

Policy Feedback in Climate Governance: Evidence from a Cross-Country Analysis on Environmental Expenditure and Public Perceptions in the EU

Anlin Zhou, Celine Ip, Kanchan Kargwal, Marissa Ruiz, Thomas Yue

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1. Executive Summary

This study examines the relationship between government environmental actions and public perceptions about climate change by testing two competing political science theories, the Thermostatic Model and the Elite Cue Model, in the context of European Union countries. Utilizing Hierarchical Ordered Logistic Regression on recent data from the European Investment Bank (EIB) Climate Survey and Eurostat's Environmental Protection Expenditure Accounts (EPEA), the analysis suggests a pattern of policy reinforcement. Specifically, higher levels of government environmental spending are significantly associated with increased public concern. These findings suggest potential for governments to utilize environmental expenditure as a strategic communication tool to drive public awareness, thereby promoting climate actions.

2. Introduction

Climate change has emerged as one of the defining socio-environmental challenges of the twenty-first century, demanding both political commitment and public engagement to drive effective climate action. As public concern about pollution and ecological decline rises, many governments have institutionalized environmental protection (EP) and increased EP spending (Cleveland, 2025). Governments also use fiscal instruments such as subsidies, incentives, or taxes to encourage or discourage consumption or economic activities with positive or negative environmental impacts (Martínez Córdoba et al., 2025). This mobilization of public funds is a direct signal of policy priority. However, the financial scale of this commitment in the EU remains modest. According to the Eurostat and International Monetary Fund climate data, environmental protection expenditures, covering waste management, wastewater management, pollution abatement, biodiversity and landscape protection, research and development for environmental protection, constitute in the European Union amounted to a only 0.8% of GDP in the year 2021 (EIPA, 2024).

Public opinion and government policy are engaged in a continuous exchange, while societal attitudes influence political priorities, government actions in turn reshape public perception. When individuals perceive a lack of clear and stable climate policies and uncertainty surrounding government actions and regulations, it can lead to feelings of insecurity and apprehension about the future (Goldwert et al. 2023). As the climate crisis intensifies,

understanding the social dynamics that drive fiscal decisions, as well as how these policies reconfigure public perceptions, has become a critical area of inquiry, providing insight into the mechanisms that sustain or diminish support for climate policy. This research aims to explore the relationship between government environmental expenditure and public concern about climate change in the EU. Using recent data from the European Investment Bank (EIB) Climate Survey and Environmental Protection Expenditure Accounts (EPEA), published by Eurostat, this research employs a Hierarchical Ordered Logistic Regression.

Research Question: How is the level of environmental protection expenditures associated with public concern and perceived risk about climate change?

3. Literature and Data Review

In a recent survey, 55% of Canadians were reported to believe that the government should strive for a balance between economic growth and climate action (Sheppard, 2024), indicating that the government should address both simultaneously. Another Canadian survey revealed that around 60% of Canadians (64% women vs. 54% men) agree that if the government doesn't act on climate change, it will be failing its people (Simpson, 2023). A study by the Pew Research Center in the United States (U.S.) reported that over half of the Americans say stricter environmental laws and regulations are worth the cost, highlighting their support for the environmental laws and costs associated with them (Kennedy, Funk and Tyson, 2023). Another study concluded that the public is likely to support increasing government spending on the environment in countries where government institutions are fair, effective, and non-corrupt (Kulin and Johansson Sevä, 2019).

