C I N T R A F O R

Working Paper 96

Consumer Willingness to Pay for Renewable Building Materials: An Experimental Choice Analysis and Survey

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January 2005

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EXECUTIVE SUMMARY

In recent years, growing consumer awareness of the environmental effects of the products they purchase has resulted in a demonstrated change in buying behavior. The tremendous rise of the organic food industry illustrates the desire and willingness by consumers to pay a price premium for food products that meet certain environmental standards. The emergence of forest eco-certification standards demonstrates that greater market share will go to companies that can demonstrate higher levels of environmental sustainability. Other developments, like carbon-trading programs and green energy programs further demonstrate this shift. Over the past decade, greater attention has also been paid to the environmental effects of building products industries.

Understanding public attitudes toward building materials and their related environmental performance is important as it can provide consumers with the product attribute information they seek. Product attribute information has important policy implications for programs that may help achieve certain environmental standards. This study uses a choice-based, stated preference approach and relies on basic consumer demand theory. Using a mail survey, respondents were asked to assess a set of goods with different levels of emissions and price attributes; they were then asked to choose their most preferred alternative. Various price and environmental levels were included in the choice sets. Surveys were sent to two different populations. The first sample came from the general population; the second came specifically from real estate agents in the western states.

The results of the general population survey demonstrated that respondents were most sensitive to reductions in greenhouse gas emissions and were willing to pay for up to eleven tons of reduction associated with building a new house. Considering a typical house produces twenty tons of such gases during the construction process, this assessment is significant. They were also willing to pay for reductions in air pollution and solid wastes, although less than they were for reductions in greenhouse gas emissions. The water pollution variable was not significant enough in this study to estimate a willingness to pay. The responses from real estate agents appear to be much more willing to pay for reductions in solid waste emissions than for reductions in the other environmental attributes.

Results: Total WTP and Amount Reductions by Pollution Type for Each Survey

Environmental Variable Total WTP and Amount of Reduction	Air Pollution	Solid Waste Emissions	Greenhouse Gas Emissions
General Mail Survey Respondents	$106.25 for up to 18%	$95.50 for up to 18%	$168.09 for up to 11 tons
Real Estate Agents	$110.90 for up to 21%	$189.16 for up to 17%	$62.21 for up to 13 tons

NB: each WTP is estimated individually while holding the other elements constant

The survey results suggest that wood-based framing construction (instead of steel- or concrete- based framing) can better achieve certain environmental standards since, particularly in the case of greenhouse gas emissions, wood framing has lower green house gas emissions than either steel- or concrete-framed houses. That is to say that the reduction in the number of tons a respondent was willing to pay for always exceeds the inherent reductions when these two framing systems were compared. For example, in Minneapolis, using wood instead of concrete results in a 9.8-ton reduction in greenhouse gas emissions; in Atlanta, using wood instead of concrete results in a 6.6-ton reduction[1].

Comparison Between Reductions in Different Building Materials and WTP

Environmental attribute	Minneapolis Steel vs. wood	Atlanta Concrete vs. wood	Maximum amount respondents WTP
Greenhouse gas emissions	9.8 tons	6.6 tons	11 tons
Air emissions	14%	23%	18%
Solid waste emissions	-0.9%	51%	18%

This survey has useful implications for both market and policy applications. For marketing purposes, the results suggest that those building materials producers seeking to increase their market share can point to better environmental performance associated with those materials that produce lower emissions, particularly greenhouse gases. For policy purposes, programs that aim to improve environmental performance standards might want to design a label that indicates the lower emissions standards in building material products. Perhaps a label similar to that of the “green star” by the EPA might be appropriate. Such a label may be used to educate homebuyers on the environmental performances associated with the building materials used in the construction of the house. Research into effective marketing tools should be conducted to provide consumers with the environmental attribute information to enable them to make better-informed decisions about the building products they purchase.

[1] Lippke, B., J. Wilson, J. Perez-Garcia, J. Bowyer, J. Meil, 2004, CORRIM: Life Cycle Environmental Performance of Renewable Building Materials, *Forest Products Journal*, 54(6): 8-19.

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1.0 INTRODUCTION

In recent years, growing consumer awareness of the environmental effects of the products they buy has had a demonstrated effect on the choices they make in purchasing behavior. The tremendous rise of the organic food industry, for instance, illustrates the desire and willingness by consumers to pay a price premium for food products that meet certain environmental standards.

Over the past decade, greater attention has also been paid to the environmental effects of building products industries. For example, eco-certification of forest products arose out of concern about the rapid deforestation rates in tropical countries. As a result, there are now a number of certification systems available for producers of forest products around the world. In the United States, the American Forest and Paper Association has made participation in its Sustainable Forestry Initiative mandatory for all its members.

Other environmental concerns, such as the potential to contribute to global warming (or greenhouse gas emissions), general air and water pollution and solid waste emissions, are also of concern to both homebuilders and homebuyers. Consumers' concerns have even permeated into builders' selection of building materials. In a survey of general contractors, it was noted that contractors cite environmental or conservation concerns related to the use of wood framing systems in a list of reasons of why they select alternative building materials (Garth et al., 2004).

This study aims to gain a better understanding of the public's attitudes toward building materials and their related environmental attributes. It is important to understand whether or not consumers value reduced environmental impacts in new home construction. By measuring consumer willingness to pay for reduced levels of pollution, it is possible to differentiate and identify the environmental attributes about which consumers are most concerned.

This study addresses the question using a choice-based, stated preference approach and basic consumer demand theory. Using a mail survey, respondents were asked to assess a set of goods with different level of attributes and to choose the most preferred one in the set according to the tradeoffs among the attributes and their preferences. The choice-based, stated preference approach has also been termed as "choice experiments" (Louviere and MacArthur, 1961) or "experimental choice analysis" (Carson et al., 1994). It is a generalization of the dichotomous-choice contingent valuation method. Discrete choice models derived from random utility theory, such as a multinomial logit model will be used to obtain results from the choice-based, stated preference approach.

The remainder of this paper is organized into nine subsequent sections. Section 2 provides a literature review of the established methodology on environmental valuation using economic models and identifies the theoretical foundation for stated preference methods. Section 3 provides the theoretical derivation of the model estimation as well as hypothesis testing. Section 4 identifies and explains the choice sets design. Section 5 explains the survey instrument and development. Section 6 provides an overview of the survey sampling, administration and analysis. Section 7 describes the final model specification and estimation, hypothesis testing and willingness to pay estimation. Section 8 discusses the validity and reliability of the study. Section 9 examines the policy and market implications of the results and provides a summarizing discussion and concluding remarks.

2.0 LITERATURE REVIEW AND ENVIRONMENTAL VALUATION METHODOLOGIES

2.1 ENVIRONMENTAL VALUATION

Economists generally study individuals' valuation of goods and services by observing their actual behavior and the prices they are willing to pay for certain items; this enables researchers to estimate directly revealed preferences, often by using existing price or market data or consumer reports (Boardman, 2001). However, this is not always possible. In traditional economics, environmental attributes have been considered as externalities. In order to incorporate environmental attributes into the estimation of public utility for such attributes, it was necessary to develop an entirely new methodology to reveal preferences based not on existing market data, but on consumer-stated preferences.

Over the past few decades, environmental valuation has become a well-established sub-sector of the economics field (Freeman, 2003). As a result, a number of different ways to quantitatively estimate consumer attitudes toward environmental products have been developed. In environmental valuation, standard methods include stated and revealed preference. Revealed preference methods include the travel cost method and the hedonic method, which infer the value of environmental variables by measuring the value of transactions of other goods (Boardman, 2001).

2.2 REVEALED PREFERENCE METHODOLOGIES

The travel cost method relies on questions surrounding the cost of the consumer's travel to the destination of interest (Hotelling, 1938). This methodology can be used to estimate the value of a park or recreational area, for example.

The hedonic method uses the market value of goods and services to derive the value of an environmental good (Brown, 1984). For example, the capitalized value of a house or the price of labor might be used. Property values can be used to estimate the value of air quality of aesthetic values in a certain location. The price of labor, using either a method such as the wage differential method or valuation of risk to life can be used to estimate the value of a certain project, such as an environmental cleanup project (Thaler and Rosen, 1976).

2.3 STATED PREFERENCE METHODOLOGIES

Stated preference methods rely on surveys that are used to elicit a respondent's stated willingness to pay for a particular attribute (Mitchell and Carson, 1989). Stated preference surveys can be conducted using one or a combination of several methodologies. These include contingent valuation, contingent ranking and experimental choice analysis method. Stated preference methods rely on eliciting consumers' preference for a change in one or more environmental attribute and estimating their willingness to pay (WTP) for an improvement in that amenity or their willingness to accept (WTA) a worsening of that amenity.

Contingent valuation methods (CVM) typically rely on surveys to measure WTP for a hypothetical environmental situation (Mitchell and Carson, 1989). This methodology, if carefully executed, has been endorsed and approved by economists like Kenneth Arrow and Robert Solow (Arrow et al, 1993).

