



The Role of Socio-Demographic Patterns in Shaping Environmental Beliefs with Mediation of population growth and health: A case of selected European countries

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Abstract

The present research focuses on the impact of socio-demographic factors on environmental beliefs (awareness) with a specific focus on the mediation and moderation effects of population growth and health spending in the context of selected European countries. The Structural Equation Modeling (SEM) results indicate that the higher the per capita GDP, health care expenditures, and level of education, the stronger the pro-environmental attitudes. Health expenditures, in particular, raise awareness of the environmental risks, while education increases comprehension of environmental matters. Urbanization, on the other hand, has a negative relationship with pro-environmental attitudes, which means that urban growth might have incidental adverse effects on sustainable practices. The analysis utilizes data from the World Values Survey (Wave 7), which is an extensive dataset that comprises multiple countries and several socio-demographic variables. The analysis indicates that it is possible to enhance environmental awareness through policies that nurture health care, education, and neighborhood sustainable development. Such outcomes are crucial in the context of developing and implementing environmental strategies concerned with socio-economically heterogeneous populations that should also guarantee their overall viability.

Keywords: Environmental Awareness, Socio-demographic Patterns, Structural Equation Modeling (SEM), European Countries.

1. Introduction

Environmental beliefs are crucial in solving today's critical ecological problems, like climate change, biodiversity loss, and pollution. Such beliefs would reflect on social attitudes and behavior concerning driving the individual and community to operate sustainably. Knowledge of what drives these beliefs would thus be significant in the long-run, particularly as environmental degradation increases. Several recent studies have indicated the complexity of such dynamics, hence internalizing significant contributions from global research in environmental psychology and policy, especially in Europe. Such research includes but is not limited to educating and understanding the factors driving gender, health, and governance in pro-environmental attitudes and behaviors (Paparas et al., 2024; Bamberg & Möser, 2007; Huddart-Kennedy et al., 2009; Muoneke et al., 2023; Stern et al., 1993). This paper focuses on the

following nine European countries, the Netherlands, Germany, Czechia, Serbia, Cyprus, Romania, Russia, Ukraine, and Armenia, in examining how these factors intersect to influence environmental attitudes and behaviors across diverse contexts.

Population growth is one of the major pressures that the environment suffers, especially in developing areas where rapid population increases lead to great pressure on the already limited natural resources. In Sub-Saharan Africa, high rates of fertility and rapid urbanization are instrumental in encouraging deforestation and habitat destruction, exacerbating pollution and leading to a deteriorating, fragile ecosystem and diminishing biodiversity (Muoneke et al., 2023). On the contrary, the economic and demographic landscapes differ in richer countries like North America and Europe. The population growth in such areas tends to be quite stable; however, they exhibit a higher-than-average per capita consumption that worsens any environmental problems as they extract more than their fair share from global resources (Bamberg & Möser, 2007). All these effects of population growth may lend themselves towards the development of sustainability strategies for different regions, which would figure demographic trends as well as different levels of consumption and resource use over different areas.

Health is a very important socio-demographic factor in environmental beliefs and actions since health outcomes themselves are influenced by and determinants of environmental conditions. Community engagement concerning environmental issues is limited under conditions of poor health, especially in polluted areas, with examples such as contaminated air and water. Both immediate economic and social needs are prioritized in crises where communities urgently require addressing health problems. Healthier populations are better positioned to demonstrate pro-environmental behaviors such as sustainable consumption and legislating policies to protect the environment (Paparas et al., 2024). The link between health and the sustainability of the natural environment calls for joint policy intervention that identifies health and environmental issues and provides a solution to the long-term sustainability of natural systems worldwide.

The relationship between socio-demographic factors and environmental beliefs is further influenced by cultural, educational, and economic variables, which vary widely across regions. In Europe, for instance, disparities in environmental attitudes among countries such as the Netherlands, Germany, Czechia, Serbia, Cyprus, Romania, Russia, Ukraine, and Armenia reflect differences in economic development, education, and cultural values. Northern European countries, such as the Netherlands and Germany, tend to exhibit stronger environmental awareness and policy adoption, driven by high levels of education, economic prosperity, and cultural values that prioritize sustainability (Eurobarometer, 2008). In contrast, Southern European nations, such as Cyprus and Armenia, face more significant economic constraints that can hinder the prioritization of environmental concerns (Eurobarometer, 2020). Similarly, Eastern European countries like Romania, Ukraine, and Russia face unique challenges, where economic instability and historical political factors influence the public's ability to engage in pro-environmental behaviors. These regional variations emphasize the importance of tailoring environmental strategies to local contexts, considering the unique socio-economic conditions that shape environmental beliefs.

Socio-demographic factors such as age, sex, education, and income directly correlate with environmental attitudes. Research results show that the fact that the latest generation is involved in more environmental education and activism contributes to their increased concern with environmental issues (Wray-Lake et al., 2010). Gender affects the difference as well, for example, with women usually showing greater environmental awareness, which is said to have a socialization-related process stating nurturing as a role (Zelezny et al., 2000; Hunter et al., 2004). Education is the most important, as those with a higher educational background are more aware of environmental issues and how to develop policies

supporting these (Huddart-Kennedy et al., 2009). Wealth correlates with attitudes; wealthier people often differ in opinions on the environment, but when they consume more than their fair share, they contradict what they believe (Dietz et al., 2007).

