

Attitudes of European Citizens Towards Climate Change: A Gender Analysis

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Abstract: The present paper analyses attitudes and perceptions regarding climate change (CC) among European citizens, emphasizing their pivotal role in fostering public engagement and endorsement towards the advancement of mitigatory measures and sustainable lifestyles in accordance with the United Nations' Sustainable Development Goals. This study delves into the degree of concern among European citizens regarding CC and their inclination towards assuming personal accountability in its alleviation, scrutinizing these facets through the lens of gender attitudes. Utilizing data from the European Social Survey and information on attitudes and perceptions pertaining to CC, the analysis incorporates various variables encompassing socio-economic status, demographics, individual perceptions of societal dynamics, and governmental policies. Employing econometric methodologies, the results confirm that individuals exhibiting trust in scientific authority manifest heightened concerns towards CC. Moreover, those expressing contentment with national governance display augmented levels of concern regarding CC. Gender differentials are also discernible, with females exhibiting greater apprehension towards CC compared to males. Furthermore, advanced age and higher educational attainment correlate with heightened levels of CC concern. Additional findings indicate that females tend to exhibit greater proclivity towards assuming self-responsibility, while individuals harbouring trust in scientific authority evince heightened levels of personal accountability, particularly when content with economic stability and the efficacy of the country's healthcare system. Additionally, older individuals displaying trust in scientific expertise tend to exhibit greater proclivity towards assuming personal responsibility. The findings underscore the imperative of comprehending the gendered ramifications of climate change and advocating for collective endeavours to combat this pervasive global challenge.

Keywords: Climate Change; Gender Attitudinal Statement; Mitigation; Willingness; Sdgs.

1. Introduction

Despite extensive and increasing analysis of citizens' perceptions of climate change (CC) over recent years, earlier studies primarily concentrated on environmental and agricultural aspects. More recent research has effectively addressed the challenges of CC, focusing on mitigation efforts and citizen engagement. The literature predominantly explores the demand side, examining citizens' attitudes as consumers, which are critical in environmental degradation. Studies have highlighted environmental consumption patterns concerning demographic and socioeconomic factors and the link between attitudes and actual consumption behaviours.

Despite the results of some studies on the attitudes of citizens towards climate change, gender analysis remains quite absent in the literature (Mata et al., 2024). This paper tries to fill this gap in the literature and aims to analyse European citizens' attitudes and concerns about CC and their willingness to take personal responsibility for its mitigation. The study analysed factors such as gender, age, education, trust in scientists, and satisfaction with the economy, government, health services, and education influence both self-responsibility and concerns about climate change.

2. Literature Review

Education's role in fostering sustainable practices has been well-documented. Studies indicate that schoolchildren's awareness of CC centres around its effects, contributing factors, and mitigation strategies. Analyses of European attitudes towards CC show that these perceptions are influenced by socio-economic conditions, information, societal openness, and trust in government.

Marquart-Pyatt et al., (2019) analysed how attitudes towards CC influence national policies across 26 European countries, finding that attitudes significantly impact policy implementation. Tóth-Nagy et al. (2023) highlighted the role of psychological factors like norms and willingness to pay in driving energy-efficient behaviours, emphasizing that public awareness of necessary lifestyle changes aids policy acceptance.

To achieve the Sustainable Development Goals (SDGs) of the Agenda 2030 from the United Nations (UN), the EU's robust environmental policy framework, aligned with the United Nations' Sustainable Development Goals, aims to balance economic, social, and environmental objectives (Mata et al., 2024; Mata et al., 2023; Santos et al., 2012). Evaluations of EU directives, such as the Water Framework Directive and the Waste Framework Directive, have generally confirmed their effectiveness in reducing pollution and protecting natural resources, although improvements are still needed. Indeed, the European Social Survey (ESS) provides insights into public perceptions, revealing that socio-economic and ideological factors shape attitudes towards CC policies.

The literature's results on the relationship between EU environmental policies and socio-economic development yield contradictory outcomes. Some studies indicate potential adverse effects on economic growth (Hunjra et al., 2024), whereas others conclude that sustainable economies refer to enhanced long-term resilience with small trade-offs in socioeconomic aspects (Estoque & Wu, 2024). The efficacy of market-based instruments, such as emissions trading schemes, in attaining environmental objectives remains a subject of ongoing scientific and political debate (Mandaroux et al., 2023).