However, CVM does have some drawbacks. It has been widely criticized as being too hypothetical, relying on consumers to state how much they would be willing to pay or accept for something (Diamond and Hausman, 1994). Where the price amount should be based on the marginal rate of substitution, it may in fact be based on a non-economic explanation. In some instances, respondents may have an ideological bias that affects their response or be experiencing the "warm glow" effect, meaning that their responses are affected by the sense that they feel like they should be supporting a good cause (Nunes and Schokkaert, 2003). In all cases, there may be a difficulty in asking individuals to evaluate their real WTP.

Another problem identified is the embedding effect, which refers to the lack of marginal change in an individual's WTP or WTA for an environmental good (Diamond and Hausman, 1994). For example, an individual may state that he is willing to pay the same amount per tree to save 100 trees as he would to save 200 trees.

The experimental choice analysis methodology (ECAM) helps avoid many of the pitfalls associated with contingent valuation (Green and Srinivasan, 1990). Instead of asking a respondent to provide a dollar amount they would be willing to pay or accept for an environmental service, they are asked to review a set of multiple options and select the one choice they most prefer based on the tradeoffs provided in the design of the choice set (Boxall et al, 1994).

There are several advantages to the ECAM model; it is not only less likely to be vulnerable to the embedding effects found in CVM, but using ECAM can also reduce the multi-collinearity problem present in other stated preference experiments (Xu, 1997). Furthermore, because of the often repeated nature of experimental choice exercises where the respondent is presented with multiple sets of choices, the problem of "informational efficiency" (i.e., degrees of freedom) typical of CVM is alleviated in ECAM (Carson, 1991).

For this study, we will rely on ECAM, as it enables us to examine multiple choices and allows the respondent to evaluate several different alternatives at once. An example of ECAM in environmental applications is Weihuan Xu's study on measuring household willingness to pay for different forest management regimes (Xu, 1997). The multinomial conditional logit model developed by McFadden (McFadden, 1973) enables an easy estimate of the model. This model is specifically designed for analyzing situations in which one alternative is selected over another from a choice set, hence "conditional."

McFadden's independence from irrelevant alternatives (IIA) axiom limits the analysis as it assumes independence of the choice from the actual choice set; therefore, it is impossible to find any kind of pattern of substitution or complement between different alternatives. The reverse implication of this problem can be tested using either the Hausman or Wald specification tests (Hausman, 1984).

3.0 THEORETICAL DERIVATION OF MODEL ESTIMATION AND HYPOTHESIS TESTING[2]

Random utility theory tells us that an individual's utility is based a number of variables. The experimental choice analysis methodology (ECAM) is based on random utility theory. Using the general utility theory, we can assume that an individual k who consumes a good i has two components; one is fixed while the other is random. As a result, we get:

$$U_{ki} = V_{ki} + e_{ki} \tag{3.1}$$

or

$$U_{ki} = \beta X_{ki} + \gamma Y_{ki} + e_{ki} \tag{3.2}$$

where U_{ki} is the utility individual k receives from consuming good i. V_{ki} is fixed while e_{ki} is random; both are components of the utility function. X_{ki} is the attribute set of the good i. Y_{ki} are personal characteristics of individual k such as income, gender, age, etc. β and γ are vectors of the above parameters. Finally, e_{ki} reflects unobserved attributes, tastes and general measurement errors.

Individual k will choose one good out of a set of goods to maximize his overall utility. Therefore, good i is chosen over alternative j from a set of goods A only if $U_{ki} > U_{kj}$. The probability of individual k choosing good i from set A is:

$$\mathrm{P}_k(i/A) = \mathrm{P}(\beta X_{ki} + \gamma(Y_k) + e_{ki} > \beta X_{kj} + \gamma(Y_k) + e_{kj},\ i,j, \in A, j \neq i) \tag{3.3}$$

Individual k's characteristics are not a function of the goods he chooses and are the same on both sides of the equation,

$$P_k(i/A) = P(\beta X_{ki} + e_{ki} > \beta X_{kj} + e_{kj},\ i,j, \in A, j \neq i) \tag{3.4}$$

[2] The model used in this study draws heavily from Xu, 1997 and Xu, Lippke, Perez-Garcia, 2003.

If the random components (e_1,.. e_j ..,e_T) are assumed to be independently and identically distributed across all alternatives with the Type I extreme value distribution (Gumbel distribution), P_k (i /A) is given by the multinomial logit model (MNL) (McFadden, 1974; Ben-Akiva and Lerman, 1985). The MNL model is equivalent to the fixed-effects logit model for panel data (Chamberlain 1980).

$$P_k(i/A) = e^{\beta X_{ki}} / \sum_{j \in A} e^{\beta X_{kj}} \tag{3.7}$$

We derive WTP for the attributes from random utility theory by treating the parameter on the cost attribute as equal to the marginal utility of income. Assuming the cost variable C is separable from other variables in vector X, the WTP for a change of attribute X_i from level 1 to 2 can be estimated by solving for the compensating variation as follows:

$$V_1 = \alpha C_{i1} + \beta X_{i1} = \alpha\left(C_{i1}\text{-}CV\right) + \beta X_{i2} = V_2 \tag{3.8}$$

where V_1 and V_2 are the utilities for the initial and subsequent level of attribute X_i, α is the estimated parameter for the cost variable C and β is the estimated parameter for X_i.

The WTP for a change of attribute X_i from level 1 to 2 is:

$$WTP(X_{i1}, X_{i2}) = CV = -\frac{\beta}{\alpha}\left(\left(X_{i1}\right) - \left(X_{i2}\right)\right) \tag{3.9}$$

Assuming that equation (3.9) is continuous and differentiable at X_{i1}, the marginal WTP of attribute X_i at level 1 is:

$$MWTP(X_{i1}) = \frac{\partial CV}{\partial X_{i1}} = -\frac{\beta}{\alpha} X_{i1} \tag{3.10}$$

Using the above equations, we can estimate the total and marginal willingness to pay.

4.0 CHOICE SETS DESIGN

4.1 ATTRIBUTES AND LEVEL SELECTION

The Consortium for Renewable Building Materials (CORRIM) has identified and measured the effects of environmental attributes associated with different building materials. CORRIM's assessment system can serve to better inform the building community in making decisions regarding the selection of design and material mixes to minimize the environmental impact of a building's life cycle (Lippke et al., 2004).

The CORRIM model estimates the environmental performance associated with the life cycle stages (from "cradle to grave") for single-family residential dwellings based on the framing system used. These possible systems include steel, concrete or timber. The five major environmental attributes measured associated with these framing systems are global warming potential, air emissions, water emissions, solid waste emissions and embodied energy use. In order to assess the entire life cycle, stages begin as early as the resource management and extraction phases and continue through the final demolition.

For our survey, the choice set design involved selecting four environmental variables associated with four different price levels. The four environmental attributes selected were global warming potential (termed "greenhouse gas emissions" for the purposes of the survey), air pollution, water pollution and solid waste emissions.

In the CORRIM model, global warming potential is defined in terms of carbon dioxide, since that is the common reference standard. Other greenhouse gases are defined in terms of their "CO_2 equivalence effects." This means that the sum that makes up the global warming potential index is comprised of CO_2 (in kilograms) methane, carbon and nitrous oxide and multipliers for the latter three. In our survey, we substituted the term "greenhouse gas emissions" for global warming potential (Lippke et al., 2004).

The air pollution index refers to other air pollutants that have more tangible human health and overall suspended particulate effects. Pollutants included in this index are phenol, sulfur dioxide, suspended particulates, volatile organic compounds, nitrous oxide and carbon. Each pollutant is measured in volume and the index takes the "worst offending substance" of these variables (Lippke et al., 2004).

The water pollution index measures a number of different water pollutants. These included suspended and dissolved solids, polynuclear aromatic hydrocarbons, non-ferrous metals, cyanide, nitrates, sulfates, iron, oil and grease, aluminum, ammonia and ammonium, halogenated organics, sulfides, chlorides, and phenols. Each pollutant is measured in volume and the index takes the "worst offending substance" of these variables (Lippke et al., 2004).

The solid wastes emissions index estimates wastes in terms of overall mass; it does not differentiate between toxic and non-toxic emissions. The materials produced in the manufacturing and building process that are included in the solid waste emissions index are: bark and wood wastes, concrete solid waste, blast furnace slag, blast furnace dust, steel waste, and other solid wastes (Lippke et al., 2004).

Steel, wood and concrete framing systems in residential construction produce different amounts of each of these four emissions; location of the construction site is also a variable as it will increase or reduce the transportation requirements for the building materials involved. Location also impacts the maintenance and appropriateness of different building materials. In order to understand these effects, CORRIM has designed new homes in Atlanta and Minneapolis and measured their possible environmental effects (Lippke et al., 2004).