Policy Feedback Mechanism in Climate Governance

The Thermostatic Model (Wlezien, 1995) suggests that the public acts as a "thermostat," adjusting its demand for policy based on the perceived "supply" of policy already enacted. Applied to climate change, a society's visible financial commitment to environmental protection may be perceived by the public as the issue being effectively managed. This perception leads to a compensatory decrease in perceived climate risk and public concern, creating a negative feedback loop where increased policy output reduces public demand for further action. This model works better in some policy domains than others, such as defence and welfare (Wlezien 2017). Conversely, the Elite Cues Model (Brulle et al., 2012) emphasizes the role of political and economic elites in shaping public perception. In this perspective, financial commitment serves as a powerful cue from elites. The scale and cost of the financial commitment itself communicate to the public that the problem is severe, urgent, and potentially catastrophic. Under this mechanism, a high level of financial commitment would be associated with high levels of public concern and perceived risk, as elite action validates and reinforces public urgency, thus establishing a positive feedback loop. These two contrasting frameworks lay the foundation for an empirical test of the relationship between environmental financial commitment and public perceptions. The study hypothesizes that higher levels of government

expenditure on environmental protection are associated with greater concern about climate change among citizens, aligning with the Elite Cues Model.

Measuring Public Perceptions of Climate Change: EIB Climate Survey

The European Investment Bank (EIB) Climate Survey symbolizes the EIB’s commitment to “placing the human parameter at the centre of economic investment.” (European Investment Bank, 2025). The Climate Survey first started in 2018, and polling is scaled up to African and Latin American countries starting from 2022 and 2023, respectively. The 2024-2025 edition provides valuable insights into people’s sentiment about climate change adaptation.¹

Measuring Institutional Commitment to Climate Change: EPEA

The [Environmental Protection Expenditure Accounts \(EPEA\)](#), published by Eurostat, measures the total economic resources used by countries to prevent, reduce, and eliminate pollution and environmental degradation. The EPEA collects data on four variables: 1. investment for the production of environmental protection services; 2. consumption of environmental protection services; 3. imports and exports of environmental protection services; 4. transfers of funds for environmental protection. Specifically, the aggregate known as [National Expenditure on Environmental Protection \(NEEP\)](#) includes both current expenditure and investments for environmental protection activities.²

Determinants of Climate Risk Perceptions

Previous literature has shown that gender, education, income, employment and age play a role in determining people’s perceptions of climate change. A 2018 Gallup analysis found that 70% of adults aged 18 to 34 in the U.S. say that they worry about global warming compared to 56% of those aged 55 or older (Reinhart, 2018). A global survey of participants in the 16-25 age group revealed that a perceived failure by governments to respond to the climate crisis is associated with increased distress and feelings of betrayal (Hickman et al., 2021). Some scholars have found that those with higher levels of education and income and “who rank themselves as members of higher social class” are more willing to give up money for greater environmental measures (Weckroth and Ala-Mantila, 2022). Determinants above are thus important to adjust environmental policies to cater more to the public’s eyes, as well as aligning regional characteristics and population dynamics.

4. Methodology

Operationalization of Variables

The central relationship of this study is the one existing between the level of environmental protection expenditures (Independent Variable) and the public concern and perceived risk

¹ Please see [Figures 1 to 3 in the Appendix](#) for data visualizations

² Please see [Figures 4 and 5 in the Appendix](#) for data visualizations

about climate change (Dependent Variables). In that sense, the operationalization of these variables is as follows:

Independent Variable (X)		Scale
X	National expenditure on environmental protection by general government and non-profit institutions	% of GDP

(Source: [EPEA](#), [Eurostat](#), 2022)

Dependent Variables (Y)	Scale	Question	
Y1	Emotional Worry	Ordinal (1 = very worried, 4 = not worried at all)	Q7: When you think of the potential impact of climate change on your life in the future, do you feel...
Y2	Personal Adaptation Burden	Ordinal (1 = A lot, 4 = Not at all)	Q8: Do you think you will have to change and adapt the way you live...
Y3	Risk to Personal Assets	Ordinal (1 = very concerned, 4 = not concerned at all)	Q14: How concerned are you that your home (house or apartment) or your car could be damaged in the coming years due to the impact of climate change?