Socio-demographic factors influence environmental beliefs in two possible ways, namely by mediation and moderation. Mediation of education, as an intermediary variable, has been taken as explaining how demographic characteristics like income enhance pro-environmental behavior through knowledge. Moderation explains how certain variables, such as governance or cultural norms, influence these relationships. The strong point of governance characterized by transparency and participation can strengthen the environmental belief-collective action nexus. Hence, stronger pro-environmental behaviors would be observed in northern European countries under robust governance than in less democratically governed regions (Stern et al., 1999).

Comprehension of the socio-demographic, health, and population interaction is key to the generation of effective policies on the environment: the factors that shape the environment are numerous and interlinked. They have to be understood for interventions to be tailored specifically to regional issues by policymakers, thus creating more inclusive, adaptable, and efficacious strategies for advancing sustainability. Such integration into global strategies toward environmental degradation offers a pathway to a future more resilient and equitable in human and environmental terms.

This study contributes to the understanding of interactions between socio-demographic factors, such as population growth, health expenditure, and environmental attitudes, in nine European countries. It discovers that there exists a positive correlation between higher GDP, health expenditure, education, and environmental attitudes, while urban population growth may have a negative effect. This study highlights the importance of health, health policies, and urban planning as crucial mediators and moderators in the pursuit of sustainability.

This study is novel and different in that it investigates the effects of population growth and health on environmental beliefs, issues largely neglected by contemporary literature. Therein lies the added significance of applying Structural Equation Modeling (SEM) for the sampled and varied sociodemographic profiles across nine European countries, providing more targeted insights that enable more efficient and context-specific responses to environmental issues.

2. Literature Review

The role of socio-demographic patterns in shaping environmental beliefs is rather very important in the pursuit of sustainable development in the wake of population growth and health. Increasing growth and urbanization in populations are placing increasing stress on ecosystems, as these factors influence the perception and behavior of individuals and communities toward environmental issues (Paparas et al., 2024). Health, in turn, has a bearing on the ability of the population to enter into engagements on sustainability, being directly related to SDG 3 (Good Health and Well-being) and SDG 15 (Life on Land), both of which focus on the relationship between people's health and the preservation of ecosystems (United Nations, 2015). Developing targeted measures for sustainable behavior across all socio-demographic contexts requires understanding such linkages better. A study conducted by Sales et al. (2024), in the article "Environmental Attitude of the Spanish and Argentine Populations", utilized 506 surveys. These results indicate that age and location matter more than any other socio-economic factor, such as employment. In addition, it emphasizes the significance of demographic variables in the formulation of public policies and participatory management schemes for environmental concerns. Papadas et al. (2024) examined CO₂ emissions in the light of economic growth, energy consumption, as well as industry-wise value added by using panel data econometric techniques between 1995 and 2022 in 23 European countries. Results indicate that economic growth coupled with renewable energy leads

to emission reduction, whereas fossil fuels and trade openness lead to higher emissions. These results indicate that agriculture, manufacturing, and services are responsible for emissions, thus providing relevant information to policymakers on how best they can opt for sustainable environmental strategies. Čábelková et al. (2023) explored environmental, economic development, and individualistic values across eleven countries in the far post-Soviet space. The results based on correlations, principal component analysis of motivations, and especially ordinal regression, motivate the conclusion that the more the support for personal liberties exists, the more the support for environmental sustainability also exists, along with economic development. Nonetheless, it should be emphasized that the mesh of relationships is such that, in some cases, these factors may enhance one of the preferences while diminishing another. For instance, the use of surveillance cameras versus the belief in God. Kovári et al. (2023) examined the environmental attitudes of young people (aged 14-25) using the NEP scale during April 2022 across four European capital cities (Estonia, Hungary, Lithuania, Romania). Descriptive statistics and relationship analysis using CAPI were applied (n=712), with little impact of demographic variables on greenness attitudes. The study provides insights into environmental education as well as directions for future research on social media's role in promoting youth activism. The exploration undertaken by Sargisson et al. (2020) was aimed at revealing the connection between sociodemographic variables and environmental values with the use of data from 11,820 participants who hail from seven European nations. A market segmentation approach was employed to evaluate for age, gender, income, and political orientation factors. Results indicate weak relationships, with only gender and political orientation being somewhat predictive. A stronger emphasis on egoistic values was found in men and right-wing persons, hence suggesting other means of conveying pro-environmental messages. Valko (2024) performed a post-hoc analysis in which a Russian sample (N = 109) was used to see what socio-demographic predictors (gender, age, income, etc.) were seen to affect the self- and other-estimation of pro-environmental behavior. The results showed inconsistent effects, ranging from small to medium effect sizes ($\beta \leq \mp 0.25$). The simple linear models had R² values in the predicted weak spectrum of 0.02 to 0.11, which indicated the necessity of wider predictors. Čater and Serafimova (2019) evaluated the profile of environmentally concerned customers in post-transition economies through a survey of 323 Macedonian consumers. The research investigates the interplay between consumption patterns, attitudes, and socio-demographic features. The results reveal that rapid alterations are taking place in consumption patterns in countries of the Western Balkans, and underline the need for addressing the unsustainable consumption practices that cause environmental problems. Such contributions to consumer behavior studies in transition economies are very useful. Pisano and Lubell (2017) analyzed cross-national contrasts in terms of environmental behavior utilizing multi-level modeling, which takes into account both individual- as well as country-level factors. The focus of the study includes several nations, taking into consideration socio-demographic, psychosocial, and contextual aspects; wealth and post-materialism were found to positively influence behavior, while negative effects were observed concerning environmental degradation. In particular, private conservation measures did not receive any impact from educational progress. Trandafilović et al. (2017) did a meta-analysis incorporating CMA software and reported some relationship between demographic features and socially conscious purchase behavior for the environment, but underscored that differences suggest further investigation to extract holistic findings.

