FACTORS INFLUENCING RESPONDENT'S WILLINGNESS TO PAY ENVIRONMENTAL TAX

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Abstract

Environmental issues are very popular these days, and people tend to behave responsible in relation to nature and environment. This tendency leads to ecological lifestyle producing less waste and to using "green" technologies. One from the tools of state policy to influence quality of environment is environmental tax. There is a question, if the people´s tendency to behave environmentally responsible also leads to their inclination to pay environmental tax. Willingness to pay environmental tax can be therefore considered as the measure of environmental preference and trust in the efficiency of government system and its ability to protect environment. The main objective of presented paper is to identify main indicators influencing tendency to pay environmental tax. Source of the analyzed data was European value study conducted in Bulgaria, Cyprus, Germany, Finland, Hungary, Italy, Poland, Romania, Sweden and Slovenia in the period of years from 2010 to 2015. Database contains 2800 observations. Method used to identification of the main factors influencing respondent´s willingness to pay environmental taxes was binary logit model. If respondent would be able to give up part of their income to protect environment, dependent variable was equal to 1, if they answer was negative, dependent variable was equal to 0. As the explanatory variables in the model were used possible factors influencing they willingness to pay environmental tax, such as: their support of awareness about environmental protection and taxes, trust in governments ability to protect environment, gender, age, if they have children or not, education, social class, trust in government, trust in environmental organizations, trust in the European union, religion and employment. Estimated model was evaluated using percentage of correct predictions and likelihood test. Influence of significant factors was evaluated using odds ratios derived from the final model. Results suggests, that

highest influence on the tendency of people to pay environmental taxes have following factors: respondent´s support of awareness about environmental protection and taxes, trust in governments ability to protect environment, trust in environmental organizations, trust in the European union, education and religion. First mentioned factor is strongly connected with environmental responsibility of respondent. Therefore, it is logical its highest influence (odds ratio 17,46). Except for this factor had the highest influence education (odds ratio 1,23) of respondent and his trust to environmental organizations (odds ratio 1,22).

Keywords: *binary logit, environmental preference,environmental tax,*

JEL classification: *C25, C51, H23, R11*

1   Introduction

Environmental issues became very popular these days, especially due to increasing rate of economic growth. Many people declare their interest in environmental problems and protection of the environment. Due to many controversial ecological indicators, it took a long time to find reliable tool to measure level of sustainable development (Hanova and Prokeinova 2008). On the other side, current environmental conditions do not suggest, that people really follow their declared preferences. One way how to measure real individual environmental preferences is willingness of people to support environmental protection financially. Data coming from World Value Survey, European Value Survey and International Social Research Programme allows to investigate individual support of environmental protection and its comparison. Respondents were asked questions about their willingness to financial support of environmental protection and prevention of environmental pollution. These data can be used as the estimate of marginal willingness to pay for environmental protection. In general, factors which has the potential to influence environmental preferences can be classified into two broad categories: individual specifics and specifics at country level.

Objective of prior studies was to analyse determinants of individual financial support of environmental protection and to investigate its relationship with environmental tax reform. The question is, how the fulfilment of environmental objectives influences the extent of meeting economic policy targets. On the other side, environmental tax reform influences also individual behaviour and affects prices of non-market natural materials and increases the cost of activities polluting environment (Ercolano et al. 2013).

According to many authors (Auci et al. 2006, Torgler and Garcia-Valinas 2007, Franzen and Meyer 2010), main factors influencing individual environmental

preferences are income, age, gender, education and employment. Positive correlation was identified between tendency to financial support of environmental protection, education, and income of respondents (Kollmann et al. 2012).

On the other side, factors age and gender are controversial in case of analysis including also geographic factor (Torgler and Garcia – Valinas 2007, Olofsson and Ohman 2006, Kollmann et al. 2012).

Environmental preferences are also strongly correlated with political attitudes. Political affiliation, interest in political discussion, identification with political ideology and political party should be taken also into account in the analysis of environmental preferences (Witzke and Urfei 2001).