(Source: *EIB Climate Survey 2024-2025*)

To ensure that the estimated relationship between the main explanatory variable and individuals' climate perceptions is not confounded by socio-demographic or economic characteristics, several individual control variables are included in the model:

Control Variables (Z)	Scale	
Z1	Income	Ordinal (1 = Lowest income, 10 = Highest income)
Z2	Education	Ordinal (1 = Less than primary, 9 = Doctor or equivalent)
Z3	Gender	Categorical (0 = Male, 1 = Female)
Z4	Age	Continuous (in years)

(Source: *EIB Climate Survey 2024-2025*)

At the same time, country-level differences are addressed by including the following variables:

Control Variables (Z)	Scale	Source	
Z5	Gini Index	%	Eurostat , 2024
Z6	GDP per capita	PPS index, EU27_2020= 100	Eurostat , 2024
Z7	Climate loss per capita	x1,000 EUR	European Environmental Agency , 2023

For our research purpose, national-level indicators were merged with the individual-level EIB Climate Survey data. Using `left_join()` in R, country-level datasets were matched to individual responses based on standardized country names. The merged dataset combines attitudinal variables, micro-level demographic with macro-level indicators, enabling analysis of how the macro context at the national level shapes individual perceptions of climate change.

Description of the Model

To analyze the relationship between individual characteristics, national context, and climate attitudes, this study employs an ordered logistic regression (proportional-odds model). This method is suitable because the dependent variables, which reflect levels of concern, worry, or perceived need to adapt to climate change, are ordinal in nature, consisting of ordered response categories ranging from 1 (“very concerned/worried”) to 4 (“not concerned/worried at all”).

The ordered logit model estimates the log-odds of being in a higher response category (that is, expressing lower concern) as a linear function of a set of predictors. The model includes individual-level predictors - income, education, gender, and age, as well as country-level indicators capturing broader structural conditions: public environmental expenditure (as a share of GDP), income inequality (Gini index), GDP per capita (PPS index), and climate-related losses per capita.

The general model can be expressed as follows:

$P(Y_{ij} \leq k) = \text{logit}^{-1}(\tau_k - n_{ij})$, where:

$$n_{ij} = \beta_0 + \beta_1 \text{Inc}_{ij} + \beta_2 \text{Educ}_{ij} + \beta_3 \text{Gender}_{ij} + \beta_4 \text{Age}_{ij} + \beta_5 \text{EnvExp}_j + \beta_6 \text{Gini}_j + \beta_7 \text{GDP}_j + \beta_8 \text{ClimLoss}_j$$

τ_k are the cutpoints or thresholds separating the ordered response categories

As for reporting, parameters are estimated by maximum likelihood using `polr()` function in R. We report odds ratios with 95% Wald confidence intervals. For interpretation, the odds ratios are interpreted such that values greater than 1 indicate a higher likelihood of being in a less concerned response category, while values below 1 indicate a higher likelihood of being in a more concerned response category. As mentioned in the previous section, this study will test the model among three different dependent variables (worry, adaptation, and risk perception).

Limitations

This study is subject to several limitations. First, the most recent source available for the EPEA data is from 2022, meaning that the analysis cannot capture the immediate public response to more recent governmental expenditures. Second, while the research focuses on public environmental expenditure as a macro-level predictor, the study did not empirically test the visibility of the expenditure, a core factor in shaping public perceptions. Future research should incorporate data on actual media coverage or public awareness of these expenditures to confirm and isolate their true strength in shaping public perceptions. Third, although the analysis includes both individual and country-level predictors, the absence of random effects could prevent capturing unobserved heterogeneity across countries, which may bias standard errors and lead to overconfident inference about the significance.

5. Findings and Analysis

Across all three models, higher income consistently predicts lower levels of concern or perceived need for adaptation, with roughly a 4–5% increase in the odds of being less concerned for each level of income. In contrast, higher education is associated with greater awareness: each additional education level decreases the odds of being less concerned by about 5%. Women show 10-20% higher odds of concern relative to men, while older individuals are marginally less worried (around 1% per year of age).