Therefore, it is useful to determine whether or not consumers are sensitive to the magnitude of these emissions and whether or not they are willing to pay a price premium for reduced amounts of one or more of these variables and whether they value a reduction in one emission over another. If consumers are sensitive to these differences, further research would be useful in determining the appropriate marketing tool to identify products with lower overall emissions or index levels.

Stated preference, as discussed in Section 2, is an appropriate method for estimating value in this study because little market research has been done to estimate consumer attitudes toward renewable building materials. Even less research has been performed to compare different environmental variables against each other, in order to determine what preferences are exhibited toward these variables.

Pilot testing for the appropriate attributes began in summer 2003 by conducting a simple survey. Three environmental variables were included: global warming potential, air pollution and water pollution. Options included high or low levels of these attributes. The price variable was included only in two levels: low or high. Using a simple ranking method, 16 combinations of various levels of pollution were included. Five responses were collected for this preliminary survey.

This early pilot survey enabled us to determine that respondents did differentiate between general air emissions and greenhouse gas emissions. We also decided to include a solid waste emission in the final version of the survey. As a result, our final attributes for the environmental characteristics were: greenhouse gas emissions, air pollution, water pollution and solid waste emissions.

4.2 CHOICE SETS DESIGN

4.2.1 Linear vs. Choice Design

A simple econometric linear system can be described by the following Ordinary Least Squares (OLS) procedure:

$$y = \beta X + \mu \tag{4.1}$$

In the OLS equation, y is the dependant variable, X is a matrix of independent variables, β is a vector of parameters to be estimated, and μ is a vector of errors. In an OLS analysis, the variance-covariance matrix for β is proportional to $(X'X)^{-1}$. An efficient or optimal design will have a minimal covariance matrix for β. But probabilistic choice models are non-linear in their parameters (i.e., in β) and therefore have a different variance-covariance matrix. The method used to design linear models can be adapted to design non-linear models; in this study, such an adaptation is necessary.

4.2.2 Final Choice Design

In fall 2003, we developed a version of the survey that included different price levels to accompany the four environmental attributes. A simple experimental design often involves a full-factorial design. In the final version of the survey, we settled on four attributes with three levels and one attribute with four levels. This can be represented as the following factorial: $3^4 4^1$. The full factorial yields 324 possible choices. Using a full factorial allows estimation of all main effects and interactions between factors. But there are many reasons why attempting to obtain answers for all possible combinations is difficult, particularly obtaining a statistically significant number of them.

Instead, it is possible to develop a fractional factorial, using fewer versions of the choices. To obtain an efficient choice set design from a fractional factorial, the following characteristics must be present: level balance, orthogonality, minimal overlap and utility balance (Huber and Zwerina, 1996). Level balance simply means that each level of an attribute must occur within the choice sets with equal frequency. Orthogonality can be interpreted as ensuring proportionality of attribute and level with all choice sets in the fractional factorial; in other words, all estimable effects are uncorrelated. Minimal overlap requires that an attribute level not be repeated within the choice set.

The efficiency of such a design is a function of the variances and covariances of the parameter estimates (Kuhfeld, Tobias, Garratt, 1994). Our goal in designing the choice sets is to minimize the size of the covariance matrix Σ. Σ is the covariance matrix for equation (3.7) and is defined by:

$$\Sigma = (Z'PZ)^{-1} = \left[\sum_{k=1} \sum_{j=1} Z'_{kj} \; P_k (j / A) \, Z_{kj} \right] \tag{4.2}$$

It is possible to quantify the variances using efficiency measures such as the A-, D- or G-efficiency tests. The D-efficiency test, used to measure the D-error, has become the standard criterion for choice set design. The D-error, the geometric mean of the eigenvalues of Σ, can be measured in the following manner:

$$\text{D-error} = \left| \Sigma \right|^{1/k} \tag{4.3}$$

In order to estimate the parameters of the MNL model, we used the data obtained from the pilot survey. We then developed the final choice sets using SAS software and the %MktEx macro to develop the preliminary linear design, followed by the %MktRoll macro to convert it into a choice design and the PROC TRANSREG procedure to code the choice design. This process enabled minimizing the D-error. The process is an iterative one that continuously seeks to improve the D-efficiency by sequencing different combinations of the choice sets. It stops only when no significant improvements in the D-efficiency can be made.

Our final result was 15 choice sets with four plans in each set, one of which was always the baseline, “no action” scenario. In other words, there were a total of 60 choices for the survey, which are described in section 5.2. The final choice set design in its entirety is included as Appendix A.

5.0 SURVEY INSTRUMENT AND DEVELOPMENT

5.1 SURVEY INSTRUMENT DEVELOPMENT AND TESTING

The survey was tested for reliability, objectivity and clarity in language and explanation in focus groups. Students at a local high school were asked to read through the survey to check for readability. Four focus groups were held, with a total of 25 participants. In the focus group, respondents (all of whom, for ease of implementation, were students within the College of Forest Resources) were asked to read the survey and initially fill out just one choice set. They were then asked to provide their reactions to the language and layout of the survey. Finally, they were asked to respond to the remaining 14 final choice sets.

The objective of the focus groups was to flesh out the format of the greenhouse gas emissions. Our two options were to present the respondent with greenhouse gas emissions measured in weight using tons, or to present the respondent with units measured in percentage reduction. There was much discussion over whether or not presenting only one attribute measured in tons, while the others were in percentage reduction, would bias the respondent. In the final version of the survey, we included it in its tonnage units, believing that this was the most efficient way to present it as a unique variable. This was particularly important since air pollution and greenhouse gas emissions might otherwise be perceived as being quite similar.

Also during the testing phase, we experimented with presenting the solid waste emissions attribute in two formats. One was in a total mass format, using tons as the unit of measurement. The other was in a percentage reduction. Although respondents did not comment on this aspect, as they had with the greenhouse gas emissions, during the analysis it was found to significantly impact the responses. Where solid wastes were represented in tons, WTP was found to be insignificant; where they were presented as a percentage reduction, they were found to have a positive, significant WTP for reductions in this attribute.

Participants were either provided with the percentage or the tonnage version, but not both. The difference in responses may perhaps be explained by the fact that the respondents had nothing against which to compare the tonnage amount. With the percentage reduction, respondents may have been examining the reduction amounts in the same context as air and water pollution, which were also expressed in percentage terms.

5.2 DESCRIPTION OF FINAL SURVEY INSTRUMENT

There are three sections to the survey. The first section provides an introduction to the four environmental attributes and an explanation of the impact of the price attribute. As discussed above, the four environmental variables are greenhouse gas emissions, air pollution, water pollution and solid waste emissions.

Table 5.1 Choice Set Price and Environmental Levels

Variables	Level for fixed option	Levels for variable options
Greenhouse gas emissions	0	6, 11, 16, 25 ***tons*** (reduction)
Air pollution	0	5, 10, 15, 25 ***%*** (reduction)
Water pollution	0	5, 10, 15, 25 ***%*** (reduction)
Solid waste emissions	0	5, 10, 15, 25 ***%*** (reduction)
Payments	0	5, 15, 45, 95 ***$*** (increase)

The second section is the choice set exercise itself. The choice set is presented in the format of a table for visual comparison and accompanied by a written explanation of the table. Table 5.1 provides a matrix of the choice set attributes and levels. Options for reductions in greenhouse gas emissions are 0 (baseline – no action), 6, 11, 16 or 25 tons. Options for air pollution reductions are 0 (baseline – no action), 5, 10, 15, or 25 percent. Options for water pollution reductions are 0 (baseline – no action), 5, 10, 15, or 25 percent. Options for solid waste emissions reductions are 0 (baseline – no action), 5, 10, 15, or 25 percent.

Options for monthly mortgage payments increases are 0 (baseline – no action), 5, 15, 45 or 95 dollars. To date, there are no estimated costs of implementation. The amounts chosen for the survey therefore do not correspond to any actual estimated cost of implementing reductions in emissions. They were chosen because they increased in non-linear amounts and would not enable the respondent to calculate the percentage or tonnage reduction associated with the dollar increase in cost.

The third section includes questions about the respondent's household. These questions covered the following: type of residence, whether or not the respondent owns or rents the home, was the house new when they purchased it, does the respondent plan to purchase a newly constructed home within the next five years, what framing system was used in the home, number of people in household, age of home, gender of the respondent, what type of home (single family, duplex, apartment, etc.), education level, annual household income, occupation and the zip code of the respondent.

6.0 SURVEY: SAMPLING, ADMINISTRATION AND ANALYSIS

6.1 SAMPLING

The final samples for the survey were taken from two separate populations. One version of the survey was sent to a random sample taken from the general population in the entire United States. The names and addresses of 1,500 individuals were obtained from a credit services agency. The only criterion was for individuals to have an annual income over $35,000.

