation. Implanting and strengthening a sense of responsibility should thus be a priority for policymakers worldwide. As discussed in more detail in Subsection 5.5, policymakers should make more effort to agree on binding international targets in order to do this.

5.2 | Costs and benefits of climate policies

The implementation of climate policies is also hindered by the fact that “*the costs of these measures are known and arise today, while the benefits are uncertain and might only emerge in the distant future*” (Andor et al., 2018, p. 173). This implies that the effectiveness of climate policies is subject to great uncertainty especially in the long run, which conflicts with the certain and important costs to be paid in the short run.

Population aging in industrialized countries is relevant for the implementation of climate policies. In fact, the combination of certain short-term costs and uncertain long-term benefits is weakly supported by older people, who are less likely to approve climate-friendly policies, agree with allocating public resources to climate policies and also have a lower willingness-to-pay for them, given their shorter individual planning horizons (Andor et al., 2018). Women exhibit greater willingness to contribute to a better environment than men (Torgler & García-Valiñas, 2007), reflecting their higher propensity to take private adaptation measures (Schwirplies, 2018). Another important individual characteristic is personal income, although its influence varies across

countries. For example, acceptance of adaptation policies is positively correlated with income in China, and higher income respondents seem to be more inclined to autonomous climate-friendly and adaptation activities in Germany (Grothmann & Reusswig, 2006; Lange et al., 2017). However, von Borgstede et al. (2013) show that sometimes green behaviors are not an act of environmental friendliness but are instead driven by the desire to save money.

The costs and benefits of environmentally friendly behaviors are important aspects of individual willingness to take action on climate change and support relevant fiscal policies, which can in fact be used to correct market failures and facilitate private resilience when risks are not priced adequately. High costs are a psychological barrier to environmentally friendly behaviors (Brügger et al., 2015; Doran et al., 2019), which is an impediment especially in high-cost behaviors such as buying low energy homes, electric cars or using more renewable energy sources (Jakučionytė-Skodienė & Liobikienė, 2021, 2022). In these situations, the willingness to pay for environmental efforts tends to be lower than the willingness to take action on climate change.

It is therefore clear that reducing the costs and increasing the benefits related to climate change mitigation should be mandatory for policymaking and requires legal and regulatory reforms to complement financial incentives. Easier access to loans, for example, should encourage the purchase of low-energy homes. In order to encourage the use of public transport instead of private cars, the policymaker should trigger economic incentives relating to parking charges and congestion fees. Lower taxes and tax breaks appear to be essential for the transition from traditional to renewable energy sources and the promotion of circular-economy initiatives. Such schemes encourage the use of reclaimed materials, save waste and energy and lower emissions (Esposito et al., 2017; Geng et al., 2019). Sun et al. (2017) show for example that the local urban industrial symbiosis network in Liuzhou City in China reduces ore mining by about 204.7 million tons, solid waste by about 6.9 million tons, and CO₂ emissions by 2.3 million tons per year.

Additional effort should be made to encourage investment in resilient infrastructures and in promoting labor market policies aiming at more climate-sustainable jobs and gender-equal education. This would be useful to counterbalance climate-induced inequality, which generally affects youth, women, refugees and rural populations (Fry & Lei, 2021). Subsidizing insurance against natural hazards, as well as improving competences for monitoring and forecasting hydrological and meteorological risks, is crucial in sectors such as agriculture and tourism and in flood- and drought-prone areas, and coastal regions. Subsidies for risk reduction and financial inclusion can also boost replacement or renovation of private physical assets which can raise levels of resilience and protection. These measures require time, capacity building and funding, but the benefits include the potential avoidance of about 50–60 per cent of climate damage, as well as improvement in agricultural productivity, innovation, health and wellbeing, food security, livelihood and biodiversity conservation (Bellon & Massetti, 2022; IPCC, 2022a). Lastly, benefits can also be measured in terms of economic and scientific advances, with additional positive repercussions on quality of life (Bain et al., 2012; Obradovich & Guenther, 2016).