Other considered variables measuring individual social capital, which influence tendency to support financially environmental protection, are attitude to tax evasion (Auci et al. 2006), trust in government (Dorsch 2011) and membership in volunteer organization (Torgler and Garcia-Valinas 2007). According to Greeley (2007) is important indicator of civic values also factor of religion. Identification with certain religion, and with certain local or global community and its perception of the environment is also important factors influencing individual preferences.

Tendency to financial support of environmental protection is higher, when people see themselves as active citizens who perceive surrounding world and people with pessimistic attitude and sensitivity to environmental risk (Dorsh 2011, Kollmann et al. 2012).

Prior econometric models usually incorporate also geographical location of respondents, index of wealth (Franzen and Meyer 2010), rate of corruption, institutional quality and tax pressure (Auci et al. 2006). Many authors used also variables related to state of the environment, such as index of sustainability (Franzen and Meyer 2010), level of air pollution in household (Auci et al. 2006), level of noise and waste (Witzke a Urfei 2001), index of environmental protection (Dorsh 2011). From the methodological point of view were results obtained by logistic regression, which allows for variable variation (Ercolano et al. 2013).

The main objective of the presented paper is identification of the main factors influencing willingness of respondents to financial support of environmental protection and their willingness to pay environmental tax. These factors were determined first in the pooled set of data and later were investigated regional specifics in the investigated countries.

2   Data and Methods

Data used in the estimated model comes from Eurostat (Environmental tax) and European value survey (individual preferences) which took place in period of years 2010-2015. Survey database includes information about 2800 respondents. In the analysed period were included in the survey 10 countries: Bulgaria, Cyprus, Germany, Finland, Hungary, Italy, Poland, Romania, Sweden and Slovenia. Estimated model includes following variables:

- prefET -Would you give up part of your income to protect environment in form of environmental tax? (0-no, 1-yes) -dependent variable
- infET – do you agree with increasing awareness about environmental taxes to protect environment? (0-no, 1-yes)
- government – should government decrease environmental pollution without decreasing your income? (0-no, 1-yes)
- gender – 0- female, 1-male
- age – 1-18 to 29 years, 2-30-49 years, 3- 50 and more years
- children – 0 do not have children, 1-have at least one child
- education – 1-basic, 2-highschool, 3-university education
- social class – 1-lowest 2-lower middle class, 3-middle class, 4-higher middle class, 5-high society
- trust in Gov – do you trust your government? (0-definitely not, 1 – rather not, 2- rather yes, 3-certainly yes)
- Trust EO – Do you trust Environmental Organizations? (0-definitely not, 1 – rather not, 2- rather yes, 3-certainly yes)
- Trust EU – Do you trust European Union? (0-definitely not, 1 – rather not, 2- rather yes, 3-certainly yes)
- Religion – Is religion important to you? (0-definitely not, 1 – rather not, 2- rather yes, 3-certainly yes)
- Employment - factor included using 3 dummy variables, D1=1 if retired, D2=1 if student, D3=1 if employed, if D1,D2,D3 are equal to 0 denotes unemployed people.

Model

If the Y is a binary response variable equal to 1 when the attribute is present and 0 if it is not present in observation. If $x=(x_1,x_2,x_3....x_k)$ is a set of explanatory variables which can be discrete, continuous or a combination. Binary dependent variable was prefET (1 if respondent would like to support environmental protection financially, otherwise 0), other factors described above were considered as the explanatory variables (Menard 2018)

Logistic regression model presents conditional probabilities (log odds) through a linear function of the predictors expressed as:

$$\ln \frac{P(y_i = 1)}{P(y_i = 0)} = \beta_0 + x_i^T \beta = l_i \tag{1}$$

Where $\beta = \left(\beta_1, \beta_2, \ldots . \beta_k\right)^T$ i s the estimated vector of k predictor coefficients. Vector of parameters β is estimated using maximum likelihood method. Following likelihood function is maximized:

$$\ln[L(\beta)] = \sum_{i=1}^{n} y_i \ln \frac{exp(l_i)}{1 + exp(l_i)} + (1 - y_i)\ln \frac{1}{1 + exp(l_i)} = \sum_{i=1}^{n} \langle y_i l_i - \ln[1 + exp(l_i)] \rangle \tag{2}$$

