CLIMATE CHANGE AND BEHAVIOR: do environmental attitudes and perceptions impact on subjective well-being in europe?

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RESUMO

As reações das pessoas às mudanças climáticas nos ajudam a compreender como essas afetam seus níveis de bem-estar? Para responder, este artigo analisa o impacto de um amplo conjunto de atitudes e percepções ambientais (APA) sobre o bem-estar pessoal entre 21 países europeus, usando o modelo *probit* ordenado. Além disso, este trabalho testará se os traços de personalidade são capazes de influenciar a relação entre os APA e o bem-estar. A estimativa usa dados do Relatório Social Europeu, juntamente com a poluição do ar, precipitação, produção de resíduos, e variáveis macro. Este paper soma ao trabalho de Ferrer-i-Carbonell e Gowdy (2007), considerando dois grupos adicionais de APA: assuntos energéticos e novas expressões de consciência ambiental. Os resultados apontam que ambos os grupos têm um efeito estatisticamente significativo sobre o bem-estar, indicando que uma maior variedade de APA pode influenciar o bem-estar dos indivíduos. Os resultados também indicam que traços da personalidade influenciam parcialmente a relação entre bem-estar e APA ao longo de toda a Europa.

Palavras-chave: Mudanças climáticas; Meio-ambiente; Comportamento; Europa.

MEIO-AMBIENTE E COMPORTAMENTO: As atitudes e percepções ambientais impactam o bem-estar subjetivo na Europa?

ABSTRACT

Do subjects' reactions to climate change help us understand how behavior affects their well-being level? To answer this question, this article assesses the impact of a large set of Environmental Perceptions and Attitudes (EPA) on subjective well-being across 21 European countries, using an ordered *probit* model. Furthermore, it tests whether personality traits are capable to influence the relationship between EPA and well-being. The estimation uses data from the European Social Survey, along with air pollution (PM_{10}), precipitation, waste production, and macro variables. This paper builds on Ferrer-i-Carbonell and Gowdy (2007), considering two additional groups of EPA: energy affairs and new expressions of environmental awareness. The results show that both groups have a statistically significant effect on well-being, indicating that a higher variety of EPA may influence welfare. The outcomes also indicate that personality traits partially influence the link between well-being and EPA across Europe.

Keywords: Climate change; Environment; Behavior; Europe.

1. INTRODUCTION

Over the last decades, concerns about how the environment impacts individual well-being have taken more space in the ecological economics' research agenda (Welsch and Kühling, 2009; Rehdanz and Maddison, 2005). Nevertheless, just a few papers explore the influence of Environmental Perceptions and Attitudes (EPA) on Subjective Well-Being (SWB), in most cases at the national or local level (Ferrer-i-Carbonell and Gowdy, 2007; Sekulova and van den Bergh, 2013).[19] However, to the best of my knowledge, no study explores these impacts in a multi-country analysis. This paper, therefore, aims to contribute to fill this gap in the literature by studying the effects of a large set of EPA on welfare across European countries.

Understanding the individuals' behavior regarding the formation of their EPA requires considering the assumption that agents have limited rationality and that their decision-making process is affected by preferences, beliefs, or other cognitive biases (Kahneman and Tversky, 1979). Accordingly, people might evaluate environmental conditions based on their expectations and values, which leads them to react differently to identical circumstances (Diener et al., 1999).

EPA represent expressions of concerns about phenomena linked to the environment. The *biophilia* hypothesis proposes the existence of a connection between human beings and nature, by considering the inherent individuals' inclination to natural systems, mainly life-like features of the nonhuman environment (Wilson, 1984; Kellert, 2008). *Biophilia* hypothesis has been frequently identified as the main determinant of environmental awareness, once climate change became a social problem (Sekulova and van den Bergh, 2013; Smyth et al., 2008).

Beyond the environmental characteristics, EPA may also relate to personality traits. These inborn features play a useful role in explaining personal behavior since there is robust evidence that they are among the factors that affect our welfare the most (Layard, 2005). Genetic factors may influence individual behavior, as well as the probabilities of experiencing certain events (Diener et al., 1999). For example, instinctively, some people prefer to be in outdoor spaces near natural environments (such as mountains, woodland, or coastal margins), which makes them happier (Mackerron and Mourato, 2013).

[19] SWB is also measured or recognized as happiness, welfare, well-being, or life satisfaction (Frey and Stutzer, 2002).

Previous studies have identified the influence of EPA on SWB, along with personality traits. Making use of a database from the British Household Panel Survey, Ferrer-i-Carbonell and Gowdy (2007) find a negative relationship between SWB and individuals' concerns about the ozone layer, but a positive relationship between welfare and animal extinction. However, when the authors add personality traits to the regression analysis, they detect a neutral impact on the relationship between EPA and SWB. In Spain, Sekulova and van den Bergh (2013) also identify ecological awareness and personality traits as relevant determinants of the life satisfaction level. These results reinforce the need to assess the influence of a broad range of EPA on SWB, especially taking into account personality traits.

This paper explores two research questions: i) Do EPA impact well-being in Europe? ii) Does the relationship between EPA and well-being across European countries change when controlling for personality traits? The first question aims to assess the effects of a large set of EPA on SWB, since environmental awareness might increase welfare (Wilson, 1984; Kellert, 2008). The second question seeks to assess whether the link between EPA and SWB might somehow be influenced by personal psychological traits when considering the individual level of welfare across 21 European countries (similar to Ferrer-i-Carbonell and Gowdy, 2007). Hypothetically, the effects of climate change on the individuals are discussed through a broad view, based on the assumption that the subjects' behavior may affect their satisfaction level. For this purpose, this study estimates an ordered probit model using data from the 8th wave of European Social Survey (ESS).

The findings suggest that a set of EPA may influence personal welfare in Europe and that personality traits partially change the relationship between EPA and SWB. The results also indicate that a greater amount of solar energy generation makes individuals happier, which reveals individuals' preference for renewable sources of electricity that contribute to environmental sustainability. Also, the results provide evidence for the existence of preferences for adopting environmental policies (Diener and Kesebir, 2008).

