

Does climate change concern alter individual tax preferences? Evidence from an Italian survey

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Abstract

Purpose – This paper analyzes the role that the climate change concern (CCC_i) has on the willingness to accept an environmental tax. The author aims to grasp how individual general tax preferences can differ with respect to the specific (environmental) tax. He focuses attention to the Italian case since it has been argued that the potential acceptability of a carbon tax in Italy is relatively high, and this topic has been scarcely explored so far among Italian citizens (Rotaris and Danielis, 2019).

Design/methodology/approach – The author conducted an online survey among 514 Italian economics students.

Findings – The CCC_i positively influences the environmental tax morale (ETM_j). The general tax morale (TM_j) positively affects the specific (environmental) TM_i. The CCC_i alters individual tax preferences. The author evidenced that also subjects with low TM_i turned out to be willing to pay an environmental tax if aware of the environmental issues.

Research limitations/implications – Although the author used a common methodology in this strand of research, he is aware that in an online survey individuals can be influenced by the self-reporting and hypothetical choice bias (see Swamy *et al.*, 2001), that in turn can characterize their reported preferences. Moreover, even if economics university students are commonly used as a subject pool in experimental economics settings, and although several studies showed that the behavioral responses of students are largely the same as those of nonstudents in identical experiments (for a discussion see Alm, 2012; Choo *et al.*, 2016), there is awareness that in this case, they are not taxpayers yet (Barabas and Jerit, 2010).

Practical implications – The author's results remark the importance of increasing climate change awareness among people to let them be more willing to pay the environmental tax, for instance through investments in sensibilization campaigns on the importance of energy source usage and climate-related topic. Then, an increase in the general TM_j leads to an increase in the specific (environmental) TM_i. The author's evidence showed that people with high tax morale logically recognize the positive impact of paying an environmental tax when the CCC_i increases, since the more the theme becomes important, the larger the willingness to pay the specific tax. For this reason, policymakers should carry on campaigns to increase the general level of TM_j to increase the overall tax compliance level and the relative tax revenues, following the guidelines given by the Organisation for Economic Co-operation and Development (2019) to support taxpayer education programs, such as including TM_i research and analysis into education programs, improving the ease of paying taxes or strengthening revenue–expenditure links to build the social contract.

Social implications – It should be paramount to increase awareness about environmental topics among people in general and among those who are relatively tax immoral. The author's results remark on the importance of targeting energy and environmental tax policies to groups rather than to individuals. According to this evidence, we support the use of nonmonetary tools to nudge people in the environmental transition by changing their behavior in energy use, for instance through the taxation on fuel and other nonrenewable energy resources.

JEL Classification — Q50, Q40, H23

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Originality/value – It is the first empirical study that analyzes the impact of CCC_i on the environmental TM_i in Italy, in particular controlling for the role of the general willingness to pay taxes (TM_g). To obtain individual attitudes toward tax payment, most of the empirical studies in behavioral economics employ international surveys. For studies across citizens living in European countries, the European Social Survey (ESS) and European Values Study (EVS) represent the most used ones (see, for instance, Martinez-Vazquez and Torgler (2009) in Spain; Torgler and Werner (2005) in Germany; Nemore and Morone (2019) in Italy). However, these surveys do not allow to study the relationship between the environmental and general TM_i across the same subject pool. In fact, despite the ESS (2016) provides individual responses about the willingness to pay an environmental tax, it does not provide information about the general individual attitude toward tax payment (this information is contained only in the ESS wave of 2004, hence referring to a different subject pool). On the contrary, each wave of the EVS (i.e. 2008, 2017) provides information about the general individual attitude toward tax payment, but this survey does not provide a question regarding the willingness to pay an environmental tax. Therefore, to obtain information about the willingness to pay both general and environmental taxes, across the same subject pool, it is needed to carry out a survey.

Keywords Energy survey, Carbon tax, Climate change, Tax evasion and avoidance, Environmental taxes and subsidies

Paper type Research paper

1. Introduction

Nowadays, political agendas across governments are converging on several global-common concerns. Among others, there is the need on one hand to globally reduce CO₂ emissions and on the other to increase tax compliance across both individuals and businesses. For both these two topics, insights from behavioral economics could be included and used as a tool to strengthen the policy-making process's effectiveness. Starting from tax compliance, several experimental and empirical studies found that it can be increased through policies focused on stimulating individual tax morale (TM_i) (OECD, 2017). TM_i refers to the intrinsic motivations of people in paying taxes (Alm and Torgler, 2006), which in turn can significantly increase overall tax compliance in a society given the evidence of a causal link between TM_i and tax compliance behavior (Cummings *et al.*, 2009; Halla, 2012). Several authors empirically showed that the TM_i varies according to the sociodemographic information at the individual level (age, gender, income, employment and religiosity) as well as their economic and social preferences, such as trust in institutions, confidence in government and agreement with redistributive policies (Torgler, 2005; Alm and Torgler, 2006; Lago-Peñas and Lago-Peñas, 2010). However, different sorts of taxes can be differently perceived by taxpayers; thus TM_i can vary according to the kind of tax considered within a country (Luttmer and Singhal, 2014), and this can be the case with environmental taxes (Park and Yoon, 2017).