At the macro level, greater public environmental expenditure and higher climate-related losses per capita both strongly relate to a higher concern, suggesting that government action and lived experience of climate damages raise issue salience. This correlation suggests that the public has shifted its perception of climate change from a routine concern to a fundamental challenge that conflicts with existing patterns of consumption (Barr et al. 2011). Conversely, inequality (higher Gini) is linked to heightened climate worry, while GDP per capita shows almost no relationship.

Associations Between Individual and Macro-Level Predictors and Climate Attitudes – Ordered Logit Odds Ratios (Q7: Worry About Climate Change; Q8: Perceived Need to Adapt; Q14: Concern About Climate Damage)

	Q7 Macro Model	Q8 Macro Model	Q14 Macro Model
Income (Level 1–10)	1.047 (1.039, 1.055)	1.050 (1.042, 1.058)	1.047 (1.039, 1.055)
Education (Level 1–10)	0.953 (0.940, 0.966)	0.946 (0.933, 0.960)	0.964 (0.951, 0.978)
Gender	0.797 (0.757, 0.839)	0.880 (0.836, 0.928)	0.989 (0.940, 1.041)
Age	1.007 (1.005, 1.008)	1.015 (1.014, 1.017)	1.014 (1.013, 1.016)
Public Sector Env. Expenditure (% GDP, 2022)	0.751 (0.691, 0.816)	0.759 (0.697, 0.826)	0.647 (0.595, 0.703)
Gini (2024)	0.946 (0.939, 0.953)	0.950 (0.942, 0.957)	0.917 (0.910, 0.924)
GDP per capita (PPS index, EU27_2020 = 100, 2024)	1.003 (1.002, 1.003)	1.003 (1.002, 1.004)	1.005 (1.004, 1.005)
Climate loss per capita (×1,000 EUR, 2023)	0.924 (0.906, 0.942)	0.986 (0.967, 1.006)	0.888 (0.871, 0.906)
Num.Obs.	20463	20463	20463

Table: Associations Between Individual and Macro-Level Predictors and Climate Attitudes-Ordered Logit Odds Ratios (Q7: Worry About Climate Change; Q8: Perceived Need to Adapt; Q14: Concern About Climate Damage)

Public Environmental Expenditure as Predictor

Across all three models, public environmental expenditure is a consistent and substantively important predictor of climate attitudes. Higher government spending on environmental protection is systematically associated with greater public concern about climate change and its impacts.³

For Q7 (worry about climate change), a one-percentage-point increase in environmental expenditure as a share of GDP is related to a 25% decrease in the odds of reporting a less concerned response to climate change (Q7: OR = 0.751). This suggests that respondents in countries investing more in environmental protection tend to feel more anxious about climate threats, potentially suggesting higher public awareness, stronger media salience, or a political climate that emphasizes environmental risks.

Similarly, **for Q8 (perceived need to adapt lifestyle)**, an increase of 1% in environmental expenditure as a share of GDP is associated with a 24% decrease in the odds of perceiving a lower personal adaptation burden (Q8 odds ratio \approx 0.76). This indicates that citizens in greener-spending countries are more inclined to anticipate future adaptation, possibly due to stronger institutional messaging around behavioural and systemic adjustments needed to confront climate change.

For Q14 (concern about property damage), the relationship remains significant and even stronger in magnitude: a one-point increase in public environmental expenditure corresponds to roughly a 35% reduction in the odds of being less concerned (odds ratio \approx 0.65). This implies that, on average, respondents in countries with higher levels of government environmental spending tend to report more concern about potential climate-related damage to their homes or vehicles.

Taken together, these findings suggest that higher levels of public environmental investment tend to correspond with stronger public concern and awareness. While this study does not establish causality, the observed associations offer valuable insights for future research and policy analysis. Government environmental expenditure and public concern about climate change appear to be related in a reinforcing pattern, suggesting a potential reciprocal relationship that needs further investigation to clarify the causality and directionality.