5.3 | The quality of political institutions

Muhammad and Long (2021) show that the quality of political institutions - generally measured in terms of political stability, the level of corruption and rule of law - is an important factor in environmental conservation. Smith and Mayer (2018) emphasize that a high level of institutional trust leads people to endorse climate policy more easily. In other words, lack of trust and corruption are associated with a lower perceived effectiveness of environmental policy (Harring, 2014),

while high quality of political institutions encourages collective actions to conserve the environment (Duit, 2011). Living in a country characterized by low levels of corruption is thus an implicit determinant of individual support for climate intervention. This suggests that poor socioeconomic conditions and weaknesses in institutional frameworks, administrative capacity and regulation are serious shortcomings for the implementation of mitigation and adaptation policies. Weak governance and tight fiscal space could limit climate-related spending, with severe consequences in terms of public management of climate risks. The strengthening of poor administrative capacity usually needs to be accompanied by upgrading the financial sector in order to facilitate adaptive and clean investments (IMF, 2022a), which generally require huge financial outlay, procedural fairness and the coordination of public-private partnerships (Davenport et al., 2007; IPCC, 2014).

It is worth noting that “*in democratic countries, the legitimacy of political decisions depends on the extent they reflect public opinion*” (Drews et al., 2018, p. 265). This implies that, in democracies, it can be difficult to implement policies which conflict with the public wishes. So, in the trade-off between economic growth and environmental degradation, if economic growth takes priority over the environment in public opinion, growth-enhancing policies will be promoted at the expense of environmental protection. This occurs especially in time of crisis, as in the current COVID-19 pandemic, where people prioritize economic and health policies which can give them an immediate individual return. Sustainable initiatives are thus today being globally promoted as the key post-crisis recovery strategy, allowing the policymaker to integrate economic, health, altruistic and environmental actions in a new and robust manner (Allain-Dupré, 2020; Escario et al., 2022). This revolutionary process is in line with the SDGs related to water and energy use, economic growth and climate change (Schroeder et al., 2019), but more is required to persuade citizens that environmental policies can complement economic goals rather than conflict with them. This is fundamental, especially in developing countries, where climate change awareness is low and the transition to sustainability often meets with obstacles including the belief that environmental protection is too expensive, the non-enforcement of existing environmental laws, the absence of effective market incentives and democratic governance, and a lack of capital, know-how and technologies (Hecht, 1999). Such problems imply that the quality of political institutions and the dissemination of environment related information need to be enhanced. This is discussed in more detail in the following subsection.

5.4 | Communication strategy

Communication is a policy tool which can improve the implementation and outcomes of environmental policies at relatively little cost. The key to affect individual attitudes and intentions on environmental problems is access to information on the impact of climate change. In fact, information about the harm caused by global warming significantly improves the ability of regulators to enforce environmental standards and ensure that intervention is supported by public opinion. According to the Aarhus Convention,²⁹ supranational, national and local public authorities should actively disseminate environmental information in their possession such as environmental and climate data and indicators, assessments, projections and maps (EEA, 2016a).

However, the abstract nature of climate change makes communication complicated, because people generally perceive the implementation of these policies as expensive and uncertain (see also Subsection 5.2). This means that communication strategies need to be well-tailored, use the language of certainty and a concrete mode, have clear and explicit targets, and be applied in a timely fashion (von Borgstede et al., 2013). In this way, communication contributes to

transparency, collaborative governance, deliberative democracy, institutional legitimacy and citizen engagement (EEA, 2016a).

Identifying the psychological and socio-demographic determinants as well as the structural aspects associated with a higher willingness to act is particularly important for disseminating constructive messages highlighting the benefits of low-carbon lifestyles, and reducing avoidance (Latkin et al., 2022; Whitmarsh, 2011). This process involves innovative communicative approaches built on behavioral sciences (Haq et al., 2013). This is crucial to support the introduction of stricter policy measures with direct repercussions on daily life, as in the case of re-use, recycle, waste management and new dietary and travelling habits (Liao et al., 2016).

Trusted sources of information need to be used, and communicators need to make scientific knowledge understandable, accurate and credible and at the same time perceived as independent, politically neutral and objective (Druckman & McGrath, 2019). On one hand, this requires a close connection between policymakers and climate scientists, and on the other, scientific evidence needs to be disseminated as broadly as possible through academic and non-academic channels. More precisely, non-academic channels play an important role for dissemination. The use of visual communication and digital storytelling tools, such as infographics, one-pagers, and interactive websites and digital reports, can allow researchers to explain their complex scientific findings by means of simple clear language for non-experts. These interactive tools can be easily shared globally on social media, which are suitable for promoting communication campaigns based on smart and direct messages, boosting environmentally friendly actions (see Subsection 4.3.2). Zobeidi et al. (2022) demonstrate for example that Instagram users following information posted on renewable energies have a higher perception of the risk of climate change and thus greater willingness to adopt alternative energy sources.