This intuition leads us to contribute to the literature about the environmental tax morale (ETM_i), namely, the individual willingness to accept an environmental tax on nonrenewable energy resources, such as fossil fuels [1]. An environmental tax can be intended as the tax rate imposed on the negative externalities coming from polluting productions (i.e. the government could set a tax in terms of euros per ton of CO₂ emissions or a tax on the percentage of carbon present in nonrenewable energy resources, such as oil, gas and coal). Despite the theoretical and empirical foundations about the efficiency and effectiveness of an environmental tax, international organizations are pushing governments to impose it (UN, 2015; OECD, 2021) since it can lead to a behavioral change in both citizens and firms in the use of greener or renewable energy resources (Aldy and Stavins, 2012), in line with the UN's sustainable development goals (SDGs), in particular SDG 7 (affordable and clean energy) and SDG 13 (climate action). However, to get a visible economic and environmental impact of an environmental tax, the latter must be supported and accepted by the public. For this reason, it is paramount to understand which factors determine the individuals' level of ETM_i.

The perception about environmental issues can shape the individual behavior in several contexts. According to recent studies on purchasing behavior, individuals tend to show a large willingness to pay for environmental products when they deal with decision-making (Morone *et al.*, 2021). This larger willingness to pay for environmental and bio-based rather

than conventional products is known in the literature as “green premium,” and it is particularly verified for those individuals who show a positive attitude toward environmental issues (Cheung and To, 2019). This phenomenon can be seen as a complement of the “circular premium,” introduced by D’adamo and Lupi (2021), who defined it as the difference between the circular and the normal price, which is taken into consideration in several industries and production sectors. All this recent evidence provides us the insights to investigate whether this sort of asymmetry between the standard and environmental goods can be seen also regarding the individual tax preferences. It is important to consider how individuals perceive different environmental policies, such as the introduction of carbon tax or subsidies and investments on renewable resources and which behavioral factors affect their acceptability most. According to several empirical and experimental studies, individuals tend to support more environmental subsidies than taxes (i.e. Cherry *et al.*, 2012; Heres *et al.*, 2015; Jagers and Hammar, 2009). This is mainly explained by the perception over the taxation system, the awareness about climate issues and the potential policy outcome such as the use of the tax revenue (i.e. Baranzini and Carattini, 2016; Douenne and Fabre, 2020).

Regarding the public acceptance of environmental taxes, Muhammad *et al.* (2021) carried out a review to analyze its determinants, arguing that most of the studies in this field were conducted through surveys and with experimental approaches. The most tested variables are the use of revenue, environmental attitude, political ideology, trust in the government and perceived policy effectiveness, as well as demographic traits (income, age, education and gender) obtaining mixed results. In general, it seems that people appear more willing to support a carbon tax when they (1) are aware of its efficacy and the policy content, (2) believe that the government is trustworthy, (3) have a positive attitude toward environmental protection, (4) perceive the policy is fair in terms of costs distribution and social sharing and (5) are concerned about climate change issues.

This paper focuses on the latter reason, thus on the role that the individual concern about climate change plays on the ETM_i , considering the interplay with the general level of TM_i . We focus our attention to the Italian case since several policies have been carried out to reduce CO_2 emissions, but different concerns have prevented the introduction of a carbon tax in Italy. Among others, a relevant concern is whether Italian citizens would be willing to accept the introduction of a new tax. Although a recent work of Rotaris and Danielis (2019) showed that the potential acceptability of a carbon tax in Italy is relatively high, this topic has been scarcely explored so far. Therefore, by conducting an online survey among Italian economics students, this paper contributes to the literature by analyzing the role that the individual climate change concern (CCC_i) has on the willingness to accept an environmental tax both directly and indirectly, trying to grasp how the individual general tax preferences can differ with respect to the specific (environmental) tax.

Taking as a reference the methodology to elicit the acceptance of a fossil fuel tax of recent empirical works (i.e. Fairbrother *et al.*, 2019; Nowlin *et al.*, 2020) we aim to demonstrate whether and how CCC_i alters individual attitudes toward paying taxes, by investigating its effect on the willingness to accept an environmental tax among both TM_i and tax immoral subject groups. Insights from this paper may help to understand how policymakers should design policies according to the group of individuals targeted based on their general level of TM_i .

The paper is structured as follows: Section 2 describes data; Section 3 points out our research hypotheses; Section 4 deals with the description of the empirical strategy; Section 5 describes the results; finally, Section 6 concludes with some tax policy implications.