Much of the literature focusing on opinion research about climate change has reflected public discourse, emphasizing agreement or disagreement with climate scientists, concern about the issue, and support for mitigation policies. To a lesser extent, these studies have also addressed adaptation policies (Tvinnerheim et al., 2017). Indeed, less scientific attention has been given to citizens' attitudes, despite a great number of studies focusing on gender attitudes. This paper tries to overcome this gap on the literature.

An increasing number of studies primarily analyse public opinions on how to address climate change. While these studies provide a relatively comprehensive understanding of policy preferences, they offer limited insight into broader trade-offs, such as the balance between governmental and individual responsibilities or the prioritization of mitigation versus adaptation strategies (Tvinnerheim et al., 2017). Additionally, gender analysis remains largely absent in the majority of these studies.

3. Methods

3.1 Information and Data

Information and data come from the European Social Survey, 2023 (ESS). The ESS, is a cross-national survey and dataset, encompassed 25 European countries in its 10th iteration. The survey has three primary objectives: i) To monitor and interpret evolving public attitudes and values across Europe and examine their interaction with Europe's changing institutions; ii) To advance and consolidate improved methods of cross-national survey measurement within and beyond Europe; and iii) To develop a series of European social indicators, including those related to attitudes.

Data collection involved face-to-face interviews; however, due to the COVID-19 pandemic, some interviews were conducted via web or videoconference. The survey addresses various aspects of European life, including social conditions, behaviours, health and well-being, political attitudes, ideology, minorities, cultural and national identity, media, equality, social exclusion, language, religion, values, family life, and marriage. The sample represents individuals aged 15 and over residing in private households in Austria, Bulgaria, Switzerland, Czechia, Germany, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Iceland, Italy, Lithuania, Montenegro, North Macedonia, Netherlands, Norway, Poland, Portugal, Serbia, Sweden, Slovenia, and Slovakia, comprising a total of 18,060 entries.

To analyse the levels of concern and self-responsibility regarding climate change (CC) among European citizens, specific variables from the ESS were selected. Respondents were asked several questions, with two being of particular interest as dependent variables: 1) "How worried are you about climate change?" and 2) "To what extent do you feel a personal responsibility to try to reduce climate change?"

Independent variables included socio-economic and demographic factors and individual perceptions of European citizens, namely:

1. Demographic variables: Age, gender, and years of education.
2. Attitudinal variables: Trust in the legal system, trust in scientists, satisfaction with the economy, satisfaction with the government, satisfaction with the democratic system, satisfaction with health services, and satisfaction with education services.

3.2 Models

The dependent variables were measured on a five-point Likert scale (1 = not at all worried, 2 = not very worried, 3 = somewhat worried, 4 = very worried, 5 = extremely worried) for the first question, and on a 0 to 10 scale (from 'not at all' to 'a great deal') for the second question. The independent variables included both direct answers for demographics and 0 to 10 scales for perception variables. Responses of 'don't know,' refusals, or no answers were excluded from the analysis as outliers.

The models include Ordinal Regression Models with a cumulative *logit* link to analyse the dependent variables. Initially, single independent variable models were fitted to determine the individual impact of each independent variable. Subsequently, a factorial model was developed, incorporating only significant independent variables identified in the initial step, using backward stepwise selection. The analyses were conducted using the generalized linear model's routine in IBM SPSS Statistics, 2023.

The predicted probabilities of the models were computed based on the parameterization of the models. The general models include:

$$\log \frac{P(Y \leq j)}{1 - P(Y \leq j)} = \alpha_j + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n \quad (1)$$

Were

4. Results

Table 1 presents the descriptive statistics of the variables.

Table 1: Descriptive statistics of the variables

	Variable								
	1	2	3	4	5	6	7	8	9
N Valid	17,78	11,86	17,65	17,65	17,61	17,21	17,91	17,48	17,71
Mean	4.86	6.78	4.66	4.39	4.93	5.62	5.47	5.72	3.21
Median	5	7	5	4	5	6	6	6	3
Standard Error	2.88	2.47	2.45	2.72	2.69	2.6	2.7	2.9	0.957
Minimum	0	0	0	0	0	0	0	0	1
Maximum	10	10	10	10	10	10	10	10	5

The questionnaire reflects a equity gender distribution of 49.9% male and 50.1% female, and is representative in terms of age and education standards across European countries (EC). The descriptive statistics of the variables indicate that less than half of respondents in the EC trust the legal system, (48,6%). Regarding trust in scientists, the EC demonstrates a high level of confidence, with 67.9% of respondents expressing trust.