However, the literature underlines that consensus between experts on human-caused climate change is essential (Van der Linden et al., 2017). Business scholars, as well as top managers of public and private companies, are a good audience in this sense, because they have a social status and educational level similar to those of climate researchers. They also understand abstract concepts like the high uncertainty associated with the evolution of the climate scenario. They are responsible for the education corporate leaders (Patenaude, 2010) who are in turn aware of market rewards for firms showing respect for natural sources and reducing input of virgin materials and output of waste (Haas et al., 2015). Fighting climate change by adopting innovative business models and practices based on re-manufacturing, refurbishment, repair, re-use and waste prevention can in fact be an opportunity to gain competitive advantage on international markets (EEA, 2016b; Geng et al., 2019).

5.5 | Cross-country policy coordination and cooperation

Climate change is a global negative externality, a cross-border challenge requiring an unprecedented level of cross-country policy coordination and cooperation. The Paris Agreement, adopted by 196 countries in December 2015, constitutes a landmark in the multilateral climate change process continuing in the post-2020 period.³⁰ This international binding agreement highlights that the decarbonization of the economy and avoidance of abrupt changes and losses at the expense of future generations can take place only through ambitious efforts made on a global scale. The acceptance by a high number of countries of international binding global climate targets is key for implementing, accelerating and sustaining adaptation in human systems and ecosystems (IPCC, 2022a), as demonstrated by recent simulations about the international carbon price floor on fossil

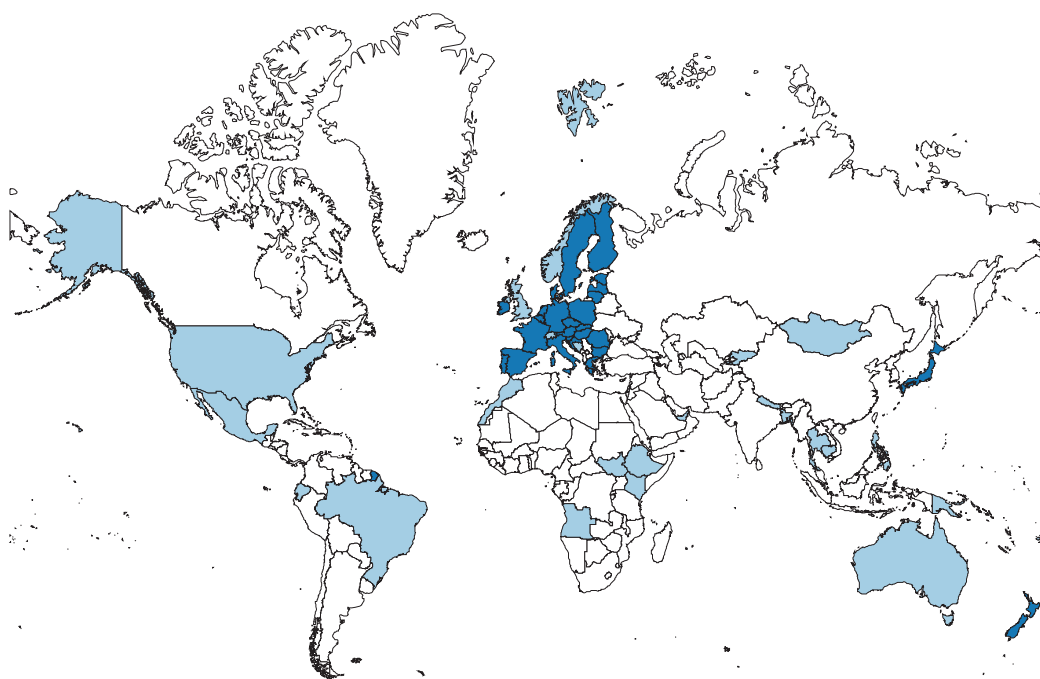


FIGURE 5 Geographic distribution of climate strategy and greenhouse gases reduction target policies. Notes: Author's elaborations on data retrieved from Climate Policy Database. Specifically, the following two types of policies have been mapped: political and non-binding climate strategy and greenhouse gases reduction target interventions (light blue) together with formal and legally binding climate strategy and greenhouse gases reduction target policies (blue). [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1111/joes.12338)]

fuel CO₂ emissions in 2030 (IMF, 2022b). Moreover, the post-crisis recovery after the COVID-19 pandemic is an extraordinary opportunity for transition to sustainability (Pianta et al., 2021).