2. Data and variables

To obtain individual attitudes toward tax payment, most of the empirical studies in behavioral economics employ international surveys [2]. For studies across citizens living in European countries, the European Social Survey (ESS) and European Values Study (EVS)

represent the most used ones (see, for instance, [Martinez-Vazquez and Torgler \(2009\)](#) in Spain; [Torgler and Werner \(2005\)](#) in Germany; [Nemore and Morone \(2019\)](#) in Italy). However, these surveys do not allow to study the relationship between the environmental and general TM_i across the same subject pool. In fact, despite the [ESS Round 8 \(2020\)](#) provides individual responses about the willingness to pay an environmental tax, it does not provide information about the general individual attitude toward tax payment (this information is contained only in the ESS wave of 2004, hence referring to a different subject pool). On the contrary, each wave of the EVS (i.e. 2008, 2017) provides information about the general individual attitude toward tax payment, but this survey does not provide a question regarding the willingness to pay an environmental tax. Therefore, to obtain information about the willingness to pay both general and environmental taxes, across the same subject pool, it is needed to carry out a survey.

We surveyed 514 Italian university students in economics, which is the commonly subject pool in experimental economics studies, such as in tax experiments ([Mascagni, 2018, p. 275](#)). We administered the questionnaire via Google Forms, spreading it through the Instagram profile “Economia del Suicidio,” the largest social community of economics students in Italy. The sample is composed of 54.7% males and 45.3% females, with an average of 23 years old [3].

We collected information at the individual level about their perception of environmental issues, their political orientation, their economic preferences as well as their sociodemographic information. The structure of the questions that we used in the questionnaire was inspired by the ESS regarding energy use and environmental preferences and by the EVS for the individual willingness to pay taxes.

Our dependent variable is “Environmental tax morale” (ETM_i), proxied by the individual answer to the question “*To what extent are you in favor or against the following policies in Italy to reduce climate change? Increasing taxes on fossil fuels, such as oil, gas and coal*” on a 5-point Likert scale from 1, “strongly against”, to 5, “strongly in favor”. The distribution of the dependent variable is visible in the following [Figure 1](#). The average level of ETM_i is 3.71 with a standard deviation of 1.09.

The main independent variable is the CCC_i , by which we measured with the question “*How worried are you about climate change?*” on a five-point Likert scale from 1, “not at all worried” to 5, “extremely worried.”

The other independent variable of interest is the general level of TM_i , proxied by the question “*Please tell me whether you think it can always be justified, never be justified, or*

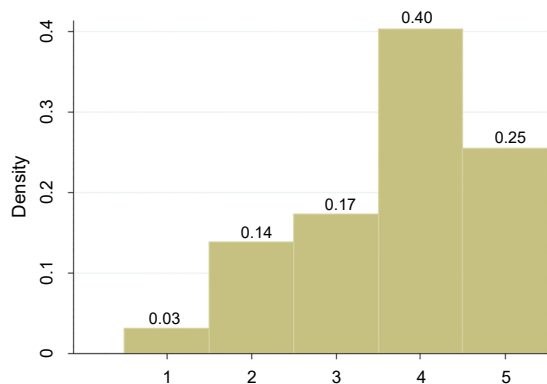


Figure 1.
Environmental tax
morality (1–5) across
all the samples

Source(s): Own elaboration, based on data from the original survey conducted

something in between: Cheating on taxes if you have the chance.” Answers range from 1, “always justified”, to 10, “never justified.”

According to the literature, we accounted for several control variables (see Horodnic, 2018; Muhammad *et al.*, 2021): trust in government, trust in politicians and political parties, political orientation (left–right), political participation, personal responsibility in combating climate change, social network activity, religiosity, age and gender. The summary of all the variables employed with their relative survey questions and descriptive statistics is reported in Table 1.

Variable	Description	Obs.	Mean	Std. dev.	Min.	Max.
<i>Dependent variable</i>						
Environmental tax morale	“To what extent are you in favor or against the following policies in Italy to reduce climate change? Increasing taxes on fossil fuels, such as oil, gas and coal” (1 = strongly against and 5 = strongly in favor)	514	3.712	1.086	1	5
<i>Main regressors</i>						
Climate change concern	“How worried are you about climate change?” (1 = not at all worried and 5 = extremely worried)	514	4.023	0.83	1	5
Tax morale	“Cheating on taxes if you have the chance” (1 = always justified and 10 = never justified)	514	8.85	1.792	1	10
<i>Control variables</i>						
Trust in government	“Please tell me on a score of 1–10 how much you personally trust each of the institutions. 0 means you do not trust an institution at all, and 10 means you have complete trust: Government”	514	4.99	2.337	1	10
Political trust	“Please tell me on a score of 1–10 how much you personally trust each of the institutions. 0 means you do not trust an institution at all, and 10 means you have complete trust: Political parties and politicians”	514	3.222	2.026	1	9
Political orientation	“In politics people sometimes talk of ‘left’ and ‘right’. Where would you place yourself on this scale, where 1 means the left and 10 means the right?”	514	6.185	2.468	1	10
Social network activity	“Have you posted or shared anything about online politics, for example on a blog, via email or on social media like Facebook or Twitter?”	514	0.36	0.48	0	1
Political participation	“Did you vote in the last national election?” (1 = yes and 0 = no)	514	0.671	0.47	0	1
Climate responsibility	“To what extent do you feel a personal responsibility to try to reduce climate change?” (1 = not at all and 10 = a great deal)	514	6.206	3.053	1	10
Religiosity	“How religious would you say you are?” (1 = not at all and 10 = a great deal)	514	2.846	2.973	1	10
Gender	Dummy = 1 for males	514	0.547	0.498	0	1
Age	Age level	514	22.82	6.19	15	32