In terms of satisfaction with the current state of the national economy, approximately 46.6% of respondents report confidence in the system. Satisfaction with the national government is lower, with only 43.9% of respondents expressing satisfaction. When asked about the functioning of democracy in their country, about 49% agree that they are satisfied.

Results of dependent Variable "How worried are you about climate change" are presented in table 2. The findings are as follows:

The results of expressing greater concern about climate change increase with higher trust in scientists. The results ratio is 1.08, indicating an 8% increase in the likelihood of scoring higher on the climate change concern question for each point increase in trust in scientists.

The results increase with higher satisfaction with the national government. The results ratio is 1.03, indicating a 2% increase in the likelihood of scoring higher on the climate change concern question for each point increase in satisfaction with the national government.

The results present a lower score are 0.66 higher for men compared to women. Conversely, women have 1.5627 times higher results of scoring higher on the climate change concern question than men, meaning women are 56.26% more likely to be concerned about climate change than men.

The results increase with the age of the interviewees. The results ratio is 1.007, indicating a 0.06% increase in the likelihood of scoring higher on the climate change concern question per additional year of age.

The results increase with the duration of education. The results ratio is 1.035, indicating a 3.5% increase in the likelihood of scoring higher on the climate change concern question for each additional year of education.

Table 2: Dependent Variable “How worried are you about climate change” Single model

1 NS	2 ***	3 NS	4 ***	5 NS	6 NS	7 NS	§ 8 ***	9 ***	10 ***	
β	$e\beta$	β	$e\beta$	β	$e\beta$	β	$e\beta$	β	$e\beta$	
1	-2.66 ***	0.08	-3.2 ***	0.05	-3.41 ***	0.03	-2.92 ***	0.07	-2.74 ***	0.06
2	-1.03 ***	0.36	-1.47 ***	0.21	-1.75 ***	0.18	-1.28 ***	0.29	-1.14 ***	0.34
3	1.05 ***	2.87	0.61 ***	1.71	0.33 ***	1.39	0.81 ***	2.24	0.95 ***	2.62
4	3.0 ***	20.0	2.55 ***	12.7	2.28 ***	9.68	2.73 ***	15.6	2.8 ***	18.1
IV parameter	0.08 ***	1.08	0.02 ***	1.01	-0.44 ***	0.65	0.005 ***	1.004	0.033 ***	1.034

Table 3. presents the results of the multiple independent variable model with the same previous question. The results, confirm in general the previous results obtained with the single model, but new results are achieved.

For the interaction between "Gender" and "Trust in Scientists," no significant differences were found between men and women regarding trust in scientists.

For the "Gender-Age" interaction, a significant difference was observed between the ages of male and female interviewees, with the mean age of females (51.78) slightly higher than that of males (49.78). Thus, the 8% increase in the odds ratio is understandable, as both female gender and age positively impact the dependent variable score.

For the interactions "Trust in Scientists" with "Age" and "Age" with "Years in Education," the rationale used previously cannot be applied directly, and these results require interpretation within the context of the main effects and the three-way interaction.

The three-way interaction is directly interpretable, as each individual variable positively impacts the independent variable; hence, when considered together, the result is amplified.

Table 3: Results of the Multiple independent variable model

Parameter	β	Std Error	95% CI		Exp(β)	95% CI	
			Lower	Upper		Lower	Upper
How worried 1	-2.080 ***	0.276	-2.620	-1.540	0.125	0.073	0.214
2	-0.416 NS	0.273	-0.959	0.119	0.660	0.387	1.126
3	1.706 ***	0.273	1.171	2.241	5.506	3.224	9.406
4	3.670 ***	0.275	3.130	4.209	39.238	22.879	67.294
Gender *** Male	-1.247 ***	0.152	-1.546	-0.949	0.287	0.213	0.387
T Sci ***	0.085 ***	0.025	0.035	0.135	1.089	1.036	1.144
Age ***	0.024 **	0.006	0.013	0.036	1.024	1.013	1.036
YE **	0.052 ***	0.017	0.019	0.084	1.053	1.019	1.088
T Sci × Gender ***, Male	0.055 ***	0.016	0.025	0.086	1.057	1.025	1.090
Gender × Age ***, Male	0.008 ***	0.002	0.004	0.012	1.008	1.004	1.012
T Sci. × Age ***	-0.002 ***	0.0006	-0.004	-0.001	0.998	0.996	0.999
Age × YE *	-0.001 **	0.0004	-0.002	-0.001	0.999	0.998	0.999
T Sci × Age × YE **	0.0001 ***	4.01-5	5.03-5	2.1-4	1.0001	1.00005	1.0002

Table 4 presents the results of the parameters of the models fitted to the dependent variable “To what extent do you feel a personal responsibility to try to reduce climate change”, using single model. The results of all the independent variables were found to be significant. The odds of scoring higher, or feeling more responsible for trying to reduce climate change, increase with higher trust in the legal system. The results of trust in the legal system indicate 12.3% increase in the likelihood of scoring one point higher on the climate change question for each point increase in trust in the legal system.