Fairbrother (2013) contests the belief that those with more resources or nations pay greater attention to the destruction of the Earth. A look at surveys from different states and periods conducted in various war-torn nations reveals that those who live in less economically fortunate areas have been more likely to raise issues about climate change than their wealthy counterparts. While richer people are found to

be marginally worried about some things, there is no clear association between economic development and the desire to spend money on saving the environment. Franzen and Vogl (2013) analyze environmental concerns using three waves of the International Social Survey Programme data. They apply multilevel models to evaluate determinants and assess their findings against the 2010 results to draw comparative rankings for countries and engage in macro-level longitudinal analysis. The study identifies a robust association between environmental concern at a national level and ecological affluence, but this has been declining over the years. Nevertheless, higher levels of concern in developing economies can be sustained by economic growth. Scruggs and Benegal (2012) assessed over thirty years of public opinion data regarding climate change in the USA and Europe. According to them, after 2008, the main reason for decreasing climate change concerns was economic instability induced by the Great Recession. Compared to other factors such as partisan politicization or media coverage, this economic explanation captures more of the temper trends than anything else does. The authors forecast that with improvement in labor market conditions, people will have more faith in climate change again. In their study, Wray-Lake et al. (2010) examined trends in adolescents' attitudes toward the environment over thirty years, i.e., from 1976 to 2005, based on monitoring the Future data. The findings indicated that environmental concern among American teenagers peaked during the early 1990s but subsequently declined. Young people expressed little sense of personal responsibility for the environment, expecting governments and consumers to take action instead. This brings out the urgency for more effective environmental education and policy leadership that can involve young people in these issues. Huddart-Kennedy et al. (2009) shared with us the people's environmental concern (EC) and their environmentally supportive behavior (ESB) concerning a national survey on urban and rural Canadian residents (n = 664). They have observed that there are not many differences between rural and urban EC, but rural people have more altruistic values and participate more in recycling and stewardship schemes. They found that socio-cultural spaces significantly differentiate environmental worldviews and values based on the analysis of socialization places, hence indicating the importance of opportunity and infrastructure for ESB. Future studies may take a broader scope of behaviors and opportunities into consideration. The Eurobarometer (2008) questioned European citizens about the latter's opinions towards the environment and discovered that 96% of them were willing to protect it. The report also notes that climate change and pollution remain critical issues; however, many Europeans only take baby steps to save their environment. While two-thirds of EU citizens back environmental measures at a European level, only 17% buy green items. The survey highlights serious deficits in understanding how human activities affect nature, especially among southern European countries and new EU member states. Bamberg and Möser (2007) replicated and extended the meta-analysis of Hines et al. (1986-87) on psychosocial determinants of pro-environmental behavior. They analyzed 57 samples and used multiple analyses of structural equation modeling (MASEM) to test the relationships between eight determinants. The results show that pro-environmental behavioral intention mediates the effects of all psychosocial variables, in which attitude, behavioral control, and personal moral norms are key predictors of intention; these account for 52 % of the variation. As regards climate change mitigation policies, Dietz et al. (2007) utilized a mail survey of 316 individuals from Michigan and Virginia to conduct their research. The respondents were in favor of the movement of subsidies toward sustainable energy sources; however, they opposed the implementation of a gas tax. The multivariate analyses indicated that there was increased trust in environmentalists, climate change awareness, income level, race, age, and individual values that contributed to such support. Moreover, political affiliation and environmental beliefs indirectly affect policy preferences via worldviews. According to a study conducted by Schultz et al. (2005) in six countries, including Brazil, the Czech Republic, Germany, India, New Zealand, and Russia,