The transition thus requires clear goals and priorities, the enhancement of knowledge on impacts and solutions, and the mobilization of, and access to, adequate financial resources. It will be enabled by international cooperation, which can accelerate the spread of low-emission technologies, higher transparency requirements for national reporting on emissions, and tracking progress toward the implementation of actions and policy development at national and transnational level (IPCC, 2022b). The transition is more likely in countries where climate change awareness and sense of responsibility is high. This is the case of the European Union,³¹ where about 93 per cent of citizens believe that climate change is a serious problem, and almost a quarter (23 per cent) believe that climate change is the single most serious problem facing the world today (Eurobarometer, 2019).

In fact, as shown by Figure 5, only European countries apply two types of interventions on a global scale, that is, political and non-binding climate strategy and greenhouse gas reduction target interventions as well as formal and legally binding climate strategy and greenhouse gas reduction target policies (blue). The remaining countries of the world at best are only implementing political and non-binding climate strategy and greenhouse gas reduction target interventions (in light blue). The European Union is gaining growing credibility as an international climate leader (Alloiso et al., 2022 ; EEA, 2016a).

Furthermore, adaptation and mitigation policies require collaboration and coordination at all levels of governance. In fact, climate change is a global phenomenon, but its impact differs from place to place (OECD, 2021). Consequently, supranational, national, regional and local authorities are all involved in the transition to sustainability, because subnational governments, such as regions, provinces and cities, are closer to citizens and therefore better understand local vulnerabilities and community's resilience (Zabaniotou, 2018). Multi-level climate governance helps to realize synergies between state and non-state actors and minimize trade-offs and should ensure effective and equitable climate governance (Jänicke, 2017). It is also accompanied by multi-stakeholder governance, thus involving civil society and political actors, private sector entities and local communities (IPCC, 2022b).

However, although the UNFCCC, the Kyoto Protocol, and the Paris Agreement provide an important stimulus for achieving ambitious climate change mitigation goals, it is the case that climate change is still not a priority everywhere in the world. Official national government responses to climate issues depend on country-specific political values, financial constraints and psychological co-benefits. Today, the only certainty is that the failure of international efforts will be accompanied by a rise in global average temperatures in the next decade, and that this will have dramatic consequences in terms of climate hazards and loss of real global GDP per capita (Kahn et al., 2019). Scientists agree that without immediate action to limit greenhouse gases, climate change will be irreversible after 2030 (IPCC, 2018). So, cross-country differences are a key element for increasing climate change awareness and for efficiently realizing coordinated environmental programs.

6 | CONCLUSIONS

Nowadays, climate change is a priority for policymakers worldwide. Identification of factors influencing individual perceptions and actions to be taken and accurate assessment of the willingness to pay for mitigating the effects of climate change are the key to understanding the nature of individual support for environmental and climate policies. The success of such policies in turn depends to a great extent on public opinion.

This study first described the evolution of climate change awareness during the last 30 years. It identified three distinct phases: the growing worldwide awareness of climate change during the 1980s and 1990s, a subsequent phase of scepticism during the 2000s and the increasing importance of opinion leaders for environmentally friendly behaviors in more recent years.

The study then reviewed the data sources most widely used in the empirical literature. It focused on the different variables used to proxy climate change awareness, taking account of studies using both individual and aggregate data. With regard to empirical papers investigating individual perceptions, the most popular question wordings capturing the emotional, cognitive and conative components of mind were analyzed. It is important to note that question wording is a thorny topic (Drews et al., 2018; Schuldt et al., 2015; Whitmarsh, 2008b), as biases due to the response process can clearly affect survey data results (Bertrand & Mullainathan, 2001; McFadden et al., 2005).

Third, this study provided an overview of the most widely investigated determinants of climate change awareness, and reviewed variables often included in the model specifications in the literature. Individual characteristics like age, gender, education, political values, media coverage of climate, experience with extreme weather conditions and trust appear to be crucial for understanding climate change, as does the stage of development of the country where people live. With

regard to political values, specific attention was given to the USA, given the existence of a huge body of papers on this topic.

