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A PROBIT ESTIMATION OF URBAN BASES OF ENVIRONMENTAL AWARENESS: EVIDENCE FROM SYLHET CITY, BANGLADESH

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Abstract : This paper evaluates the major factors contributing to environmental awareness among people living in the urban area of Sylhet, Bangladesh. Ordered Probit (OPM) estimation was conducted on the value of ten measures of individual environmental concern and estimated results of OPM reveal the dominance of higher education, higher income and full-employment status on environmental concern and environmentally responsible behavior. Younger and more educated respondents tended to be more knowledgeable and concerned more than the older and less educated respondents. Marginal effect of household size, mid level income and part time employment status of the survey respondents played a less significant role in the degree of environmental awareness. Findings also validate "age hypothesis" proposed by Van Liere and Dunlap (1980), and the gender effect reveals an insignificant role in determining the degree of environmental concern. Environmental awareness among urban individuals with higher income increased linearly with environmental awareness programs which may have significant policy importance, such as environmental awareness program for old-aged and less-educated individuals, and may leads to increased taxation on higher income group to mitigate city areas' pollution problems.

Introduction

In the era of globalization, environmental issues become the core in the scholarships of social sciences due to its inseparable relationships between economy, environment and how humans interact with the environment. An economic plan frequently motivated by factors such as concern of green environment and sectoral economic policy variables (Markandya et al, 2002).

Environmental concern among cities and city populations can shape the country's environmental future which includes environmental governance lace with individual perception and socio-economic determinants of environmentally responsible behavior. Economic dimension of urban development plans (Roberts et al, 1997) are also incomplete if any inattention of environmental protection and without resorting to legal frameworks and economic instruments of environmental or resource factors ((Fujisaki et al, 1997). In recent years research interest has grown in the protection of environment in the city areas of Bangladesh due to its major social, political and economic importance for ensuring the long-term sustainability in improving environmental quality. Researchers and academics with interests in the protection of environment have commonly documented that personal and social awareness, and subsequent concern or true preferences are at the heart of environmental protection (Duroy, 2005, Shen & Sajob, 2007, Liere & Dunlap, 1980, Wall, 1995). This study is an attempt to investigate the influence of social and economic characteristics on different measures of environmental concern of individuals in Sylhet, Bangladesh. It attempts to clarify how environmental awareness can be utilized as a tool for environmental policy making and management. Issues that policy makers want to know the determinants of social and urban bases of environmental concern so that regulatory attempt and social initiatives can provide optimum outcome for environmental protection.

This paper sets the core objective as to find out the correlations between these determinants and environmental concern of urban populations. Respondent's true preference is one of the most pertinent information to take important decision on taxation, provision of public good for urban people and pricing of public utilities. Therefore research findings will be an important step for policy maker to clarify the relationship between environmental quality and well-being, and perhaps will give influential ways to control the environmental degradation. In terms of organization of this paper, the next section outlines the theoretical motivation with a varied array of environmental issues, urbanization and hypotheses examined in the previous studies. Section three presents brief outline of data and variables. We introduce the model specification in section four and analysis of empirical results in section five. Finally, section six presents the policy implications of findings, its limitations and concluding remarks with future research direction.

Theoretical Motivation

The term environmental concern in this study mainly originated from the definition presented by Jones and Dunlap (2002): "the degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicate a willingness to contribute personally to their solution". Environmental concern indicates the degree to which people are

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aware of problems regarding the environment and support efforts to solve them and or indicate the willingness to contribute personally to their solution. Stern and Dietz (1994) define environmental concern in relation to egoistic, social-altruistic, and biospheric value orientations and also to beliefs about the consequences of environmental changes for valued objects. Theoretically, urbanization refers to the increased degree of demographic and economic expansion in the city areas with modern facilitations. Urbanization is a process of the growth of cities, increased degree of industrialization and economic development, and that leads to urban related changes in specialization, modernization, labor division and human behaviors.

Most of the research and theory on environmental concern includes attitudinal studies, experimental and quasi-experimental surveys and applied research on environmental attitudes and behaviors (Buttel, 1987). Research on attitude theory (Bagozzi and Warshaw 1990, Harry 1971, Maslow 1970), human behavior (Howell and Laska, 1992, Stern and Dietz, 1993) and environment and behavior (Poortinga, Steg, and Vlek, 2004, Schahn and Hotzer, 1990) envisages environmental concern as an evaluation of individual to environment or attitude towards facts or individual own behavior to the environmental protection.

