Are American households willing to pay a premium for greening consumption of Information and Communication Technologies?

Natalia Milovantseva^{a*}

^aNational Research University Higher School of Economics, Myasnitskaya,
20, Moscow 101000, Russia

*Corresponding author. Tel.: +1 949 464 7915. E-mail address: natalimil@gmail.com

Abstract

The United States lags other nations in adapting policy approaches that would stimulate cleaner consumption of Information and Communication Technologies (ICT) by limiting the use of potentially toxic materials in electronics production. This study analyzes nationally-representative U.S. data from a unique web-based survey to investigate whether American households are willing to support greening the ICT devices by paying a premium for a green cell phone. Green cell phone does not contain hazardous materials and can be safely disposed with general municipal waste. A survey-based economic technique of contingent valuation was utilized in to examine the relationship between socio-psychological and economic parameters for evaluating and explaining the stated willingness to pay the green phone premium, controlling for socio-economic and demographic characteristics. The findings indicate that respondents with higher scores on general environmental beliefs, greater engagement in pro-environmental behavior, and positive attitudes toward recycling small electronics are likely to be willing to pay a premium to purchase a green cell phone compared to a conventional cell phone with similar capabilities. This suggests that educating the public about benefits of electronics recycling, promoting pro-environmental norms, and encouraging pro-environmental behavior can help increase public support for implementing policies aimed at greening ICT production and consumption in the United States.

Keywords: Environmental policy; Generalized ordered logit; Green cell phone; Green ICT consumption; Stated preference; Willingness to pay

1. Introduction

Spurred by rapid technological change and greater economic prosperity, mass consumption of ICT produces increasing volumes of obsolete electronics, known as electronic waste (e-waste). Its improper disposal threatens environmental integrity and represents a potential health hazard. Possible options to prevent potential risks of e-waste include two broad areas of activities: boosting the rates of e-waste recycling in environmentally safe ways and transitioning to green ICT consumption by replacing toxic components in most conventional electronics with environmentally harmless materials.

To mitigate e-waste problem, comprehensive policy approaches have been adopted worldwide (Maxianova, 2008). For example, to decrease ecological and human health hazards of e-waste, the European Union (EU) was first to enact the RoHS Directive. This Directive restricts six hazardous substances in consumer electric and electronic equipment (EU, 2003). These include: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ether. The EU Directive is often viewed as a model and similar policies are being adopted worldwide, including the U.S. state of California (CDTSC, 2006). Nevertheless, other U.S. states seemingly do not perceive material composition in consumer electronics as a priority. A national U.S. attempt to pass federal legislation aimed at helping develop greener electronics (S. 1397) failed in 2011.

Cell phones, on average, contain a proportion of materials similar to other electronics with a 2.7% overall estimated fraction of highly toxic materials (Lincoln et. al., 2007; Widmer et. al., 2005). In particular, they include potentially toxic metals such as cadmium, copper, lead, nickel, and zinc, as well as various flame retardants containing polybrominated diphenylethers polychlorinated dioxins, and furans, which are known to be harmful to human health and to

ecosystem (Alaee et. al., 2003; Petreas and Oros, 2009; Sepulveda et. al., 2010). Although current cell phones are fairly small, their potential environmental risk in case of improper after-life handling (processing or disposal) is compounded by the magnitude of their popularity and by their short useful life. On average, a U.S. consumer replaces a cell phone every 21 months (Entner, 2011). With consistently low collection rates for recycling in the U.S., an estimated 129 million units were either incinerated or landfilled in 2009 (U.S. EPA, 2011).

Partly driven by existing regulations and thanks to technological progress, an increasing range of nontoxic materials suitable for today's electronics market has been identified (Kang et al., 2006). For example, current substitutions allow meeting EU RoHS Directive's requirements by eliminating lead from solder mixes. From a cost perspective, economies of scale permit new devices to be priced affordably. Consequently, a consumer does not incur a cost burden of new, greener technologies. However, devices currently touted by the cell phone industry as green and RoHS-compliant electronics with lead-free solders and other restricted materials eliminated from the production are not yet completely environmentally benign (Henshall et al., 2011). Designing and manufacturing truly green, or environmentally harmless, cell phones will likely result in more expensive equipment for consumers, at least initially.