Then predicted probability can be expressed as follows:

$$F_i(l_i) = P(y_i = 1) = \frac{exp(l_i)}{1 + exp(l_i)} \tag{3}$$

It is difficult to relate estimated parameters value directly with the outcome. Better way how to explain influence of explanatory variables on the outcome, is the interpretation of the odds ratio rather than estimated parameters of logistic regression. Odd ratio is Euler number raised to value of the estimated coefficient of logistic regression.

$$Odds\ Ratio_j = e^{B_j} \tag{4}$$

If the odds ratio of the explanatory variable is higher than 1, it means that increasing of explanatory variable will increase also odds in favor of positive outcome. On the other side, if the odds ratio is smaller than 1, increasing value of explanatory variable will decrease chance of positive outcome.

In case of logistic regression is no more necessary to hold the assumptions of classical linear econometric model based on ordinary least square. Linear relationship between dependent and independent variables, explained variables and error term does not need to be normally distributed. Logistic regression also does not need variances to be homoscedastic and can handle also nominal or ordinal data as explanatory variables. Models were estimated using SAS 9.4.

3   Results and Discussion

Binary logit model was estimated using the data coming from European value survey. Basic indicators of model quality were McFadden R-Squared and number of correct predictions. Due to nature of dependent variables was McFadden

pseudo R-square value 0,28 which suggest excellent model fit. (Interpretation of McFadden R-square is different from classical R-square known from OLS, in this case are expected lower values due to nature of dependent variable). Accuracy of the model measured by correct predictions was 78,7%, which also suggest good prediction ability of the model. Model was evaluated as significant and appropriate to describe suggested relationship among variables. It means, that most of the estimated model parameters are significantly different from zero (p-value 0,0000). In table 1 are shown the factors which affects significantly tendency of respondents to financial support environmental protection.

Table 1 **Estimated logit model**

variable	pvalue	slope at mean	coefficient	odds ratio	significance
Intercept	<0,0001		-1,82		***
InfET	<0,0001	0,52	2,86	17,46	***
government	<0,0001	-0,16	-0,70	0,50	***
gender	0,29	-0,02	-0,11	0,90	
age	0,17	0,03	0,12	1,13	
children	0,51	-0,02	-0,09	0,92	
education	0,00	0,05	0,21	1,23	***
trust in government	0,85	0,00	-0,01	0,99	
trust in EO	0,00	0,05	0,20	1,22	***
trust in EU	0,02	0,03	0,15	1,16	**
religion	0,04	0,02	0,10	1,10	**
social class	0,06	0,03	0,11	1,11	
retirement	0,46	-0,03	-0,13	0,87	
student	0,72	0,02	0,08	1,09	
employee	0,87	-0,01	-0,02	0,98	

Source: Author´s work

Following factors included in the model were evaluated as significant: InfET, government, education, trust in EO, trust in EU and religion. It means that people who agree with increasing awareness about environmental taxes are also ready to support environmental protection financially. Strength of their conviction correlates with their tendency to financial support. This variable was evaluated as the most significant, it means that people who agree with environmental taxes would probably pay them.

Second important factor was education. With increasing degree of education will people more likely to pay environmental tax. Each level of education will increase odds in favour of paying environmental tax by 23%. More educated people prefer ecological lifestyle, and have tendency to support environment also financially. Another important variable was trust in environmental organizations. With increasing level of trust in environmental organizations, increased also tendency of respondent´s to support them financially. In this case, if level of environmental organizations support increase by 1, odds in favour of financial support of environment will increase by 22%.

Similar result was recorded also in case of trust in EU. People who trust in EU will be more likely to pay environmental tax. If the level of trust in EU will increase by one, odds in favour of financial contribution will increase by 16%.

Last significant factor, which increase probability in favour of environmental tax is religion. If the self-evaluation of religious preferences increased by 1, it increased also odds in favour of environmental tax by 10%. More religious people will therefore more likely contribute to environmental protection financially. Last variable which was evaluated as significant was the one denoted as government. It included answers to question: should government decrease environmental pollution without decreasing your income? People who replied positively to this question have 50% smaller probability of supporting environment financially. From all the indicators considered in the model, this one was the only factor decreasing the probability of paying environmental tax. All the other indicators included in the model were evaluated as insignificant.