Several possible mechanisms could be explored in such analyses. For instance, the visibility of environmental investments may shape the degree to which they influence public perceptions of climate issues. When media coverage is extensive and results are widely disseminated, individuals are exposed to more information, which may increase their concern about climate change and their willingness to support or adapt to related policies. Moreover, the tangibility of

³ The dependent variables are coded so that lower values indicate greater concern or perceived risk, the odds ratios below 1 for environmental protection expenditure (ranging from 0.65 to 0.76) imply that higher government spending is associated with greater levels of public concern and perceived risk about climate change.

environmental spending could also affect its impact. For example, when expenditures take the form of direct household subsidies, the benefits become more concrete and personally relevant, raising awareness about the urgency of the matter. Conversely, if the causal direction were reversed, greater public concern about climate change could generate stronger political pressure on policymakers to allocate additional resources to environmental protection, green infrastructure, and adaptation measures.

6. Conclusions and Recommendations

Our findings from the three EIB survey questions align with Brulle's Elite Cues Model. Risk to personal assets is recorded as the strongest magnitude, while the personal adaptation burden is the weakest. The positive loop between higher government spending on environmental protection and all three variables holds across models, regardless of controlling for individual socio-demographic factors and country-level variables.

To make such spending more perceptible and meaningful to citizens, governments should move beyond viewing environmental expenditure as a purely technical budget item and treat it as a strategic communication tool. For example, broad media coverage can be a pathway for mainstreaming climate policies, particularly in liberal and free democracies like the European Union (Lyytimäki, 2011).

Therefore, governments can effectively leverage the visibility of major infrastructure investments and policy disbursements through public-facing campaigns to proactively drive essential individual and private sector behavior change. Linking spending to visible results, such as renewable energy infrastructure, flood protection, and community adaptation projects, and promoting these through transparent and public-facing campaigns can reinforce awareness and trust, stimulating individual and behavioral change.

The positive link between climate-related economic losses and public concern suggests that tangible, local impacts heighten citizens' awareness of climate risks. Governments could enhance risk communication by integrating localized climate data into public education efforts. The association between a higher Gini index and greater concern underscores the need to embed social and economic equity in climate policymaking, for instance by involving low-income communities in adaptation planning and integrating social protection measures. Gender differences also stand out: women consistently report higher concern about climate change, highlighting the value of promoting women's leadership and ensuring gender perspectives in adaptation and resilience initiatives.

To sum up, at a time when climate action has been increasingly absent from political agendas and public discourse, both domestically and internationally, effective communication and inclusive engagement strategies are essential. Policymakers should design initiatives that reflect public perceptions, values, and lived experiences to rebuild momentum for meaningful climate action.

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Appendix

Figure 1: Distribution of Responses to Q7 by Country, EU (Source: EIB Climate Survey 2024-2025)