The main contribution of this research stems from providing new dimensions of EPA that might significantly influence welfare in Europe in a climate change scenario. This is relevant given that better understanding how the environment affects life satisfaction enriches the discussion around climate change effects. This paper also adds to Ferrer-i-Carbonell and Gowdy (2007) as it offers a more diverse analysis by using a multi-country sample and adding new elements to

it (such as new expressions of environmental awareness and energy affairs). Whereas Ferrer-i-Carbonell and Gowdy (2007) use a dataset from a single country, the present paper brings valuable information from 21 countries across Europe, using a richer dataset that features a higher level of heterogeneity. Namely, it is important due to the specific environmental condition of each country. Moreover, when controlling for personality traits, even in a joint analysis of countries, most EPA coefficients keep statistical significance, which ensures stability of the relationship between EPA and well-being. Also, this paper considers how energy affairs affect personal welfare in a climate change scenario. This linkage has hardly been explored in the welfare literature, despite the impact of energy generation on air pollution (EEA, 2021) and the clear benefits arising from the usage of renewable sources (IPCC, 2014). Furthermore, this study may contribute to the design of the European climate change policy, since it allows policymakers to understand, at individual level, how EPA affect SWB and therefore may hint at how public policies may improve people's lives.

This study is limited in scope to Europe for two reasons. Firstly, the 8th wave of ESS (2016) offers a unique and rich dataset covering 21 European countries with information at the individual level, plus a special module related to climate change. Secondly, the European Union (E.U.) has played an important role as a promotor of adjustments regarding climate change policy.[20] For instance, since the 1990s, the E.U. has attained strong public support for signing international agreements such as the Kyoto Protocol (Rayner and Jordan, 2016). Therefore, deeper knowledge about EPA might be particularly helpful in its trajectory.[21]

The rest of this paper is organized as follows: in Section 2, I review the relevant literature; in Section 3, I describe the data, and in Section 4, I outline the econometric approach. Next, I report the results in Section 5. Finally, in Section 6, I provide a short discussion and final remarks.

[20] For a broad perspective, see Oberthür (2017).

[21] In this paper, even though three of the 21 countries were not EU members when the 8th wave of ESS took place (Iceland, Norway, and Switzerland), it is assumed that the European Parliament's power of influence over environmental climate policy was still strong across Europe, at that time.

2. LITERATURE REVIEW

Environmental perceptions and attitudes

The *biophilia* hypothesis states that the interaction with nature may improve psychological well-being among humans (Wilson, 1984; Kellert, 2008). This link is empirically found in several studies. For instance, there is evidence that shorter distances from green areas increase happiness (Krekel et al., 2016), and that patients have shorter postoperative stays if they are in hospital rooms with windows facing trees in the external area (Ulrich, 1984).[22] These findings can increase environmental awareness as well as promote the strengthening of attitudes and perceptions about the environment.

Ferrer-i-Carbonell and Gowdy (2007) is a pioneering work in this area. The authors assess the environmental attitudes of British citizens by analyzing if these citizens express concern about the destruction of the ozone layer and animal extinction. They show that apprehension towards the ozone layer depletion impacts welfare negatively, while the concern with the loss of biodiversity is a signal of caring for the living world that positively affects SWB. Similarly, Rehdanz and Maddison (2008) show that concerns with the perceived noise level and air pollution affect happiness negatively. Also, Guardiola et al. (2016) find that people who are concerned with nature and who work as volunteers in environmental nonprofit organizations are happier.

Sekulova and van den Bergh (2013) use the consumption of ecological products as a proxy for environmental awareness. The authors find a positive and statistically significant relationship between environmental awareness and SWB, suggesting that the consumption of green products contributes to happiness. Smyth et al. (2008) measure environmental attitudes by means of two variables: i) whether environmental protection is a social problem of major interest to the respondent or not; and ii) the respondent's perception of changes in the environmental consciousness in the neighborhood in which he or she lived during the two years before the survey. For both variables, they find a positive impact on welfare, indicating that individuals who care for nature tend to have more life satisfaction.

[22] Also, Moro et al. (2008) find that people who live near the sea have a higher degree of life satisfaction. Moore (1982) explains that prisoners in cells with direct visual contact with forests and farmlands are healthier than other prisoners.

The degree to which individuals perceive themselves as having environmentally friendly behavior (green self-image) influences welfare positively (Binder and Blankenberg, 2017), mainly when this action is a shared social norm (Welsch and Kühling, 2018). However, when there are differences in society about the utility derived from conforming to a socially accepted view on what are appropriate attitudes, the EPA might affect SWB negatively (Welsch and Kühling, 2018).[23]

Based on German panel data, Binder and Blankenberg (2016) find that environmental concerns have a positive effect on happiness and increase the likelihood of individuals volunteering for organizations dedicated to protecting the environment. In other words, people who are concerned with the environment are more prone to take attitudes to protect nature.[24] Likewise, Binder and Ward (2013) demonstrate that a global worry about the environment increases life satisfaction over time. Amérigo et al. (2012) show that pro-environmental attitudes are related to greater well-being, while those individuals that are more apathetic towards nature tend to be more anxious.

Undoubtedly, assessing the impact of EPA on SWB regarding climate change may bring hard questions due to its complexity and amplitude. However, "the happiness approach is able to capture all effects of a change in environmental conditions, even though the individual may not be consciously aware of them." (Welsch and Kühling, 2009, p. 393).

Personality traits

When one argues about the effects of climate change on current well-being, one should use all the available information on both external and inner conditions to form the best judgment (Veenhoven, 1997). In what inner conditions are concerned, personality traits represent the characteristics that make individuals different from one another. Personality is one of the strongest and most consistent predictors of well-being (Diener et al., 1999). Moreover, personality characteristics are moderately heritable and stable over time (Diener and Lucas, 2009). Even though our genes do not define the exact pattern that specifies how we shall inevitably be, they provide operating instructions about how we shall develop in response to our environment (Layard, 2005).

[23] Binder et al. (2020) find similar results at the regional level.
[24] For a discussion about the value-action gap, see Binder and Blankenberg (2017).

Our inborn features influence the way we see our entire life, setting the mode in which we face challenges and build our perspective on several subjects: "Personality appears to color how people perceive life events (…) [it] also colors along the way" (DeNeve and Cooper, 1998, p. 219).[25] Comparing freedom and happiness across nations, Veenhoven and Rahman (2018) explain that perceived freedom (average self-rating of the freedom of choice and control over one's life) is associated with greater well-being, suggesting that the possibility of choosing how to drive one's life makes respondents happier.

Ambrey et al. (2014) use personality traits, among other variables, in a cost estimation of air pollution in Australia, by applying questions whereby the respondents claim their degree of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience. They identify a positive and statistically significant effect of most variables on SWB. However, those individuals that are more open to new experiences report being less happy than others. Later, Kaida and Kaida (2016) find evidence for the existence of a structural relationship between psychological factors, environmental attitudes, and well-being, indicating that values like universalism, competence, and frugality are strong predictors of pro-environmental behavior.

