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Climate risk perceptions and pro-active environmental behavior: the case of Belarus

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The study aimed to examine the drivers of pro-environmental behavior in Belarus based on the survey, conducted in 2022, on the attitudes to climate change and environmentally responsible behavior among the urban Belarusian population aged 18-75. The results of the analyses reveal that climate change risk perception has a strong positive impact on pro-environmental behavior in Belarus. PEB index of individuals, who start perceiving climate change as a risk, increases by 4.135 points, i.e. that they fully adopt one more pro-environmental activity in their life. Exposure to climate change information on the Internet, environmental self-efficacy and age are other relevant determinants of pro-environmental behavior in Belarus. Among these factors, the largest effect on engagement in pro-environmental actions has environmental self-efficacy, which is a belief in individual's own abilities to take action that help the environment. At the same time, the results show that neither such socio-demographic factors as gender, income, education, number of people in the household, region of living, nor such media variables as exposure to climate change information on TV, radio, newspapers exert a direct impact on PEB in Belarus.

1. Introduction

Understanding the importance of combating climate change and achieving environmental sustainability has become a vital concern in the contemporary world since global warming and the depletion of natural resources have become major global challenges. Reduction of negative environmental impacts caused by human activities such as pollution, deforestation, and wastage of resources may promote environment sustainability. To achieve this, people need to be motivated to behave pro-environmentally and take actions that contribute to the reduction of negative environmental impacts. These actions can include contracting energy and water consumption, recycling, using public transport, and etc. Adoption of eco-friendly practices is crucial in addressing the challenge of global warming and achieving environmental sustainability, as it helps reduce environmental degradation and GHG emissions. By adopting pro-environmental behavior (PEB), individuals can become environmental stewards and contribute to creating a sustainable future for upcoming generations.

Since PEB has become an integral part of the environmental sustainability concept, it is important to analyze the underlining factors and socio-economic premises of such behavior in order to encourage people to be more eco-conscious. Bearing this in mind, this paper aims to examine the determinants of pro-environmental behavior in Belarus based on the survey on the attitudes to climate change and environmentally responsible behavior among the urban Belarusian population aged 18-75. The paper is structured as follows: next section presents a brief overview of the factors determining pro-environmental behavior. Section 3 provides an approach taken to measure PEB and methodology used to determine key drivers of pro-environmental behavior in Belarus. Section 4 presents the result of analysis. Section 5 offers some concluding remarks.

2. Factors determining pro-environment behavior

Pro-active environmental behavior refers to the individual-level efforts undertaken with the aim to reduce the environmental impact of human activities. Various studies distinguish from 3 to 50 different behaviors that can be divided into broad categories, namely recycling (separation of items for recycling, avoidance of excess packaging in purchases, and etc.); reuse (reuse or reparation of goods, and etc.); energy use; conservation of water (water saving); consumption of food (purchase of locally produced food, waste less food, and etc.); nutrition (eating food which is organic, locally-grown or seasonal, avoid eating meat, and etc.); consumption of products (purchase of energy-efficient, environmental-friendly

products, and goods are made from recycled materials, and etc.); transport (use of public transport, walk or cycle and etc.) *(Blankenberg & Alhusen , 2019).*

PEB is influenced by various socio-demographic (age, education, gender), cultural, attitudinal (norms, beliefs, awareness, and values), psychological (environmental concern, perceived environmental threat, exposure to extreme weather events), and economic factors (income, economic incentives). Although, individuals of all ages have the potential to make favorable changes for the planet by adopting eco-friendly practices, some studies revealed that age is positively correlated with a care about environmental issues *(Wiernik et al., 2013)*. Gender also determines pro-environmental behavior, and researchers have found that women are relatively more engaged in environmentally friendly actions *(Xiao & McCright, 2015)*. Education plays a vital role in influencing pro-environmental behavior, as it enhances people's understanding of how their choices and actions impact the environment *(Mayer, 2015).*

But at the same time, research shows that attitudinal and value-related factors are more significant drivers of PEB than socio-demographics characteristics *(Iwinska et al., 2023)*. In particular, awareness and knowledge about environmental issues are important in shaping pro-environmental behavior. People who are more informed about the detrimental effects of climate change are more likely to make environmentally conscious decisions. Hence, media exposure has a potential to have a sizable impact on dissemination of environmental knowledge and cultivation of PEB *(Awan et al., 2022)*. Social norms and values, as peer pressure, social approval, and desire to conform to environmental standards also have a positive effect on pro-environmental behavior and can motivate people to adopt green practices. Besides, personal beliefs and attitudes towards the environment are key factors affecting PEB *(Miller et al., 2022)*. People who hold strong environmental values and beliefs are more likely to engage in eco-friendly practices.