value systems and attitudes towards the environment were reviewed. The findings of their surveys revealed that there is a positive correlation between environmental concern and self-transcendence values, whereas an inverse relationship exists for self-enhancement values. This study elucidates the cross-cultural nature of these relationships as well as norm activation for self-transcendence, confirming it is those values that mold environmental actions. Using data collected through the International Social Survey Program (ISSP), Hunter et al. (2004) carried out a multi-country study to compare how gender differences lead to variation in environmental action across 22 countries. Their findings indicated that in predominantly wealthy countries, husbands tend to be significantly less caring when it comes to private acts of environmentalism than their wives, but men do not differ greatly from women in the public sector (Blocker & Eckberg, 1997; Tindall et al., 2003). Overall, both sexes would rather participate in private initiatives like recycling, irrespective of the level of economic development of a given country. Uzzell et al. (2002) analyzed how residential satisfaction, social cohesion, and place identification contribute to social identity and environmental sustainability based on the case study of Guildford in the United Kingdom. To do this, they compared 90 households from two different neighborhoods through cognitive mapping techniques, survey questionnaires, and structural equation modeling. Significant variations were found between the levels of residential satisfaction, with a connection between identity and sustainable behavior emerging as a main finding that could guide further investigations into sustainability or social identity. Zelezny et al. (2000) conducted a review of studies (1988-1998) focusing on variations based on sex in environmental attitudes and behaviors, which revealed that consistently, women presented stronger pro-environmental attitudes and actions when compared to men. In terms of Study 1, age groups as well as Study 2 from 14 countries show that gender effects are more pronounced in terms of behavior rather than attitudes. Study 3 relates this to women being more socialized for responsibility. The research provides input into theory, social action, and policy about gender and environmentalism. Diekmann and Franzen (1999) analyzed the ISSP data from 21 countries and found that there are positive correlations between environmental priorities and income (GNP per capita) on one hand, and negative correlations on the other hand when it comes to environmental concerns. They reconcile these seemingly contradictory findings of Dunlap and Mertig (1994, 1996) by offering two dimensions: local environmental concern as well as willingness to prioritize environmental goals. Richer nations concentrate on the quality of their ecosystems while poorer ones face more severe local problems. Stern et al. (1999) conceptualized the environmental movement through a Value-Belief-Norm (VBN) theory that explains its support. Using a national survey of 420 respondents, they identify three types of support, including citizenship actions, policy acceptance, and personal behavior. One of the primary conclusions drawn from this research is that supporters of a social movement are likely to take action when they share its values and perceive danger to those values. This means that VBN theory serves as a more appropriate framework for understanding why individuals become involved in environmental movements. In America, a study involving O'Connor et al. (1999) examined the extent to which individuals perceive climate change as a threat before any action has been taken against it. The authors employed results from 1,225 mail surveys that were spread across the nation. The authors discovered that risk perceptions were significant predictors of behavioral intentions, even though general environmental beliefs had no effect at all on them. Additionally, understanding the causes of climate change has a strong influence on intentions, pointing to the intricacy of public opinion regarding climate programs and culminating in an urgent question for future research related to risk perception and demographic elements. Klineberg et al. (1998) analyzed environmental concerns through data from four Texas statewide surveys that were done every two years. Eight demographic variables were regressed against 21 measures of environmental attitudes in this study. The outcome produced a consistent

relationship between education and age, whereas gender, religion, and ethnicity had varying effects. Apart from that, income was found to have particular impacts together with town size and political ideology. Thereby, their results indicated different determinants depending on how questions were framed. According to Guth et al. (1995), determining the extent to which religious variables affect environmental attitudes in the U.S. shows that, in terms of influencing Americans’ opinions on the environment, religiosity is a very important factor. They found that there is less concern for the environment among evangelicals compared to non-religious persons and Catholics, who are supportive in this aspect. The authors argue that religion has a stronger impact than any specific belief system and recommend future investigations into how liberal theological perspectives and institutional signals shape these attitudes toward ecology. The theory of planned behavior is reviewed by Ajzen (1991), who states that attitudes, subjective norms, and perceived behavioral control can be used to predict a person’s intention to engage in certain behaviors. Although there is empirical evidence supporting the theory, there are still some unresolved issues, like what kind of relationship exists between beliefs and actions. Taking into account that past actions must be included in evaluating the adequacy of this argument, it can also be stated who has previously attended.

I: Data Description and Sources

Table 1: Data description

Variable	Obs	Mean	Std. Dev.	Min	Max	Value Label	Variable Label
GDPPC	9,931	37,224.99	16,382.62	13,341.21	59,686.83		GDP per capita, PPP (current international \$) [World Bank, 2019]
Gender	9,931	1.54788	0.4977272	1	2	Q260	Sex
HE	9,931	2.19424	1.342928	1	4	Q88	Confidence: The World Health Organization (WHO)
Upgr	9,931	72.01636	11.50327	54.08	91.88		Urban population (% of the total population) [World Bank, 2019]
edu	9,931	399,445.3	304,416.3	1	8	Q275A	Highest educational level: Respondent (country-specific)
EMP	9,931	2.56963	0.8508393	1	4	Q79	Confidence: The Environmental Protection Movement
EC	9,931	1.480415	0.5579184	1	3	Q111	Protecting the environment vs. Economic growth
MEO	9,931	0.1079448	0.3803167	0	2	Q99	Active/Inactive membership: environmental organization

Sources: Compiled by author from World Bank and World Value Survey (Wave 7)

The data shows an average GDP per capita of 37225 dollars in current terms. The standard deviation of 16383 suggests that there is a substantial variation across the countries in the dataset. The minimum GDP per capita is 13341, while the maximum value is 59687, indicating a significant range across different countries.

The variable gender is a binary variable coded 1 to represent male and 2 to represent female. The mean value is 1.548, which suggests a slight skew towards the male category, though the distribution is fairly balanced as indicated by the standard deviation of 0.4977.

The variable reflects the respondent's Health expenditure (WHO). The mean score of 2.19 suggests a generally positive confidence level in the health system, while the wide standard deviation indicates considerable variability in responses.

This variable measures the percentage of the total population living in urban settlements. On average, 72 percent of the population in these countries resides in urban areas. The standard deviation of 11.5% indicates a significant variation in the urbanization levels across countries. The minimum urban population is 54% while the maximum is approximately 92% reflecting a range from moderately urbanized to highly urbanized country.