The second was a random sample taken from a list of real estate agents working for Windermere Real Estate Company. Surveys were mailed to 100 agents with addresses in California, Nevada, Idaho, Montana, Oregon and Washington.

6.2 ADMINISTRATION

As indicated above, the final survey was conducted as a mail survey. This survey was not possible to conduct as a phone survey as it would have been too difficult to obtain reliable responses from a large sample size. Performing in-person interviews would likewise have been too costly.

The design is adapted from Dillman's Total Design Method (1978). Approval of the survey was obtained from the Human Subjects Division of the University of Washington in early March and the survey was sent out to all 1,500 individual households in the second week of April. In the first week of May, a follow up and reminder postcard was sent out to all 1,500 intended recipients of the survey.

Because of concerns about the likelihood of a low response rate if we had provide each respondent with all 15 versions of the survey, we opted to send out only one choice set per survey to each respondent. 100 copies of each of the 15 versions were sent out, for a total of 1,500 intended respondents. In the general mail survey, each respondent was asked to complete only one choice set. Because each choice set contained only four options, one of which was always the baseline (no action choice set), not all respondents in the general survey saw all five possible price levels.

Of the original surveys, none were returned by the postal service. However, of the reminder postcards, 123 were returned. This means that at least 8% of the sample never received the survey. In addition, five individuals called on the telephone indicating that they had never received a survey and either requested one or requested that one not be mailed at all. 120 completed surveys were received; of these, two surveys were returned with the socio-economic questions section completed, but not the choice set.

In early June, another version of the survey was sent out to the 100 real estate agents mentioned above. This version omitted the section on socio-economic questions but included all 15 choice sets. This survey instrument was more complicated and required greater time on the part of the survey respondent as it included 15 choice sets instead of just the one choice set sent in the previous version mailed to the general population. Four of these were returned with the indication that the intended recipient was no longer at the address or that the address was incorrect. Eleven completed surveys had been received; of these, nine had usable choice sets.

6.3 ANALYSIS OF QUALITATIVE QUESTIONS

The socio-economic questions yielded some interesting results. Occupations listed ranged from investment banker to law enforcement to engineer. Nearly a third of the respondents indicated they were unemployed; a large number of the unemployed respondents wrote that they were retired. This affected the answers for several of the other household questions. Because many of the individuals were retired, they typically had lower household incomes. The median household income was between $50,000 and $75,000 per year. Close to 6% of the respondents indicated an annual income of less than $25,000. Nearly half of the respondents had an annual household income between $50,000 and $100,000.

The mean number of members of a household was 2.7 persons, while the median was two persons. The range was one to eight persons. About 81% of the respondents were men, with the remaining 19% being women. 87.5% of the respondents own their own homes; the remaining 12.5% are renters. 80% of the respondents indicated that they live in single-family residences. 50% of the respondents had a bachelor's degree or higher; 23% had a graduate degree. 18.5% had only a high school-level education. Almost 86% of respondents lived in wood frame housing. 7.5% lived in concrete-framed housing, while just 2.5% lived in steel framed buildings.

Table 6.1 What Type of Frame Does Your House Have?

Question From Socio-Economic Questions Section

	Number of Responses	Percentage of Total
Wood	103	89.5
Steel	3	2.6
Concrete	9	7.8
Don't know	2	1.7

Table 6.2 What is Your Annual Household Income, Before Taxes?

Question From Socio-Economic Questions Section

	Number of Responses	Percentage of Total
$25,000 or less	6	6.1
$25,001 to $50,000	19	19.4
$50,001 to $75,000	24	24.5
$75,001 to $100,000	29	29.6
$100,001 to $125,000	5	5.1
$125,001 to $150,000	7	7.1
$150,001 to $175,000	4	4.1
Above $175,000	4	4.1

The results from all socio-economic questions are included as Appendix H.

7.0 MODEL SPECIFICATION WTP ESTIMATION

7.1 MODEL SPECIFICATION

The model follows the multinomial conditional logit (MNL) design. The final best fit model is specified following the MNL model where

$$P_k(i/A) = e^{\beta X_{ki}} / \sum_{j \in A} e^{\beta X_{kj}} \tag{7.1}$$

Several different forms of the indirect utility function were tested, including different linear and quadratic forms. The final best fit included a combination of linear and quadratic forms. Our model had one dependent variable and five independent variables: air pollution, water pollution, greenhouse gas emissions, solid waste and payments. Putting these into the model, our equation looks like:

$$\beta X_{kj} = \beta_1 * air_{kj} + \beta_2 * airq_{kj} + \beta_3 * water_{kj} + \beta_4 * ghg_{kj} + \beta_5 * ghgq_{kj} + \beta_6 * solid_{kj} + \beta_7 * solidq_{kj} + \alpha * payments_{kj}$$

air: quantitative variable for air pollution;

airq: quantitative variable, square of *air*, for capturing quadratic effect of air pollution;

water: quantitative variable for water pollution;

ghg: quantitative variable for greenhouse gas emissions;

ghgq: quantitative variable, square of *ghg*, for capturing quadratic effect of greenhouse gas emissions;

solid: quantitative variable for solid waste emissions;

solidq: quantitative variable, square of *solid*, for capturing quadratic effect of solid waste emissions;

payments: quantitative variable for monthly mortgage payments.

The estimated parameters of the MNL model are identified in Table 7.1. The P-values demonstrate that the individual parameters are statistically significant. The air pollution, solid waste emission and greenhouse gas emission variables all demonstrate positive linear and negative quadratic effects on the respondents' choice behavior. This can be interpreted as respondents deriving benefit from a reduction in these three attributes at a decreasing rate. Eventually, respondents will derive no further benefits from any greater reductions. The water pollution variable shows a positive linear effect, but not a significant quadratic effect. This makes it difficult to interpret respondents' attitudes toward reductions in water pollution and to obtain any point elasticity in a marginal WTP (demand) curve.

Table 7.1 Coefficients for MNL for Household Sample

Variable	Coefficient	Standard Error	z	P>|z|	95% Confidence Interval	
ghg	1.381716	.285208	4.845	0.000	.8227188	1.940713
air	.7891995	.1202475	6.563	0.000	.5535187	1.02488
water	.1825837	.0287868	6.343	0.000	.1261626	.2390049
solid	1.241015	.1709997	7.257	0.000	.9058621	1.576169
payments	-.0703939	.0072529	-9.706	0.000	-.0846093	-.0561785
ghgq	-.0585703	.0131156	-4.466	0.000	-.0842764	-.0328642
airq	-.0203349	.0035752	-5.688	0.000	-.0273421	-.0133277
solidq	-.0356877	.0050521	-7.064	0.000	-.0455896	-.0257858

Number of observations = 759
Log likelihood = -223.65576
chi2(8) = 419.42
Prob > chi2 = 0.0000
Pseudo R2 = 0.4839

7.2 WILLINGNESS TO PAY ESTIMATION

Using equation (7.1) we can derive total and marginal willingness to pay (WTP) for air pollution, greenhouse gas emissions and solid waste emissions. Each WTP is estimated individually while holding the other elements constant. The following equations are used to estimate the WTP values:

$$\text{Total WTP}(air) = -\frac{1}{\alpha}\left(\beta_1 * (air_i - air_j) + \beta_2 * (airq_i - airq_j) \right)$$

$$\text{Total WTP}(ghg) = -\frac{1}{\alpha}\left(\beta_4 * (ghg_i - ghg_j) + \beta_5 * (ghgq_i - ghgq_j) \right)$$

$$\text{Total WTP}(solid) = -\frac{1}{\alpha}\left(\beta_6 * (solid_i - solid_j) + \beta_7 * (solidq_i - solidq_j) \right)$$

$$\text{Marginal WTP}(air) = -\frac{1}{\alpha}\left(\beta_1 + 2\beta_2 * air \right)$$

$$\text{Marginal WTP}(ghg) = -\frac{1}{\alpha}\left(\beta_4 + 2\beta_5 * ghg \right)$$

$$\text{Marginal WTP(solid)} = -\frac{1}{\alpha}\left(\beta_6 + 2\beta_7 * \text{solid} \right)$$

7.3 RESULTS FROM HOUSEHOLD SURVEYS

In this survey, we found that the respondents were most sensitive to reductions in greenhouse gas emissions. As depicted in Figure 7.1, the maximum willingness to pay per tons of reduction is $27.39; for a reduction of five tons, these households were willing to pay $16.63 per ton. After eleven tons, households were no longer willing to pay for any further reductions. It is important to point out that survey participants were informed that the average house produces 20 tons of GHGs during the construction process, so a reduction of eleven tons is a significant amount.

For reductions in air pollution, we found that the respondents were willing to pay a maximum of $10.88 for the percentage of reduction; for a 10% reduction, they were willing to pay $5.26 per unit. At about an 18% reduction, the household loses its willingness to pay anything further for increased reductions.