Two influential studies (Van Liere and Dunlap 1980, Fransson and Garling (1999) have shown that how age, gender, social class, household size and political ideology can persuade to the explanation of various environmental attitudes and behaviors. Age hypothesis documents inverse relationship between age and environmental concern and settle the proposition that younger people tend to concern more about environmental protection than the elders. Considering gender impact on environmental concern, women appear to be slightly and consistently more concerned about environment than male (e.g., Davidson and Freudenburg 1996). Education, occupational status and income are positively related with environmental concern as demonstrated by the social class hypothesis (Van Liere and Dunlap, 1980, Inglehart 1990, Andrews 1978, Schaha and Holzer 1990). Regarding residence hypothesis, those living in metropolitan areas were significantly more concerned than those living in towns or in countryside (Fransson & Gorling 1999). Referring U.S. data, link between political ideology and environmental concerns show that people who support democrats and liberals are more concerned about environmental quality than those support republican and conservative counterparts (Buttel & Flinn 1978, Van Liere and Dunlap 1980).

Data

Three hundred twenty individuals from different locations in the Sylhet city, Bangladesh participated in the survey and completed the questionnaire in

the fall of 2012. The questionnaire consisted of 34 questions grouped into the following categories of major environmental issues. The target population encompassed people with different backgrounds including gender, age, education levels, location of residency, and social status. The information's were collected according to the population density throughout five major areas of city areas. Table I shows the summary information's of all the associated socioeconomic characteristics of data. Following Shen and Saijo (2007), we have set one index to estimate the specification for general environmental concern, used eight indices for specific environmental issues including land, energy and environmental issues of Sylhet city area and finally one index to examine the attitude towards pro-environmental behavior.

Independent Variables

The independent variables included in this study were six demographic, socioeconomic and regional factors. A set of dummy variables were developed.

1. Gender. Female was coded (1) and male, the reference group, was coded (0).
2. Social class. Six dummy variables were developed for social class: (a) Higher education was coded (1), if respondent completed undergraduate level and below undergraduate, the reference group, was coded (0). (b) Higher income class was coded (1) when monthly income level is more than BDT 100,000, otherwise (0) and middle income class was coded (1) if monthly income in between 60,000-99,999 BDT. (c) Full employment was coded (1) if respondent is full employed, otherwise (0) and part-time employed respondent coded (1), otherwise (0).

Table 1: summary statistics of independent variables

Variable	Mean	S.D.
Female (=1 if female)	0.62	0.48
Age: actual age of respondent	32.15	9.72
High_ed (=1 if above undergraduate)	0.47	0.49
High_inc(=1 if income above 100,000)	0.52	0.49
Low_inc(=1 if income in between 20000-50000)	0.27	0.44
House_size: Actual household size	5.57	1.74
Ful_emp(=1 if respondent is full employed)	0.48	0.50
Prt_emp(=1 if respondent is part time employed)	0.38	0.48

We provide a correlation matrix (in appendix) that reveals whether any significant correlation among all the independent variables. It displays moderate negative correlations between age and part time employment, high income and mid income, full employment and part time employment. Separate regression models excluding two collinear variables have been

estimated in order to avoid this multicollinearity problem. All other variables exhibit low correlation and therefore co-linearity is not a problem in the regression analysis.

Dependent Variable – The dependent variables in this study are general environmental concern, concern about global warming, concern about city areas and cross-areas pollution, concern about air/water/soil problem, concern about energy problem, Sylhet city green land and ecological problem, concern about health problem, concern about recycling, concern about noise/odor and environmental consideration when buying electronics. All were measured by Likert type response formats, using a five point response anchored by 'not concern', 'not quite concern' 'neither concern nor unconcern', 'somewhat concern', and 'concern' correspond to censoring values 0, 1, 2, 3, and 4, respectively, meaning that higher score indicated more favorable environmental attitudes & stronger norms. Variable VJ examines pro-environmental behavior where respondents were asked to rank of environmental consideration when buying electronics. The scores of this statement were coded as: consider environmental impact as the first issue (4) second issue (3) third issue (2) and neither (1). Table II shows these variables that we have used in the questionnaire to demonstrate the different measures of individual environmental concern.