This variable edu with an average of 399,445 represents the highest educational level of respondents in various countries with values potentially reflecting the number of years of schooling or expected years of schooling. The maximum value of 8 indicates a very high level of educational attainment for some countries. The large standard deviation of 394, 416 suggests that there are outliers in the dataset.

The variable EMP measures the confidence in the environmental protection movement with values ranging from 1 to 4. The average score of 2.57 suggests a positive level of confidence overall with some variation indicated by the standard deviation of 0.85.

The variable EC represents environment consciousness that captures the attitudes between economic growth and environment protection with values ranging from 1 to 3. The average value of 1.48 suggests a slight preference for environmental protection over economic growth with relatively little variation as indicated by the standard deviation of 0.56.

The variable MEO represents active or inactive membership of the environmental organization, with 0 indicating no membership, 1 indicating some level of affiliation, and 2 indicating active membership. The low average of 0.108 suggests that only a small percentage of respondents are members of environmental organizations, with some variation in activity levels as indicated by the standard deviation of 0.38.

3. Data and Methodology

This research adopts Structural Equation Modeling (SEM) to assess the potential direct and indirect causes and effects of Environmental Awareness (EA), which is considered a latent variable. The secondary data employed in this research were obtained from the World Bank and the World Value Survey (Wave 7). The SEM makes it possible to visualize and analyze the observed indicators and unobserved latent factors, such as Environmental Awareness (EA), as well as how different types of beliefs are affected by various socioeconomic and demographic attributes. Such data includes wide-ranging economic, health, and demographic variables such as GDP per capita (GDPPC), population, and health expenditures, among others, from the World Bank. Contributions of the World Values Survey (Wave 7): This survey provides detailed level information on the orientations, beliefs, and approaches of people, for example, on how they view environmental conservation, and the importance of joining agencies for environmental protection versus economic development.

The study uses Structural Equation Modeling (SEM), a multivariate technique that provides the ability to analyze intricate cause-and-effect relationships between observable and unobservable variables.

The latent variable Environmental Awareness (EA) shall be operationalized using the following three indicators: involvement in the Environmental Protection Movement (EMP), the trade-off between 'protecting the environment' and 'economic growth' (EC), and the level of activity in Environmental Organizations (MEO).

Population Growth (Upgr) is the Mediator Variable directly affecting EA. Remember that environmental attitudes depend on factors such as policies and issues that socially influence individuals, most notably

population growth. Health expenditure (HE) is also a mediator that directly affects EA. Improving social well-being can influence people’s perspectives towards the environment.

Exogenous Variable GDPPC (Gross Domestic Product per capita) influences EA indirectly by population increase and health expenditure, as well as in a direct way (with an increase in GDP, there may be a higher environmental concern). Education has a direct implication on EA, as with increased education often progress against environmental constraints is often more effective. Gender, on the other hand, is perceived to directly affect EA as it embodies differences in concern for the environment and activism for the cause between the sexes.

This model is fitted with the Maximum Likelihood Estimation (MLE). MLE will give the estimates of the factor loading, path coefficients, and variances of the latent variables.

The SEM model for this study is shown with the following equations:

The latent Variable Equation for EA is given as:

$$EA_i = \lambda_1 \cdot EMP_i + \lambda_2 \cdot EC_i + \lambda_3 \cdot MEO_i + \epsilon_{i1} \text{ ----- (2)}$$

Where:

EA is the latent variable (Environmental Awareness), the factor loadings of the indicators EMP, EC, and MEO are respectively given as λ_1 , λ_2 , and λ_3 , and ϵ_{i1} is the error term.

Mediating Effects of Urban Popgr and Health

$$Upgr_i = \beta_0 + \beta_1 \cdot GDPPC_i + \eta_1 \text{ ----- (3)}$$

$$HE_{i1} = \delta_0 + \delta_1 GDPPC_i + \eta_2 \text{ ----- (4)}$$

Where:

Population growth, Upgr_i, and Health expenditure, HE_{i1} are the terms defined, while β_1 and δ_1 are the structural parameters, while η_1 and η_2 are the error terms.

Direct Effects of Exogenous Variables on EA are given as:

$$EA_i = \gamma_0 + \gamma_1 \cdot GDPPC_i + \gamma_2 \cdot Upgr_i + \gamma_3 \cdot HE_{i1} + \gamma_4 \cdot Edu_i + \gamma_5 \cdot Gender_i + \epsilon_{i2} \text{ ----- (5)}$$

Where:

γ_1 , γ_2 , γ_3 , γ_4 , γ_5 are the direct effect coefficients, and ϵ_{i2} is the error term.

$$EA_i = \beta_0 + \beta_1 GDPPC_i + \beta_2 Urban\ Popgr_i + \beta_3 Health_i + \beta_4 (Urban\ Popgr_i \times Health_i) + \beta_5 Edu_i + \beta_6 Gender_i + \epsilon_i \text{ ----- (6)}$$

where:

β_1 , β_2 , β_3 , β_4 , β_5 , and β_6 are the coefficients to be estimated, and ϵ is the error term.

The present study analyzes the various aspects of the economic, demographic, and social factors that account for different shades of environmental attitudes across countries. To achieve this, SEM is employed to assess both the direct and mediating aspects of how individuals view the issue of environmental conservation and its relationship with economic growth. The results will be beneficial to the policymakers who wish to focus on making people aware of the environmental issues, and people supporting the policies that consider these issues everywhere.

