QMSS – Data Analysis Final Independent Project

Does Environmental Concern Translate into Pro-environmental Behavior?

Introduction

Environmental issues have gained importance in our society and consistently become more of interest to the public. People are more knowledgeable about environment related problems and develop the awareness of recycling, energy saving and purchasing environmentally friendly products. Generally, it is assumed that such environmental concern will motivate people to take their responsibility by developing pro-environmental habits in their everyday life. However, a few empirical studies show that although people are becoming more conscious of environmental issues, such environmental concern does not necessarily translate into pro-environmental behavior, at least not directly affect people's action on environmental issues. In other words, there is a difference "between what they say and what they do". James Blake (1999) called the phenomenon that people place high value on the environment while show low level of environmentally responsible action taken, as "Value-Action Gap[1]".

According to the data from General Social Survey of 2010, 63% people show high self-reported degree of environmental concern (at least 4 out of 5 degree, with 5 being the highest); 45% people respond that they are fairly or even very willing to pay higher prices to protect the environment; 53.69% people agree they will do what they can to protect the environment, even at the expense of time and money. However, when it comes to the actual environmentally responsible behavior, it seems that the concerns for the environment do not all turn into action. 34% people "always or often" buy pesticide-free fruits and vegetables; only 18% people often drive less; 28% people usually save or reuse water for environmental reasons. The study of the public environmental concern and action taken should be insightful for policymakers to promote environmental protection or tackle environmental issues.

This project grew out of the curiosity about how environmental concern and action in the real life are associated. I will focus on the relationship between environmental concern and pro-environmental behavior based on the response people made to the environment related questions in General Social Survey of the year 2010. Furthermore, I will also explore how other factors will affect the impact of the environmental concern on the environmentally friendly behaviors or habits.

[1] Blake, J. (1999). Overcoming the 'Value-Action Gap' in Environmental Policy: Tensions between National Policy and Local Experience. *Local Environment: The International Journal of Justice and Sustainability 4* (3): 257–278.

Data and Methods

The study will primarily use the respondents' self-reported degree of environmental concern as an indicator of the environmental concern (EC), which ranges from 1 to 5, and respondents' reported daily behavior related to environmental protection (EB), including purchase of fruits and vegetables grown without pesticides or chemicals, cutting back on driving car, saving water, recycling and reducing fuel and energy at home. I will also include people's perception of the seriousness of environmental problems (ES), which I presume will affect their behavior, by combining their attitudes towards issues including car pollution, industrial air pollution, water pollution, temperature rise caused by "green effect", nuclear power and pesticides (how dangerous they are to the environment). The data of these key independent variables and dependent variables all come from 2010 GSS.

Dependent Variables

The dependent variable of the model is Environmentally Responsible Behavior (EB). Although the category of behavior related to the environmental protection is quite broad, because of the limitation of options in the GSS data, I include 5 types of behavior of environmental protection and further summarize them into 3 main categories.

(1) EB1: Frequency of Buying Pesticide Free Fruits and Vegetables. Basically, I use the variable "chemfree" in GSS. The variable is recoded in the order of increasing frequency, ranging from **1**, meaning "never", to **4**, meaning "always", and I exclude those respondents who answers these products are "not available" to them or they "do not know" about these products.

(2) EB2: Frequency of Water and Energy Conservation. I combine the following variables in GSS by creating a scale to represent them: cutting back on driving car ("drivless"), saving or reusing water ("H2OLESS") and reducing fuel and energy at home ("redcehme"). All of them are recoded in the direction of increasing frequency, ranging from **1**, meaning "never", to **4**, meaning "always", and responses like "do not know" and "no car, do not drive" are excluded. The scale "EB2" is created by standardization, which represents the frequency of water and energy conservation. However, the scale reliability coefficient of these three variables is 0.67, which may be a little low, as shown in Table 1.

Table 1: *Scale Reliability Coefficient of EB2*

Test scale = mean (unstandardized items)	
Average interitem covariance:	0.3538411
Number of items in the scale:	3
Scale reliability coefficient:	0.6684

(3) EB3: Frequency of Recycling. I simply use GSS variable "recycle", arrange them in the same direction as the variables above and exclude answers, "not available" and "do not know". EB3 ranges from **1**, meaning "never", to **4**, meaning "always", which shows the frequency of recycling.

Key Independent Variables

The key independent variables in the model are people's self-reported degree of environmental concern (EC) as well as their view on the seriousness of environmental problems (ES).

(1) EC: Degree of Environmental Concern. I use people's response to the question "how concerned are you about environmental issues" and exclude the answer "do not know". EC shows the degree of environmental concern, ranging from **1**, meaning "not at all concerned", to **5**, meaning "very concerned".

(2) ES: People's Perception of the Seriousness of Environmental Problems. I look at the issues including the air pollution caused by car ("carsgen" in GSS), pesticides and chemicals used in farming ("chemgen"), air pollution caused by industry ("indusgen"), nuclear power stations ("nukegen"), temperature rise caused by "greenhouse effect" ("TEMPGEN1") and water pollution ("watergen"), and then explore the degree of dangerousness at which people perceive these environmental problems. These variables are all recoded in the increasing perception of the dangerousness of these problems and excluded answers like "do not know". The responses all range from **1**, meaning "not dangerous", to **5**, meaning "extremely dangerous". Again, to find an underlying trait of these variables, a scale "ES" is created by standardization to represent people' perception of the seriousness of environmental problems, which I assume that the more serious they think these problems are to the environment, the more likely they will adopt environmentally friendly living habits in their everyday life. The scale reliability coefficient is 0.81, which indicates ES is a relatively strong indicator, as shown in Table 2.

Table 2: *Scale Reliability Coefficient of ES*

Test scale = mean (unstandardized items)	
Average interitem covariance:	0.3850664
Number of items in the scale:	6
Scale reliability coefficient:	0.8062

Controlled Variables

Basically, I will include several demographic attributes and socioeconomic status factors as controlled variables in the model.

(1) realinc: Total Family Income in Constant Dollars. Its value ranges from USD259 to USD119606.1. I assume the income will be positively associated with EB1, the purchasing behavior of pesticide-free vegetables and fruits, because these products are generally more costly; but it may be negatively related to EB2, the water and energy conservation, because high income group are the major consumers of automobiles and other energy-consuming appliances, and income tends to be positively correlated with the amount of water use. However, some studies show that there is no correlation between income level and recycling habits.