Assessing the impacts of the Big Five factors[26] on SWB, Schimmack et al. (2008) demonstrate that neuroticism and extraversion have a significant unique contribution to predict the level of happiness.[27] Using data from the World Value Survey, Helliwell (2006) demonstrates that extroversion has a positive and moderate relationship with SWB, once other factors such as social trust and belief in God are also considered in the estimation. In addition, a cross-section study in Switzerland finds distinct impacts of personality traits on SWB across age groups (Gomez et al., 2009).

Another way of approaching these organic features is by controlling for personality characteristics using mental health screening questions. Ferrer-i-Carbonell and Gowdy (2007) evaluate psychological traits through questions that provide reflections on self-judgment, namely questions about the ability to concentrate, the ability to enjoy day-to-day activities,

[25] For instance, how important is religion, how safe one feels in a given zone, or how comfortable one feels to speak about personal intimacies.
[26] Openness, conscientiousness, extraversion, agreeableness, and neuroticism (Cummings et al., 2019).
[27] For a review of the main determinants of each factor, see DeNeve and Cooper (1998).

beliefs in oneself, and feelings that one plays a useful role in society. Again, the authors find that personality traits are good determinants of SWB, obtaining statistical significance for most coefficients.

Subjective well-being and the environment

The SWB contemplates the extent to which people think and feel that their life is going well (Diener and Lucas, 2009). Usually, the SWB measures include a global assessment of all aspects of a person's life (Diener, 2009). The literature on SWB discusses a large number of determinants of happiness, which shows its versatility and capacity of including relevant elements beyond economic prosperity (Dolan et al., 2008; Di Tella and MacCulloch, 2006).[28] Findings in the current literature corroborate the influence of socio-economic variables (such as gender, age, having children, marital status; for an overview see Diener et al., 1999), education (Di Tella et al., 2001), unemployment, and inflation[29] (Clark and Oswald, 1994; Winkelmann and Winkelmann, 1998; Di Tella et al., 2003), population density (Cramer et al., 2004), health (Alesina et al., 2004), airport noise (van Praag and Baarsma, 2005), nuclear catastrophe (Berger, 2008), noise pollution (Rehdanz and Maddison, 2008), environmental engagement (Choi, 2018), democratic and federal institutions (Frey and Stutzer, 2000), among others. The SWB approach offers a great complimentary path to the mainstream view, acting as a proxy for "true" utility (Frey and Stutzer, 2002).

In what climate conditions are concerned, precipitation measured by mean annual precipitation in millimeters is positively correlated with well-being (Ferreira and Moro, 2010). Moreover, there is strong evidence of the influence of temperatures on welfare (Frijters and van Praag, 1998; Rehdanz and Maddison, 2005).

Regarding extreme weather events (such as forest fires, heatwaves, or droughts), they may have lasting psychological effects, due to health problems and negative emotional effects (Sekulova and van den Bergh, 2013). Thus, individuals might be afraid of the impacts of these events, and this tends to impact happiness negatively (Osberghaus and Kühling, 2016).

[28] Regarding economic prosperity, Easterlin (1974) finds a positive relationship between income and SWB within the country.

[29] According to Peiró (2006), economic factors condition a sphere of well-being: satisfaction. Thus, macroeconomic variables (such as unemployment and inflation) might have a large effect on it.

Among the studies based on the ESS survey, Ferreira et al. (2013) link SWB to air pollution (SO_2) using regional data in a multi-country analysis, with spatial controls and socio-demographic indicators. They use data from the first three waves of ESS, which cover 23 European countries, and their findings confirm the results in the literature.

Table 1 – Description of the variables used

Variable name	Source	Description
Subjective Well-Being (SWB)	ESS	"Taking all things together, how happy would you say you are?": 0 (extremely unhappy) - 10 (extremely happy)
Socio-economic and demographic variables		
Income	ESS	Net household income from all sources (in euros)
Employment status	ESS	9 categories: paid work, in education, unemployed seeking a job, unemployed not seeking a job, disabled, retired, housework, community/military services (reference), and others (reference)
Gender	ESS	Dummy: 1= Female
Age	ESS	Age in years
Children	ESS	Dummy: 1= If children live at home
Education (years)	ESS	Years of education completed (full or part-time)
Marital status	ESS	6 categories: legally married, in a legally registered civil union, legally separated, legally divorced/civil union dissolved, widowed / civil partner died and none of these (reference).
Citizenship	ESS	Dummy: 1=Citizen of the country of residence
Born in country	ESS	Dummy: 1=Born in the country of residence
Health (self-reported)	ESS	5 categories: 1 (Very good) - 5 (Very bad)
Environmental Perceptions and Attitudes (EPA)		
Energy affairs		
Ideal amount of generation - Solar or sun power*	ESS	"How much of the electricity used in [country] should be generated from sun or solar power?": 01 (A very large amount) - 05 (None at all)
Ideal amount of generation - Wind power*	ESS	"How much of the electricity used in [country] should be generated from wind power?": 01 (A very large amount) - 05 (None at all)
Ideal amount of generation - Biomass energy*	ESS	"How much of the electricity used in [country] should be generated from biomass energy (from materials like wood, plants, and animal excrement)?": 01 (A very large amount) - 05 (None at all)
Interruption of energy supplies by disaster or extreme weather	ESS	"How worried are you that energy supplies could be interrupted by natural disasters or extreme weather?": 01 (Not at all worried) - 05 (Extremely worried)
New expressions of environmental awareness		
Climate change awareness	ESS	"You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing? 1 (Definitely changing) - 4 (Definitely not changing)
Personal responsability	ESS	"To what extent do you feel a personal responsibility to try to reduce climate change?": 00 (Not at all) - 10 (A great deal)
General level of concern about climate change	ESS	"How worried are you about climate change?": 01 (Not at all worried) - 05 (Extremely worried)
Benefits or setbacks from climate change across the world	ESS	"How good or bad do you think the impact of climate change will be on people across the world?": 00 (Extremely bad) - 10 (Extremely good)
Government's role to reduce the impacts of climate change	ESS	"And how likely do you think it is that governments in enough countries will take action that reduces climate change?": 00 (Not at all likely) - 10 (Extremely likely)
Spatial control		
Size of settlement	ESS	"Which phrase on this card best describes the area where you live?": 1 (Big city) - 5 (a farm or home in the countryside)
Environmental variables and amenities		
Air pollution - PM_{10}	Eurostat/EEA	Population weighted annual mean concentration of PM_{10} ($\mu g/m^3$)
Precipitation	Eurostat	Total volume of precipitation in m^3 (absolute value)
Waste generation per capita	Eurostat	Ratio among waste generation during the calendar year (in tons) and the average resident population
Macro variables		
Population density	Eurostat	The ratio between the annual average population and the land area
GDP per capita	Eurostat	Gross domestic product (PPS per inhabitant) by country

* The option "I have not heard of this energy source before" is also considered, since, in this paper, it has the same impact as the option "none at all".