Pro-environmental behavior can be triggered by such physiological factors as exposure to extreme weather events and perceived environmental threat. Individuals who have experienced the devastating effects of natural disasters such as hurricanes, floods, and wildfires are often more likely to take action to prevent further environmental degradation. This heightened concern for the environment can lead to changes in behavior, including reducing energy consumption, recycling, and using public transportation. Additionally, experiencing extreme weather events can increase awareness and concern about climate change, leading to more advocacy for policies aimed at mitigating the effects of climate change. As such, exposure to extreme weather events can be a catalyst for pro-environmental behavior and can increase individuals' willingness to take action to protect the environment.

The interaction between perceived environmental impact or threat and pro-environmental behavior is complex and multifaceted. Individuals' perceptions of the environmental impact of their actions can influence their willingness to engage in pro-environmental behavior. Research also showed that perceptions of ecological threat can result in higher engagement in pro-environmental behavior *(Schmitt et al., 2018).*

Similarly, engaging in pro-environmental behavior can lead to increased awareness of people's environmental impact. When individuals start recycling and become more conscious of the amount of waste produced, they may become more sensitive to their impact on surroundings, and as a result, it can be a cause of adopting other environmentally friendly practices. However, the relationship between perceived environmental impact and pro-environmental behavior can also be complicated. For example, some people may underestimate the impact of their actions and not engage in behavior they believe will have significant consequences. Additionally, even when individuals recognize their actions' environmental impact, they may not always engage in pro-environmental behaviors due to factors such as inertia, convenience, and habituation.

The interaction between economic factors and pro-environmental behavior is a dynamic and non-linear relationship influenced by various factors such as, for example, government policy. In theory, financial security may play a role in promoting sustainability, and therefore, higher income should be positively linked to a greater likelihood of engaging in pro-environmental behavior. However, there is no clear evidence about positive connection between income and PEB. Studies revealed that household income either has no effect on PEB *(Whitmarsh & O'Neill, 2010)*, or it is correlated with lower individual pro-environmental behavior *(Longhi, 2013)*. On the contrary, poorer people undertake more eco-friendly actions *(Longhi., 2013)*.

There is a relationship between economic incentives and disincentives and pro-environmental behaviors. Governments can encourage it by providing financial incentives to individuals that adopt green practices. Accessibility to green technologies and products would influence pro-environmental behavior, as well as availability and affordability of sustainable technologies and products, which may encourage individuals to adopt environmentally friendly practices.

3. Data and Methodology

3.1 Data

The study uses the data of the online-survey conducted in April, 2022 among the urban population in Belarus aged 18-75. The aim of the survey was to collect

individual data on environmentally responsible behaviors and climate change perceptions. The sample includes 1029 individuals and is representative by age, gender and region. According to the results, 72.7% of the respondents consider climate change as a threat to the country in the next 20 years. In the sample, 48.59% of the respondents are men and 51.41% are women. The average age is 41.03 years. 26.92% of the respondents live in Minsk, the capital city, 14.77% – in Brest region, 12.24% – in Vitebsk region, 14.67% – in Gomel region, 10.01% – in Grodno region, 11.37% – in Minsk region, and 10.01% – in Mogilev region.

3.2 Empirical model

In our study we aim to investigate whether climate change risk perception can influence pro-environmental behavior of individuals. To do that, we estimate the following structural equation model:

$$beh_i = \beta_0 + \beta_1 clim\_risk_i + \sum \beta_n media_i + \sum \beta_l beliefs_i + \sum \beta_m dem\_char_i + u_i \quad (1)$$