This study focuses on consumer stated preferences for greener electronics containing no toxic materials. It investigates how much of a premium U.S. households are willing to pay for green cell phones compared to conventional cell phones with similar capabilities. The cell phone is used in the study because it represents a current technological trend toward the proliferation of hand-held electronics, cell phones are very popular and frequently replaced, and the materials they contain are similar to those of other electronic products. Previous studies have attempted to measure willingness to pay (WTP) for green electronics (Nnorom et al., 2009; Saphores et al.,

2007). However, they used non-generalizable samples and did not incorporate response uncertainty in their analysis. This study addresses this gap.

The paper is organized as follows. A brief review of recent research analyzing WTP for green technologies and some key studies that focus on the significance of pro-environmental attitudes, beliefs, and behavior are set forth in the next section. Next, survey instrument and data are discussed, followed by an explanation of the modeling methodology. Finally, results pertaining to the estimation of WTP are offered along with discussion of factors that influence the amount of WTP, followed by a conclusion that includes pertaining policy implications.

2. Literature

A great deal of research has focused on identifying determinants of green consumption, and the results are varied. Among socio-demographic variables, income appears to be an important factor of increased willingness to make pro-environmental choices along with education and age, while other studies find the opposite (Barr, 2007; Clarke and Maantay, 2006; Ferrara and Missios, 2005; Jenkins et al., 2003; Spash, 2006). Findings on gender and ethnicity are mixed as well. Studies on green energy find that WTP a green premium depends on people's overall environmental awareness and their age and education (Bollino, 2009; Grösche and Schröder, 2011; Hansla et al., 2008; Kotchen and Moore, 2007; Zoric and Hrovatin, 2012). Several papers found a positive link between both income and younger age and WTP more for green electricity (Oliver et al., 2011; Yoo and Kwak, 2009). Socio-demographic characteristics were found to play no role in the decision to pay a premium for green energy in other studies (Claudy et al., 2011). Literature focused on assessing households' WTP a premium for more energy efficient home appliances reports that positive attitudes toward general environmental issues influence the WTP (Bull, 2012; Ward et al., 2011; Yamamoto et al., 2008). Studies on green transportation found, in

most cases, that WTP for more sustainable transportation increases with education and income but decreases with age (Avineri and Waygood, 2010).

Literature that has grounded its analysis on the theory of planned behavior combines both internal and external variables. These studies suggest beliefs, attitudes, and past pro-environmental behavior play important roles in making pro-environmental consumption decisions (Fielding et al., 2008; Kaiser et al., 2005; Menzel and Bögeholz, 2010; Oreg and Katz-Gerro, 2006). Environmental beliefs seem to explain households' greater propensity to make various pro-environmental choices (Sauer and Fischer, 2010). Additional literature also reports evidence of significant positive relationship between positive pro-environmental attitudes and pro-environmental choices (Bernarth and Roschewitz, 2008; Knussen and Yule, 2008; Milovantseva and Saphores, 2013a; Schlöpfer, et al., 2004; Veisten, 2007).

Few studies examined WTP for green cell phones. There are two surveys undertaken in California and two elsewhere (Nixon and Saphores, 2007; Nixon et al., 2009; Nnorom et al., 2009; Song et al., 2012). Results broadly suggest that common predictors of increased WTP across studies include environmental attitudes, age, income, and education. None of the existing studies, however, used a generalizable sample or accounted for preference uncertainties in their analyses.

3. Methods

3.1 Data

This study uses nationally representative data from a random subset of an established online research panel of over 43,000 U.S. adults. The panel is based on a sampling frame afforded by the random digit dialing (RDD) technique which includes both listed and unlisted telephone numbers to avoid limiting the sampling to only web or computer owners. The RDD is augmented by

randomly sampling the U.S. Postal Service Delivery Sequence File to ensure inclusion of underrepresented minorities, low-income households, and people with no landline telephone in. The enrolled panel members are routinely asked for socio-economic and demographic information that included gender, age, race, income, education, and size and geographic location of their households. This information is updated annually and available for subsequent customized surveys. In exchange for their monthly survey participation, panel members are offered a free laptop and monthly Internet access, or, alternatively, receive points redeemable for cash. This approach is convenient for respondents and permits conducting surveys quickly and economically¹. The survey for this study was completed by 3,156 panelists (69% response rate) in 2010.