Results interpreted above comes from econometric model, which was estimated using pooled data coming from all European countries included in the survey. This offers general information about factors, which influence environmental preferences of people in the analysed set of countries. On the other side, there are also country specific factors different for each nation. Factors, which were evaluated as insignificant in general result can be significant in the result for individual country. This is caused by cultural and social diversity in Europe.

Individual specifics **of investigated countries**

Analogical models were estimated for all investigated countries using the same dependent and explanatory variables, as it was in case of pooled model. All the individual models were significant, since p-value testing joint significance of estimated coefficients was less than 0,05. Significance of individual variables was different. This was influenced especially by specific socio-economic and cultural conditions in each analysed country. Estimated odds ratios for individual models can be found in table 2. Odds ratios offers in this case better information than

estimated coefficients, due to their direct relation with modelled phenomenon. The odds ratio higher than 1 suggest, that variable support willingness of people to pay environmental tax, odds ratio smaller than 1 means factor which decrease chance that people will support environment financially.

In all investigated countries was the most significant variable infET, which is in accordance with general model. It is because of strong correlation of this question with dependent variable.

Variable denoted as government, which was respondents' agreement with decreasing environmental pollution by government without decreasing respondents' income, was evaluated in general model as significant with negative effect on dependent variable. In case of individual models for Italy, Poland, Romania and Sweden was parameter of this variable very significant (p-value less than 0,01), in case of Cyprus, Germany and Finland was this parameter significant (p-value less than 0,05). People who agreed with the statement about government in Italy have 90% less odds to contribute to environmental protection financially than people who did not agree. In Finland was this difference only in odds only 55%. On the other side, in Italy and Poland would people support environmental protection financially despite their positive answer to this question.

Table 2 **Estimated odd ratios in individual models for each country**

Variable /country	BG	CY	DE	FI	HU
Intercept	0,025***	0,308	0,924	0,093**	0,346
infET	11,029***	10,689***	25,473***	9,758***	12,815***
government	0,639	0,378**	0,412**	0,449**	0,592
gender	0,81	0,774	0,41***	1,197	1,781
age	1,202	0,927	1,17	1,17	1,21
children	1,015	0,892	0,881	0,851	0,39**
education	1,076	1,038	1,204	1,202***	0,87
TrustGov	0,723	1,49	0,917	1,09	0,848
TrustEO	1,424	1,245	0,852	1,115	1,499
TrustEU	1,099	1,403	0,862	0,692	1,061
religion	1,273	1,192	0,568***	1,166	1,091
social class	1,794**	1,362	1,257	0,975	1,148
retired	1,398	0,429	1,047	0,845	0,889
students	3,778	0,248	0,721	4,026	0,252
employed	2,55**	0,535	0,663	0,789	0,573

Variable /country	IT	PL	RO	SE	SL
Intercept	0,066	0,87	0,116	0,069	0,085**
infET	29,648***	16,945***	19,441***	7,737***	8,057***
government	0,101***	0,304***	0,149***	0,367***	0,953
gender	1,367	0,429**	0,753	1,244	0,999
age	1,355	0,927	1,123	1,588	1,681
children	0,363**	0,445	1,401	1,562	0,509
education	1,468	0,865	1,744**	1,238	1,249
TrustGov	1,134	1,097	1,202	0,922	0,705
TrustEO	1,827**	1,12	1,163	1,153	1,281
TrustEU	1,313	0,98	1,637**	1,585**	1,214
religion	0,739	1,274	1,193	0,85	1,447**
social class	1,219	1,027	0,69	0,956	1,14
retired	1,279	2,332	0,973	1,224	0,92
students	1,232	2,212	5,079	1,159	1,851
employed	0,761	1,343	1,083	1,268	1,369

Source: Author´s work

Variable "trust in EU" was strongly significant only in Sweden (p-value less than 0,01) and significant (p-value less than 0,05) in Romania. People who trust European Union has 58% higher chance to pay environmental tax in Sweden and 63% to pay environmental tax in Romania. In Italy was significant also factor "Trust in Environmental Organisations". In this country, people who trust environmental organizations have 82% higher odds in favour to support environment financially.