The outcome variable beh_i represents a sum of indicators denoting frequency of performing different pro-environmental actions (table 1). Unlike the majority of studies in which different pro-environmental actions are researched separately, we follow the approach of *Zeng et al. (2020)* and analyze the sum of scores on different pro-active environmental behaviors. The main variable of interest is $clim\_risk_i$. It is a binary variable describing whether a person thinks that climate change is a threat to the people in the country in the next 20 years. However, climate change risk perception is likely to be influenced by other observed and unobserved factors. This means that $clim\_risk_i$ might be correlated with the error term u_i, which can result in endogeneity bias in the estimation of β_1. To reduce this bias, we use an instrumental variable (IV) approach. This approach requires an instrumental variable which is correlated with the endogenous variable $clim\_risk_i$, has no direct effect on the outcome variable beh_i and is uncorrelated with the error term u_i *(Wooldridge, 2010).* The estimation is performed via two-stage-least-squares (2SLS) in which $clim\_risk_i$ is instrumented through exposure to extreme weather events $weather_i$ and perceived environmental impact en_impact_i (table 1). Our instruments build on the fact that personal experience of extreme weather events, natural disasters and other environmental problems is positively associated with climate change risk perceptions. That is confirmed by considerable research literature (e.g., *Zaalberg et al., 2009; Akerlof et al., 2012; Wachinger et al., 2013; Carlton et al., 2015; Dai et al., 2015; Lujala et al., 2015; Demski et al., 2017; Frondel et al., 2017; Hamilton-Webb et al., 2017*).

In our regression model we control for variables which can jointly influence climate change risk perception and pro-environmental behavior. They include media variables ($\sum \beta_n media_i$), such as exposure to climate change information on TV, on the radio, on newspapers, and on the Internet; psychological factors ($\sum \beta_l beliefs_i$), such as environmental self-efficacy and beliefs; and demographic characteristics of individuals ($\sum \beta_m dem\_char_i$), such as age, gender, income, education, number of people in the household, region of living (table 1). Table 1 represents construction and definition of variables used in the model.

Table 1

Construction and definition of variables

Variable	Description
Dependent variable • Behavioral index	The index is calculated as a sum of indicators denoting frequency (1-never; 4-always) of performing the following pro-environmental actions: (a) sorting glass or plastic or paper for recycling; (b) walking, biking or using public transportation instead of a car; (c) buying food products grown/produced locally; (d) reducing the use of plastic bags, or using your own bag when shopping; (e) choosing to reuse or repair something (e.g., clothes) rather than throw it away; (f) buying second-hand; (g) reducing the energy or fuel used at home; (h) choosing to save or reuse water; (i) eating less meat and more vegetables.
Endogenous variable • Climate risk perception	A dummy variable equal to 1 if a person thinks that climate change is a threat to the people in the country in the next 20 years, and 0 otherwise
Instruments • Exposure to extreme weather events	A dummy variable equal to 1 if a person or someone who they personally know experienced serious harm from severe weather events, such as floods or violent storms, in the past two years, and 0 otherwise;
• Perceived environmental impact	A variable estimated on a 5-point Likert scale (1-don't agree at all; 5-completely agree) whether environmental problems have a direct effect on an individual everyday life.

Independent variables • Climate TV	A variable estimated on a 4-point Likert scale (0-don't use this type of media; 1-never; 4-very often) to denote the frequency of coming across the information about climate change, environmental problems or sustainable lifestyle on TV;
• Climate radio	A variable estimated on a 4-point Likert scale (0-don't use this type of media; 1-never; 4-very often) to denote the frequency of coming across the information about climate change, environmental problems or sustainable lifestyle on radio;
• Climate newspapers	A variable estimated on a 4-point Likert scale (0-don't use this type of media; 1-never; 4-very often) to denote the frequency of coming across the information about climate change, environmental problems or sustainable lifestyle on newspapers;
• Climate Internet	A variable estimated on a 4-point Likert scale (0-don't use this type of media; 1-never; 4-very often) to denote the frequency of coming across the information about climate change, environmental problems or sustainable lifestyle on the Internet;
• Self-efficacy 1	A variable estimated on a 5-point Likert scale (1-don't agree at all; 5-completely agree) to evaluate whether an individual believes that they have the ability to take action to help the environment
• Self-efficacy 2	A variable estimated on a 5-point Likert scale (1-don't agree at all; 5-completely agree) to evaluate whether an individual agrees that they can still change behavior to be more environmentally-friendly, even when it costs more money or takes more time
• Environmental beliefs 1	A variable estimated on a 5-point Likert scale (1-don't agree at all; 5-completely agree) to evaluate whether an individual agrees that humans are severely abusing the environment
• Environmental belief 2	A variable estimated on a 5-point Likert scale (1-don't agree at all; 5-completely agree) to evaluate whether an individual agrees that if things continue on their present