In the case of solid waste emissions, the maximum willingness to pay for the first percentage of reduction is $9.99; for a 10% reduction, the household was willing to pay $4.71. At about 18% reduction, the household was no longer willing to pay for any further reduction. Here we see that the demand for GHG attribute is much less elastic than the demand for air or solid.

Using the results from the socio-economic questions, we can see how factors like gender, education and income affect WTP sensitivity. By breaking education levels into two groups – one limited to high school degree and below, the other to college degree or higher – we can see a distinct difference in preferences. While the more highly educated group was willing to pay $39 for the first ton of reduction of greenhouse gas emissions, the lower-educated group was willing to pay only up to $21 for the initial unit. This pattern is similar for the air and solid waste attributes. Similarly, when dividing household income into two groups – those with $75,000 and less and those with $75,001 and above – we see a lower total and marginal WTP for the greenhouse gas and air emissions for those in the lower income group; however, the lower income group in this survey had a higher marginal WTP for solid waste emissions than for the other environmental attributes.

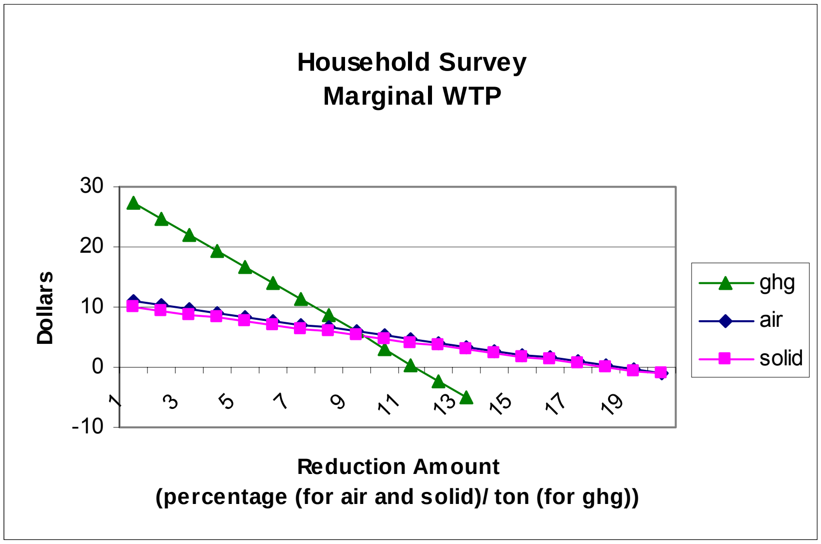

Figure 7.1 Marginal WTP for Household Survey

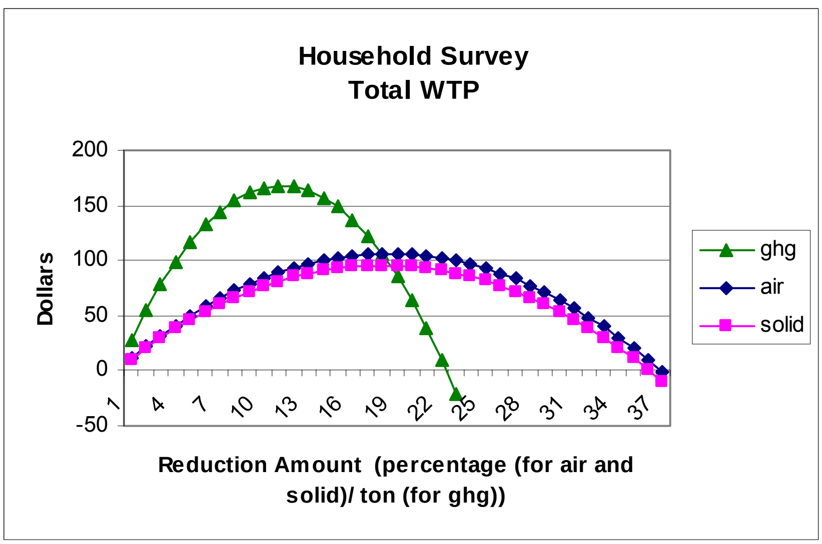

Figure 7.2 Total WTP for Household Survey

7.4 RESULTS FROM REAL ESTATE AGENTS SURVEY

In this survey, we found that the agents were more sensitive to reductions in solid waste emissions. As demonstrated in Figure 7.3, the maximum willingness to pay for the first percentage of reduction is $20; for a 10% reduction, the household was willing to pay $9.15. At about 17% reduction, the household was no longer willing to pay for any further reduction.

For reductions in air pollution, we found that the respondents to this survey had very similar sensitivity to the air pollution index as the respondents in the general mail survey. Here, the agents were willing to pay a maximum of $10.13 for the first percentage of reduction; for a 10% reduction, they were willing to pay $5.52 per unit. At about 20% reduction, the household loses its willingness to pay anything further for increased reductions.

For reductions in greenhouse gas emissions, the maximum respondents were willing to pay is $8.84 for the first unit (here tons) of reduction; for a 10-ton reduction, they were willing to pay $2.20 per ton of reduction. At 13 tons of reduction, the household was no longer willing to pay for any further reductions. Of this group, demand for reductions in air pollution had the highest elasticity, while greenhouse gas emissions had the lowest elasticity. Solid waste fell in between.

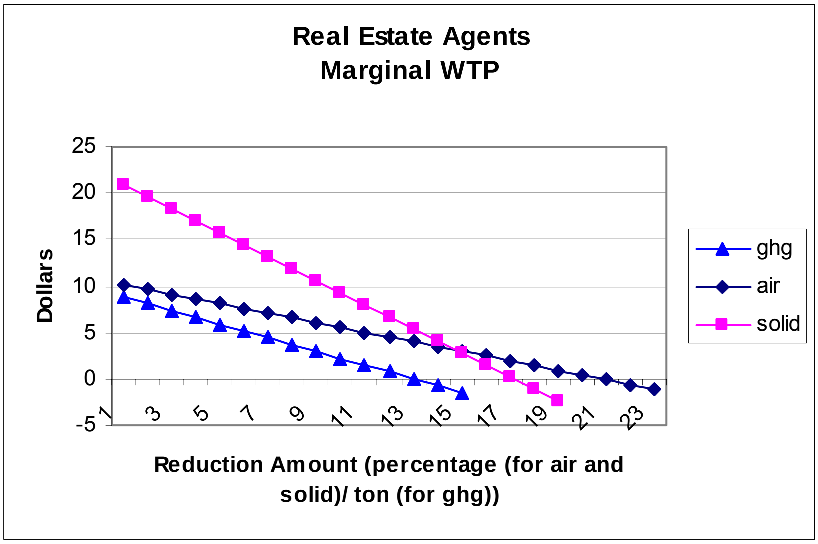

Figure 7.3 Marginal WTP for Real Estate Agents Survey

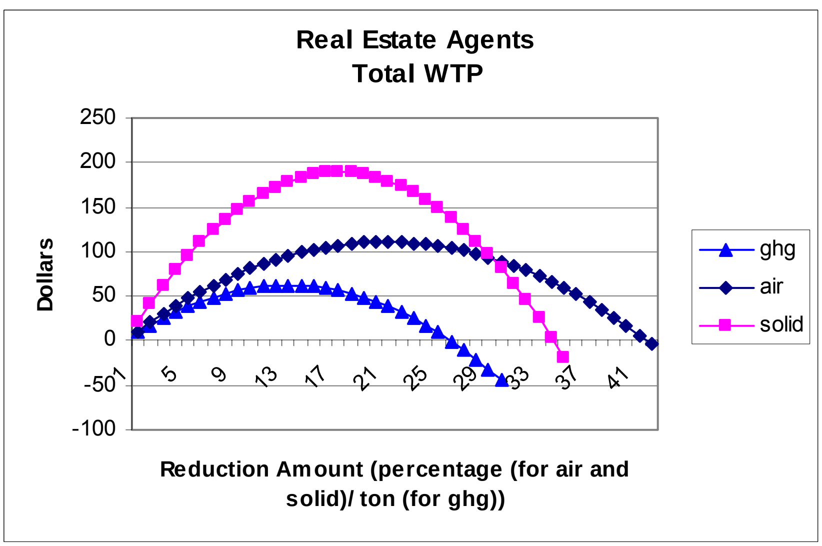

Figure 7.4 Total WTP for Real Estate Agents Survey

7.5 COMBINED RESULTS

With the combined dataset, we found that the water variable was insignificant and we could derive no positive willingness to pay for reductions in water pollution. The marginal WTP for GHG reductions was $17.96 for the first ton of reduction. Figure 7.5 illustrates that respondents were willing to pay for up to 12 tons of reduction.

In solid waste emissions, respondents were willing to pay up to $16.61 for the first unit and ceased to be willing to pay for further reductions after an 18 % reduction. In air pollution, respondents wanted up to a 22% reduction, but were not willing to pay more than $10.63 for the first unit of reduction. As depicted in Figure 7.6, the highest total willingness to pay was $153.58 for an 18% reduction in solid waste emissions.