(2) educ: People's Education Level. I will use "educ" in GSS, which shows respondents' highest year of school completed, ranging from **0**, meaning "no formal schooling" to **20**, meaning "8 years of college", and exclude response of "do not know". The usual expectation of the correlation between education level and environmentally responsible behavior should be positive, i.e. one more schooling years people completed will lead to more actual behavior of environmental protection.

(3) female: People's Gender (1=Female; 0=Male). I expect females are more likely to develop environmentally responsible habits than males, since some research found out that women display higher levels of environmental concern and behavior adjustments, compared to males[2].

(4) polviews: Political Views People Hold, which is measured by a seven-point scale, rearranged from **1**, meaning "extremely liberal" to **7**, meaning "extremely conservative". Response of "do not know" is excluded. It is generally expected that people hold more liberal political views tend to display higher level of environmentally responsible behavior. This variable should be negatively correlated with the dependent variable.

Summary of Data

Table 3: *Descriptive Statistics Table for Variables*

(1) Mean, Standard Deviation, Range, Skewness and Kurtosis

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
EB1	1385	2.158123	0.9819068	1	4	0.3714749	2.078592
EB2	1317	0.0062806	0.774255	-1.045181	2.167569	0.4356486	2.562694
EB3	1394	2.903874	1.080772	1	4	-0.457096	1.853762
EC	1404	3.861111	1.104619	1	5	-0.758561	2.920289
ES	1235	0.0201589	0.7172926	-2.059277	1.399921	-0.101334	2.464317
realinc	1805	30813.31	29348.29	259	119606.1	1.720874	5.717434
educ	2039	13.46101	3.149267	0	20	-0.428579	4.233134

[2] Hunter, Lori M., et al (2004). Cross-National Gender Variation in Environmental Behaviors. *Social Science Quarterly*, *85*(3).

polviews	1973	4.079574	1.456695	1	7	-0.067432	2.511447
female	2044	0.56409	0.4959968	0	1	-0.258492	1.066818

(2) Percentiles

Variable	25th Percentile	Binom Interp. (25th) 95% Conf. Interval		75th Percentile	Binom Interp. (75th) 95% Conf. Interval	
		L(a)	L(b)		L(a)	L(b)
EB1	1	1	1	3	3	3
EB2	-0.697336	-0.7031018	-0.697336	0.406729	0.400963	0.7156593
EB3	2	2	2	4	4	4
EC	3	3	3	5	5	5
ES	-0.508818	-0.5489243	-0.466787	0.5415704	0.495359	0.6284454
realinc	11007.5	9712.5	11007.5	42735	34965	42735
educ	12	12	12	16	16	16
polviews	3	3	3	5	5	5
female	-	-	-	-	-	-

Variable	95th Percentile	Binom Interp. (95th) 95% Conf. Interval	
		L(a)	L(b)
EB1	4	4	4
EB2	1.438731	1.330712	1.444497
EB3	4	4	4
EC	5	5	5
ES	1.212065	1.106376	1.252172
realinc	119606.1	119606.1	119606.1
educ	19	18	19
polviews	6	6	6.406814
female	-	-	-

For dependent variables, EB1's mean equals 2.16, indicating, on average, people only "sometimes' purchase fruits and vegetables grown without pesticides and chemicals. The total of 64.48% people's answers is "never" or "seldom". The distribution is approximately symmetric (skewness = 0.37 ϵ (-0.5, 0.5)) with shorter and thinner tails (kurtosis < 3). Standard deviation equals 0.98, meaning the typical distance of a response away from the mean is 0.98. For EB2, 44% people "never" save or reuse water for environmental reasons; 48% people "never" drive less for environmental reasons, and the proportion of people "always" drive less for environmental reasons is only 4.8%; 57% people "never" or "sometimes" reduce energy or fuel used at home. EB3 has the mean which is almost 3, indicating, on average, people "often" recycle cans, bottles, papers etc.

For independent variables, EC's mean approximates 4, showing that, generally people report a high degree of environment concern. The distribution of EC is moderately negatively skewed and with its kurtosis ≈ 3, it is mesokuirtic. Its 25th percentile is 3 and 75th percentile is 5 (very concerned about the environment). ES has the range, (-2.1, 1.4), with its distribution approximately symmetric. But it still shows diversity in people's perception of seriousness of different category of environmental problems, for its mean is 0.02 while its standard deviation is 0.72. 54% people think pesticides and chemicals used in the farming are "extremely or very dangerous"; 46% for car pollution and nuclear power station; 49% for temperature rise caused by "greenhouse effect". Moreover, a greater proportion of people agree water pollution and air pollution caused by industry, which are 70% and 66% respectively.

For controlled variables, *realinc* show high variability in its data. With its skewness equals 1.72, the distribution is highly positively skewed; the kurtosis is 5.71, showing that the distribution's tails are longer and fatter than normal distribution. I will use the log transformation in the analysis to make the variable more "normal" and easier to interpret. A range of total family income which has 95% probability of containing the actual 25th percentile, 75th percentile and 95th percentile are (9712. 5, 11007.5), (34965, 42735) and 119606.1 respectively. For *educ*, he average number of completed schooling years is 13, 1 year of college and 75th percentile is 16. The distribution of political views is approximately symmetric, with its "average" political views being "moderate". And, more females took part in the survey than males.

(More tables describing variables can be found in the **Appendix**.)

Hypotheses

(1) Both environmental concern and realization of seriousness of environmental problems does not directly affect people's environmentally responsible behavior.

(2) Controlling for the demographic and socioeconomic status variables, the increase in the people's degree of environmental concern as well as the increase in the realization of seriousness of environmental problems will lead to increase in the frequency of people's environmentally responsible behavior.

Models

Multiple Linear Regression Model

I will first perform three multiple linear regression models with three dependent variables respectively, EB1, EB2 and EB3, representing three types of environmentally responsible behavior. Because these dependent variables are to evaluate the frequency of behavior and are ordinal level variables, they satisfy the measurement requirement of linear regression model. Three prediction models are:

$$EB_1 = a + b_1 EC + b_2 ES + c_1 \ln(realinc) + c_2 educ + c_3 polviews + c_4 female \quad \text{..... (1.1)}$$

$$EB_2 = d + e_1 EC + e_2 ES + e_1 \ln(realinc) + f_2 educ + f_3 polviews + f_4 female \ldots\ldots\ldots\ldots \quad (1.2)$$

$$EB_3 = g + h_1 EC + h_2 ES + j_2 educ + j_3 polviews + j_4 female \ldots\ldots\ldots\ldots\ldots\ldots \quad (1.3)$$

Note: the controlled variable *realinc* is included by taking the natural logarithm of its real value, i.e. *ln(realinc)*. The variable *ln(realinc)* is excluded from the equation 1.3, since studies show that income is not related with the behavior of recycling.