Finally, the study concluded by stating policy implications derived from the most significant results in terms of the determinants affecting individual preferences. This is a crucial step as public policies and individual attitudes are closely connected. In fact, on one hand, policymaker decisions affect human behavior towards the environment, while on the other hand, individual awareness of climate change is both a sufficient condition for supporting costly adaptation activities and a necessary condition for implementing mitigation policies.

Notes

- ¹In 2018, the 10 biggest emitters of carbon dioxide were: China, the USA, the European Union, India, the Russian Federation, Japan, Korea, Iran, Indonesia and Canada.
- ²The NIPCC is the climate change denial advocacy organization set up in 2003 by S. Fred Singer's Science & Environmental Policy Project, later supported by the Heartland Institute lobbying group. The IPCC is the United Nations body for assessing the science related to climate change in order to provide policymakers with regular scientific assessments on global warming, its implications and potential future risks, and proposing adaptation and mitigation options.
- ³See, for example, <https://www.vox.com/policy-and-politics/2017/6/1/15726472/trump-tweets-global-warming-paris-climate-agreement>.
- ⁴In fact, in the USA, various studies show that climate change awareness reflects the increasingly partisan and ideological polarization of American public life (Hoffarth and Hodson, 2016), and Liberals and Democrats are more likely to express concern about climate change than are Conservatives and Republicans (Lee et al., 2015).
- ⁵The most recent Arab Barometer Wave V for the years 2018-2019 introduced for the first time a specific question on the environment: 'How serious a problem do you think the following issues are: Is [INSERT ITEM] a very serious problem, a somewhat serious problem, not a very serious problem, not at all a serious problem', where the items are: 'climate change', 'air pollution', 'water pollution' and 'trash'.
- ⁶'The ideas that die do so because they don't fit with the others. You've got the sort of complicated, living, struggling, cooperating tangle like what you'll find on any mountainside with the trees, various plants and animals that live there - in fact, an ecology' (Bateson, 1991, p. 24). In other words, human behaviours can be related to those characterizing ecological systems.
- ⁷Starting from this classification, Lee et al. (2015) build a binary variable used in the empirical analysis, assigning the value of 1 to aware respondents and 0 otherwise.
- ⁸In this case too, the authors compute a binary variable by assigning the value of 1 to those who state that the problem is either 'Somewhat serious' or 'Very serious' and 0 otherwise.
- ⁹For details, see www.forsa.com.
- ¹⁰Respondent support is indicated on a 5-point scale (1 'strongly in favour', 2 'somewhat in favour', 3 'neither in favour nor against', 4 'somewhat against', and 5 'strongly against').
- ¹¹The first paper by Jakučionytė-Skodienė and Liobikienė (2021) is based on the Eurobarometer 91.3 survey made in April 2019, and the second, Jakučionytė-Skodienė and Liobikienė (2022) uses five Eurobarometer surveys (75.4; 80.2; 83.4; 87.1; 91.3 performed in June 2011; November-December 2013; May-June 2015; March 2017 and April 2019 respectively).
- ¹²With regard to Energy, respondents are asked which of the following policies they would like their country to pursue to address climate change: 'using solar, wind and renewable power', 'wasting less energy in homes, buildings, and factories', 'stopping burning fuels that pollute', for the Economy, the policies suggested are: 'investing more money in green businesses and jobs', 'requiring more information on how products are made', and 'making companies pay for their pollution'. With regard to Transportations, the actions suggested are: 'using more clean electric cars and buses, or bicycles', 'transporting good on planes, ships, trains and trucks that run on clean energy', and 'improving the design of cities and rural communities', and for Farms and Food they are: 'using climate-friendly farming techniques', 'reducing food waste', and 'promoting plant-based diets'. With regard to Protecting People from extreme storms, flooding, droughts, forest fires, and other climate impacts, the options suggested are: 'installing more early warning systems for disasters', 'providing good and affordable insurance', 'building infrastructure and

conserve nature to protect lives and livelihoods', and for Nature they are: 'conserving forests and land', 'keeping the ocean and waterways healthy' and 'supporting local communities, indigenous peoples, and women that are environmental stewards'.