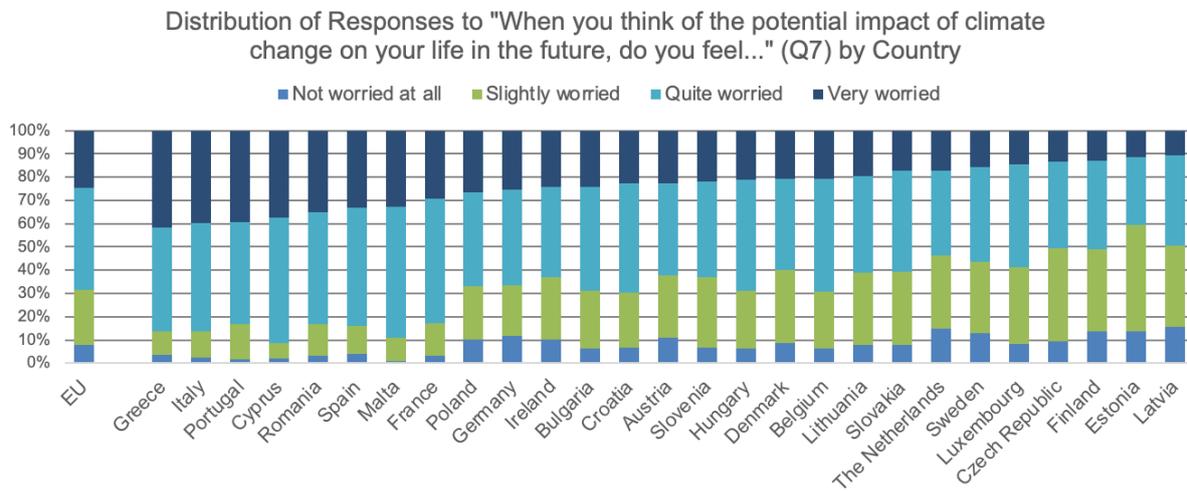


Figure 2: Distribution of Responses to Q8 by Country, EU (Source: EIB Climate Survey 2024-2025)

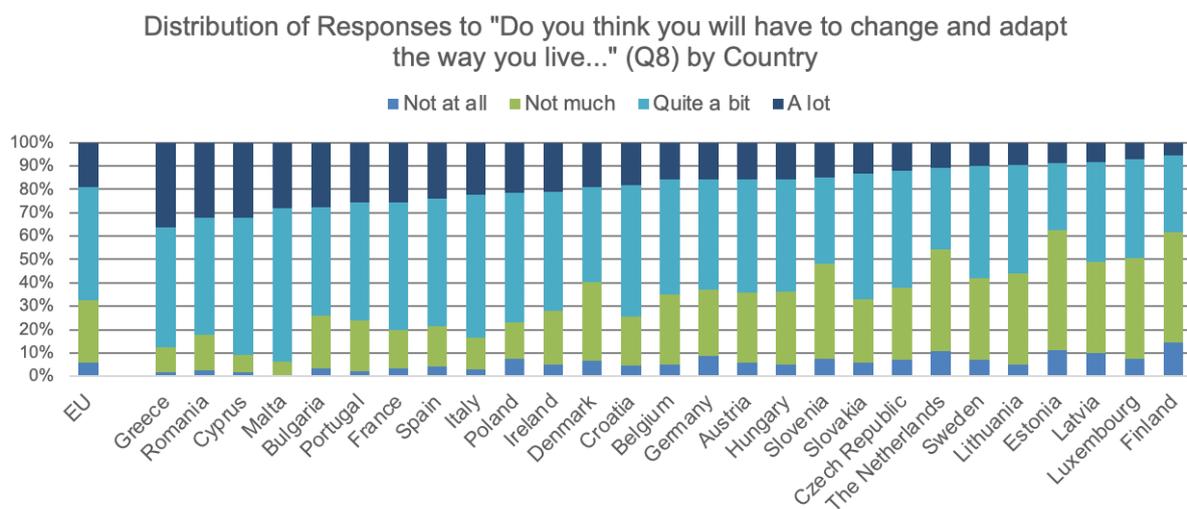


Figure 3: Distribution of Responses to Q14 by Country, EU (Source: EIB Climate Survey 2024-2025)