The first part asked respondents about their environmental beliefs, recycling-related attitudes, and pro-environmental activities in the last twelve months. The second part concerned respondents' use and disposal of cell phones and included randomly assigned questions to elicit each respondent's WTPa premium for a green cell phone. A contingent valuation survey must include a hypothetical scenario and a payment vehicle with respect to preceding scenario (Arrow et al., 1993). Survey's hypothetical scenario described a choice between purchasing a green phone and a conventional cell phone. We defined a green cell phone as a cell phone with functional capabilities similar to the conventional cell phones commonly used by consumers. However, the green phone is made from hypothetical non-toxic biodegradable materials. The

¹ Additional details on research panel are available in Milovantseva and Saphores (2013b) and at www.knowledgenetworks.com/knpanel/index.html.

green phone's material composition renders it environmentally friendly when discarded. Consequently, with no risk to human health and the environment after disposal, the use of green phones is associated with environmental improvement when compared to the disposal of conventional cell phones (most cell phones currently sold in the U.S.) that contain components made with potentially hazardous materials. The respondents were asked to consider, when purchasing their next personal cell phone, a choice between a green cell phone and a conventional cell phone with similar capabilities. As a payment vehicle, we used a dichotomous-type valuation question that asked: "Would you be willing to pay an extra amount of {randomly varied choices: \$2.40, \$6.00, \$12.00, \$18.00, \$24.00, \$48.00, \$84.00, \$120.00} to buy a green cell phone?" The follow-up questions validated "yes" responses on a scale from one to five (where one is very certain and five is very uncertain). To verify the general consistency of responses, the survey included auxiliary questions in this portion of survey. The auxiliary questions allowed, first, to check whether amounts of premium selected by respondents were not disproportionally large in comparison to household's income, and second, to detect inconsistencies between the degree of expressed interest in green cell phone and the ranking of buying a green cell phone compared to other causes. No inconsistencies were detected.

Figure 1 illustrates the distribution of responses to randomly presented value of the green phone premium (the bid). As expected, the frequency of positive responses decreases as the bid value increase from \$2.40 to \$120.00. The reverse holds for "no" responses. The majority of "yes" responses (22.33%) is for the lowest bid of \$2.40. Interestingly, the frequency of "yes" responses is approximately leveled off between the bid levels of \$18 (11.65%) and \$24 (11.97%). The majority of "no" responses (26.13%) is for the highest bid level equal to \$120.

[Insert Figure 1 approximately here]

The response pattern for the follow-up question designed to tease out the certainty of a “yes” response is shown in Figure 2. The majority of “very certain” responses is for two lowest bid levels that equal to \$2.40 (31%) and to \$6 (27%). For bid levels below \$24 most answers are “very certain”. The level of certainty decreases as bid value increases from \$24 to \$120, where the frequency of “not sure” exceeds “very certain” responses. Overall, with the exception of lower bids, the certainty response distributions are approximately bell-shaped and substantial suggesting that uncertainty is an important component of responses.

[Insert Figure 2 approximately here]

The sub-sample considered in this study is limited to 596 observations relevant to the dichotomous-choice contingent valuation segment of the survey’s part two. Summary statistics of the variables considered in the analysis are presented in Table 1. Overall, the willingness to pay sub-sample represents well the distribution of key socio-economic and demographic characteristics compared to U.S. Census estimates and provides substantial variations in all key variables (see supplementary Table A.1 for comparison).

[Insert Table 1 approximately here]

3.2 Analytic approach

Based on the literature, in this study it was hypothesized that: (i) respondents who scored higher on attitudes toward recycling and those who reported engagement in pro-environmental activities in the past twelve months are more likely to be willing to pay a higher premium to purchase a

green cell phone; and (ii) general environmental awareness does not play a role in determining the WTP.

General concerns for the environment were captured by ten items adapted from the commonly used New Environmental Paradigm (NEP) (Dunlap et al., 2000). Attitude toward recycling small household electronics (AR) was assessed by ten questions on a five-point Likert scale. The NEP and AR were summarized by performing a principal components analysis (Kline, 1994). The Kaiser criterion was adopted to select the number of factors to consider for a group of variables, which yielded one factor for each of the two sets of questions considered. To facilitate their interpretation, the resultant two factors were normalized to range between zero and one, where larger scores indicate respectively higher pro-environmental concerns and greater inclinations to recycle small household electronics. Common statistical tools were subsequently used to assess the validity of these factors: Bartlett's test for sphericity checked for sufficient correlation of component items; excessive correlation was checked using Kaiser-Meyer Olkin statistic; and Cronbach's alpha (α) helped assess inter-item reliability. Responses distribution for general environmental beliefs and attitudes toward recycling and factor analysis results is available in the supplementary Table A.2.