The maximum WTP for reductions in air pollution is $108.96 for a 20% reduction. For greenhouse gases, the total WTP was $115.73 for a twelve-ton reduction. We noticed that the price elasticity is greater for the air pollution and solid emissions attributes than for the greenhouse gas variable.

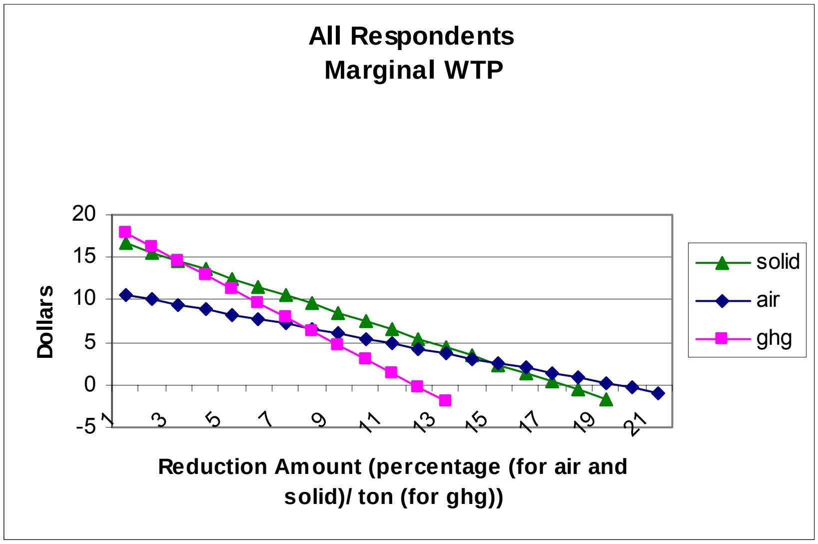

Figure 7.5 Marginal WTP for Combined Datasets

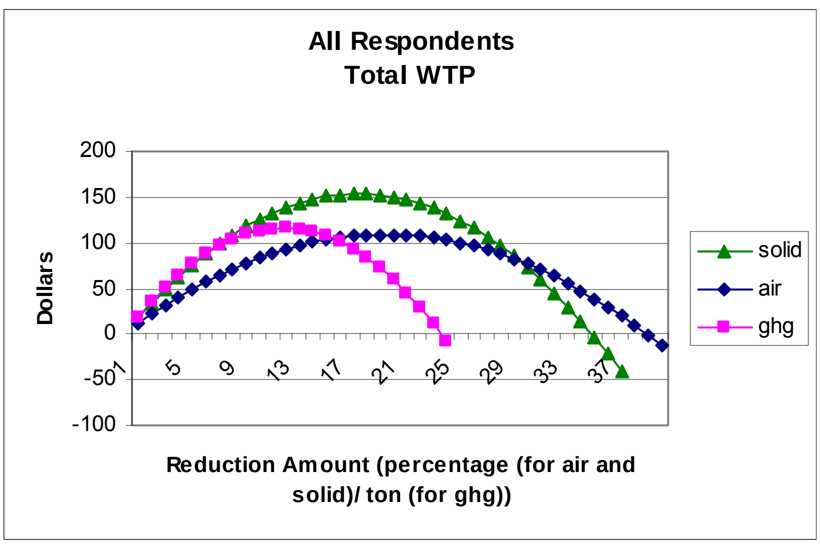

Figure 7.6 Total WTP for Combined Datasets

8.0 VALIDITY AND RELIABILITY OF STUDY

As discussed in the description of the model and survey instrument, every effort was made to ensure the validity and reliability of this study. First, the experimental choice analysis method (ECAM) enabled us to avoid many of the pitfalls commonly associated with stated preference methods such as contingent valuation. Second, the willingness to pay estimates were made according to the multinomial conditional logit model and in accordance with general economic theory.

Third, every effort was made to thoroughly explain in clear language the content of the survey. All attributes were explained in plain language; in fact, part of the Human Subjects process required a refinement of the text's language to make it more understandable to readers who possess only a middle school reading level. The survey was tested thoroughly in focus groups to ensure clarity of explanations.

Although it might have been even simpler for participants to understand the survey had we administered it in person, providing the general public with only one choice set was a means of easing the burden placed on the respondent. However, that choice did result in a lower response rate and fewer degrees of freedom.

A number of tests are embedded into the data analysis process. Maximum likelihood ratio, p-value and confidence intervals are calculated during the data analysis phase.

The two surveys elicited similar responses to the air pollution index, but the households studied in the general mail survey exhibited a higher willingness to pay for greenhouse gas emissions; the real estate agents appeared to be more willing to pay for greater reductions in solid waste emissions.

Limitations to this study include a small sample size. From the general survey, there were 120 completed choice sets. From the survey sent to the real estate agents, there were 135 completed surveys (135 represent the nine completed surveys with 15 choices per survey). As a result, the total number of choice sets completed was 255.

Another limitation is the problem of the hypothetical nature of stated preference surveys. Respondents in this survey were not faced with any real tradeoffs between their stated preference and what their actual behavior would be in a market situation.

9.0 DISCUSSION, CONCLUSION AND FUTURE WORK

9.1 DISCUSSION

The results of the two samples show an overall higher WTP for reductions in greenhouse gas emissions, followed by a significant WTP for reductions in solid waste emissions. Respondents were also willing to pay for reductions in air pollution, but had a flatter demand curve than for reductions in solid waste.

The results of the household survey demonstrated that respondents were most sensitive to reductions in greenhouse gas emissions and were willing to pay for up to ten tons of reduction. Considering that a typical house produces 20 tons of such gases during the production process, this assessment is significant. They were also willing to pay for reductions in air pollution and solid wastes, although less than they were for reductions in greenhouse gas emissions. The sensitivity to the former two attributes was about the same.

The responses from real estate agents provide a somewhat different story. The respondents to this survey appear to be much more willing to pay for reductions in solid waste emissions than for reductions in the other environmental attributes. It is difficult to assess why the agents are so concerned with solid waste reductions; it may be a result of frequent exposure to new home construction and large amounts of waste at construction sites.

If we compare the amounts by which respondents were willing to pay for reductions in the environmental attributes to the amounts of reduction when wood is used as a framing system (instead of steel or concrete), we can see that respondents would favor the wood framing system because it automatically facilitates the reduction. Indeed, wood is preferable, particularly in the case of greenhouse gas emissions, where the WTP always exceeds the intrinsic reductions. As depicted in table 9.1, in Minneapolis, using wood instead of concrete results in a 9.8-ton reduction in greenhouse gas emissions; in Atlanta, using wood instead of concrete results in a 6.6-ton reduction. Our survey demonstrates that respondents were willing to pay for up to eleven tons of reduction.

Table 9.1 Comparison Between Reductions in Different Building Materials and WTP

Environmental attribute	Minneapolis Steel over wood	Atlanta Concrete over wood	Maximum amount respondents WTP
Greenhouse gas emissions	+9.8 tons	+6.6 tons	11 tons
Air emissions	+14%	+23%	18%
Solid waste emissions	-0.9%	+51%	18%

This survey has useful implications for both market and policy applications. The responses from the datasets demonstrate that those seeking to increase their market share in building materials that involve lower greenhouse gas emissions or solid waste production might want to design a label that indicates the lower emissions standards in their products. Perhaps a label similar to that of the "green star" by the EPA would be appropriate.

9.2 CONCLUSION AND FUTURE WORK

Understanding public attitudes toward building materials and their related environmental attributes is important because it can help researchers and producers better provide consumers with the product attribute information they seek. This study addresses the question using a choice-based, stated preference approach and basic consumer demand theory. Using a mail survey, respondents were asked to assess a set of goods with different level of attributes and choose the most preferred one.

There is much room for future work. A thorough cost-benefit analysis could be useful in comparing the savings and benefits obtained from using wood over steel or concrete as building materials. A simple calculation of the net present value of the total WTP for the environmental attributes demonstrates that the amounts are roughly equivalent to ten percent of the cost of a median mortgage in either Atlanta or Minneapolis over a 30-year term. Because building with the latter two materials can be more costly than the former, the additional amounts by which respondents stated they were willing to pay, estimated in this study, could therefore inherently be included in the cost of building. A more thorough examination of the interaction between socio-economic factors and the WTP amounts might also be useful. As mentioned above, research into effective marketing tools should be conducted to provide consumers with the environmental attribute information to enable them to make better-informed decisions about the building products they purchase.