	course, we will soon experience a major ecological catastrophe
• Age	A number of years of a person's age
• Gender	A dummy variable equal to 1 if a person is a female and to 0 if a person is a male
• Income	A variable describing the total income of a respondent's family on average per month in Belarusian rubles: (1)up to 450 BYR (2) 451-900 BYR (3) 901-1350 BYR (4) 1351-1800 BYR (5) 1801-2250 BYR (6) 2251-2700 BYR (7) 2701-5700 BYR (8) 5701 and more
• Education	A variable describing the highest achieved level of education: (1) Basic education (up to 8/9 years of schooling) (2) Secondary education (up to 10/15 years of schooling) (3) Vocational and technical education (4) Secondary specialized education (5) Incomplete higher education (6) Higher/tertiary education
• Household	The total number of people in your household
• Region	A variable describing the region of living: (1)- Brest region (2) - Vitebsk region (3) - Gomel region (4) - Grodno region (5) – Minsk (6) - Minsk region (7) - Mogilev region

3.3 Descriptive statistics

Table 2 compares the mean values of the different characteristics between individuals who consider climate change as a risk and those who don't. As we can see from table 2, individuals who consider climate change as a risk have a higher behavioral index. This means that they are engaged in pro-environmental actions more often than people who don't see climate change as a threat.

Table 2

Characteristics of individuals who consider climate change as a risk vs. those who don't

Characteristics	Observations	Climate change is a risk		Climate change is not a risk	
		Mean	Std. Err.	Mean	Std. Err.
Behavioral index	1029	24.219	0.151	22.911	0.253
Climate TV	1029	1.832	0.045	1.680	0.074
Climate radio	1029	1.186	0.039	1.053	0.063
Climate newspapers	1029	1.007	0.039	0.794	0.060
Climate Internet	1029	2.782	0.032	2.530	0.058
Self-efficacy 1	1029	3.659	0.028	3.221	0.057
Self-efficacy 2	1029	3.610	0.030	3.089	0.057
Environmental beliefs 1	1029	4.313	0.027	3.883	0.052
Environmental beliefs 2	1029	4.164	0.033	3.512	0.063
Age	1029	40.876	0.482	41.452	0.791
Gender	1029	0.533	0.018	0.463	0.030
Income	1029	3.648	0.060	3.698	0.102
Education	1029	4.864	0.052	4.801	0.089
Household	1029	2.929	0.045	2.807	0.074

Besides, individuals who believe in climate change are more often exposed to information about it and other environmental problems on all the media (TV, radio, newspapers, the Internet) included in the analysis. It is worth noting that in both groups of individuals the Internet is the leading platform through which they are exposed to information related to environmental problems and climate change. As regards environmental self-efficacy and beliefs, these psychological variables are stronger in individuals who treat climate change seriously, in particular, environmental belief 2 (if things continue on their present course, we will soon experience a major ecological catastrophe). There are no substantial differences in socio-demographic characteristics between both groups of individuals. The mean age in both groups is 41 years old, the household's income is in the range 1351-1800 BYR, the average size of a family is 3 people.

For both groups the average education level is incomplete higher education. The only peculiar thing in socio-demographic characteristics is that among individuals who consider climate change as a risk the majority (53.34%) are women. Among individuals who do not believe in climate change the majority are men (53.74%).

4. Results

Table 3 presents the results of the 2SLS estimation and also the OLS results for comparative purposes. In the 2SLS first stage we get predicted values for climate risk perception and use them in the 2SLS second stage to correct for the endogeneity. The results of the 2SLS estimation show that climate risk perception is a significant predictor of pro-environmental behavior. When individuals start perceiving climate change as a risk, their behavioral index increases by 4.135 points, i.e. that they fully adopt one more pro-environmental activity in their life. These results are statistically significant at a 5% level.

Table 3

Comparison of the OLS and 2SLS estimation results

	OLS	2SLS – first stage	2SLS – second stage
Variables	Behavioral index	Climate risk perception	Behavioral index
Climate risk perception	0.091		4.135**
	(0.290)		(1.685)
Climate TV	-0.068	-0.023*	0.021
	(0.124)	(0.013)	(0.139)
Climate newspapers	0.416***	0.034**	0.232
	(0.149)	(0.016)	(0.178)
Climate Internet	0.401***	0.021	0.312*
	(0.147)	(0.016)	(0.164)
Climate radio	-0.183	-0.003	-0.152
	(0.141)	(0.015)	(0.153)
Self-efficacy 1	0.982***	0.026	0.805***
	(0.171)	(0.019)	(0.199)
Self-efficacy 2	0.176	0.051***	-0.071
	(0.166)	(0.018)	(0.206)
Environmental beliefs 1	0.433**	0.052***	0.212
	(0.178)	(0.019)	(0.213)