Table 1 *(continued)*

Variable name	Source	Description
Personality traits		
Individual is sociable with others	ESS	"How often do you meet socially with friends, relatives, or work colleagues?": 01 (Never) - 07 (Every day)
Individual feels comfortable commenting on personal issues and intimacies	ESS	"How many people, if any, are there with whom you discuss intimate and personal matters?": 00 (None) - 06 (10 or more)
Individual enjoys social activities	ESS	"Compared to other people of your age, how often would you say you take part in social activities?": 1 (Much less than most) - 5 (Much more than most)
Individual feels safe in the region where he/she lives after dark	ESS	"How safe do you – or would you – feel walking alone in this area after dark? Do – or would – you feel?": 1 (Very safe) - 4 (Very unsafe)
Individual considers himself/herself religious	ESS	"Regardless of whether you belong to a particular religion, how religious would you say you are?": 0 (Not at all religious) - 10 (Very religious)
Individual considers himself/herself attached to his/her country	ESS	"How emotionally attached do you feel to [country]?": 0 (Not at all emotionally attached) - 10 (Very emotionally attached)
Individual considers himself/herself attached to Europe	ESS	"And how emotionally attached do you feel to Europe?": 0 (Not at all emotionally attached) - 10 (Very emotionally attached)

3. DATA

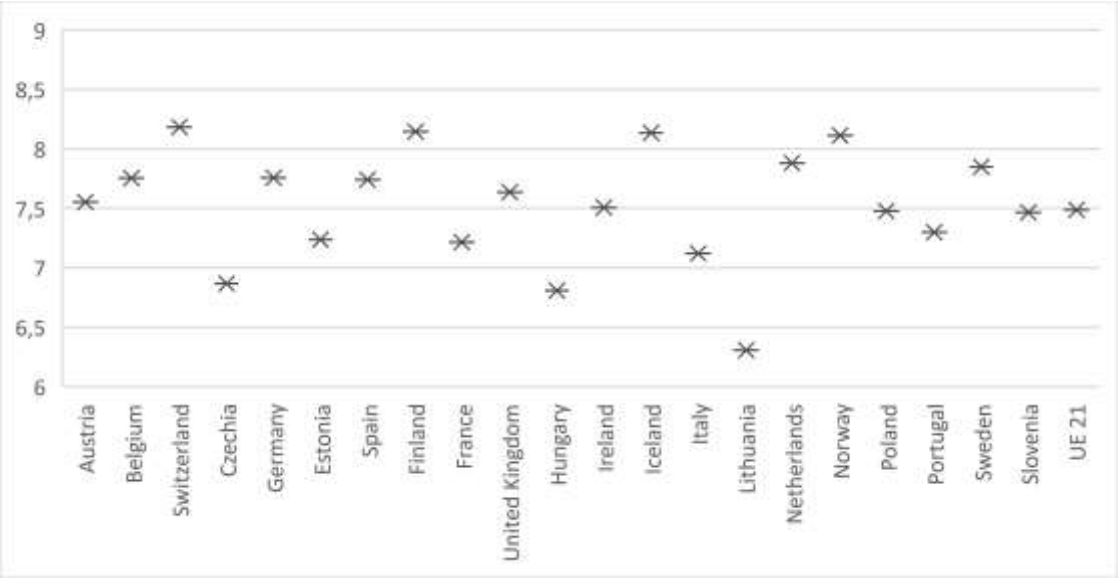
This paper uses cross-section data taken from the 8th wave of European Social Survey (ESS) carried out across Europe in 2016.[30] The ESS is a multi-country survey with its first data collection in 2002. Its design includes reaching random samples throughout countries, which may change either within-country or inter-nation. To ensure representativeness and capacity of comparability between countries, ESS has the following main principles: a) apply the sample frame with the best coverage on the target population; b) employ probability sampling; c) seek for the design that offers higher statistical precision according to the prescribed level. After applying all the necessary adjustments, the final dataset comprises approximately 39,400 observations from 21 European countries.[31]

The score of subjective well-being is based on the answers to the following question: "Taking all things together, how happy would you say you are?". The subjects could choose a value from 0 (extremely unhappy) to 10 (extremely happy). According to Figure 1, the average happiness scores across the countries covered by ESS 2016 is 7.48.[32] In this wave, the performance by country is similar to the one recorded in previous waves, with the highest score belonging to Switzerland (8.18), followed by Finland (8.14), and Iceland (8.13). On the other

[30] In total, the 8th wave of ESS interviewed individuals in 23 countries. However, Israel (for not being part of Europe) and Russia (due to a high absence of data) were not considered in the sample.
[31] The countries considered in the paper are Austria, Belgium, Switzerland, Czechia, Germany, Estonia, Spain, Finland, France, United Kingdom, Hungary, Ireland, Iceland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Sweden, and Slovenia.
[32] After the exclusion of Israel and Russia.

hand, the lowest scores in the 8th wave of ESS are recorded in Lithuania (6.30), followed by Eastern Europe (6.80 in Hungary and 6.86 in Czechia).

Figure 1 – Happiness in European countries (UE 21).



Source: ESS (2016) / Adapted.

Following the current literature, this study uses socio-economic variables at the individual level due to their impact on well-being (gender, age, education, children, employment situation and, marital status).[33] The ESS also has two questions related to citizenship. In the first, the respondent must answer if he/she is a citizen of the country where he/she lives, whereas the second asks where he/she was born. Both are considered in this paper to control for any possible link between citizenship and identification with the country. Moreover, to avoid omitted bias, the size of the settlement is applied as a proxy for spatial control.

The environmental conditions and amenities are composed of air pollution (PM_{10}, see Ambrey et al., 2014), precipitation (Brereton et al., 2008), and waste production *per capita*. To the best of my knowledge, no study has directly discussed the relationship between the amount of waste production and well-being. It is included in this paper given its high importance in the respondent's quality of life, due to the problems caused by the incorrect agglomeration / selection in the cities or by its direct impact on the environment. The paper also uses two variables as macro controls: GDP per capita and population density (Ferreira et al., 2013; Cramer et al., 2004).