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APPENDIX A: FINAL CHOICE SETS DESIGN

Choose Program	Reduce Greenhouse Gas Emission	Reduce Air Pollution	Reduce Water Pollution	Reduce Solid Waste Production	Increase Monthly Mortgage Payments by
A	16 tons	15%	5 %	5 %	$45
B	6 tons	0 %	25%	25%	$15
C	11 tons	25 %	15%	15%	$5
D	0 tons	0 %	0 %	0 %	$0
A	16 tons	5 %	25%	5 %	$15
B	6 tons	15 %	15%	15%	$95
C	11 tons	25 %	5 %	25%	$45
D	0 tons	0 %	0 %	0 %	$0
A	6 tons	25%	15%	5 %	$45
B	16 tons	15 %	5 %	25%	$95
C	11 tons	0 %	25%	15%	$15
D	0 tons	0 %	0 %	0 %	$0
A	6 tons	15%	5 %	15%	$45
B	11 tons	0 %	25%	5 %	$95
C	16 tons	25 %	15%	25%	$5
D	0 tons	0 %	0 %	0 %	$0
A	11 tons	15%	15%	5 %	$15
B	16 tons	0 %	15%	15%	$45
C	6 tons	25 %	25%	25%	$95
D	0 tons	0 %	0 %	0 %	$0

A	16 tons	5 %	5 %	15%	$45
B	6 tons	25 %	15%	5 %	$15
C	11 tons	15 %	25%	25%	$5
D	0 tons	0 %	0 %	0 %	$0
A	16 tons	15%	25%	25%	$5
B	11 tons	0 %	15%	5 %	$95
C	6 tons	25 %	5 %	15%	$15
D	0 tons	0 %	0 %	0 %	$0
A	11 tons	5 %	25%	15%	$45
B	16 tons	25 %	5 %	5 %	$95
C	6 tons	15 %	15%	25%	$15
D	0 tons	0 %	0 %	0 %	$0
A	6 tons	15%	25%	5 %	$45
B	16 tons	0 %	15%	25%	$15
C	11 tons	25 %	5 %	15%	$95
D	0 tons	0 %	0 %	0 %	$0
A	16 tons	5 %	15%	15%	$45
B	11 tons	15 %	25%	5 %	$95
C	6 tons	25 %	5 %	25%	$15
D	0 tons	0 %	0 %	0 %	$0
A	6 tons	15%	15%	15%	$5
B	16 tons	25 %	25%	5 %	$45
C	11 tons	0 %	5 %	25%	$15
D	0 tons	0 %	0 %	0 %	$0

A	11 tons	5 %	15%	25%	$45
B	16 tons	15 %	5 %	15%	$95
C	6 tons	25 %	25%	5 %	$15
D	0 tons	0 %	0 %	0 %	$0
A	16 tons	15%	15%	5 %	$15
B	6 tons	0 %	25%	15%	$95
C	11 tons	25 %	5 %	25%	$45
D	0 tons	0 %	0 %	0 %	$0
A	11 tons	15%	5 %	15%	$15
B	16 tons	25 %	15%	5 %	$95
C	6 tons	15 %	25%	25%	$45
D	0 tons	0 %	0 %	0 %	$0
A	11 tons	15%	5 %	5 %	$45
B	16 tons	25 %	25%	15%	$5
C	6 tons	0 %	15%	25%	$95
D	0 tons	0 %	0 %	0 %	$0

APPENDIX B: COVER LETTER FOR SURVEY SENT TO HOUSEHOLDS

March, 2004

Dear Survey Participant:

Home construction requires the use of many resources, such as cement, wood and steel. These building materials require different energy levels to produce. The production and disposal processes affect the environment and may create pollution.

We want to know how the public feels about pollution and environmental concerns related to building materials. We are asking people to take part in this University of Washington research study. We would like you to fill out the attached survey. The survey will take about 15 minutes to complete. Participation is voluntary. You do not have to answer every question.

Your household is one of a few randomly chosen. All information that you provide in the survey is completely confidential and will not be provided to a third party. Your identity is not linked to the survey. Return postage has been prepaid. All you need to do is place the survey in the enclosed envelope and drop it in any post box.

I would be more than happy to answer any questions or concerns you might have. Please feel free to call me at (206) 685-2315.

Thank you,

Dr. John Perez-Garcia

Associate Professor

College of Forest Resources

University of Washington

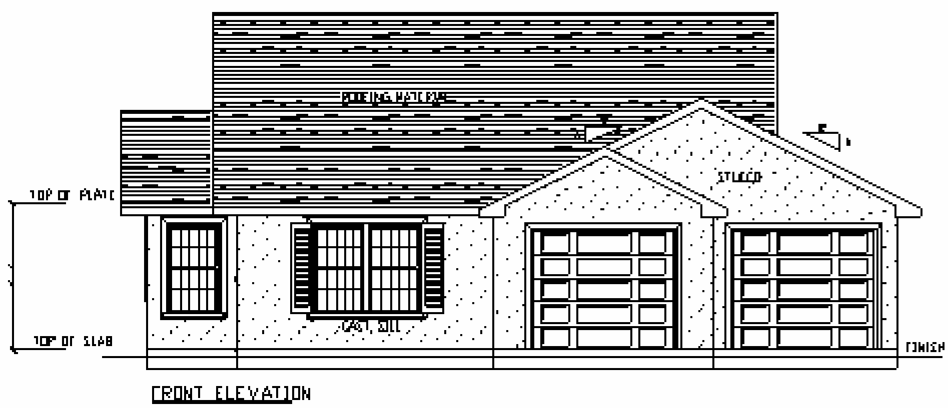
Seattle, WA 98195

APPENDIX C: EXAMPLE OF SURVEY SENT TO HOUSEHOLDS

RESIDENT SURVEY:

HOW DO YOU FEEL ABOUT

RENEWABLE BUILDING MATERIALS?



We want to know how the public feels about pollution and environmental concerns related to building materials. We are asking people to take part in this University of Washington research study.

2004

University of Washington

Seattle, WA

Introduction

We want to know how the public feels about pollution and environmental concerns related to building materials. We would like you to fill out the attached survey. The survey will take about 15 minutes to complete. Participation is voluntary. You do not have to answer every question.

Below is an explanation of the environmental and financial attributes. Following the explanation is an exercise that allows you to make a choice between different levels of the environmental attributes and the financial attribute.

Environmental Attributes

In our survey, we consider four environmental attributes related to home construction: greenhouse gas emissions, air pollution, water pollution and solid waste production. All of these attributes may increase or decrease, depending on the type and amount of building material used.

Greenhouse Gas Emissions

Scientists have related the human consumption and release of these gases to global warming. Global warming is the gradual process by which the average surface temperature of the Earth is increasing. The average amount of greenhouse gases that are emitted during the construction of a new house is 20 tons.

Air Pollution

The air pollution index is different from “greenhouse gas emissions” because it includes pollutants that have more direct human health problems like asthma and contribute to acid rain.

Water Pollution

The water pollution index calculates the amount of typical water pollutants created and released during the production processes.

Solid Waste Production

Solid waste production relates specifically to the total mass of solid wastes produced during construction.

Financial Attribute

In order to better understand your opinion toward environmental and pollution attributes, we also include a price variable.

Increase in Monthly Housing Payment

Here we see that different *increases in monthly mortgage or rental payments* relate to the cost incurred as a result of *reducing the different environmental attributes*. This increase in mortgage or rental payment represents an increase in cost due to a change in the pollution and environment attributes (described above). The increase in cost has no effect on the size of the house or the number of rooms.

How Do You Feel About Renewable Building Materials?

Step 1: Based on the information provided on the previous page, please review the following plans.

	Increase Monthly Housing Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$15	11 tons	15%	15%	5 %
Plan B	$45	16 tons	5 %	15%	15%
Plan C	$95	6 tons	25%	25%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Explanation of Plans

Plan A results in a $15 monthly increase in mortgage payment, while greenhouse gas emissions associated with the building materials used in construction go down by 11 tons, air pollution goes down by 15%, water pollution goes down by 15% and solid waste production is reduced by 5%.

Plan B results in a $45 monthly increase in mortgage payment, while greenhouse gas emissions associated with the building materials used in construction go down by 16 tons, air pollution goes down by 5%, water pollution goes down by 15% and solid waste production is reduced by 15%.

Plan C results in a $95 monthly increase in mortgage payment, while greenhouse gas emissions associated with the building materials used in construction go down by 6 tons, air pollution goes down by 25%, water pollution goes down by 25% and solid waste production is reduced by 25%.

Plan D represents no change from standard home construction. There are no decreases in emissions, pollution or solid waste production; as a result there is no increase in monthly payments.

Step 2: If you were to purchase a newly constructed home, which plan would be the most appealing to you and your household? ***Please circle one plan (A, B, C, or D).***

Plan A

Plan B

Plan C

Plan D

Questions about your household

1) What best describes the type of residence in which you are currently living?

Apartment □ Duplex □ Other □

Single family house □ Mobile home □

2) Do you rent or own your current residence?

Rent □ Own □

3) If you own your home, was your house new when you purchased it?

Yes □ No □ Don't know □

Not applicable □

4) Do you plan to purchase a newly constructed house within the next five years?