(1) Prediction Equation 1.1 with Dependent Variable EB1

As shown in the Table 4, the correlation between EB1 and EC as well as EB1 and ES are weak.

Table 4: *Correlation between Variables*

	EB1	EC	ES
EB1	1		
EC	0.2299	1	
ES	0.2603	0.423	1

Table 5: *Multiple Linear Regression Results 1*

Source	SS	df	MS		Number of obs	1064
					F(6, 1057)	22.17
Model	114.359636	6	19.0599394		Prob > F	0.0000
Residual	908.669499	1057	0.8596684		R-squared	0.1118
					Adj R-squared	0.1067
Total	1023.02914	1063	0.96239806		Root MSE	0.92718

EB1	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
EC	0.1522993	0.030103	5.06	0.000	0.0932301	0.211368
ES	0.2484537	0.047236	5.26	0.000	0.1557671	0.34114
lnrealinc	-0.0567429	0.026844	-2.11	0.035	-0.1094157	-0.00407
educ	0.0231565	0.010561	2.19	0.029	0.0024336	0.043879
polviews	0.0014669	0.020664	0.07	0.943	-0.0390798	0.042014
female	0.1738588	0.058704	2.96	0.003	0.0586691	0.289049
_cons	1.726935	0.296608	5.82	0.000	1.144927	2.308943

$$EB_1 = 1.73 + 0.15EC + 0.25ES - 0.06\ln(realinc) + 0.02educ + 0.0015polviews + 0.17female$$

At the 95% Confidence interval, the coefficients mostly are statistically significant, because P-Values < 0.05, except for the coefficient on the variable *polviews*. However, the adjusted R-squared is only 0.1067, which means only 10.67% of the total variance in the dependent variable EB1 can be explained by the prediction model, or the explanatory variables.

Controlling for the total family income, education level, political views people hold, gender and their perception of the seriousness of environmental problems, one more degree of environmental concern people report, the "frequency" of purchasing pesticide- and chemical-free vegetables and fruits will move up by 0.15.

Controlling for the total family income, education level, political views people hold, gender and their reported degree of environmental concern, one category of their perception of the seriousness of environmental problems people move up, the "frequency" of purchasing pesticide- and chemical-free vegetables and fruits will move up by 0.25.

The "frequency" here should be understood along with the original definition of the dependent variable, i.e. 1 = never, 2 = sometimes, 3 = often, 4 = always. The effect on the dependent variable should rely on its previous level, and the change is really minimum. *This applies to the prediction model 1.2 and 1.3 as well.*

Besides, the total family income is negatively associated with the purchasing of pesticide-and chemical-free vegetables and fruits, which is contrary to my expectation. A USD1100 ($\approx e^7$) increase in the total family income will lead to 0.42 ($= 7 \times 0.06$) decrease in the "frequency" of the purchase, holding all the other variables constant. One more schooling years completed will lead to 0.02 increase in the frequency of purchase, with all the other variables held constant. The coefficient on *polviews* is not statistically significant, and the sign, again, is contrary to my assumption, since it indicates the more conservative a person is, the more likely he will purchase the pesticide- and chemical-free vegetables and fruits, controlling for the other variables (the change is insignificant). Females are more frequently to purchase vegetables and fruits, holding other variables constant, than males by increasing the "frequency" by 0.17.

(2) Prediction Equation 1.2 with Dependent Variable EB2

As shown in the Table 6, the correlation between EB2 and EC as well as EB2 and ES are at most moderate, which is around 0.30.

Table 6: *Correlation between Variables*

	EB2	EC	ES
EB2	1		
EC	0.3054	1	
ES	0.3148	0.423	1

Table 7: *Multiple Linear Regression Results 2*

Source	SS	df	MS	Number of obs	1024
				F(6, 1017)	30.44

Model	94.847011	6	15.8078352	Prob > F	0.0000
Residual	528.220895	1017	0.51939124	R-squared	0.1522
				Adj R-squared	0.1472
Total	623.067906	1023	0.60905954	Root MSE	0.72069

EB2	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
EC	0.1583658	0.02472	6.41	0.000	0.1098584	0.206873
ES	0.2326024	0.038055	6.11	0.000	0.1579277	0.307277
lnrealinc	-0.0202807	0.021637	-0.94	0.349	-0.0627399	0.022178
educ	0.0057631	0.008393	0.69	0.492	-0.0107069	0.022233
polviews	-0.0253777	0.016417	-1.55	0.122	-0.0575926	0.006837
female	0.0471768	0.046424	1.02	0.31	-0.0439209	0.138275
_cons	-0.3830829	0.243614	-1.57	0.116	-0.8611254	0.09496

$$EB_2 = -0.38 + 0.16EC + 0.23ES - 0.02\ln(realinc) + 0.0058educ - 0.03polviews + 0.047female$$

Although the coefficient on the EC and ES are statistically significant, all the coefficients on the controlled variables are statistically insignificant, at 95% Confidence Interval, judging by the P-Value. Adjusted R-squared is only 0.1472, indicating only 14.72% of the total variance in the frequency of water and energy conservation can be explained by these explanatory variables.

Controlling for the total family income, education level, political views people hold, gender and their perception of the seriousness of environmental problems, one more degree of environmental concern people report, the "frequency" of water and energy conservation will move up by 0.16.

Controlling for the total family income, education level, political views people hold, gender and their reported degree of environmental concern, one category of their perception of the seriousness of environmental problems people move up, the "frequency" of water and energy conservation will move up by 0.23.

Besides, the USD1100 ($\approx e^7$) increase in the total family income will lead to 0.14 ($= 7 \times 0.02$) decrease in the "frequency" of the water and energy conservation, holding all the other variables constant. The direction of change matches my expectation. One more schooling years completed will lead to 0.02 increase in the frequency of purchase, with all the other variables held constant. The coefficient on *polviews* indicates the more conservative a person is, the less frequently he will conserve water and energy, controlling for the other variables. Females are more frequently to conserve water and energy, holding other variables constant, than males by increasing the "frequency" by 0.047. However, the model has great limitations because of the statistical insignificance of the coefficients.