[33] For an overview, see Dolan et al. (2008).

Table 2 – Descriptive statistics of variables used

Variable name	Obs	Mean	Std. Dev.	Min	Max
Subjective well-being (SWB)	39,240	7.4878	0.0091	0	10
Socio-economic and demographic variables					
Income (in euros)	36,445	35,508	21,373	3,844	187,000
Employment status					
Paid work	39,400	0.54	0.49	0	1
In Education	39,400	0.09	0.29	0	1
Unemployed seeking a job	39,400	0.04	0.19	0	1
Unemployed not seeking a job	39,400	0.01	0.13	0	1
Disabled	39,400	0.03	0.18	0	1
Retired	39,400	0.26	0.44	0	1
Housework	39,400	0.001	0.03	0	1
Gender	39,391	0.52	0.49	0	1
Age	39,272	36.43	18.56	18	86
Children	39,389	0.34	0.47	0	1
Education (years)	38,990	12.68	12.63	1	42
Marital status					
Legally married	19,962	0.038	0.19	0	1
In a legally registered civil union	19,962	0.009	0.09	0	1
Legally separated	19,962	0.012	0.11	0	1
Legally divorced / Civil union dissolved	19,962	0.18	0.38	0	1
Widowed / Civil partner died	19,962	0.16	0.36	0	1
Citizenship	39,379	0.94	0.21	0	1
Born in country	39,386	0.9	0.29	0	1
Health (self-reported)	39,354	2.19	0.9	1	5
Environmental Perceptions and Attitudes (EPA)					
Energy affairs					
Ideal amount of generation - Solar or sun power	38,435	1.88	0.96	1	5
Ideal amount of generation - Wind power	38,314	2.00	1.02	1	5
Ideal amount of generation - Biomass energy	37,205	2.69	1.26	1	5
Interruption of energy supplies by disaster or extreme weather	39,041	2.63	0.98	1	5
New expressions of environmental awareness					
Climate change awareness	38,772	1.49	0.65	1	4
Personal responsability	37,795	6.96	2.83	1	11
General level of concern about climate change	38,344	3.04	0.92	1	5
Benefits or setbacks from climate change across the world	37,351	4.94	2.42	1	11
Likelihood that Government takes action	37,136	6.37	2.29	1	11
Spatial control					
Size of settlement	39,358	2.97	1.20	1	5
Environmental variables and amenities					
Air Pollution - PM_{10}	39,400	19.02	5.48	10.3	31.3
Precipitation	39,400	83,018	131,017	0	509,871
Waste Production per capita	39,400	5.74	5.63	0	22.4
Macro variables					
Population density	39,400	141.7	118.0	3.3	498.1
GDP per capita	39,400	27,739	11,152	19,238	49,950
Personality traits					
Individual is sociable with others	39,273	4.84	1.54	1	7
Individual feels comfortable commenting on personal issues	39,017	3.85	1.42	1	7
Individual enjoys social activities	38,798	2.71	0.89	1	5
Individual feels safe in the region where he/she lives after dark	39,052	1.95	0.76	1	4
Individual considers himself/herself religious	39,088	5.72	3.23	1	11
Individual considers himself/herself attached to his/her country	39,232	7.36	3.16	1	11
Individual considers himself/herself attached to Europe	38,888	7.12	2.66	1	11

In 2016, the ESS survey enlarged the scope of its topics by adding a rotating module called "Climate change and energy, including attitudes, perceptions and policy preferences". This

study selects nine questions from this new section, which aim to explore the perceptions and attitudes of each subject regarding the relationship between energy, environmental awareness, climate change, and well-being. These variables are divided into two groups. The first group encompasses the EPA related to the connection between energy affairs (sources and supply) and happiness, due to climate change; the second group is related to EPA concerning five distinct expressions of environmental awareness.

Lastly, given the importance of personality traits to influence current well-being (Layard, 2005; Diener et al., 1999), this paper considers seven questions from ESS, that have been used to proxy individual feelings. The application of these psychological characteristics aims to assess its influence on the link between EPA and SWB, while it prevents problems with omitted variable bias, given their high impact on SWB. Table 1 contains the descriptions of all variables used in this paper and Table 2 contains their descriptive statistics.[34]

Some limitations apply to this study. First, the database is restricted to the year 2016, which might also narrow the influence of experienced events in the judgment process (Diener et al., 1999). Second, for the sake of simplicity, the set of environmental variables is smaller than the one used in other studies in the area (Moro et al., 2008; Cuñado and Gracia, 2013) since the paper's focus is on EPA.[35]

4. ECONOMETRIC APPROACH

The personal SWB is a latent variable, which is not observed, but it may be expressed by Equation (1). In this sense, what is observed is the SWB level given in Equation (3), which is an ordered variable and has a relationship with the latent SWB. Therefore, for answering the research questions, the estimation may use the Ordered Probit Model (Ambrey et al., 2014; Ferrer-i-Carbonell and Gowdy, 2007).[36] Following Maddala (1983), the $SWB^{*}_{i,k}$ associates and orders the levels of well-being, such as 0 for "extremely unhappy" and 10 for "extremely happy". Thus, the SWB unobserved latent variable is:

[34] In all questions, the answers "Refusal to respond" or "Don't know" are not considered, because none offers any applicable interpretation to this paper's purpose.
[35] For instance, most studies in environmental economics apply a common set of environmental variables that encompasses the maximum and minimum temperatures (annual or by season), wind speed, whether the country has a coastal zone, and the mean annual total duration of bright sunshine (in hours/day). Despite the restrictions applied in this paper, the effects of environmental conditions are considered partially by country dummies.
[36] OLS may offer similar outcomes (Ferrer-i-Carbonell and Frijters, 2004).

$$SWB^*_{i,k} = \alpha + \nu_k + \gamma X_{i,k} + \eta EPA_{i,k} + \theta Z_{i,k} + e_{i,k} \quad (1)$$

Where the $SWB^*_{i,k}$ is the subjective well-being of individual *i*, in country *k*; $X_{i,k}$ is a set of explanatory variables, which includes a vector of socio-economic characteristics (such as employment status, household income, gender, age, so forth), size of settlement, environmental variables and macro controls; $EPA_{i,k}$ represents the EPA regarding climate change; $Z_{i,k}$ is a vector of individual psychological traits, and $e_{i,k}$ represents the usual error term. To control for unobserved country-level heterogeneity, the model uses country dummies (ν_k). The distribution of errors is normal to obtain an Ordered Probit.