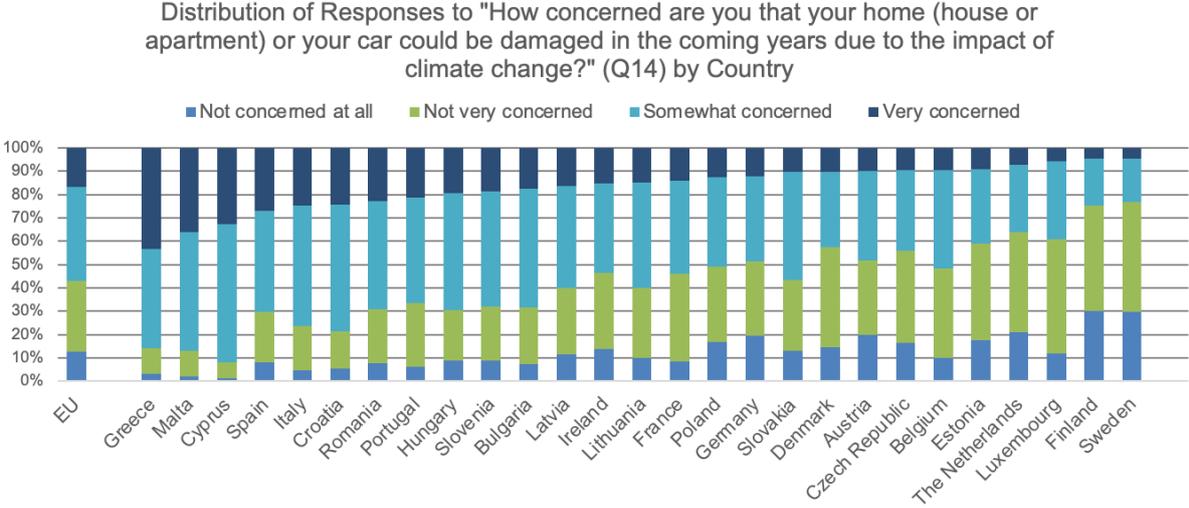


Figure 4: Institutional Breakdown of NEEP, 2022 (Source: EPEA, Eurostat, 2022)

Institutional sector	Description	Proportion (2022)
Corporations	Corporations as producers and consumers of environmental protection services	~50% of EU's total environmental protection expenditure
General government & non-profit institutions serving households	Government and non-profit institutions serving households as producers and consumers of environmental protection services	~30% of EU's total environmental protection expenditure
Households	Households as consumers of environmental protection services	~20% of EU's total environmental protection expenditure

Figure 5: General Government and Non-Profit Environmental Protection Expenditures as Percentage of GDP, by Country, EU, 2022 (Source: EPEA, Eurostat, 2022)

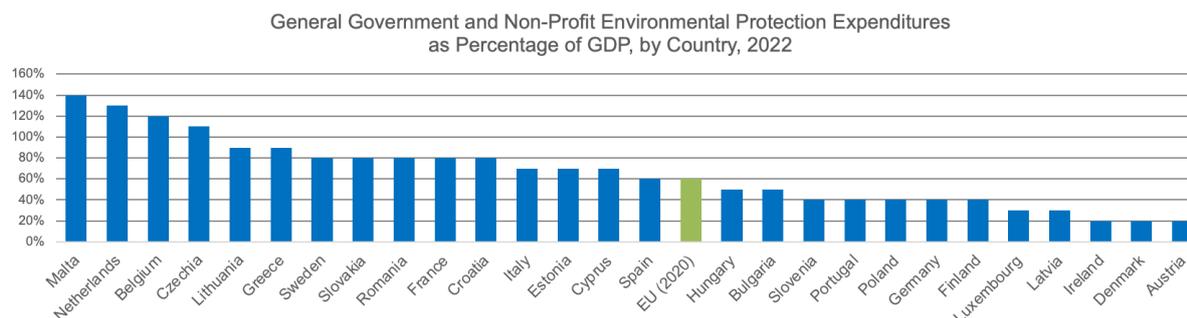


Figure 6: Association Between Individual and Macro-Level Predictors and Worry About Climate Change – Ordered Logit Odds Ratio (Q7)

Associations Between Individual and Macro-Level Predictors and Worry About Climate Change – Ordered Logit Odds Ratios (Q7)