(3) Prediction Equation 1.3 with Dependent Variable EB3

Table 8 suggests that the correlation between EB2 and EC as well as EB2 and ES are weak.

Table 8: *Correlation between Variables*

	EB3	EC	ES
EB3	1		
EC	0.2069	1	
ES	0.147	0.423	1

Table 9: *Multiple Linear Regression Results 3*

Source	SS	df	MS		
				Number of obs	1180
				F(5, 1174)	21.41
Model	108.456813	5	21.6913625	Prob > F	0.0000
Residual	1189.3898	1174	1.01310886	R-squared	0.0836
				Adj R-squared	0.0797
Total	1297.84661	1179	1.10080289	Root MSE	1.0065

EB3	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
EC	0.1508177	0.030957	4.87	0.000	0.0900799	0.211556
ES	0.1350013	0.047977	2.81	0.005	0.0408717	0.229131
educ	0.0667268	0.010004	6.67	0.000	0.0471001	0.086354
polviews	-0.0229366	0.021151	-1.08	0.278	-0.0644346	0.018562
female	-0.0178386	0.060007	-0.3	0.766	-0.1355714	0.099894
_cons	1.545958	0.211732	7.3	0.000	1.130543	1.961373

$$EB_3 = 1.55 + 0.15EC + 0.14ES + 0.067educ - 0.023polviews - 0.018female$$

At 95% Confidence Interval, the coefficient on the EC, ES and *educ* are statistically significant, while the coefficient on the *polivews* and *female* is statistically insignificant, judging by the P-Value. Adjusted R-squared is even lower and indicates that only 7.97% of the total variance in the frequency of recycling can be explained by these explanatory variables.

Controlling for the total family income, education level, political views people hold, gender and their perception of the seriousness of environmental problems, one more degree of environmental concern people report, the "frequency" of recycling will move up by 0.15.

Controlling for the total family income, education level, political views people hold, gender and their reported degree of environmental concern, one category of their perception of the seriousness of environmental problems people move up, the "frequency" of recycling conservation will move up by 0.14.

Besides, one more schooling years completed will lead to 0.067 increase in the frequency of purchase, with all the other variables held constant. The coefficient on *polviews* indicates the more conservative a person is, the less frequently he will develop recycling habits. Females are less frequently to recycle, holding other variables constant, than males by decreasing the "frequency" by 0.018. However, both coefficients on *polviews* and *female* are statistically insignificant.

Remarks on the Multiple Linear Regression Models

According to the results above obtained from multiple linear regression, both environmental concern and perception of the seriousness of environmental problems somehow increase the "frequency" of three types of environmentally responsible behavior, controlling for the education, income, gender and political views people hold, but the effect only leads to minimal change. Besides, the correlations between them are not strong. These two variables may not directly affect the action of environmental protection.

I also consider the interaction effect of education and income in 1.1 and 1.2. I assume that additional schooling years respondents have completed will lead to the increase in the effect of income on the frequency of purchasing of the pesticide- and chemical-free food and conserving water and energy. However, the results of model 1.1 shows that the coefficients on the interaction term is statistically insignificant, so is the coefficient on *educ* and adjusted R-squared is even lower. The coefficients on EC and ES are almost the same as the model where the interaction term is not included. Similar results can be found in Model 1.2 after the interaction term is included. Thus, the interaction term should not be included in the model. (The results are shown in Table 21 in the **Appendix**.)

Furthermore, I find the models are insufficient in discussing the relationship between independent and dependent variables in this case. First, it is difficult to interpret the relationship since EC, ES, EB1, EB2 and EB3 are all ordinal variables. In the multiple linear regression model, I treat them as continuous variables, which may lead to large bias, since they are originally four or five discrete categories. Second, the adjusted R-squared is low in all these models, which indicates the weak explanatory power of the model, and also, statistical insignificance of several coefficients makes the analysis confusing. These limitations make the inference drawn from the models not very convincing.

Ordinal Logistic Regression Model

Considering the limitations of multiple linear regression model mentioned above, it may not be an appropriate statistical method to interpret ordinal variables since it ignores the ordinal measurement and treats them as continuous variable. Some researchers suggest the ordered logistic and probit regression model may provide more reliable results and assumptions' tests,

although they are more complex than the multiple regression models[3]. Therefore, I perform the ordinal logistic regression model to further study the effect of environmental concern on the environmentally responsible behavior. Three prediction models are:

$$logit[P(EB_1 \leq k)] = a_k + b_1 EC + b_2 ES + c_1 \ln(realinc) + c_2 educ + c_3 polviews + c_4 female.. \quad (2.1)$$

$$logit[P(EB_2 \leq l)] = d_l + e_1 EC + e_2 ES + e_1 \ln(realinc) + f_2 educ + f_3 polviews + f_4 female \ldots. (2.2)$$

$$logit[P(EB_3 \leq m)] = g_m + h_1 EC + h_2 ES + j_2 educ + j_3 polviews + j_4 female \ldots\ldots\ldots\ldots\ldots\ldots \quad (2.3)$$

Note: k=1, 2, 3, 4, the number of response EB1's category; l=1, 2, 3, … , 61, the number of response EB2's category (the number of category becomes 61, not 4, due to the created scale)' m=1, 2, 3, 4, the number of response EB3's category.

(1) Prediction Equation 2.1 (EB1)

Table 10: *Ordinal Logistic Regression Results 1*

Iteration 0: log likelihood = -1405.1784
Iteration 1: log likelihood = -1343.7522
Iteration 2: log likelihood = -1343.359
Iteration 3: log likelihood = -1343.3587
Iteration 4: log likelihood = -1343.3587

Ordered logistic regression	Number of obs	=	1064
	LR chi2(6)	=	123.64
	Prob > chi2	=	0.0000
Log likelihood = -1343.3587	Pseudo R2	=	0.044

EB1	Coef.	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
EC	0.3044124	1.355828	0.0614579	4.95	0.000	0.1839572	0.4248676
ES	0.4817516	1.618908	0.0958755	5.02	0.000	0.2938391	0.6696642
lnrealinc	-0.105609	0.899776	0.0544672	-1.94	0.053	-0.212363	0.0011443
educ	0.0461073	1.047187	0.0207498	2.22	0.026	0.0054385	0.0867761
polviews	0.0103022	1.010355	0.0416454	0.25	0.805	-0.071321	0.0919257
female	0.3517238	1.421516	0.1169843	3.01	0.003	0.1224388	0.5810089
/cut1	0.062498	0.6042637				-1.121837	1.246833
/cut2	1.621826	0.6070231				0.4320821	2.811569
/cut3	3.234234	0.6118385				2.035052	4.433415

[3] Winship, Christopher & Robert D., Mare (1984). Regression Models with Ordinal Variables. *American Sociological Review*, Vol. 49 (August), 512-525.