Table 1. Variables’ description and summary statistics

3. Research hypotheses

Building on the proposed literature and data, we formalize the following research hypotheses:

H1. There exists a direct and positive relationship between ETM_i and CCC_i .

According to the literature, we expect that the more people are concerned with climate change the more they are willing to pay an environmental tax.

H2. The ETM_i positively depends on the level of individual TM_i .

The expected result is that the people who are more willing to pay taxes, in general, will be also more willing to pay a specific (environmental) tax.

H3. For individuals with high tax morale (HTM), an increase in CCC_i increases the ETM_i . For individuals with low TM_i , the relationship between ETM_i and CCC_i should vanish.

We expect that an increase in CCC_i should positively affect the willingness to pay an environmental tax only for those showing a higher level of general TM_i . They correctly evaluate the positive externalities generated by the tax payment. Thus, with an increasing interest in a particular topic (concern about climate change), it is logical to expect that the estimated value of the positive externality generated by the tax payment on that specific topic would be positive. On the contrary, an increase in CCC_i should not affect the willingness to pay an environmental tax for those who are tax immoral. In fact, given that they show low general TM_i , they should not evaluate the importance of paying either a specific tax. The theoretical prediction is that given that they do not recognize the economic value of the positive externality generated by the tax payment, they would not be willing to accept an environmental tax even though they are concerned with climate change. Evidence against this hypothesis can be intended as incoherence between general and specific tax preferences (Luttmer and Singhal, 2014) which can demonstrate whether and how CCC_i alters individual TM_i preferences.

4. Empirical strategy

Given the ordinal distribution of our respondent variable, we estimate an ordered probit model. We start by estimating the baseline (restricted) model represented by the following equation, Equation (1):

$$ETM_i^* = CCC_i \alpha + X_i' \beta + u_i \quad (1)$$

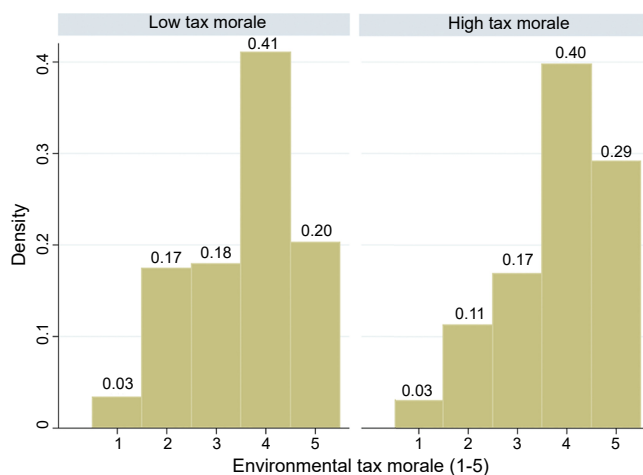
where ETM_i^* represents an unobservable latent variable underlying the five-point scale measure of the ETM_i of each subject i . The coefficient CCC_i refers to the individual CCC_i , and X_i' is a vector including the control variables previously described. Finally, u_i represents the error term. For the sake of robustness, we also estimate Equation (1) as a linear regression, applying the ordinary least squares (OLS) method, assuming that the dependent variable is a cardinal measure ranging from 1 to 5. Estimates are reported in Table A1 from Appendix 1.

According to the first hypothesis (*H1*), we expect a positive sign of the CCC_i 's coefficient. To test our second hypothesis (*H2*) we extend the previous model by including as regressor the individual level of general tax morale, TM_i , expecting a positive sign of the respective coefficient. In this case, TM_i and ETM_i could be reasonably jointly determined, since subjects who are intrinsically more willing to pay taxes in general may also be more willing to pay an environmental tax and vice versa. Therefore, in order to tackle with this potential concern, we estimate a two-stage least squares' model by employing the second and higher moments of the potential endogenous variable as

instrumental variables, following the methodology proposed by Lewbel (1997). In fact, the author demonstrates that in case of linear regressions with measurement errors, the second, third and higher moments of the potentially endogenous could represent good instruments with a two stages least squares estimates (2SLS) estimator. This approach has been widely used in empirical works (e.g. Gamso and Yuldashev, 2018; Sullivan *et al.*, 2011). As instruments we have thus constructed the second, third and fourth moments of the TM_i variable. According to this approach, the postestimation tests suggest that instruments are relevant and exogenous, and the Durbin–Wu–Hausman test suggests that the TM_i variable is exogenous; hence, endogeneity unaddressed estimates can be assumed as consistent. For this reason, we report and discuss the results of the 2SLS regression in Appendix 2.