A commonly used approach to estimate the WTP in stated preferences studies is a contingent valuation technique. For modeling the WTP, using both internal (general environmental awareness, attitudes toward recycling small household electronics, self-reported pro-environmental activities in the past twelve months) and external (socio-economic and demographic household characteristics) variables were used (Bateman and Willis, 2001). The estimated amount of WTP quantifies public welfare derived from eliminating the risk of future environmental harm potentially caused by improperly discarded conventional cell

phones. Responses for follow-up certainty questions were combined and recoded into four ordinal outcomes to achieve more balanced categories as follows: 1=no, 2=somewhat uncertain, 3=somewhat certain, and 4=yes. Two models were estimated and contrasted: a logit model with complete certainty and a generalized ordered logit model that takes into account response uncertainty. Explanatory variables were checked for multicollinearity and a variety of interaction terms were examined (Kutner et al., 2004). A battery of statistical tests was conducted to select the best fitted models and to assess the validity of the models' assumptions. To assess whether each model is correctly specified, post estimation analysis and examined measures of fit were used as recommended by Long and Freeze (2006). The robustness of results included check for outliers and high leverage observations (Cook and Weisberg, 1999; Pregibon, 1981). Hosmer-Lemeshow test was used to assess goodness of fit for the logit model (Hosmer and Lemeshow, 2000). Wald test was used to test significance of estimated coefficients and to check proportional odds assumption for the ordered logit model (Brant, 1990).

The WTP was computed using a simulation approach developed by Krinsky and Robb (1986) as follows: the mean and median WTP with 95% confidence intervals are computed by random drawings from the multivariate standard normal distribution of coefficients estimated via the logit model to construct a new distribution. Next, the amount of WTP is computed using a new vector of parameters constructed from the coefficients of each drawing. This procedure is repeated multiple times (up to 50,000) to obtain the empirical distribution of the WTP. Finally, observations are trimmed by 2.5% at both tails to obtain lower and upper bounds (Jeanty, 2007).

4. Results and discussion

Results from the estimated models are presented in Table 2. Results confirmed the hypothesis (i). Indeed, both, attitude toward recycling small household electronics and participation in pro-

environmental activities in the past twelve months were significantly associated with the likelihood of willing to pay an extra sum for a green cell phone. The odds ratio (OR) for AR were highest in magnitude and equaled 17.62 in the complete certainty logit model (LM) and 15.78 in the generalized ordered logit model (GOLM). Also, respondents who participated in pro-environmental activities in the past twelve months were significantly more willing to pay extra to purchase a green cell phone (OR: 2.40 in LM and OR: 1.14 in GOLM). However, hypothesis (ii) was not confirmed. Unexpectedly, the NEP was significantly associated with the WTP across both models (OR: 5.47 in LM and OR: 7.84 in GOLM).

The associations of control variables (socio-economic and demographic characteristics) with likelihood of higher WTP were consistent with previous finding reported in the literature. Income, education, age, and household size exhibited various levels of significance. The role of income was somewhat surprising. Intuitively, higher income earners could be expected to show a greater likelihood to be willing to pay more. However, results suggested quite the opposite: households with incomes \$50,000 or below were more likely to pay greater premium compared to households with annual income between \$50,000 and \$100,000 (the baseline group) with OR slightly above 2.0 for these two income ranges in both models.

[Insert Table 2 approximately here]

Response uncertainty model showed that higher earners, \$100,000 and above, were also more likely to be willing to pay more. This suggests that middle-income families do not put a premium on green cell phones. Moreover, response patterns for education were also complicated. Education was not important in the complete certainty model. There was a significant association between having a college degree or higher level of education and a greater WTP a green phone

premium in only GOLM model (OR: 1.93) compared to a reference group with a high school diploma as highest educational level. The story was different for age: younger to middle-aged respondents were less inclined to be interested in paying extra for a green cell phone. Compared to a reference group (respondents aged 45-59 years), younger respondents (30-44 years) were significantly less likely to pay a premium for green phones (OR: 0.51 in LM and OR: 0.48 in GOLM), while other ages did not differ from the reference. Finally, larger households were significantly more likely to be willing to pay more (OR: 1.73 in LM and OR: 1.43 in GOLM).