Factor specific only for Bulgaria was social class. According to estimated model, people who belongs to higher social class have 79% higher odds than others to support environmental protection financially.

Curious result was found in case of Religion. This parameter was significant in Germany and Slovenia. While in Slovenia have religious people 45% higher odds of willingness to pay environmental tax, on the other side, in Germany are religious people less willing to pay environmental tax (odds smaller by 43%).

Education was factor specifically significant in Finland and Romania. In both countries are people with higher education more willing to pay environmental tax. In Romania have people with higher education 74% higher odds in favour of paying environmental tax. In Finland it was only 20% higher odds.

Factor gender was significant only in Germany and Poland. In both cases are women more environmentally oriented gender. In Germany are odds in favour of paying environmental tax higher in case of women by 41% than in case of men. In Poland was this difference 43%.

Another specific factor influencing willingness to pay environmental tax was Children. This factor was significant only in Hungary and Italy. In both countries are people with children less willing to pay environmental tax. In case of Hungary have people with children 61% smaller odds in favour to pay environmental tax, in Italy it was 63%.

Last factor included in the estimated models as explanatory variable was employment. Suggested model distinguished between students, employed, unemployed and retired people. This variable was significant only in case of Bulgaria. In this country are employed people 2,5 times more willing to pay environmental tax.

4 Conclusion

Proposed paper was focused on the investigation of the factors which influence tendency of people to financial support of environmental protection. The main objective was identification of the most significant factors, and partial objective was identification of factors specific for individual countries. According to result of the model estimated using the data collected in 10 countries for the period 2010-2015 are the most important following factors: individual support of awareness about environmental protection, their agreement with the statement that people should also support financially environmental protection, education, trust in European Union and Environmental organisations and religion. In case of first two factors were result expected, because data correlated with environmental preference of people. According to other variables, people who have tendency to support environmental protection also with their own financial sources are better educated, religious and trust in environmental organisations and European Union. This can be described as the average environmental supporter in ten analysed countries.

Next step of the conducted analysis was the estimation of individual model for each analysed country to investigate country specific factors and to identify differences between countries. The results of individual models suggest, that if people support increasing of awareness about environmental issues, they would also contribute financially to protect environment. This variable was significant in all the estimated models which is expected due to strong correlation of this variable with dependent variable. This was expected also in the case of second variable.

This variable was related to question, if government should finance environmental protection without decreasing individuals' income. Despite of expectations, this variable was not significant in case of Bulgaria, Hungary and Slovenia.

Significance of other variables were different in each analysed country. In case of Bulgaria are environmental preferences influenced especially by economic factors social class and employment. It means that employed people and people from higher social class are more willing to support environment financially. This can be related with economic situation in this country.

In case of Germany was significant only social factors gender and religion. Despite of expectations, result suggest that women and less religious people will have tendency to support environmental tax more. This result is in contrast with Slovenia, where was the only significant factor religion, and estimated odd ratio suggest, that increasing religiosity will increase environmental support. On the other side, significant influence of gender in Germany corresponds to almost the same result in Poland.

The only significant factor in Finland was education. Each level of education will increase odds in favour of environmental protection by 20%. In Romania was the effect of education even stronger (74%). In this country were environmental preferences affected also by trust in EU. This corresponds also with Sweden results. In both countries are environmental preferences strongly related to trust in EU. Result suggest, that supporters of environmental tax are people with stronger trust in EU.

Factor specific for Hungary and Italy were children. Estimated odd ratios suggests that people with children are less willing to support environment financially. It can be related to their economic situation, and with the fact that they probably use these financial sources rather for their children. Another significant factor significantly influencing environmental preferences in Italy was trust in environmental organizations.

Result suggest, that willingness of people to support environment financially is connected in the first place with their environmental preferences. Other factors differ among countries. This is influenced by economic, social and cultural factors specific for each individual country. This should be considered particularly in case of environmental promotion campaign in these countries. Especially in situation, when new environmental taxes are introduced and government wants to increase awareness about environmental protection.

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