Particularly, for the development of this study, where $SWB \in \{0, 1, 2, \dots, 10\}$, the unknown parameters α_m with $m = 0, 1, 2, \dots, 9$ are considered such that:

$$\alpha_0 < \alpha_1 < \cdots < \alpha_9 \quad (2)$$

While the ordinal dependent variable satisfies:

$$SWB = \begin{cases} 0, if\ SWB^* \leq \alpha_0 \\ 1, if\ \alpha_0 < SWB^* \leq \alpha_1 \\ \dots \\ 9, if\ \alpha_8 < SWB^* \leq \alpha_9 \\ 10, if\ SWB^* > \alpha_9 \end{cases} \quad (3)$$

The unknown parameters α_m and $\nu, \gamma, \eta, \theta$ are estimated by the Maximum Likelihood Method (Maddala, 1983). I estimated five different specifications of Eq. (1), each one capturing the effect of a new block of variables, from socio-economic characteristics to personality traits.

Table 3 – Ordered Probit at SWB level

Variable	Traditional LS	Including EPA			
		+ EPA + Spatial control	+ Amenities + Environmental Variables	+Macro controls	+ Personality Traits - Spatial control
	(1)	(2)	(3)	(4)	(5)
Socio-economic and demographic variables					
Ln (Income)	0.146***	0.130***	0.130***	0.130***	0.108***
	(0.0127)	(0.014)	(0.014)	(0.014)	(0014)
Employment status					
Paid work	0.092***	0.090***	0.091***	0.091***	0.076**
	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)
In education	0.116***	0.077**	0.077**	0.077**	0.035
	(0.035)	(0.037)	(0.037)	(0.037)	(0.038)
Unemployed seeking a job	-0.177***	-0.198***	-0.198***	-0.198***	-0.195***
	(0.045)	(0.047)	(0.047)	(0.048)	(0.048)
Unemployed not seeking a job	-0.227***	-0.196***	-0.196***	-0.196***	-0.196***
	(0.058)	(0.063)	(0.064)	(0.064)	(0.064)
Disabled	-0.119**	-0.104**	-0.104**	-0.104**	-0.085
	(0.047)	(0.051)	(0.050)	(0.051)	(0.051)
Retired	0.0817**	0.074	0.074	0.074	0.064
	(0.041)	(0.045)	(0.045)	(0.045)	(0.045)
Housework	-0.304	-0.406**	-0.406**	-0.406**	-0.456**
	(0.197)	(0.205)	(0.205)	(0.205)	(0.205)
Gender	0.0754***	0.075***	0.076***	0.076***	0.084***
	(0.017)	(0.018)	(0.018)	(0.018)	(0.019)
Age	-0.006***	-0.006***	-0.006***	-0.006***	-0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age Squared	7.75e-05***	8.25e-05**	8.25e-05**	8.25e-05**	8.35e-05**
	(2.89e-05)	(3.29e-05)	(3.28e-05)	(3.29e-05)	(3.36e-05)
Children	0.041*	0.049**	0.045**	0.050**	0.071***
	(0.021)	(0.023)	(0.023)	(0.023)	(0.023)
Education (years)	-0.002***	-0.001	-0.001	-0.001	-5.57e-04
	(7.08e-04)	(7.82e-04)	(7.82e-04)	(7.82e-04)	(7.93e-04)
Marital status					
Married	-0.062	-0.071	-0.071	-0.071	-0.076
	(0.045)	(0.048)	(0.048)	(0.048)	(0.048)
Civil union	0.139	0.119	0.119	0.119	0.134
	(0.084)	(0.087)	(0.087)	(0.087)	(0.088)
Separated	-0.160**	-0.145*	-0.145*	-0.145*	-0.145*
	(0.076)	(0.082)	(0.082)	(0.083)	(0.083)
Divorced	-0.0463*	-0.038	-0.038	-0.038	-0.039
	(0.025)	(0.027)	(0.027)	(0.027)	(0.028)
Widowed	-0.093***	-0.102***	-0.102***	-0.102***	-0.102***
	(0.034)	(0.037)	(0.037)	(0.038)	(0.038)
Citizenship	0.112**	0.112**	0.112**	0.112**	0.084
	(0.048)	(0.052)	(0.052)	(0.052)	(0.053)
Born in country	0.048	0.051	0.051	0.051	0.069*
	(0.036)	(0.039)	(0.039)	(0.039)	(0.040)
Health (self-reported)	-0.186***	-0.180***	-0.180***	-0.180***	-0.136***
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)
Environmental Perceptions and Attitudes (EPA)					
Energy affairs					
Ideal amount of generation - Solar or sun power		-0.022*	-0.022*	-0.022*	-0.023*
		(0.012)	(0.012)	(0.012)	(0.012)
Ideal amount of generation - Wind power		0.007	0.007	0.007	0.010
		(0.012)	(0.012)	(0.012)	(0.012)
Ideal amount of generation - Biomass energy		-0.011	-0.011	-0.011	-0.009
		(0.007)	(0.007)	(0.008)	(0.008)
Interruption of energy supplies by disaster or extreme weather		-0.033***	-0.033***	-0.033***	-0.026***
		(0.009)	(0.009)	(0.010)	(0.009)

Table 3 - Ordered Probit at SWB level (continued)