	Q7 M1	Q7 M2	Q7 M3
Income (Level 1-10)	1.033 (1.026, 1.041)	1.042 (1.035, 1.050)	1.047 (1.039, 1.055)
Education (Level 1-10)	0.941 (0.929, 0.954)	0.946 (0.933, 0.959)	0.953 (0.940, 0.966)
Gender	0.798 (0.759, 0.839)	0.798 (0.759, 0.840)	0.797 (0.757, 0.839)
Age	1.006 (1.005, 1.008)	1.006 (1.005, 1.008)	1.007 (1.005, 1.008)
Public Sector Env. Expenditure (% GDP, 2022)		0.845 (0.782, 0.913)	0.751 (0.691, 0.816)
Gini (2024)			0.946 (0.939, 0.953)
GDP per capita (PPS index, EU27_2020 = 100, 2024)			1.003 (1.002, 1.003)
Climate loss per capita (×1,000 EUR, 2023)			0.924 (0.906, 0.942)
Num.Obs.	21388	20463	20463
AIC	52775.1	50540.0	50189.9
BIC	52830.9	50603.4	50277.1
RMSE	2.08	2.09	2.10

Figure 7: Association Between Individual and Macro-Level Predictors and Perceived Need to Adapt to Climate Change – Ordered Logit Odds Ratio (Q8)

Associations Between Individual and Macro-Level Predictors and Perceived Need to Adapt to Climate Change – Ordered Logit Odds Ratios (Q8)

	Q8 M1	Q8 M2	Q8 M3
Income (Level 1-10)	1.031 (1.023, 1.038)	1.042 (1.034, 1.050)	1.050 (1.042, 1.058)
Education (Level 1-10)	0.932 (0.919, 0.944)	0.939 (0.927, 0.952)	0.946 (0.933, 0.960)
Gender	0.868 (0.824, 0.913)	0.878 (0.833, 0.925)	0.880 (0.836, 0.928)
Age	1.015 (1.013, 1.016)	1.015 (1.013, 1.016)	1.015 (1.014, 1.017)
Public Sector Env. Expenditure (% GDP, 2022)		0.801 (0.741, 0.867)	0.759 (0.697, 0.826)
Gini (2024)			0.950 (0.942, 0.957)
GDP per capita (PPS index, EU27_2020 = 100, 2024)			1.003 (1.002, 1.004)
Climate loss per capita (×1,000 EUR, 2023)			0.986 (0.967, 1.006)
Num.Obs.	21388	20463	20463
AIC	49836.8	47634.8	47330.7
BIC	49892.6	47698.2	47417.9
RMSE	2.10	2.11	2.11

Figure 8: Association Between Individual and Macro-Level Predictors and Concern about Climate Change – Ordered Logit Odds Ratio (Q14)

Associations Between Individual and Macro-Level Predictors and Concern about Climate Damage – Ordered Logit Odds Ratios (Q14)

	Q14 M1	Q14 M2	Q14 M3
Income (Level 1-10)	1.024 (1.017, 1.031)	1.037 (1.030, 1.045)	1.047 (1.039, 1.055)
Education (Level 1-10)	0.945 (0.933, 0.958)	0.955 (0.942, 0.968)	0.964 (0.951, 0.978)
Gender	0.975 (0.927, 1.024)	0.988 (0.939, 1.039)	0.989 (0.940, 1.041)
Age	1.013 (1.012, 1.015)	1.013 (1.012, 1.015)	1.014 (1.013, 1.016)
Public Sector Env. Expenditure (% GDP, 2022)		0.773 (0.715, 0.835)	0.647 (0.595, 0.703)
Gini (2024)			0.917 (0.910, 0.924)
GDP per capita (PPS index, EU27_2020 = 100, 2024)			1.005 (1.004, 1.005)
Climate loss per capita (×1,000 EUR, 2023)			0.888 (0.871, 0.906)
Num.Obs.	21388	20463	20463
AIC	54587.3	52011.5	51099.9
BIC	54643.1	52074.9	51187.1
RMSE	2.32	2.34	2.34