Finally, to understand the role played by the general TM_i on the relationship between CCC and ETM by testing Hypothesis 3, we interact the level of CCC_i with a tax morale dummy (TMD) identifying subjects with HTM. In fact, we used the TM_i level as a contextual variable to split the subject pool into two subgroups: high and low TM_i subjects. According to several studies about TM_i , to get the respective variable, it is common to construct a dummy equal to one if the respondent declared that cheating on taxes is “never justified,” while it is zero for all the other cases (see, for instance, Torgler and Valev, 2010; Alm, 2012). This is done because with a dichotomous measure, it is possible to distinguish the group of individuals who do not justify tax evasion under any circumstances from the others (Andriani, 2016). Following this methodology, we created a TMD variable identifying those respondents who answered “never justified” to the TM_i question, clustering the remaining ones in the low TM_i group [4]. The HTM_i group is composed by 302 subjects, while the remaining 212 subjects compose the low TM_i group.

We report the distribution of the ETM_i for the two groups of subjects in Figure 2. As one can see, the 29% of the HTM_i group of subjects declared the largest level of ETM_i , while this percentage is equal to the 20% in the low TM_i group. We run some statistical tests to evaluate whether the average level of ETM_i is statistically different between the two subgroups of individuals. The Mann–Whitney U test suggests that the average willingness to pay an environmental tax between high and low TM_i subjects is



Source(s): Own elaboration, based on data from the original survey conducted

Figure 2. Environmental tax morality (1–5) across high and low TM_i subjects

statistically different at 5% level ($z = -2.481$ and p value = 0.013). The same result is given by the two-sample t test ($t = -2.4$ and p value = 0.008).

Once we categorized the subjects into these two categories, we construct an interaction term between the CCC_i and the dummy identifying the subgroup with HTM (TMD). Hence, we run the baseline model including as regressors the TMD as well as the interaction with the CCC_i ($CCC_i \times TMD$). According to Hypothesis 3, we expect the interaction coefficient to be positive and statistically significant, meaning that the effect of CCC_i differs between the TM_i subgroups.

5. Results

This section describes the results and discusses the significance of the results. Table 2 reports the estimated coefficients and marginal effects of the restricted (Column 1), extended (Column 2) and with interaction (Column 3) models employing as the dependent variable the (ETM_i).

Starting from the first column, the coefficient of CCC_i is positive and statistically significant at a 1% level. This confirms the first hypothesis ($H1$), as already evidenced in Italy

	(1) Restricted		(2) Extended		(3) With interaction	
	Estimated coefficient	Average ME †	Estimated coefficient	Average ME †	Estimated coefficient	Average ME †
Climate change concern (CCC_i)	0.426*** (0.061)	0.125***	0.422*** (0.061)	0.124***	0.471*** (0.138)	0.136***
Tax morale (TM_i)			0.055** (0.027)	0.016**		
Tax morale dummy (TMD)					0.733** (0.314)	0.212**
$CCC_i \times TMD$					0.238** (0.101)	0.069**
Trust in government	0.115*** (0.029)	0.034***	0.111*** (0.030)	0.033***	0.123*** (0.0295)	0.036***
Political orientation	-0.052** (0.020)	-0.015**	-0.047** (0.020)	-0.014**	-0.056*** (0.020)	-0.016***
Political trust	-0.034 (0.034)	-0.010	-0.034 (0.034)	-0.010	-0.043 (0.034)	-0.013
Political participation	-0.077 (0.111)	-0.023	-0.062 (0.111)	-0.018	-0.069 (0.111)	-0.020
Climate responsibility	-0.007 (0.016)	-0.002	-0.006 (0.016)	-0.002	0.009 (0.017)	0.003
Social network activity	-0.043 (0.101)	-0.013	-0.034 (0.101)	-0.010	-0.049 (0.101)	-0.014
Religiosity	0.044 (0.101)	0.013	0.042 (0.101)	0.012	0.046 (0.101)	0.013
Gender	0.134 (0.099)	0.039	0.167* (0.101)	0.049*	0.162 (0.101)	0.047
Age	0.010 (0.009)	0.003	0.008 (0.009)	0.002	0.010 (0.009)	0.003
Observations	514	514	514	514	514	514
Pseudo R^2	0.062		0.065		0.061	