Table 10 shows the proportionate slopes across 4 different categories as well as 3 different intercepts of 3 estimated simultaneous logistic equations.

At 95% Confidence Interval, the coefficient on the EC, ES, *educ* and *female* are statistically significant (P-Value < 0.05), while the coefficient on the *lnrealinc* and *polviews* is statistically insignificant (P-Value > 0.05). Pseudo R-squared is 0.044. Since P-Value for *polviews* is large, I drop *polviews* and do not find the improvement judging by the change in pseudo R-squared, which is now 0.0434 and *lnrealinc* is still statistically insignificant. I still choose to keep *polviews* in the model.

For one more degree of environmental concern people reported, their odds of displaying a higher level of frequency of purchasing fruits and vegetables grown without pesticides and chemicals are 1.36 times higher, holding all the other variables constant, including total family income, education level, political views people hold, gender and their perception of the seriousness of environmental problems.

For one higher category of people's perception of the seriousness of environmental problems, their odds of displaying a higher level of frequency of purchasing pesticide- and chemical-free food are 1.62 times higher, holding all the other variables constant, including total family income, education level, political views people hold, gender and their self-reported degree of environmental concern.

The level of frequency of purchasing fruits and vegetables grown without pesticides and chemicals (EB1) is basically **1**, meaning "never", **2**, meaning "sometimes", **3**, meaning "often" and **4** meaning "always". The interpretation based on the ordinal logistic regression is much clearer than that based on the multiple linear regression model.

Besides, for one unit increase in the natural logarithm of respondents' total family income, their odds of being displaying a higher level of frequency of purchasing pesticide- and chemical-free food are (statistically insignificant) 0.90 times over the previous unit level in income, holding all the other variables constant, i.e. the odds go down by 10%, which is contrary to my expectation. For one more schooling years the respondents have completed, their odds of displaying a higher level of frequency of purchasing pesticide- and chemical-free food are 1.05 times higher, holding all the other variables constant. The coefficient on *polviews* is not statistically significant, and its effect on the change in the odds of EB1 is small (odds only go up by 1%); however, its sign is contrary to my assumption. Females' odds of displaying a higher level of frequency of purchasing pesticide- and chemical-free food are 1.42 times higher than males', holding the other variables constant.

From Table 22 (in Appendix) which shows discrete changes of the explanatory variables on the change in probabilities for EB1, we can see that the marginal effect of increasing respondents' degree of environmental concern is reflected in their probability of "always" purchasing pesticide- and chemical-free food increasing by 2.7%; while the marginal effect

of increasing perception of the seriousness of environmental problems is reflected in their probability of "always" purchasing pesticide- and chemical-free food increasing by 4.3%.

Then, the test for the parallel odds (parallel regression) assumption, Brant test, is conducted under the null hypothesis that slope coefficients are identical across levels of the outcome variable, i.e. each probability curve is assumed to differ only in being shifted to the left or right. As shown in Table 11, the variable *realinc* violates the parallel regression assumption. I further try to perform the Generalized Ordered Logit Regression, which allows some of the slopes to not be parallel.

Table 11: *Brant Test of Parallel Regression*

Variable	chi2	p>chi2	df
All	24.85	0.016	12
EC	2.82	0.244	2
ES	1.32	0.518	2
lnrealinc	8.05	0.018	2
educ	5.92	0.052	2
polviews	0.25	0.882	2
female	2.97	0.226	2

A significant test statistic provides evidence that the parallel regression assumption has been violated.

Table 12: *Generalized Ordinal Logistic Regression for EB2*

Generalized Ordered Logit Estimates — Number of obs = 1064
LR chi2(18) = 150.14
Prob > chi2 = 0.0000
Log likelihood = -1330.1108 — Pseudo R2 = 0.0534

EB1	Coef.	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
never							
EC	0.3226081	1.380724	0.072	4.46	0.000	0.1807723	0.464444
ES	0.4264067	1.531744	0.118	3.63	0.000	0.1960315	0.6567819
lnrealinc	0.0111283	1.01119	0.066	0.17	0.867	-0.118893	0.1411495
educ	0.0484498	1.049643	0.025	1.92	0.054	-0.000898	0.0977976
polviews	-0.014133	0.9859667	0.053	-0.27	0.790	-0.118347	0.0900812
female	0.484387	1.62318	0.145	3.35	0.001	0.2009524	0.7678215
_cons	-1.289737		0.739	-1.75	0.081	-2.737785	0.1583104
sometimes							
EC	0.2565765	1.292498	0.073	3.52	0.000	0.1135759	0.3995771
ES	0.471073	1.601712	0.111	4.24	0.000	0.2532586	0.6888874
lnrealinc	-0.171014	0.84281	0.061	-2.78	0.005	-0.291534	-0.050494

educ	0.0624327	1.064423	0.024	2.63	0.009	0.0158414	0.1090241
polviews	0.0063322	1.006352	0.048	0.13	0.896	-0.08872	0.1013846
female	0.2378494	1.268518	0.136	1.74	0.081	-0.029401	0.5050999
_cons	-0.936024		0.692	-1.35	0.176	-2.292221	0.4201736
often							
EC	0.4453875	1.561095	0.123	3.63	0.000	0.2046606	0.6861144
ES	0.7005035	2.014767	0.17	4.13	0.000	0.3678197	1.033187
lnrealinc	-0.163808	0.8489054	0.085	-1.93	0.053	-0.329772	0.0021568
educ	-0.015869	0.9842564	0.034	-0.46	0.643	-0.082915	0.0511773
polviews	0.0488773	1.050092	0.069	0.71	0.481	-0.086981	0.1847358
female	0.3436041	1.41002	0.211	1.63	0.104	-0.0704	0.7576083
_cons	-2.651135		1.016	-2.61	0.009	-4.642408	-0.659862

From Table 12, the coefficients on EC and ES are all positive, which means, the higher value of EC and ES makes it more likely that the respondent will be in a higher category of frequency of purchasing pesticide- and chemical-free fruits and vegetables than the current one, controlling for all the other variables. However, the sign of the coefficients on controlled variables, except for *female*, whose coefficients are always positive, in different category are different. For example, more schooling years makes the respondent more likely to be in a higher category of purchasing pesticide- and chemical-free food than in the current category, when the current category is either "never" or "sometimes", holding the other variables constant. However, when the current category is "often", *educ* affects the explanatory variable in an opposite direction. More schooling years increase the likelihood of being in the current category "often" (a lower category) than in the category "always" (a higher category). This information is obscured in an ordinal logistic regression model[4]. However, the generalized ordinal logistic regression model may generate too many parameters, which add to the difficulty of interpretation.