- ¹³ In both papers, data are pooled by using the algorithm developed by Stimson (1999).
- ¹⁴ Bateson writes that in studying cultural elements, anthropologists divide relationships into two main categories: (1) *symmetrical*, i.e., when differentiation is made in terms of moieties, clans, towns or countries. In this case, individuals have the same aspirations and the same behaviour patterns, but are differentiated in the orientation of these patterns; and (2) *complementary*, i.e., when differentiation is made in terms of social strata, classes, age or gender. In this case, individuals exhibit different behaviours and aspirations. The type of relationship affects the desire for conformity in individual behaviours, and where this conformity fails, it affects the behavioural and cultural changes taking place.
- ¹⁵ For example, the meta-review by Zelezny et al. (2000) shows that of 13 studies, 9 found that women are significantly more active in pro-environmental behaviors than men, 3 found no statistically significant difference between males and females and one study reports greater participation of men.
- ¹⁶ As noted by Franzen and Vogl (2013), younger people are more concerned than older people because global warming has received stronger media coverage in their lives.
- ¹⁷ Rowlands et al. (2003) investigate 2000-2001 survey responses from large Canadian cities (Waterloo and Ontario) by means of a Spearman's correlation analysis.
- ¹⁸ James G. Watt, the head of the Department of the Interior during Ronald Reagan's presidency, distinguished for its hostility towards environmental issues. A popular pun at the time was 'How much power does it take to stop a million environmentalists? One Watt'.
- ¹⁹ However, Ripberger et al. (2017), considering political predispositions in data from the Meso-Scale Integrated Socio-geographic Network (M-SISNet), a longitudinal (panel) survey conducted in Oklahoma, find that political predispositions imply biased assimilation and confirmation bias in the cognitive process, and thus affect climate change awareness. But the influence is not strong enough to completely counteract feedback from the climate system.
- ²⁰ Sampei and Aoyagi-Usui (2009) analyse 25,532 newspaper articles, published between January 1998 and September 2007 in Japan, using as keywords 'climate change' and 'global warming'. Their findings show that the overall trend of Japanese media coverage on this topic has increased but only gradually.
- ²¹ Participants number is 3,388 in 1999 and 3,122 in 2000.
- ²² For more details, see <https://www.weforum.org/agenda/2016/04/can-social-media-help-to-save-the-environment>.
- ²³ Response categories range from 1 (complete distrust) to 5 (complete trust) for each institution.
- ²⁴ This information was captured by the question: 'From the following list, which are your three main sources of information about the environment?', with possible answers: internet, publications, brochures or information materials, events (conferences, fairs, exhibitions, festivals, etc.), social media, TV films and documentaries, conversations with relatives, family, friends, neighbors or colleagues, books, magazines, newspaper, television news, the radio. Trust in the following information providers has also been considered: institutions (national and international), companies, environmental and consumers' organizations, and scientists.
- ²⁵ Frondel et al. (2017) consider the role of risk perception associated to climate change by using two surveys conducted in 2012 and 2014 by the German institute *forsa*.
- ²⁶ Data retrieved from two 2008 USA surveys; online interviews with independent cross sections and a nationwide telephone survey.
- ²⁷ According to Gifford (2011), individual actions are hindered by seven psychological barriers, i.e. limited cognition, ideologies, comparison with others, the presence of sunk costs, discredence, perceived risks and limited behaviours.
- ²⁸ The existing literature thus shows that an important policy question is the following: 'Will the predicted increasing frequency and severity of extreme weather events lead citizens to reassess climate change risks, possibly increasing pressure on governments to invest more resources in mitigation and adaptation?' (Konisky et al., 2016, p. 534).
- ²⁹ The United Nations Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, adopted in 1998 and entered into force in 2001, is commonly referred to as the Aarhus Convention.

- ³⁰The 2015 Paris Agreement was the first-ever legally binding global climate agreement and was signed by 196 countries with the goal of limiting global warming to under 2 degrees Celsius compared to pre-industrial levels (UNFCCC, 2015).
- ³¹The Green Deal is important here in giving member states of the EU countries an opportunity to follow a new path of sustainable and inclusive growth, in order to become a modern, resource-efficient, competitive and climate neutral economy in 2050, where economic growth is decoupled from resource use (European Commission, 2019).
- ³²In the Special Eurobarometer survey on Europeans' attitudes towards climate change, the global problems listed are: international terrorism, poverty, hunger and lack of drinking water, the spread of infectious diseases, arm conflicts, the economic situation, the proliferation of nuclear weapons and the increase of global population. In the Gallup World Poll, climate change/global warming is compared with other environmental problems, such as pollution of drinking water, pollution of rivers, lakes and reservoirs, air pollution, loss of tropical rain forests and extinction of plant and animal species.
- ³³See <https://www.gesis.org/en/issp/modules/issp-modules-by-topic/environment>.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author.