Table 2: Summary statistics of environmental concern indices

Description	Mean	(S.D.)
VA: Concern about general environmental problem	3.44	0.81
VB: Concern about global warming problem	3.15	1.15
VC: Concern about City areas pollution and cross-areas pollution problem	3.14	1.50
VD: Concern about air/water/soil pollution problem	3.36	0.87
VE: Concern about energy problem	2.97	1.10
VF: Concern about Sylhet City's green land and ecological problems	2.95	2.01
VG: Concern about the effect of harmful substances on health	2.76	1.09
VH: Concern about disposal, reduction and recycling of waste	2.45	1.17
VI: Concern about living environmental problems such as noise/odor	3.23	0.86
VJ: Rank of environmental consideration when buying electronics	2.24	1.62

Model specification

We employed the ordered probit model (OPM) in which environmental concern were measured by Likert type response formats. Because of the discrete nature of the dependent variable in this study, ordinary least squares regression would be an inappropriate model. Through the ordered probit

model, we are able to not only identify which socioeconomic factor determines individual environmental concern, but also discern which factor plays the most important role through predicting each factor's marginal effect on the probability being the most and/or least environmentally concerned individual (Shena and Saijo, 2007). We can describe the choices of concern as a discrete variable y_i . The probability that a respondent will fall into one of the five categories of environmental concern can be decomposed into a deterministic component and an additive stochastic component. According to our categorization, this variable can take one of the following five values

$y_i = 0$, if the degree of concern is chosen as 'Not concern'

$y_i = 1$, if the degree of concern is chosen as 'Not quite concern'

$y_i = 2$, if the degree of concern is chosen as 'Neither concern nor unconcern'

$y_i = 3$, if the degree of concern is chosen as 'Somewhat concern'

$y_i = 4$, if the degree of concern is chosen as 'Concern'

Then, we assume that individual environmental concern is based on a continuous and latent variable y_i^* . This latent variable is assumed to be a linear function of all the socioeconomic variables and the standard ordered probit model is widely used to analyze discrete data of this variety and is built around a latent regression of the following form:

$$\text{for } i = 1, 2, \dots, N \quad (i)$$

Where y_i^* is the unobserved measure of environmental concern, X_i is a vector of independent variables, N is the number of respondents, and ϵ_i is the error term. The relationship between y_i^* and the ordinal likelihood ranking (observed category) y_i is a function of the cut-off points or thresholds, s , which are unknown but can be estimated along with β s.

Let s be unknown cut points or threshold parameters and with zero as a normalization assumption, the censored variable can be define as:

$$\begin{aligned} y_i &= 0, \text{ if } (ii) \\ y_i &= 1, \text{ if } (iii) \\ y_i &= 2, \text{ if } (iv) \\ y_i &= 3, \text{ if } (v) \\ y_i &= 4, \text{ if } (vi) \end{aligned}$$

Note that the four cut points are estimated along with the coefficients of the independent variables of vector X_i . Consequently, the probabilities of y_i being classified as 'not concern', 'not quite concern' 'neither concern nor unconcern', 'somewhat concern', and 'concern' are given by

$$\begin{aligned} &) (vii) \\ &) (viii) \\ &) (ix) \\ &) (x) \\ &) (xi) \end{aligned}$$

With a normal distribution of the error term ε in equation (vii) - (xi), the cut points κ and coefficients β can be estimated as an ordered probit model (OPM). The estimation of OPM is based on the maximization of the likelihood function, which is expressed as:

In terms of available data for this study, latent regression can be formulated as:

Results for each model will be presented in the next section along with an explanation. From the slope parameter and threshold estimates, it is relatively straightforward to calculate probabilities of individuals' five choices of environmental concern with their marginal effects. Given the cumulative normal function, $\Phi(\beta'x)$ and the probabilities we can estimate the associated marginal effects and examine in what direction those effects are exerted.

Analysis of Results

Empirical results of this OPM technique is presented in terms of a specific environmental choice of concern, in which choice of concerns are classified into five categories. Two separate regression models were estimated: one model includes basic eight variables and another model excludes two collinear variables such as mid level income and part time employment status. The OPM estimates of eight and six slope coefficients of both models are reported in table III – XII in appendix and the unknown threshold parameters are not reported because of space limitation. Cut points or threshold parameters are estimated by the data and help to match the probabilities associated with each discrete outcome. Note that the estimated coefficient has no direct interpretation but can be used to calculate probabilities of getting different choice of concerns and their corresponding marginal probabilities. Estimated value of marginal effects on probabilities also reported in the appendix.