Environmental beliefs 2	0.551***	0.081***	0.171
	(0.145)	(0.015)	(0.221)
Age	0.067***	-0.001	0.071***
	(0.010)	(0.001)	(0.011)
Gender	0.133	0.006	0.124
	(0.248)	(0.026)	(0.268)
Income	-0.166**	-0.007	-0.134
	(0.078)	(0.008)	(0.084)
Education	0.032	-0.005	0.047
	(0.089)	(0.010)	(0.097)
Household	0.119	0.014	0.043
	(0.103)	(0.011)	(0.115)
Region	0.098	-0.005	0.119*
	(0.064)	(0.007)	(0.069)
Exposure to extreme weather events		0.152***	
		(0.034)	
Perceived environmental impact		0.055***	
		(0.016)	
Constant	11.452***	-0.257**	12.430***
	(1.004)	(0.107)	(1.159)

Note: Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1*

Other statistically significant predictors of pro-environmental behavior include exposure to climate change information on the Internet, environmental self-efficacy and age. Among these factors environmental self-efficacy, a belief in individual's own abilities to help the environment, exerts the largest effect on engagement in pro-environmental actions.

As regards the 2SLS first stage results, we can conclude that exposure to extreme weather events and perceived environmental impact are good instruments for climate change risk perception. Additionally, we conduct the tests to check whether the instruments are uncorrelated with the error process, relevant and strong (table A1 in the Annex). The Sargan test of overidentification checks whether the instruments are appropriately independent of the error process. The null hypothesis for this test is that all instruments are uncorrelated with the error term u_i. According to the results (table A1 in the Annex), we accept the null hypothesis and conclude that the instruments are valid. The underidentification test checks whether the instruments are relevant. The null hypothesis for this test says that the instruments are underidentified. Based on the results, we reject underidentification. As the F statistic in the weak identification test is higher than 10 (F statistic = 18.150), we can conclude that the instruments are strong.

5. Conclusions

Pro-environmental behavior is crucial for protecting the environment, reducing the greenhouse gas emissions, preventing the depletion of natural resources, and mitigating climate change. This study aimed to examine the drivers of pro-environmental behavior in Belarus based on the survey, conducted in 2022, on the attitudes to climate change and environmentally responsible behavior among the urban Belarusian population aged 18-75. In order to estimate factors determining PEB the structural equation model was built, where pro-environment behavior, as a dependent variable, represents a sum of indicators denoting frequency of performing different pro-environmental actions. The instrumental variable approach was used as a means to overcome endogeneity of the main explanatory variable of interest, namely climate change risk perception. Exposure to extreme weather events and perceived environmental impact served as instruments. Other control variables of the model included exposure to climate change information on TV, radio, newspapers, and on the Internet; such psychological factors as environmental self-efficacy and beliefs; and socio-demographic characteristics (age, gender, income, education, number of people in the household, region of living).

According to the analyses (2SLS estimation), the climate change risk perception has a strong positive impact on pro-environmental behavior. PEB index of individuals, who start perceiving climate change as a risk, increases by 4.135 points, i.e. that they fully adopt one more pro-environmental activity in their life. Exposure to climate change information on the Internet, environmental self-efficacy and age are other relevant determinants of pro-environmental behavior in Belarus. Among these factors, environmental self-efficacy, which is a belief in individual's own abilities to take action that help the environment, has the largest effect on engagement in pro-environmental actions. At the same time, the results show that neither such socio-demographic factors as gender, income, education, number of people in the household, region of living, nor such media variables as exposure to climate change information on TV, radio, newspapers exert a direct impact on PEB in Belarus.

The findings underline the necessity of increasing public awareness of environmental issues and promoting a sustainable lifestyle among the Belarusian population. The role of such mass media as television, radio and newspapers to deliver the message on the need for more sustainable consumption and greater involvement in environmentally friendly actions, should be increased. In addition, environmental life-long education programmes ought to be developed in order to encourage people to take actions for conserving the natural environment.

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Annex

Table A1

Tests of overidentification, underidentification and weak identification for the instrumental variables

Test	Statistic
Sargan statistic (overidentification test of all instruments)	1.296
Chi-sq(1) P-val	0.255
Underidentification test (Anderson canon. corr. LM statistic)	35.629
Chi-sq(2) P-val	0.000
Weak identification test (Cragg-Donald Wald F statistic)	18.150