3.1 . Results and Discussions

Table 2: Results without Moderator and Covariance

VARIABLES	Main Model EA	1 EC	2 MEO	3 HE	4 Upgr
HE	0.112*** (0.00661)				-0.171*** (0.0590)
Upgr	-0.0110*** (0.000687)				
Gender	-0.0413*** (0.0154)				
edu	3.00e-07*** (2.59e-08)				
GDPPC				-6.16e-06*** (8.20e-07)	0.000511*** (4.83e-06)
EA		0.296*** (0.0271)	-0.148*** (0.0135)		
Constant		1.625*** (0.0260)	0.0357*** (0.0122)	2.424*** (0.0334)	53.37*** (0.243)
Observations	9,931	9,931	9,931	9,931	9,931

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

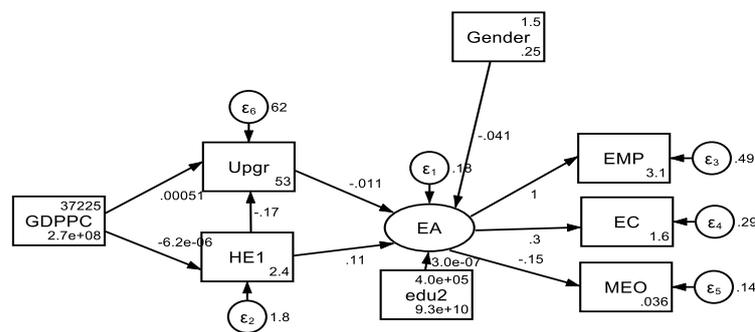


Figure 1: Structural Equation Model without moderator and covariance

The SEM model without moderators and covariance assumes that the correlation between the measured variables and their associated error terms is straightforward. Under this model, HE is found to reduce Upgr, whereas EA is claimed to enhance it. Further relationships include a low negative association of Gender with EA, as well as an insignificant negative association of EA with GDP per capita. Edu has a significant effect on EA. Negative covariance is displayed between EMP and EC, while EC has a quite low connection with MEO. Estimates for variances for all the variables involved in this study (that is, EMP, EC, MEO, HE, Upgr, and EA) were made with the aid of a huge sample of 9,931 observations that enhanced the reliability of the model.

Table 3: Results without Moderator and with Covariance

VARIABLES	Main Model EA	1 HE	2 Upgr	3 EMP	4 EC	5 MEO
HE	0.111*** (0.00665)		-0.171*** (0.0590)			
Upgr	-0.0115*** (0.000672)					
Gender	-0.0455*** (0.0152)					
edu	2.76e-07*** (2.64e-08)					
GDPPC		-6.16e-06*** (8.20e-07)	0.000511*** (4.83e-06)			
EA				1 (0)	0.345*** (0.0288)	-0.102*** (0.0171)
Constant		2.424*** (0.0334)	53.37*** (0.243)	3.112*** (0.0614)	1.668*** (0.0298)	0.0525*** (0.0118)
Observations	9,931	9,931	9,931	9,931	9,931	9,931

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.