Equation (xii) was initially estimated for general environmental concern including all explanatory variables. Table III supports positive impact of higher education and higher income on general environmental concern although we find gender, age, mid-level income and full employment level are insignificant in the choice of various degree of environmental concern. Estimated R^2 tells that model is correctly predicts 55 % of the choice even though only 4 of 8 variables have significant coefficients. Model, excluding co-linear variables also validate the social class hypothesis as we find significant positive impact (1.39) of higher education on individual general environmental concern. The marginal effects of each explanatory variable on each concern levels are also reported in table III. A positive value indicates that an increase in the magnitude of the explanatory variable increases the probability that environmental concern will be of a specific choice. In this regard, positive impact of higher education is strong only with the category of $y = 4$ and not for other choices. Regarding general environmental concern,

marginal effects on the probability of $y = 4$ indicates that an incremental change in the class of higher education or an additional year of schooling increases the probability of environmental concern by 48.8% but decreases the probability of choosing "somewhat concern" by 31.8 %. Household size shows significant negative impact on general environmental concern for both models.

Regression results for the concern about specific environmental issues are presented in Table IV-XI. It appears that higher education and higher income shows consistent results and serves as a general and significant indicator of specific environmental concern such as global warming, city areas and cross-areas pollution, air/water/soil pollution, energy problem, green land and ecological problem, substances on health, reduction and recycling of waste and living environmental problem such as noise/odor. Comparing to male, female is found to be relatively more concerned about the city areas and cross-areas pollution and found to be relatively less concerned about environmental considerations when buying electronics items.

Findings support age hypotheses for eight indices although a number of results are found to be inconsistent. There is no effect of gender on general environmental concern, global warming, energy problem, air/water/soil pollution, health hazards and recycling of waste. Age is found significant and shows negative impact of choosing "concern" in global warming, city areas and cross-areas pollution, air/water/soil pollution, harmful substances on health, recycling waste and living environmental problems, while it is positively related with the concern about city green land and ecological problem. Therefore findings support that the younger citizens in Sylhet city are more concern about various specific environmental problems than older. Considering employment status, model with all variables show a positive impact of part-time employment status on individual general environmental concern while full-time employment status shows mixed scenario and it is found insignificant for six indices. In contrast to the concern about city areas pollution and air/water/soil pollution, individual with full-time employment status expresses their positive concern about Sylhet city green land and ecological problem. For all models, average predictive power as measured by R^2 is 0.53 which is statistically acceptable. The estimated threshold variables are very significant indicating the ordered probit model with 5 different choice of concern is highly appropriate.

An examination of Table IV- XII indicates that higher education is the dominant explanatory variable with the z statistics ranges from 10.39 to 3.02 (probability value of 0.00) indicating that a higher education leads to greater probability of more concern in environmental protection, i.e., a greater value in y . Another important explanatory variable is the dummy variable income. When income = 0, the respondent is in lower or mid-level income group;

when it is equals 1, the respondent is in higher income group. For six indices, given the larger z statistic (ranges from 2.38 to 3.84) and small probability value (0.0), it implies that the probability for an individual with greater income, all other factors held constant, to be "concern" about specific environmental index is greater. The estimated coefficient on gender (dummy variable with value of 0 for male students and 1 for female respondents) is insignificant for eight indices except concern about pro-environmental behavior with a z statistic of 2.24. Furthermore, individual with part-time employment and mid-level income has no significant impact on specific environmental concern.

Estimated result of attitude towards pro-environmental behavior is presented in table XII. Concerning individual's environmental consideration when they are buying electronics, we find that women are less concern than male and marginal effects of higher education and full employment status on choice probability is higher (0.338 and 0.054 when $y = 4$ and when $y = 3$ marginal effects on probabilities are 0.026 and 0.005 consecutively). Age is found significant factor when buying electronics with positive sign and estimated marginal effects of age on probabilities of choosing "regard its environmental impact as the first issue to consider" and "regard its environmental impact as the second issue to consider" are 0.004 and 0.0005 respectively.

Conclusion and Policy Implication

Urban impacts of environmental problems are local issue and solutions to these problems must be made at a local level. However, national and multinational environmental research and policy actions should be conducted to spur individual environmental concern that may be a core to protect urban environment. The survey findings reported in this paper represents an initial attempt to understand determinants as a policy making variables involved in environmental concern. The study suggest a local understanding of individuals values, motives and pro-environmental behavior that motivate urban environmental concern is needed before we formulate environmental policies or interventions designed to increase pro-environmental behavior. The results from OPM about the relationship between environmental concerns and socio-economic determinants, specifically education, income and individual age can influence urban policy makers to formulate feasible actions. Exploring the connectivity between income and environmental concerns has brought us closer to understanding the connectivity of City Corporation's taxation policy and financing plan on environmental protection in general. Of the findings this research generated, the most salient is the finding that young with higher education level has an undeniably strong positive correlation with the environmental concern. This work serves as a starting point and we suggest further study to explore the topic of behavioral

aspect environmental concern and willingness to pay to protect city areas environment.

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