(2) Prediction Equation 2.2 (EB2)

Table 13: *Ordinal Logistic Regression Results 2*

```
Iteration 0:   log likelihood = -3466.2807
Iteration 1:   log likelihood = -3380.4328
Iteration 2:   log likelihood = -3379.6099
Iteration 3:   log likelihood = -3379.6093
Iteration 4:   log likelihood = -3379.6093

Ordered logistic regression                     Number of obs   =       1024
                                                LR chi2(6)      =     173.34
```

[4] Williams, Richard (2006). Generalized Ordered Logit/ Partial Proportional Odds Models for Ordinal Dependent Variables. *The Stata Journal 6* (1), 58-82.

Prob > chi2 = 0.0000

Log likelihood = -3379.6093 Pseudo R2 = 0.025

EB2	Coef.	Odds Ratio	Std. Err.	z	P>z	[95% Conf. Interval]	
EC	0.4244983	1.528823	0.0634143	6.69	0.000	0.3002085	0.548788
ES	0.5375781	1.711856	0.0933713	5.76	0.000	0.3545737	0.7205824
lnrealinc	-0.071569	0.930932	0.0515593	-1.39	0.165	-0.172623	0.0294853
educ	0.0209026	1.021123	0.020668	1.01	0.312	-0.019606	0.0614111
polviews	-0.062767	0.9391621	0.0397624	-1.58	0.114	-0.1407	0.0151658
female	0.1008241	1.106082	0.1137444	0.89	0.375	-0.122111	0.3237589
/cut1	-0.84607	-0.84607	0.5923012			-2.006959	0.3148187
/cut2	-0.293907	-0.293907	0.5915878			-1.453398	0.8655834
	**********omitted**********						
/cut59	5.586631	5.586631	0.6481576			4.316266	6.856997

Table 13 shows the proportionate slopes across 4 different categories as well as 59 cut scores.

At 95% Confidence Interval, the coefficient on the EC and ES are statistically significant (P-Value < 0.05), while the coefficient on all the controlled varaibles *lnrealinc*, *educ*, *female* and *polviews* are statistically insignificant (P-Value >0.05). Pseudo R-squared is 0.025.

For one more degree of environmental concern people reported, their odds of displaying a higher level of frequency of water and energy conservation are 1.53 times higher, holding all the other variables constant, including total family income, education level, political views people hold, gender and their perception of the seriousness of environmental problems.

For one higher category of people's perception of the seriousness of environmental problems, their odds of displaying a higher level of frequency of water and energy conservation are 1.72 times higher, holding all the other variables constant, including total family income, education level, political views people hold, gender and their self-reported environmental concern degree.

Besides, for one unit increase in the natural logarithm of respondents' total family income, their odds of displaying a higher level of frequency of water and energy conservation are 0.93 times over the previous level in income, holding all the other variables constant, i.e. the odds go down by 7%, which is, again, contrary to my expectation. For one more schooling years the respondents have completed, their odds of displaying a higher level of frequency of conserving water and energy are 1.02 times higher, holding all the other variables constant. The one level change in people's political views, moving towards "extremely conservative", their odds of being in a higher level of behavior frequency go down by 7%, with the other variables held constant. Females' odds of displaying a higher level of frequency of water and energy conservation are 1.11 times higher than males', holding the other variables constant.

I find some problems in this model. Since the dependent variable is basically a scale I created, there are many more ordered levels than the original 4 categories. The ordered logistic regression still can be run, but the Brant test cannot be performed and the marginal effect of the change in the independent variable is confusing. In this case, the ordinal logistic regression model is not any better than the linear regression model. But since the dependent variable still should not be treated as the continuous variable, I choose to use the ordered logistic regression model.

(3) Prediction Equation 2.3 (EB3)

Table 14: *Ordinal Logistic Regression Results 3*

Ordered logistic regression	Number of obs = 1180
	LR chi2(5) = 98.97
	Prob > chi2 = 0.0000
Log likelihood = -1482.1467	Pseudo R2 = 0.0323

EB3	Coef.	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
EC	0.2640383	1.302178	0.0578762	4.56	0.000	0.1506031	0.3774736
ES	0.2580833	1.294447	0.0896965	2.88	0.004	0.0822815	0.4338852
educ	0.1202097	1.127733	0.0187587	6.41	0.000	0.0834433	0.1569762
polviews	-0.041708	0.9591502	0.0393889	-1.06	0.29	-0.118909	0.0354933
female	-0.047337	0.9537655	0.110169	-0.43	0.667	-0.263265	0.16859
/cut1	0.3571091		0.3924149			-0.41201	1.126228
/cut2	1.818234		0.3933995			1.047185	2.589282
/cut3	2.892643		0.3986846			2.111236	3.674051

Table 14 shows the proportionate slopes across 4 different categories as well as 3 different intercepts of 3 estimated simultaneous logistic equations.

At 95% Confidence Interval, the coefficient on the EC, ES and *educ* are statistically significant (P-Value < 0.05), while the coefficient on the *female*, *lnrealinc* and *polviews* is statistically insignificant (P-Value >0.05). Pseudo R-squared is 0.032.

For one more degree of environmental concern people reported, their odds of displaying a higher level of recycling habit are 1.30 times higher, holding all the other variables constant, including total family income, education level, political views people hold, gender and their perception of the seriousness of environmental problems.

For one higher category of people's perception of the seriousness of environmental problems, their odds of displaying a higher level of recycling habit are 1.29 times higher, holding all the

other variables constant, including total family income, education level, political views people hold, gender and their self-reported degree of environmental concern.