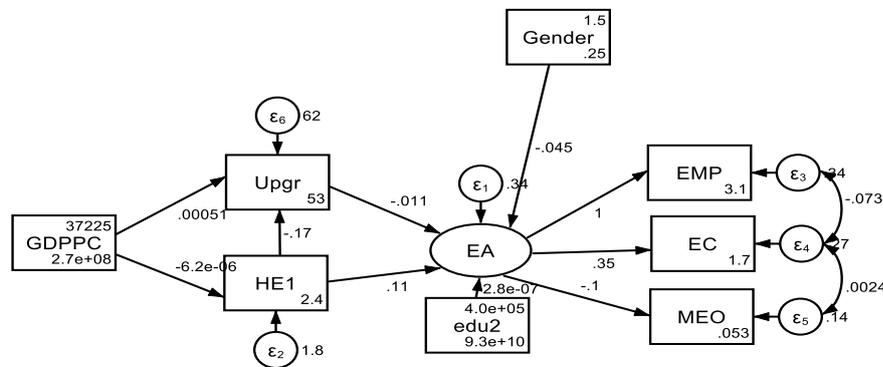


Figure 2: Structural Equation Model with covariance and without moderator

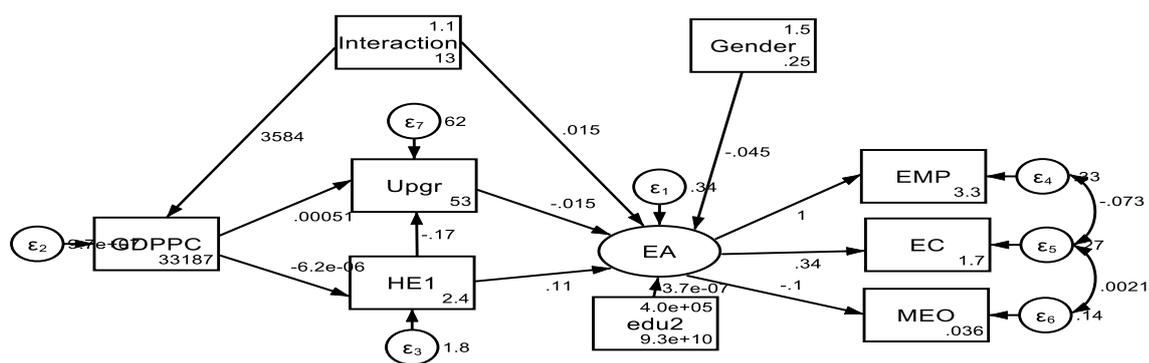
The SEM model with covariance but without moderators assesses only the direct paths and covariance of the endogenous variables and their error terms. The variances of the variables were estimated (EMP, EC, MEO, HE, Upgr, and EA), with Upgr presenting the highest variance at 61.92, followed by HE1 at 1.793. The value of the covariance of EC and EMP is negative at -0.0727, indicating that they are inversely correlated, while the covariance of EC and MEO is around zero. Furthermore, it is observed that HE1 negatively influences Upgr with a coefficient of -0.171, while EA has a positive effect on Upgr with a coefficient of 0.345. Additional direct effects include low coefficients for GDPPC, Gender, and Edu. Given

the sample size of 9,931, reliable estimates are assured. This model sets the stage for the next one, where there will be both covariance and moderators to allow for relationships that are more complicated.

Table 4: Results with Moderator and Covariance

VAR	Main Model EA	1 GDPPC	2 HE	3 Upgr	4 EMP	5 EC	6 MEO
HE	0.111*** (0.00663)			-0.171*** (0.0590)			
Upgr	-0.0146*** (0.00137)						
Interaction	0.0147*** (0.00552)	3,584*** (27.11)					
Gender	-0.0451*** (0.0153)						
edu	3.75e-07*** (4.56e-08)						
GDPPC			-6.16e-06*** (8.20e-07)	0.000511*** (4.83e-06)			
EA					1 (0)	0.339*** (0.0286)	-0.100*** (0.0169)
Constant		33,187*** (103.6)	2.424*** (0.0334)	53.37*** (0.243)	3.284*** (0.0888)	1.722*** (0.0382)	0.0363** (0.0152)
Observations	9,931	9,931	9,931	9,931	9,931	9,931	9,931

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



Figure

3: Structural Equation Model with moderator and covariance

The SEM model with both moderators and covariance determines the direction of relationships, the direct relationships, the variances, and the covariance between the variables concerning the moderator

effects as well. The variances for each variable (i.e., EMP, EC, MEO, GDPPC, HE, Upgr, and EA) are present and have observable variances, with the more significant variances being observed for Upgr (61.92) and GDPPC ($9.724e+07$). The covariance values of EMP and EC are low (-0.0728), meaning an inverse correlation exists, whereas the covariance established between MEO and EC is almost non-existent (0.00215). Also within the model are direct effects like HE being a negative predictor of Upgr (-0.171) and GDPPC predicted to adversely associate with EA ($-6.16e-06$), in contrast to Upgr, which showed a positive association (0.000511).

The significant interaction effect (3,584) on EA suggests that there is a conditional effect present. Other direct effects include a negative effect of Gender on EA (-0.0451) and a comparatively negligible positive effect of Edu on EA ($3.75e-07$). The positive interaction effect on EA (0.0147) suggests that there are variables that interact to produce EA. The model does not entertain the existence of direct effects among the variables under study, EA, Upgr, and the remaining variables, but includes very real values of constants for each of the equations. Regardless of the model accounting for 9,931 observations, its estimates are sound, provide details on the moderating effect between the variables, and address the issues of covariance between the errors.

The linkage between the levels of GDP per capita (GDPPC) and attitudes about environmental issues is multifaceted, as an increase in GDPPC is associated with rising health expenditures and changes in population structure. It is common to find that richer societies tend to be more environmentally conscious because they are more educated (Inglehart & Welzel, 2005). Increased healthcare expenditure contributes to better overall health of a population and enhances awareness of the health and environmental health connection (Benson & McGee, 2018). Furthermore, in most cases of increasing GDP per capita, population growth may cease or decline, making it possible to embrace sustainable strategies (Myrskylä et al., 2009). All the above illustrate that while some policies are quite explicit and have an immediate impact on the environment, others, such as the enhancement of people's education, have long-term effects on the environment more indirectly (Lutz et al., 2017; Roth & Uhlenbruck, 2020). There is a positive correlation and a very strong relationship between Health Expenditure (HE) and Environmental Awareness (EA), such that the more people spend on health, the more they tend to believe in environmental issues. This can be attributed to a few factors, including how aware the people are about the health risks posed by environmental degradation, the enhanced living conditions or sophistication of the people, as well as the provision of social systems that motivate them to think and behave sustainably. Expenditures on health care are considered by some as a natural deterrent to the deterioration of the environmental assets in a country. There is a corresponding demand for better maintenance of the quality of the environment as an irreparable asset, which in turn leads to action towards its protection. These are similar to the findings of Seligman et al. (2010) that state public health education is a major factor in people's understanding of how the environment affects their health and consequently changes their attitudes towards the environment for the better. On the other hand, however, some other studies, including those mentioned above by O'Neill and Hulme (2009) suggested that in poorer places, the uplift in healthcare investment might not lead to any sizeable increase in the environmental beliefs since there are more pressing concerns, which shows that the socio-economic dimension influences this relationship. Hence, even if a clear trend suggests there is a value-positive relationship, exceptions are observed depending on certain cores of the society and their respective economies.