Variable	Traditional LS	Including EPA			
		+ EPA + Spatial control	+ Environmental Variables and Amenities	+ Macro controls	+ Personality Traits - Spatial control
	(1)	(2)	(3)	(4)	(5)
New expressions of environmental awareness					
Climate change awareness		7.45e-04	7.45e-04	0.001	-0.009
		(0.017)	(0.017)	(0.017)	(0.017)
Personal responsability		0.034***	0.034***	0.034***	0.027***
		(0.003)	(0.034)	(0.003)	(0.004)
General level of concern about climate change		-0.024**	-0.024**	-0.024**	-0.034***
		(0.012)	(0.012)	(0.012)	(0.012)
Benefits or setbacks from climate change across the world		0.007*	0.007*	0.007*	0.005
		(0.004)	(0.004)	(0.004)	(0.004)
Government's role to reduce the impacts of climate change		0.026***	0.026***	0.027***	0.018***
		(0.004)	(0.004)	(0.004)	(0.004)
Environmental variables and amenities					
Air Pollution - PM_{10}			-0.015***	-0.015*	-0.008*
			(0.005)	(0.009)	(0.005)
Precipitation			2.60e-07	2.75e-07	4.48e-07
			(6.47e-07)	(6.61e-07)	(1.07e-06)
Waste production per capita			-0.022	-0.022	-0.025
			(0.042)	(0.020)	(0.029)
Spatial control					
Size of settlement		-0.008	-0.008	-0.008	
		(0.007)	(0.007)	(0.007)	
Macro variables					
GDP per capita				3.33e-06*	1.63e-06
				(2.00e-06)	(3.14e-06)
Population density				4.42e-04	
				(0.002)	
Personality traits					
Individual is sociable with others					0.037***
					(0.007)
Individual feels comfortable commenting on personal issues and intimacies					0.047***
					(0.007)
Individual enjoys social activities					0.058***
					(0.011)
Individual feels safe in the region where he/she lives after dark					-0.076***
					(0.013)
Individual considers himself/herself religious					0.005*
					(0.003)
Individual considers himself/herself attached to his/her country					0.017***
					(0.003)
Individual considers himself/herself attached to Europe					0.027***
					(0.004)
Dummy for countries	Yes	Yes	Yes	Yes	Yes
Log likelihood	-30,434	-26,468	-26,468	-26,468	-25,721
N	16,104	14,254	14,254	14,254	13,967
Pseudo R^2	0.0287	0.0309	0.0309	0.0309	0.0366

Note: standard errors in parentheses. The intercepts are not shown. *** p<0.01; ** p<0.05; * p<0.1

5. RESULTS

Table 3 shows the econometric results. They represent five different specifications of the model presented in Eq. (1). All models have a set of dummy variables indicating the country where the respondent lives. Following the traditional life satisfaction approach in the literature, Model 1 includes only the first group of individual characteristics ($X_{i,k}$) as explanatory variables. Overall, the influence of socio-economic and demographic variables is in line with previous studies (Dolan et al., 2008; Diener et al., 1999). Having a higher income and being female have a positive and significant impact on latent well-being (Easterlin, 1974; Frey and Stutzer, 2012). Education has a negative influence on latent happiness (Smyth et al., 2008). Age has a U-shaped effect on latent SWB.

Students, workers in a paid job, and retired people report higher levels of latent life satisfaction. While being unemployed (seeking a job or not) and having a disability is found to have a negative and statistically significant effect on latent well-being (Ferreira et al., 2013). Having children living at home is associated with being happier. Regarding marital status, being separated, divorced, or widowed is associated with a lower latent SWB (Luechinger, 2010). Being a citizen of the country where the subject lives has a positive and significant impact on SWB, which may relate to the practice of direct democratic rights (Frey and Stutzer, 2000). The health status coefficient is negative and significant, showing that unhealthy individuals are less happy (Cuñado and Gracia, 2013).

Model 2 incorporates EPA regarding climate change jointly with a spatial control (size of settlement). The first group of EPA includes energy affairs. The "ideal amount of generation – solar or sun power" coefficient are associated with lower levels of latent well-being. This finding may reflect the concerns of the population when there is a reduction in the share of renewable energies in the energy matrix, given the relevant impact that non-renewable sources have on the generation of air pollution (EEA, 2021). The fear of interruptions of energy supply due to a disaster or extreme weather has a negative and significant impact on life satisfaction. Apprehension towards such interruptions may be due to their possible negative emotional effects (Sekulova and van den Bergh, 2013) or damage experiences (Osberghaus and Kühling, 2016). This last result is interesting since no example of a specific event was presented to respondents.[37]

[37] In my opinion, this finding stands out because it gathers a bunch of fears (the direct fear of lacking electric energy, on which we are highly dependent; and the fear that some disaster or extreme climate weather interferes

A second group of EPA is composed of questions related to new expressions of environmental awareness. "Climate change awareness", "personal responsibility", and "benefits or setbacks from climate change across the world" are found to have a positive relationship with well-being, but only the last two have statistical significance. This finding might be related to the *biophilia* hypothesis (Wilson, 1984; Kellert, 2008), whereby individuals are happier for having a deeper connection with natural systems. For instance, an increase of one unit in the "personal responsibility" scale makes the individual approximately 0.43% more likely to feel extremely happy.[38] Existing studies show that environmental awareness variables generally have a positive relationship with SWB (Binder and Blankenberg, 2016; Smyth et al., 2008; Sekulova and van den Bergh, 2013). However, after including personality traits, the coefficient on "climate change awareness" becomes negative, but still without statistical significance.[39]

The coefficient of the "general level of concern about climate change" has a negative and significant impact on latent welfare, which might be linked to the fear of several restrictions coming from climate change that generate a type of "anticipation effect" (Binder and Ward, 2013).[40] Following Diener and Kesebir (2008), the belief that the government's role is relevant to decrease the impacts of climate change is associated with a positive and highly significant (at 1% level) effect on well-being. This finding is relevant since the successful climate policy is supported at the citizen level (Di Tella and MacCulloch, 2006). In doing so, as citizens have extra expectations that more countries should take actions to reduce climate change, they are about 0.30% more likely to feel deeply happy.

Model 3 includes three environmental variables and amenities. The annual average of PM_{10} and waste production per capita emerge with negative coefficients, the former related to the health impacts (Ambrey et al., 2014) and the latter related to environmental degradation. However, it is worth highlighting that only air pollution influences significantly latent SWB at the 1% level. One additional annual mean concentration of PM_{10} ($\mu g/m^3$) is associated with 0.13% fewer

negatively with the energy supply), even though, to the best of my knowledge, their causality relationship with SWB or the weight of each type (lack of electricity, disaster or extreme environmental events) is unknown.

[38] The full list of marginal effects is available under request.

[39] It is worth knowing that 93.2% of the respondents believe that climate change is *definitely* or *probably* occurring. This variable represents a collective behavior, while the next question ("personal responsibility") relates to the individual. Also, after testing for the misspecification or just a better specification, I find acceptable correlation and Variance Inflation Vector' (VIF) values for this variable. Thus, the behavior of "climate change awareness" seems to be highly dependent on the interaction with other variables.

[40] In comparison with Binder and Blankenberg (2016), despite they use the expression "concerns with the environment", their study reflects an individual behavior more similar to environmental awareness and therefore it has a positive impact on SWB.

chances of the subject to be fully satisfied. Model 4 adds the macro controls. The coefficient on GDP per capita has a sign that is in line with the existing literature (Ferreira et al., 2013), and is statistically significant at the 10% level.