Besides, for one more schooling years the respondents have completed, their odds of displaying a higher level of recycling habit are (statistically significant) 1.13 times higher, holding all the other variables constant. The one level change in people's political views, moving towards "extremely conservative", their odds of being in a higher level of recycling behavior go down by 4%, with the other variables held constant. Females' odds of displaying a higher level of recycling habit go down by 5%, compared to males, holding the other variables constant.

As shown in the Table 23 (in Appendix), the marginal effect of increasing respondents' degree of environmental concern is reflected in their probability of "always" recycling increasing by 6.4%; while the marginal effect of increasing perception of the seriousness of environmental problems is reflected in their probability of "always" recycling increasing by 6.2%.

Then, I conduct Brant test, under the null hypothesis that slope coefficients are identical across levels of the outcome variable. As shown in Table 14, no variables violate the parallel regression assumption.

Table 15: *Brant Test of Parallel Regression*

Variable	chi2	p>chi2	df
All	8.04	0.624	10
EC	0.69	0.707	2
ES	0.07	0.966	2
educ	2.09	0.351	2
polviews	2.06	0.357	2
female	2.65	0.266	2

A significant test statistic provides evidence that
the parallel regression assumption has been violated.

Remarks on the Ordinal Logistic Regression

According to the results obtained from ordinal logistic regression, both the increase in environmental concern and perception of the seriousness of environmental problems lead to the increase in the respondents' odds of displaying higher level of frequency in three types of environmentally responsible behavior, controlling for the education, income, gender and political views people hold. The effect of these two variables is stronger than that of multiple regression results. They still have weak impact on the recycling habit (EB3), but have moderate impact on purchasing pesticide- and chemical-free food (EB1) and stronger impact on water and energy conservation (EB2).

Although the ordinal logistic regression model still has statistical insignificance issue, it is still a more superior model than the multiple regression model mainly because it treats ordinal variables better and makes it easier for me to interpret the change in the dependent variables. However, the Model 2.2 (EB2) is difficult to interpret and should be improved since the dependent variable is a scale with quite a few ordinal levels. Therefore, I choose the ordinal logistic regression model as my final model for EB2 and EB3 and generalized ordinal logistic regression model for EB1. (Ordinal logistic regression model can be seen as a special case for generalized ordinal logistic regression model.)

Conclusions

According to the statistical findings in this project, the increase in the people's degree of environmental concern as well as in people's perception of seriousness of environmental problems will increase the frequency of people's environmentally responsible behavior, specifically purchase of pesticide- and chemical-free fruits and vegetables, water and energy conservation and recycling. The magnitude of these effects is not very strong, which may indicate these two factors are not the major influence on the frequency of the action people have taken to protect environment.

Multiple linear regression models may lead to difficulty and even bias in interpretation when the outcome is ordinal variable. In this case, ordinal logistic regression is a better choice although the model is more complicated, especially the generalized ordinal logistic regression model adopted when discussing variable EB1.

However, the model still has its limitations. First, coefficients on the controlled variables are statistically insignificant. It should be improved by a better transformation of total family income, which has greater variability and by further exploring the relationship between political views and environmental responsibility behavior to figure out whether it should be kept as controlled variable in the model. Second, the scale created to capture the underlying traits of different variables adds to the difficulty in the choice of model as well as interpretation. It is important to study how to better incorporate the scale when it serves as the dependent variable or simply how to come up with a better scale to represent different related variables. Finally, the project does not really test the hypothesis that "the environmental concern is the direct cause of environmentally responsible behavior". Further study should focus more on how to test their causality and explore other factors influence the individuals' efforts in environmental protection.

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APPENDIX

Table 16: *Frequency of Buying Pesticide- or Chemical-Free Fruits and Vegetables*

	EB1	Freq.	Percent	Cum.
1	never	424	30.61	30.61
2	sometimes	469	33.86	64.48
3	often	341	24.62	89.1
4	always	151	10.9	100
	Total	1,385	100	

Table 17: *Frequency of Water and Energy Conservation*

Variable	Obs	Mean	Std. Dev.	Min	Max
EB2	1317	0.0062806	0.774255	-1.045181	2.167569

	"Water"Freq.	Percent	"Drive" Freq.	Percent	"Home"Freq.	Percent
never	631	44.47	637	48.22	362	25.55
sometimes	386	27.2	427	32.32	450	31.76
often	308	21.71	193	14.61	440	31.05
always	94	6.62	64	4.84	165	11.64
Total	1,419	100	1,321	100	1,417	100

Table 18: *Frequency of Recycling Glass, Cans, Papers, etc.*

	EB3	Freq.	Percent	Cum.
1	never	190	13.63	13.63
2	sometimes	317	22.74	36.37
3	often	324	23.24	59.61
4	always	563	40.39	100

Total	1,394	100

Table 19: *Degree of Environmental Concern*

EC	Freq.	Percent	Cum.
Not at all concerned (1)	60	4.27	4.27
2	86	6.13	10.4
3	349	24.86	35.26
4	403	28.7	63.96
Very concerned (5)	506	36.04	100
Total	1,404	100	

Table 20: *Perception of the Seriousness of the Environmental Probblems*

Variable	Obs	Mean	Std. Dev.	Min	Max
ES	1235	0.0201589	0.7172926	-2.059277	1.399921

	"Pesticide" Freq.	Percent	"Car" Freq.	Percent	"Nuke"Freq.	Percent
not dangerous	7	0.51	13	0.94	66	4.96
not very dangerous	103	7.49	105	7.59	210	15.78
somewhat dangerous	525	38.15	627	45.3	442	33.21
very dangerous	464	33.72	411	29.7	336	25.24
extremely dangerous	277	20.13	228	16.47	277	20.81
Total	1,376	100	1,384	100	1,331	100
	"Temp" Freq.	Percent	"Water" Freq.	Percent	"Indus" Freq.	Percent
not dangerous	78	5.89	10	0.72	4	0.29
not very dangerous	181	13.66	51	3.67	48	3.45
somewhat dangerous	416	31.4	353	25.41	417	29.98
very dangerous	364	27.47	549	39.52	545	39.18
extremely dangerous	286	21.58	426	30.67	377	27.1
Total	1,325	100	1,389	100	1,391	100

Table 21: *Multiple Regression Model with Interaction Term Included*

Source	SS	df	MS		
				Number of obs	1064
				F(7, 1056)	19.37
Model	116.397	7	16.62815	Prob > F	0.0000

Residual	906.6321	1056	0.858553	R-squared	0.1138
				Adj R-squared	0.1079
Total	1023.029	1063	0.962398	Root MSE	0.92658