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The Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change and the Gallup World Poll

The Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change is a periodic survey, authored by the European Commission and produced by TNS Opinion & Social and the Leibniz Institute for the Social Sciences (GESIS). The data constitute the main source of statistical information on the pro-environmental attitudes and behaviors of European Union citizens. Questionnaires are administered by means of a face-to-face interview conducted in people's homes in the 27 countries of the European Union, and the final sample size is composed of about 27,000

respondents. Specifically, 1000 individuals are interviewed in each country, with the exception of the smaller ones (Luxembourg, Cyprus, and Malta), where approximately 500 interviewees are performed. Data are gathered using computer assisted personal interviews (CAPI). The survey is repeated every two years. Currently, data are available for the years 2009, 2011, 2013, 2015 and 2019 in Special Eurobarometer surveys numbered 322, 372, 409, 435, 459 and 490, respectively.

The Gallup World Poll is a periodical survey of semi-annual, annual, or biennial frequency determined on a country-by-country basis, conducted by interviewing at least 1000 individuals in more than 115 countries worldwide. Sample size can differ: for example, it is at least 2000 for China and Russia, while, in a few cases, it is between 500 and 1000. In some countries (e.g., USA, Canada, Western Europe, Japan, Australia), it covers at least 80 per cent of the population. The survey is conducted by means of a 30 min telephone interview, and participants are selected by means a random-digit-dial method or a nationally representative list of phone numbers. Face-to-face interviews of about 1 h of randomly selected households are carried out in developing countries, Latin America, the former Soviet Union countries, Asia, the Middle East, and Africa. With some exceptions, all samples are probability-based and nationally representative of the resident population aged 15 and older.

The strength of these databases is that the information collected is very rich, since participants are invited to express their opinions on the degree of severity they attribute to climate change compared to other major global problems or other environmental problems,³² and on other related topics as well. For example, the Gallup World Poll investigates whether individuals are satisfied with their country's efforts to preserve the environment, and the Eurobarometer Survey asks whether they have taken any personal action to fight climate change in the last 6 months, such as buying a new low fuel consumption car or electric car, whether they regularly use environmentally-friendly alternatives to their car, whether they have insulated their home better to reduce energy consumption, have bought a low energy house or have installed solar panels, and whether they try to reduce and regularly separate waste. Both surveys ask respondents their opinion of the responsibility of national governments and business and industry in fighting climate change, and about the relationship between economic growth and environmental problems.

The International Social Survey Programme (ISSP)

With reference to the years 1993, 2000 and 2010, the topics investigated by the Special Eurobarometer Survey on Europeans' Attitudes towards Climate Change (see Section A.1) are also taken into consideration in the 'Environment Module' by International Social Survey Programme (ISSP).³³ The ISSP Environment module series is a cross-national survey, which covers numerous European countries together with Argentina, Australia, Canada, Chile, Iceland, Israel, Japan, Mexico, New Zealand, Philippines, Russia, South Africa, South Korea, Switzerland, Taiwan, Turkey and the USA. It mainly deals with attitudes towards environmental issues, such as environmental protection and respondents' behavior and preferences regarding governmental measures on environmental protection. The 1993 and 2000 surveys do not explicitly refer to 'climate change', but investigate individual attitudes towards the environment, by asking then to attribute air pollution to cars or industries, and asking whether pesticides and chemicals used in farming are possible causes of environmental degradation. Respondents are also asked about their perceptions of what increase in world temperatures caused by the greenhouse effect could be dangerous for the environment. The 2010 Edition substitutes the expression 'climate change' for 'greenhouse effect/global warming'. In all the editions there are specific questions aiming to reveal the individual willingness to pay to protect the environment (including through taxation), and questions

on the role of individuals, business and government in environmental protection. These aspects are also present in the Life in Transition Study, a survey conducted by the World Bank and the European Bank for Reconstruction and Development. Lastly, participants are also asked to express their opinion about the trade-off between economic growth and the environment, and which is the main priority, and the role of developing and developed countries in determining climate change. This issue is also analyzed in The World Value Survey and in the Gallup World Poll.