Lastly, Model 5 incorporates personality traits. In general, after including these variables, the results remain robust. Most of the personality traits are statistically significant at the 1% level and have a positive impact on well-being. The results confirm previous findings, showing that inborn features are among the most important determinants of well-being (Layard, 2005; Diener et al., 1999; DeNeve and Cooper, 1998).[41] For example, the measure of extraversion ("Individual feels comfortable commenting on personal issues and intimacies") has a positive relationship with latent welfare. However, feelings of insecurity in the area where the subjects live have a highly negative and significant relationship with welfare (Ambrey et al., 2014), which has the expected sign since a more unsafe sensation may generate more uncomfortable feelings. Lastly, both coefficients on the level of attachment to the country and Europe show a high positive and significant impact on happiness (at the 1% level), suggesting a feeling of belonging and integration with the nation and the continent in which the respondent resides. Therefore, the act of feeling European increases latent happiness.

In sum, the inclusion of 7 proxy variables for personality traits shows that when controlling for psychological features, EPA results only partially change, as most of the previous conclusions remain unchanged.[42] Unlike Ferrer-i-Carbonell and Gowdy (2007), across the 21 European countries, the relationship between EPA and welfare is partially due to the possible correlation between psychological traits and environmental awareness. Furthermore, these results increase the relevance to the literature, since I consider a larger range of EPA (energy affairs and new expressions of environmental awareness), based on a multi-country analysis.

6. DISCUSSION AND FINAL REMARKS

Environmental Perceptions and Attitudes (EPA) have an important role to play in determining an individual's level of well-being (Ferrer-i-Carbonell and Gowdy, 2007). The present study

[41] Due to multicollinearity, the spatial control was excluded in Model 5.
[42] There are only three changes on EPA coefficients. First, "Climate change awareness" takes on a negative sign, but still without statistical significance. Second, "Overall level of concern about climate change" maintains the same sign, but it increases the significance level from 5% to 1%. Third, "Climate change benefits or setbacks around the world" loses its statistical significance.

brings new insights into how EPA impact happiness across 21 European countries, even when controlling for personality traits. Therefore, understanding individuals' reactions to climate change may be useful to support the discussion on how behavior affects their well-being level.

The results in this paper suggest that the impact of EPA related to energy affairs on SWB is relevant. In fact, the amount of solar power energy generation reveals a positive relationship with welfare, indicating that a higher share of participation of renewable energy sources in the energy matrix influences society's well-being positively since the harmful effects coming from non-renewable options are well-known. Therefore, these findings show the double benefits from investing in renewable energy sources (higher level of happiness and less air pollution), which reinforces the arguments for the application of more public resources into building a greener energy matrix.

Also, the possibility of an interruption in energy supply due to extreme climate events tends to reduce the happiness level (Osberghaus and Kühling, 2016). This finding is impressive, because even though the respondents were not informed about which type of extreme event should be considered for answering, just "the fear of" already results in an important effect upon SWB. Indeed, Ferrer-i-Carbonell and Gowdy (2007) demonstrated the influence of the "preoccupation itself" regarding environmental issues on well-being.

Concerning the new expressions of environmental awareness, most coefficients support the finding of a strong connection between human beings and natural systems, whereby the individuals might improve their happiness level in several different ways (Wilson, 1984; Kellert, 2008; Smyth et al., 2008). Moreover, the outcomes show that, at the individual level, the respondents clearly express their blame share ("personal responsibility"), at the same time that they hope for a relief from the state ("government's role"), demonstrating a preference for the existence of an environmental policy (Diener and Kesebir, 2008). Therefore, this paper provides additional grounds for discussion of environmental policy since its development and implementation is supported at the citizen level. This finding entails an important contribution, mainly in the European Union, given its traditional role as a promotor in defending policies aiming to reduce the effects of climate change.

When including inborn features, they slightly alter the EPA results, for example, the "climate change awareness" coefficient becomes negative. However, this change of sign is not relevant,

since the coefficient remained without statistical significance throughout all models, and hence does not influence happiness. Although personality traits produce partial changes in the results, the existence of a relationship between a more varied set of EPA and SWB in Europe is assured, since the sign and significance in most EPA coefficients remain.

At first, the negative relationship between waste production and life satisfaction might also represent an important contribution to the subjective well-being literature. However, for all estimations, this coefficient never shows any statistical significance.

Moreover, this paper contributes to the SWB literature by showing a wider range of EPA capable of impacting well-being, by going beyond the traditional view of simple "environmental awareness" and hence extending the results of Ferrer-i-Carbonell and Gowdy (2007). The findings show that EPA related to energy affairs and additional expressions of environmental awareness (such as "personal responsibility") also have a relevant impact on happiness. Consequently, this paper expands the understanding about how the environment affects our lives, which enriches the discussion around climate change effects. Additionally, the results reveal some duality of the EPA's effects, since the subjects experience an increase in well-being for being conscious of their responsibilities with the environment, while they are also reducing life satisfaction due to the fear of future bad consequences from climate change. However, exploring the trade-off between these factors is beyond what this dataset allows. On top of that, this paper applies the EPA's debate in a multi-country analysis, implying that its findings reflect the behavior of a large number of citizens, with different national guidelines about the environment, but following similar orientations of the European Parliament. Such expansion is relevant because it exceeds the domestic characteristics of a nation (like the main political orientation and the availability of natural resources) that may influence the formation of EPA regarding climate change.

Additionally, public policies must be implemented aiming to improve the share of individual participation in the programs of selective collection of waste in municipalities, by highlighting individual responsibilities throughout the process. This way, the rate of recycling, and therefore SWB might become higher, while public spending in waste management would tend to decrease. Also, policymakers may consider the benefic effect of ecological awareness on happiness, and claim support for the adoption of climate policies, such as prohibiting the usage of single-use plastic products, recently approved by the European Parliament (Directive

2019/904). By addressing environmental issues, these actions may, through EPA, improve the quality of life and increase SWB in Europe.

Future research may extend this analysis. For instance, by adding new aspects of EPA, such as whether individuals perceive the potential channels through which climate change may become a threat to their lives (such as floods, heatwaves, etc.). These perceptions will support the adoption of public policies devoted to mitigating the effects of climate change, either policies aimed at avoiding the occurrence of climate change-related events (like a dike for containing the advance of sea-level rise) or at partially compensating for future damages. Also, it will be useful to explore EPA at the regional level, which may offer an even richer analysis by considering more disaggregated data; for instance, knowing whether a region has a coastal zone is important since this feature is correlated with precipitation (Cuñado and Gracia, 2013).

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