Table 2. Results from Equation (1), ordered probit estimates

Note(s): The standard errors in parentheses are heteroskedasticity consistent. We employ *, ** and *** to denote statistical significance at the 10, 5 and 1% levels, respectively. † We report the average marginal effects for the highest score of tax morality

from the empirical work of [Rotaris and Danielis \(2019\)](#). Moreover, the individual political ideology matters: people from the right wing seem to be less willing to accept an environmental tax, and this result is in line with the conclusions of [Lozza et al. \(2013\)](#) who argue that left-wing taxpayers generally show higher levels of voluntary cooperation and seem to be more prone to consider tax compliance a civic duty rather than right-wing subjects. Another interesting result is that the more people trust the government the more they are willing to accept an environmental tax, and this is in line with the existing evidence ([Harring and Jagers, 2013](#); [Savin et al., 2020](#); [Umit and Schaffer, 2020](#)). The effect of other control variables is overall statistically negligible.

Looking at the second column, the positive and statistically significant coefficient of the TM_i variable confirms the second hypothesis (*H2*). Also in this specification, the effect of control variables is overall consistent.

Focusing on Column 3, in line with our third hypothesis, it is visible that the coefficient of the interaction term between CCC_i and TM_i is positive and statistically significant at 5%. This result indicates that the concern about climate change has a diverse effect among different subgroups of people based on the level of TM_i . It could play a stronger role for those individuals who declare to never justify cheating on taxes, while it is relatively weaker for those who show a lower level of general TM_i .

To conclude, we summarize the following main results:

R1: The CCC_i positively influences the ETM_i .

R2: The general level of TM_i is positively related to the willingness to pay an environmental tax.

R3: An increase in CCC_i significantly increases the willingness to pay an environmental tax for all the individuals, although its effect may depend on the level of general TM_i ; it is stronger (weaker) for individuals with high (low) TM_i .

6. Concluding remarks and discussion

Employing a survey among Italian economics students, this work provided innovative evidence about the differential impact of having low or HTM_i on the willingness to pay an environmental tax. In line with previous evidence on both taxpayers ([Muhammad et al., 2021](#)) and consumer behavior ([Morone et al., 2021](#)), our results remark the importance of increasing climate change awareness among people, for instance through investments in sensibilization campaigns on environmental issues. Several European programs are moving in this direction. At the institutional level, in 2020, the European Commission launched the Climate Pact, which is a movement of citizens, communities and organizations that aim to mobilize people to take part in climate action to lower carbon pollution [5]. In this vein, we showed that also the trust in government and the personal political orientation matter in terms ETM_i .

We further pointed out that the general level of TM_i is positively related to the willingness to accept an environmental tax. Taking as reference the [OECD \(2019\)](#) guidelines, we advise policymakers to invest on education campaigns to raise the overall tax compliance level of citizens through the morality channel (i.e. supporting taxpayer education programs, including TM_i research and analysis into education programs, improving the ease of paying taxes and strengthening revenue–expenditure links to build the social contract).

An innovative insight from this study is represented by the evidence of a different effect of CCC_i depending on the individual TM_i level. The results showed that there is an interaction between CCC_i and TM_i . This cannot be neglected in designing an effective

policy aimed to increase a carbon tax's acceptability. In fact, the perceptions about climate change and tax evasion are potentially linked: the CCC_i has a stronger (weaker) effect in shaping the willingness to accept an environmental tax for individuals with a high (low) morality toward their tax duties.

Although this study presented some new evidence about the linkage between climate change and tax preferences, we want to point out some limitations. Despite we employed a common methodology in this strand of research, we are aware that in an online survey individuals can be influenced by self-reporting and hypothetical choice bias (Swamy *et al.*, 2001). Moreover, even if university students are commonly used as a subject pool in experimental studies, and although several articles showed that the behavioral responses of students are largely the same as those of nonstudents in identical experiments (for a discussion see Alm *et al.*, 2015; Choo *et al.*, 2016), we are aware that in this case they are not taxpayers yet (Barabas and Jerit, 2010). Therefore, we recognize the limitations for the external validity of results, which are hardly generalizable to the whole population.

Notes

1. With the term "environmental tax" we refer to taxes on fossil fuels, such as oil, gas and coal that may be generally intended as "carbon tax" or "Pigouvian tax."
2. Some examples: ESS, EVS, International Social Survey Programme (ISSP), Latinobarómetro and World Values Survey (WVS)
3. The structure of the survey is reported in [Appendix 3](#).
4. For the sake of robustness, we replicate the analysis considering an alternative classification of high and low TM_i subgroups. Results are reported in [Appendix 4](#).
5. European Commission (https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-pact_en), accessed on August 12, 2022.

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Appendix 1

We replicated the empirical analysis by applying the OLS, obtaining the same statistical relevance of the results. Estimated coefficients are reported in the following [Table A1](#).