The negative value associated with the growth of the urban population (Upgr) indicates that with more people residing in cities, there is a lower tendency for environmental awareness (EA), thus revealing the likely compatibility of urbanization with negative environmental attitudes. This could be due to several

reasons, including the activities associated with urban life, which always seem to favour achievements of economic and developmental objectives over environmental goals, reducing the level of awareness or concern for environmental issues (Gifford, 2011). It has been established that urban agglomerations give rise to inter- and intra-city movement, which also leads to heavy resource use and waste generation, a factor that entangles citizens in the active community, making them less disposed to environmental care (Newman & Kenworthy, 1999). Additionally, Kahn (2006) noted that city life provides opportunities for individuals to feel integrated, but in a way that removes the components of nature that such individuals are biologically programmed to need, compassionately reducing the desire to protect the environment. In conclusion, our results corroborate a line of research that argues that urban expansion may have adverse impacts on environmental attitudes, pointing to the necessity for equitable urbanization, including the development of appropriate strategies for environmental management.

The positive moderation coefficient observed between health and urban population growth (Urbanpgr) indicates that public health and urbanization have a constructive effect on environmental awareness (EAs). This trend may suggest that as the urban population grows, there is a shift in the focus towards enhancing the quality of life of the people, which usually comes about by way of advancement, service delivery, and involvement of the people in those communities. It has been found that healthier populations are more inclined to care about their way of living, focusing more on the environmental sustainability aspects (Maller et al., 2008). Additionally, healthcare programs in cities are likely to encourage people to participate in social activities and organize them to solve specific problems, including that of the protection of the environment (Frumkin, 2003). For instance, Karp (1996) examines the impact of personal values on pro-environmental behavior and concludes that commitment to self-transcendence, openness to change, and universalism foster such behavior, while self-enhancement and conservation are inhibitory. Nevertheless, the reader should also be aware that this positive association is not necessarily a general rule; some studies show that the same social transformation may also enhance the healthcare needs of the population (Ravetz, 2000). Overall, our results align with numerous studies, which posit that there is a complex relationship involving health and urban growth, such as the awareness of the environment, hence, the need to deal with health issues in urban planning.

When it comes to environmental awareness (EA), a negative coefficient for gender indicates that the authors perceive women more favorably than they perceive men concerning the environment, thereby exhibiting an attitude towards the environment across genders. This resonates with past research, which frequently indicates that females are more caring of the environment and practice pro-environmentalism more than males (Zelezny et al, 2000; Dietz et al., 2002). Such disparities, however, could be the result of socialization where women tend to be socialized in a more communal and caring way, resulting in a greater concern towards environmental issues (Stern et al, 1993). Pereira and Forster (2015) conducted research and found a positive correlation between connectedness to nature, altruistic and biospheric values, and pro-environmental behaviors, with values being a partial mediator in this relation among 76 students. According to Lee et al. (2013), there are more women actively adopting energy-saving practices and internalizing those environmental values in a Midwestern town in the U.S. However, women were not found to differ from men in buying energy-efficient lamps. So, the results you present are in line with gender and environmental attitudes literature, but these results cannot be understood simplistically.

The positive coefficient associated with education and environmental awareness, for example, suggests that people with high education levels are also inclined to have positive attitudes towards the environment. This is a consistent finding, as many will agree that education raises the levels of consciousness and understanding of environmental issues, which in turn breeds the urge to engage in sustainable practices (Kollmuss & Agyeman, 2002). Meyer (2015) employed a regression discontinuity

design and found that the increased level of education induced by the 20th-century European laws encourages pro-environmental actions and social welfare concerns. In addition, it has been proven that more educated people are more likely to take part in any activities that might be seen as advancing the cause of the environment, be it support for relevant legislation, or even active participation in the street (Wang et al. 2022; Gifford, 2011). However, education as a determinant of environmental attitudes should also consider the degree to which these attitudes vary by discipline and mode of education, given that not all systems of education prioritize environmental concern (O'Brien, 2012). To sum up, our results correspond with theoretical frameworks that regard education as an important determinant of pro-environmental desires and actions.

Conclusion and Practical Policy Implications

This study examines the link between socio-demographic variables, health expenditure, urbanization, and awareness. Findings reveal the following: GDP per capita, health expenditure, and education all positively affect environmental attitudes; urbanization inhibits them. Moderation analysis reveals that health expenditure and urbanization can interact to elevate awareness, depending on the socioeconomic condition. Gender and education level also significantly influence pro-environmental behaviors: women and the highly educated tend to have a stronger concern for the environment. These findings provide additional insights into the nature of specific conditions affecting environmental beliefs over diverse socio-economic contexts.

Policymakers should include sociodemographic variables in environmental strategies that encourage pro-environmental behavior. Environmental Education, in a healthy infrastructure, supports promoting healthy populations. Urban planning must guarantee population growth within sustainable gardens and sustainable policies. Strategies must be gender-specific and tackle the disparities in environmental attitudes. Lastly, public governance is a prerequisite for building community-based and sustained action for the entire demographic category in transforming the environment. Promote gender-responsive approaches that are based on the high level of environmentalism of women and promote community-based environmental management.

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