To compute the amount of WTP, a sensitivity analysis was performed by estimating separate models with re-classified dependent variable, in which responses with different degrees of uncertainties were moved from “yes” to “no” one category at a time (see supplementary Table A.3). This was based on the WTP literature that reported that inclusion of preference uncertainty into the model typically reduces estimated WTP compared to conventional complete certainty assumption in a dichotomous choice model (Ethier et al., 2000; Champ and Bishop, 2001; Poe et al., 2002). The computed WTP ranged between \$29.55 in the model with complete certainty and \$5.63 in the model for which all uncertain responses were re-classified as “no”.

Considering that in the U.S. a conventional cell phone is frequently offered free of charge by wireless service providers to customers who agree to a one to two year contract, these findings suggest that U.S. consumers, on average, support innovative green technologies for materials used in small electronics by showing their WTP more for a green cell phone containing no potentially toxic materials when compared side by side with a conventional phone with similar capabilities.

5. Conclusions

This stated preferences study contributes to a better understanding of public support for designing policies aimed toward replacing potentially hazardous conventional popular consumer electronics, such as cell phone, with slightly more expensive but environmentally benign, green electronics. The research had two objectives. First, to understand the determinants of U.S. households' willingness to pay more for a green cell phone (i.e., cell phone that does not contain potentially hazardous materials) compared to a conventional phone presently in common use. Second, to estimate the value that consumers place on the improvement of environmental quality associated with a hypothetical switch from conventional cell phones to green cell phones. An economic method of contingent valuation was applied to analyze the generalizable sample based on survey data of American households. Estimated models included both internal (general beliefs with respect to the environment, attitudes toward recycling small electronics, and pro-environmental behavior in the past 12 months) and external (socio-economic and demographic characteristics) variables.

The findings suggest that respondents' WTP is not solely based on a rational financial reasoning. Significant factors associated with WTP for green cell phones included general awareness of environmental issues, attitudes toward recycling small household electronics, and pro-environmental behavior. Larger households and those with greater educational attainment were more likely to be willing to pay a premium on green cell phone. Conversely, younger to middle age people and middle income families do not seem to value green cell phones. Estimates of the WTP showed that people are likely to be willing to pay on average between \$5.63 (after accounting for uncertainty) and \$29.55 (under full certainty) more to purchase a green cell phone over a conventional cell phone with same functionalities. Even the lower value of \$5.63 is substantial given that consumers can often get free devices if they commit to a specific-length

contract with a service provider. The estimated amount consumers are willing to pay quantifies public welfare derived from eliminating the risk of future environmental harm potentially caused by discarded conventional cell phones. A conservative approach of estimating the aggregate WTP based on the lower threshold parameter helps illustrate the total amount of the value that consumers placed on environmental improvement associated with a switch from a conventional to a green cell phone. Based on the lower value, the aggregated sum of WTP estimated in this study is approximately \$662 million for every 18 months. If instead the estimate of \$29.55 from the complete certainty model is used, the corresponding aggregate amount is \$2.8 billion for every 18 months. To put this in a perspective, the aggregated value of public's WTP to prevent another oil spill similar to 1989 Exxon Valdez in the state of Alaska was estimated at \$11.5 billion (Carson et al., 2003).

The study offers implications for the industry and policy makers. Computed ranges of WTP provide a better idea for electronics industry of how much more innovative green phones could command in the marketplace compared to conventional devices. For public policy, two recommendations can be drawn from this research. First, findings clearly indicate that U.S. households are willing to support financially greener ICT products. This suggests that an introduction and implementation of a comprehensive U.S. national regulatory framework intended to improve product design by limiting the use of potentially toxic materials in consumer electronics can rely on public support. Second, educating the youth about benefits of proper e-waste processing to elicit positive attitudes towards electronics recycling, increasing public awareness of general environmental issues to help promote pre-environmental norms, and incentivizing pro-environmental behavior can help transform perceptions and increase public support of federal policies on reducing and limiting toxic materials in consumer electronics.

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Figure 1. Distribution of Yes and No responses to the proposed amount of bid.

Figure 2. Distribution of responses for the certainty follow-up question.