	(1) Restricted	(2) Extended	(3) With interaction
Climate change concern (CCC_i)	0.391 ^{***} (0.055)	0.386 ^{***} (0.055)	0.402 ^{***} (0.129)
Tax morale (TM_i)		0.051 ^{**} (0.025)	
Tax morale dummy (TMD)			0.702 ^{**} (0.352)
$CCC_i \times TMD$			0.223 ^{***} (0.095)
Trust in government	0.104 ^{***} (0.027)	0.100 ^{***} (0.027)	0.112 ^{***} (0.027)
Political orientation	-0.050 ^{***} (0.019)	-0.045 ^{**} (0.019)	-0.054 ^{***} (0.019)
Political trust	0.025 (0.031)	0.026 (0.031)	0.034 (0.031)
Political participation	-0.092 (0.104)	-0.078 (0.104)	-0.081 (0.105)
Climate responsibility	0.001 (0.015)	0.001 (0.015)	0.015 (0.016)
Social network activity	-0.055 (0.095)	-0.048 (0.095)	-0.062 (0.096)
Religiosity	0.025 (0.094)	0.023 (0.094)	0.030 (0.095)
Gender	0.103 (0.093)	0.133 (0.094)	0.126 (0.095)
Age	0.009 (0.01)	0.008 (0.01)	0.0175 (0.01)
Constant	1.827 ^{***} (0.353)	1.341 ^{***} (0.429)	1.571 ^{***} (0.480)
Observations	514	514	514
R^2	0.157	0.164	0.149

Note(s): The standard errors in parentheses are heteroskedasticity consistent. We employ ^{*}, ^{***} and ^{***} to denote statistical significance at the 10, 5, and 1% levels, respectively

Table A1.
Results from
Equation (1), OLS
estimates

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Variable	Coeff.	2SLS extended	SE
Climate change concern	0.383 ^{***}		(0.056)
Tax morale	0.054 ^{**}		(0.026)
Trust in government	0.105 ^{***}		(0.028)
Political orientation	-0.044 ^{**}		(0.019)
Political trust	-0.028		(0.033)
Political participation	-0.074		(0.097)
Climate responsibility	-0.000		(0.015)
Social network activity	-0.041		(0.095)
Religiosity	0.028		(0.096)
Gender	0.124		(0.090)
Age	0.008		(0.008)
Constant	1.312 ^{***}		(0.443)
Observations		514	
R^2		0.163	
Kleibergen–Paap rk LM	298.261		[0.000]
Kleibergen–Paap rk Wald F	2316.512		
Hansen J statistic	1.993		[0.574]
Durbin–Wu–Hausman test	0.677		[0.381]

Table A2. Results from Equation (1), 2SLS with TM_i as a potential endogenous variable in the extended model

Note(s): The standard errors in parentheses are heteroskedasticity consistent. We employ *, ** and *** to denote statistical significance at the 10, 5 and 1% levels, respectively. p values are presented in brackets. The TM_i variable has been instrumented by its second, third and fourth moments, following the methodology of Lewbel (1997). The dependent variable is environmental tax morality on a five-point scale

Robustness check

As it is visible from Table A2, the sign and the magnitude of the coefficients remained overall stable with respect to the OLS estimates. Regarding the postestimation tests, the “Kleibergen–Paap rk LM” statistic rejects the null hypothesis, suggesting the absence of an under-identification concern, while the Hansen J statistic fails to reject the exogeneity of instruments. The Kleibergen–Paap Wald F test statistic is larger than the rule of thumb of ten, suggesting that our instruments are not weak. Finally, the Durbin–Wu–Hausman test fails to reject the null hypothesis of equality between 2SLS and OLS, suggesting that the OLS estimates can be assumed as consistent.

For the sake of soundness, Table A3 below reports the results from the first stage of the 2SLS regression. All the excluded instrumental variables (second and higher moments of TM_i) are jointly significant in explaining the potential endogenous variable, providing evidence that the instruments are neither weak nor under identified. Also the postestimation tests, at the bottom of the table, confirm the relevance and exogeneity of the instrumental variables.

Table A3. First stage regression results with TM_i as potential endogenous

Variables	Coeff.	SE
	First stage regression	
$(TM_i - \overline{TM})^2$	0.437***	(0.041)
$(TM_i - \overline{TM})^3$	0.307***	(0.022)
$(TM_i - \overline{TM})^4$	0.034***	(0.003)
Climate change concern	0.029	(0.040)
Trust in government	0.012	(0.019)
Political orientation	-0.010	(0.012)
Political trust	-0.014	(0.020)
Political participation	0.033	(0.066)
Climate responsibility	-0.010	(0.010)
Social network activity	-0.071	(0.060)
Gender	-0.067	(0.060)
Age	0.001	(0.004)
Religiosity	0.050	(0.062)
Constant	8.703***	(0.255)
Observations	514	
F test of excluded instruments	$F(3, 500) = 571.59$ Prob > $F = 0.000$	
Sanderson–Windmeijer multivariate F test:	$F(3, 500) = 571.59$ Prob > $F = 0.0000$	

Note(s): The standard errors in parentheses are heteroskedasticity consistent. We employ *, ** and *** to denote statistical significance at the 10, 5 and 1% levels, respectively. p values are presented in brackets. The TM_i variable has been instrumented by its second, third and fourth moments, following the methodology of Lewbel (1997). The dependent variable is tax morality on a ten-point scale

Appendix 3

Survey structure

This appendix provides the structure of the survey that we conducted in order to carry out the analysis.