EB1	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
EC	0.151661	0.030087	5.04	0.000	0.092625	0.210698
ES	0.246513	0.047222	5.22	0.000	0.153854	0.339173
lnrealinc	-0.22647	0.113395	-2	0.046	-0.44897	-0.00396
educ	-0.09873	0.079826	-1.24	0.216	-0.25537	0.057902
polviews	0.001694	0.020651	0.08	0.935	-0.03883	0.042216
female	0.175633	0.058677	2.99	0.003	0.060496	0.29077
lnrealince~c	0.012381	0.008037	1.54	0.124	-0.00339	0.028152
_cons	3.383184	1.115267	3.03	0.002	1.194793	5.571575

Source	SS	df	MS		
				Number of obs	1024
				F(7, 1016)	26.14
Model	95.09883	7	13.58555	Prob > F	0.0000
Residual	527.9691	1016	0.519655	R-squared	0.1526
				Adj R-squared	0.1468
Total	623.0679	1023	0.60906	Root MSE	0.72087

EB2	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
EC	0.15796	0.024733	6.39	0.000	0.109426	0.206493
ES	0.232243	0.038068	6.1	0.000	0.157543	0.306944
lnrealinc	-0.0826	0.092101	-0.9	0.37	-0.26333	0.098131
educ	-0.03913	0.065035	-0.6	0.548	-0.16675	0.088488
polviews	-0.02548	0.016422	-1.55	0.121	-0.05771	0.006744
female	0.047887	0.046447	1.03	0.303	-0.04326	0.13903
lnrealince~c	0.004532	0.00651	0.7	0.487	-0.00824	0.017307
_cons	0.230702	0.914775	0.25	0.801	-1.56436	2.025766

Table 22: *Change in Probabilities for EB1*

```
ologit: Changes in Probabilities for EB1

EC
            Avg|Chg|       never    sometime       often      always
Min->Max    .13282216  -.26564431   .01644963   .15975167   .08944303
   -+1/2    .03485299  -.06070118   -.0090048   .04241636   .02728963
  -+sd/2    .03695749  -.06437194  -.00954303   .04496591    .0289491
MargEfct    .03490359  -.06074753  -.00905965   .04256616   .02724101

ES
            Avg|Chg|       never    sometime       often      always
Min->Max    .17209139  -.33640754  -.00777525   .20801301   .13616977
   -+1/2    .05503699  -.09595276  -.01412123   .06677118   .04330279
  -+sd/2    .03917153  -.06823483  -.01010823    .0476459   .03069717
MargEfct    .05523711  -.09613676  -.01433746   .06736361   .04311061
```

```
lnrealinc
            Avg|Chg|       never    sometime       often      always
Min->Max   .07630665   .12110966   .03150365  -.08776586  -.06484745
   -+1/2   .01210694   .02107313   .00314075  -.01476116  -.00945272
  -+sd/2   .01399235   .02435553   .00362918  -.01705848  -.01092623
MargEfct   .01210906   .02107506   .00314305  -.01476742  -.00945069

educ
            Avg|Chg|       never    sometime       often      always
Min->Max   .09054445  -.17350724  -.00758165   .11317013   .06791877
   -+1/2   .00528643  -.00920084  -.00137201   .00644669   .00412618
  -+sd/2   .01551764  -.02701116  -.00402412   .01891655   .01211872
MargEfct   .00528661  -.00920102   -.0013722   .00644721   .00412601

polviews
            Avg|Chg|       never    sometime       often      always
Min->Max    .0070861  -.01233739  -.00183481   .00864232    .0055299
   -+1/2   .00118125  -.00205588  -.00030661   .00144058   .00092192
  -+sd/2   .00172956  -.00301021  -.00044894   .00210923   .00134987
MargEfct   .00118124  -.00205588  -.00030661   .00144057   .00092192

female
       Avg|Chg|       never    sometime       often      always
0->1   .04006598  -.07061224  -.00951973   .04898043   .03115153

             never    sometime       often      always
Pr(y|x)   .2754041   .36840901   .25682738   .09935953

              EC         ES   lnrealinc       educ    polviews      female
   x=    3.92293    .022911     9.88405    13.7744     4.04417     .545113
sd_x=    1.06057    .710454      1.1558    2.93611     1.46419     .498195
```

Table 22: *Change in Probabilities for EB2*

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ologit: Changes in Probabilities for EB3

EC
            Avg|Chg|       never    sometime       often      always
Min->Max   .12375154  -.12250341  -.12499967   .01333669    .2341664
   -+1/2   .03163944  -.02511072  -.03398713  -.00418103   .06327888
  -+sd/2   .03359883  -.02667438  -.03608553  -.00443774   .06719765
MargEfct   .03167986  -.02507944  -.03407755  -.00420273   .06335973

ES
            Avg|Chg|       never    sometime       often      always
Min->Max   .10366471  -.09186987  -.11090259  -.00455697   .20732942
   -+1/2   .03092762  -.02454302  -.03322455  -.00408766   .06185526
  -+sd/2   .02203551  -.01746582  -.02368745  -.00291777   .04407102
MargEfct   .03096537  -.02451381  -.03330898  -.00410795   .06193073

educ
            Avg|Chg|       never    sometime       often      always
Min->Max   .26650218  -.32866687  -.20433749   .05971459   .47328977
   -+1/2   .01441919  -.01142097  -.01550607  -.00191134    .0288384
  -+sd/2   .04278126  -.03402462  -.04590283  -.00563505   .08556253
MargEfct   .01442301  -.01141801  -.01551462  -.00191339   .02884602

polviews
            Avg|Chg|       never    sometime       often      always
Min->Max   .03001351   .02372395     .032223   .00408006  -.06002703
   -+1/2    .005004   .00396167   .00538255   .00066376  -.01000801
  -+sd/2   .00731396    .0057909   .00786695   .00097007  -.01462793
MargEfct   .00500416   .00396155    .0053829   .00066386  -.01000832

female
       Avg|Chg|       never    sometime       often      always
0->1   .00568214   .00448796   .00610925   .00076705  -.01136428

             never    sometime       often      always
Pr(y|x)  .10627939   .23262119   .26127869   .39982072

              EC         ES       educ    polviews      female
   x=    3.92288    .005982    13.6915     4.09237     .550847
sd_x=     1.0621    .712058    2.97312     1.46168     .497619
```