Table 1. Summary statistics for key variables.

Variable name	Mean	Std. Dev.	Min	Max
<i>Dependent variables</i>				
Would you be willing to pay an extra \$(A) to purchase a green cell phone instead of a conventional cell? Yes=1	0.518	0.500	0	1
Would you be willing to pay an extra \$(A) to purchase a green cell phone instead of a conventional cell? (4 categories)*	2.010	1.155	1	4
<i>Explanatory variables</i>				
Logarithm of the amount of bid A	3.076	1.292	0.875	4.787
<i>Beliefs and attitudes</i>				
General environmental believes	0.584	0.208	0	1
Attitudes toward recycling small electronics	0.587	0.201	0	1
<i>Self-reported behavior out of concern for the environment in the last 12 months</i>				
Signed a petition for an environmental cause? Yes=1	0.121	0.326	0	1
<i>Socio-economic characteristics</i>				
Annual household income <\$20,000? Yes=1	0.146	0.353	0	1
Annual household income \$20,000 - \$49,999? Yes=1	0.295	0.457	0	1
Annual household income \$50,000 - \$100,000? Yes=1	0.361	0.481	0	1
Annual household income >\$100,000? Yes=1	0.198	0.399	0	1
Education: less than high school? Yes=1	0.089	0.285	0	1
Education: high school? Yes=1	0.329	0.470	0	1
Education: associate degree or some college? Yes=1	0.275	0.447	0	1
Education: bachelor's degree or higher? Yes=1	0.307	0.462	0	1
<i>Demographic characteristics</i>				
Respondent is 18 to 29 years old? Yes=1	0.163	0.369	0	1
Respondent is 30 to 44 years old? Yes=1	0.238	0.426	0	1
Respondent is 45 to 59 years old? Yes=1	0.320	0.467	0	1
Respondent is 60 years old or older? Yes=1	0.279	0.449	0	1
Caucasian? Yes=1	0.752	0.432	0	1
African-American, non-Hispanic? Yes=1	0.087	0.282	0	1
Hispanic? Yes=1	0.106	0.308	0	1
Other ethnicity, non-Hispanic? Yes=1	0.055	0.229	0	1
Respondent is female? Yes=1	0.490	0.500	0	1
Logarithm of the size of household**	0.871	0.561	0	2.708

Notes:

1. The bid A takes one of the following eight values: \$2.40, \$6.00, \$12.00, \$18.00, \$24.00, \$48.00, \$84.00, \$120.00.

2. These statistics were calculated for the 596 observations used to estimate models for willingness-to-pay.

*Categories are: no=1, somewhat uncertain=2, somewhat certain=3, and yes=4.

Table 2. Relationship of explanatory variables with the decision to be willing to pay the offered amount.

Variable	Logit model (LM) Odds ratio (SE)	Generalized ordered logit model (GOLM) Odds ratio (SE)
I	II	III
General environmental believes	5.47*** (3.51)	7.84*** (4.15)
Attitudes toward recycling small electronics	17.62*** (12.47)	15.78*** (8.97)
Pro-environmental behavior (signed a petition for an environmental cause in the last year)	2.40*** (0.59)	1.14*** (0.35)
Income:		
less than \$20K	2.64*** (0.96)	2.39*** (0.68)
\$20K-\$50K	2.12** (0.65)	2.09*** (0.48)
\$100K plus	1.57 (0.47)	1.98*** (0.50)
Education:		
less than high school	0.92 (0.40)	0.99 (0.33)
some college	1.24 (0.35)	1.48* (0.33)
college plus	1.22 (0.36)	1.93*** (0.59)
Age:		
18-29	0.82 (0.28)	0.71 (0.19)
30-44	0.51** (0.15)	0.48*** (0.11)
60 plus	0.83 (0.23)	1.43 (0.41)
Household size (logged)	1.73** (0.43)	1.43** (0.27)
Constant	0.43 (0.25)	0.07 (0.03)

Notes:

1. *, **, *** refer to $p \leq 0.10$, $p \leq 0.05$, and $p \leq 0.01$, respectfully.
2. Robust standard errors in parenthesis.
3. The number of observations is 596 in both models.
4. The outcome categories in GOLM are: 1=no; 2=somewhat uncertain; 3=somewhat certain; 4=yes. In column III, category 4 is contrasted with categories 1, 2, and 3 (Williams, 2006).