N	Question	Answer	Scale
1	Gender	Male; Female; Other	1–3
2	Age	Open question	–
3	Are there children/young people in your household?	Yes; No; Don't know	1–3
4	Please indicate a score from 1 to 10. 1 means that you do not trust at all, and 10 means that you trust completely. Most people	From “no trust at all” to “completely trust”	1–10
5	Please indicate a score from 1 to 10. 1 means that you do not trust at all, and 10 means that you trust completely. Your country's government	From “no trust at all” to “completely trust”	1–10
6	Please indicate a score from 1 to 10. 1 means that you do not trust at all, and 10 means that you trust completely. Politicians and political parties	From “no trust at all” to “completely trust”	1–10
7	Have you posted or shared anything about politics online, for example on blogs, via email or on social media such as Facebook or Twitter?	Yes; No; Don't know	1–3
8	In politics people sometimes talk about 'left' and 'right': where would you place yourself considering this scale, where 1 means left and 10 means right?	From “left” to “right”	1–10

(continued)

Table A4. Survey structure

N	Question	Answer	Scale
9	Would you say that it is a behavior that can always be justified, never justified or something in between that of cheating on taxes to be paid if you have the chance?	From “always justified” to “never justified”	1–10
10	Regardless of whether you belong to a particular religion, how religious would you say you are?	From “not religious at all” to “a great deal”	1–10
11	Overall, how confident are you that you could use less energy than you do now?	From “not sure at all” to “completely sure”	1–10
12	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 opinion on this? Do you think the world’s climate is changing?	From “not changing at all” to “completely changing”	1–5
13	To what extent do you feel a personal responsibility to try to reduce climate change?	From “not at all” to “a great deal”	1–10
14	How worried are you about climate change?	From “not worried at all” to “extremely worried”	1–5
15	To what extent are you in favor or against the following policies in your country to reduce climate change: Increasing taxes on fossil fuels, such as oil, gas and coal	From “strongly against” to “strongly in favor”	1–5

Table A4.

Appendix 4

Alternative classification of TM_i

In this appendix we aim to evaluate whether results remain stable considering a more extreme classification of TM_i . Following the methodology pointed out in Section 4, we propose an alternative classification of the two subgroups based on the level of individual TM_i . To do so, inspired by Nemore and Morone (2019), we create a dummy variable that takes the value one for all those individuals showing a level of TM_i larger than five (492 subjects) and zero for the others (22 subjects). In this way, we cluster individuals with very low level of TM_i , and replicating the ordered probit regression with the interaction, we can evaluate whether our research hypotheses are confirmed or change considering an alternative definition of TM_i . Results are reported in the following Table A5.

	Estimated coefficient	With interaction Average ME †
Climate change concern (CCC_i)	0.497*** (0.127)	0.145***
High tax morale (HTM) dummy	0.158* (0.091)	0.046*
$CCC_i \times HTM$	0.139*** (0.051)	0.040***
Trust in government	0.118*** (0.030)	0.035***
Political orientation	-0.053*** (0.020)	-0.015***
Political trust	-0.039 (0.034)	-0.011
Political participation	-0.066 (0.111)	-0.019
Climate responsibility	0.006 (0.017)	0.002

Table A5.
Ordered probit estimates considering an alternative definition of tax morale

(continued)

Table A5.

	Estimated coefficient	With interaction	Average ME †
Social network activity	-0.033 (0.101)		-0.010
Religiosity	0.041 (0.101)		0.012
Gender	0.186* (0.101)		0.054*
Age	0.009 (0.009)		0.003
Observations	514		514
Pseudo R^2	0.062		

Note(s): The standard errors in parentheses are heteroskedasticity consistent. We employ *, **, and *** to denote statistical significance at the 10, 5, and 1% levels, respectively. † We report the average marginal effects for the highest score of tax morality

From the results it is visible that all the three research hypotheses are confirmed also considering a more extreme classification of TM_i . Results remain overall stable and consistent with the previous ones. Despite an increase in CCC_i is positively related with the ETM_i , its effect may differ across groups of subjects based on their tax morality. In fact, from the interpretation of the HTM dummy coefficient, we can say that those subjects who declared higher (lower) levels of TM_i are on average more (less) willing to pay an environmental tax. Moreover, the interaction between the CCC_i and the dummy variable identifying HTM subjects turned out to be statistically significant. This result strengthens the fact that the CCC_i plays a different role across the two subgroups.

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