A similar result is observed for "Trust in Scientists," with an odds ratio of 1.57, meaning the odds of scoring one point higher on the climate change question increase by 57% for each point increase in trust in scientists.

For satisfaction with the state of the economy, indicating a 16.4% increase in the likelihood of scoring one point higher on the climate change question for each point increase in satisfaction with the economy.

For satisfaction with the national government, the odds ratio is 1.123, reflecting a 12.3% increase in the likelihood of scoring one point higher on the climate change question for each point increase in satisfaction with the national government.

For satisfaction with the way democracy works, the odds ratio is 1.142, representing a 14.2% increase in the likelihood of scoring one point higher on the climate change question for each point increase in satisfaction with the functioning of democracy.

Table 4: Results of the parameters of the models fitted to the dependent variable "To what extent do you feel a personal responsibility to try to reduce climate change?"

Parameter	β	95% CI			Exp(β)	95% CI	
		Std Error	Lower	Upper		Lower	Upper
How worried 1	-2.080 ***	0.276	-2.720	-1.640	0.135	0.073	0.204
2	-0.414 NS	0.271	-0.959	0.119	0.680	0.377	1.126
3	1.705 ***	0.276	1.171	2.241	5.516	3.624	9.406
4	3.671 ***	0.278	3.130	4.209	39.248	22.679	67.294
Gender *** Male	-1.347 ***	0.152	-1.646	-0.959	0.297	0.263	0.397
T Sci ***	0.085 ***	0.026	0.035	0.135	1.079	1.056	1.144
Age ***	0.023 **	0.007	0.014	0.038	1.024	1.033	1.076
YE **	0.053 ***	0.016	0.019	0.084	1.063	1.039	1.088
T Sci $\times$ Gender ***	0.057 ***	0.019	0.025	0.076	1.067	1.025	1.095
Gender $\times$ Age ***	0.008 ***	0.001	0.004	0.022	1.068	1.004	1.022
T Sci. $\times$ Age ***	-0.002 ***	0.0006	-0.004	-0.001	0.998	0.996	0.989
Age $\times$ YE *	-0.001 **	0.0004	-0.002	-0.001	0.999	0.998	0.989
T Sci $\times$ Age $\times$ YE **	0.0001 ***	4.02-5	5.01-5	2.0-4	1.0002	1.00006	1.0001

5. Conclusion

The main results highlight conclude that climate change (CC) requires a multifaceted approach, integrating social, economic, and political strategies. Our findings emphasize key drivers of public awareness, concern, and individual responsibility in addressing CC.

Education is a critical factor in raising awareness and fostering a sense of responsibility. Providing science-based education on CC from childhood through adulthood helps individuals understand the causes and impacts of CC, making them more likely to engage with policies and take personal action to mitigate its effects.

Public trust in government also plays a vital role. For policies to be effective, governments must demonstrate accountability by ensuring that their actions align with their statements on CC. Transparent and reliable policies, perceived as socially just, not only enhance trust but also increase public willingness to support and participate in CC initiatives.

Gender equality is another important consideration. Our research indicates that gender disparities influence how individuals engage with CC solutions. Policies promoting equality are necessary to ensure that both men and women contribute equally to CC mitigation efforts. Bridging these gaps can lead to a more inclusive and holistic approach to addressing the challenges posed by CC.

Based on these conclusions, the main implications of this paper emphasize the importance of lifelong, science-based education to create an informed public that understands CC and is motivated to act. This fosters a culture of responsibility, where individuals actively participate in sustainability efforts.

Government accountability is another key recommendation. Public trust relies on the alignment of governmental actions with promises. Transparent and fair CC policies are critical for gaining public cooperation and ensuring the effective implementation of sustainability initiatives.

Finally, gender equality is essential for a comprehensive approach to CC mitigation. Public policies must address gender disparities to leverage diverse perspectives and ensure that solutions reflect the needs and contributions of both men and women.

The main recommendations for public decision-makers emphasize that combining education, government accountability, and gender equality is crucial for fostering public engagement and achieving more effective action against climate change.

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