Yes □ No □ Don't know □

5) What type of frame does your house have?

Wood □ Steel □ Concrete □

Don't know □

6) How old is your home?

Less than five years □ 20 to 30 years □ More than 50 years □

5 to 10 years □ 30 to 40 years □ Don't know □

10 to 20 years □ 40 to 50 years □

7) What is your gender?

Male □ Female □

8) Are you currently employed?

Yes ☐ No ☐

9) If yes, what is your occupation? ____________________

10) What is your household annual income, before taxes?

$25,000 or less ☐ $75,001 to $100,000 ☐ $150,001 to $175,000 ☐

$25,001 to $50,000 ☐ $100,001 to $125,000 ☐ Above $175,000 ☐

$50,001 to $75,000 ☐ $125,001 to $150,000 ☐

11) What is the highest level of education you have received?

High school graduate ☐ Associate’s Degree ☐ Master’s Degree ☐

Some college ☐ Bachelor’s Degree ☐ Ph.D, M.D. or J.D. ☐

12) What is your zip code? ____________________

13) How many people are in your household? ____________________

APPENDIX D: REMINDER NOTICE SENT TO GENERAL MAIL SURVEY RECIPIENTS

May, 2004

Two weeks ago a questionnaire from the University of Washington was sent to you seeking your opinion on paying for renewable building materials. Your name was drawn from a random sample of households across the country.

If you have already completed and returned the survey, thank you! If not, please take the time to fill it out today. Because we have sent the survey out to a small number of people, it is important to us that we receive your response.

If you did not receive the questionnaire, or if it was misplaced, and would like one now, please call me at (206) 685-2315 and I will send out to you as soon as possible.

Sincerely,

John Perez-Garcia

Associate Professor

University of Washington

APPENDIX E: COVER LETTER SENT TO REAL ESTATE AGENTS

June, 2004

Dear Real Estate Agent:

We want your opinion on the value of various environmental attributes associated with home construction.

The University of Washington is conducting a survey on residential home construction values. As a part of the study we have developed a survey instrument to ask for your opinion on specific environmental values associated with home construction. We have mailed this survey to you because, as a real estate agent, you are particularly aware of consumer preferences in home buying and home values.

We would like you to fill out the attached survey. The survey will take about 15 minutes to complete. If you are unable to fill out the survey, we would greatly appreciate it if you could pass it along to someone else in your office that is able to complete it and mail it back to us. ***Your prompt response is important to the success of this study.***

The information gathered from the survey will be used to evaluate whether a label identifying the environmental effects of home construction would add value to a house. Home construction requires the use of many competing resources such as cement, wood and steel. The production of these building materials and their use in home construction cause varying levels of pollution that affect the environment. ***Your opinion is important to us. We want to know how you feel about pollution and environmental concerns related to common building materials used in home construction.***

All information that you provide in the survey is completely confidential and will not be provided to a third party. Your identity is not linked to the survey. Return postage has been prepaid. All you need to do is place the survey in the enclosed envelope and drop it in any post box.

I would be more than happy to answer any questions or concerns you might have. Please feel free to call me at (206) 685-2315.

Thank you,

Dr. John Perez-Garcia

Associate Professor

College of Forest Resources

University of Washington

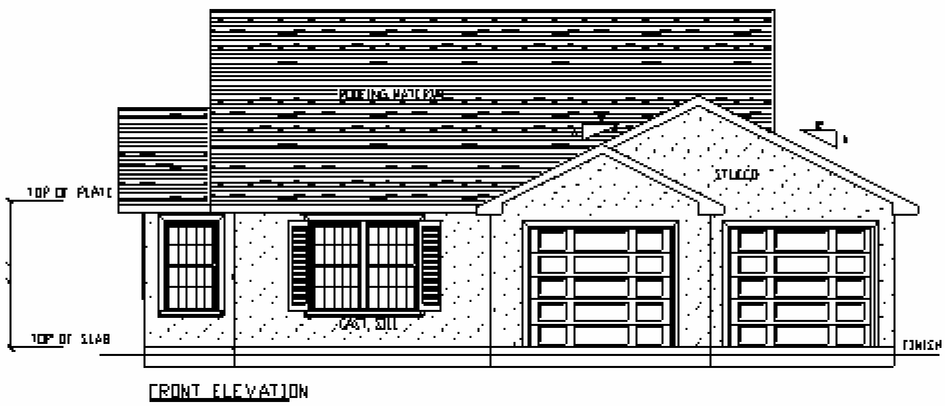
Seattle, WA 98195

APPENDIX F: SURVEY SENT TO REAL ESTATE AGENTS

SURVEY:

HOW DO YOU FEEL ABOUT

BUILDING MATERIALS AND THE ENVIRONMENT?



We want to know how the public feels about pollution and environmental concerns related to building materials. We are asking people to take part in this University of Washington research study.

2004

University of Washington

Seattle, WA

Introduction

We want to know how the public feels about pollution and environmental concerns related to building materials. We would like you to fill out the attached survey. The survey will take about 15 minutes to complete. Participation is voluntary. You do not have to answer every question.

Below is an explanation of the environmental and financial attributes we include in the survey. Following the explanation is an exercise that allows you to make a choice between different levels of the environmental attributes and the financial attribute.

Environmental Attributes

In our survey, we consider four environmental attributes related to home construction: greenhouse gas emissions, air pollution, water pollution and solid waste production. All of these attributes may increase or decrease, depending on the type and amount of building material used.

Greenhouse Gas Emissions

Scientists have related the human consumption and release of these gases to global warming. Global warming is the gradual process by which the average surface temperature of the Earth is increasing. The average amount of greenhouse gases that are emitted during the construction of a new house is 20 tons.

Air Pollution

The air pollution index is different from "greenhouse gas emissions" because it includes pollutants that have more direct human health problems like asthma and contribute to acid rain.

Water Pollution

The water pollution index calculates the amount of typical water pollutants created and released during the production processes.

Solid Waste Production

Solid waste production relates specifically to the total mass of solid wastes produced during construction.

Financial Attribute

In order to better understand your opinion toward environmental and pollution attributes, we also include a price variable.

Increase in Monthly Housing Payment

Here we see that different *increases in monthly mortgage or rental payments* relate to the cost incurred as a result of *reducing the different environmental attributes*. This increase in mortgage or rental payment represents an increase in cost due to a change in the pollution and environment attributes (described above). Please note that the increase in cost has no effect on the size of the house or the number of rooms.

How Do You Feel About Renewable Building Materials?

Step 1: Based on the information provided on the previous page, please review the following plans.

	Increase Monthly Housing Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	16 tons	15%	5%	5 %
Plan B	$15	6 tons	5 %	25%	25%
Plan C	$5	11 tons	25%	15%	15%
Plan D	$0	0 tons	0 %	0 %	0 %

Explanation of Plans

Plan A results in a $45 monthly increase in mortgage payment, while greenhouse gas emissions associated with the building materials used in construction go down by 16 tons, air pollution goes down by 15%, water pollution goes down by 5% and solid waste production is reduced by 5%.

Plan B results in a $15 monthly increase in mortgage payment, while greenhouse gas emissions associated with the building materials used in construction go down by 6 tons, air pollution goes down by 5%, water pollution goes down by 25% and solid waste production is reduced by 25%.

Plan C results in a $5 monthly increase in mortgage payment, while greenhouse gas emissions associated with the building materials used in construction go down by 11 tons, air pollution goes down by 25%, water pollution goes down by 15% and solid waste production is reduced by 15%.

Plan D represents no change from standard home construction. There are no decreases in emissions, pollution or solid waste production; as a result there is no increase in monthly payments.

Step 2: If you were to purchase a newly constructed home, which plan would be the most appealing to you and your household? ***Please circle one plan (A, B, C, or D).***

Plan A

Plan B

Plan C

Plan D

Step 3: Below are an additional 14 sets from which to choose plans. ***It is important for our survey that you complete all 15 of the choice sets.*** *Following the above directions, please circle* **one plan within each set**. *The written explanation of each plan has been omitted from subsequent sets.*

Set 2

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$15	16 tons	5 %	25%	5 %
Plan B	$95	6 tons	15%	15%	15%
Plan C	$45	11 tons	25%	5 %	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 3

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:.

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	6 tons	25%	15%	5 %
Plan B	$95	16 tons	15%	5 %	25%
Plan C	$15	11 tons	5 %	25%	15%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 4

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	6 tons	15%	5 %	15%
Plan B	$95	11 tons	5 %	25%	5 %
Plan C	$5	16 tons	25%	15%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 5

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$15	11 tons	15%	15%	5 %
Plan B	$45	16 tons	5 %	15%	15%
Plan C	$95	6 tons	25%	25%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 6

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	16 tons	5 %	5 %	15%
Plan B	$15	6 tons	25%	15%	5 %
Plan C	$5	11 tons	15%	25%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 7

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$5	16 tons	15%	25%	25%
Plan B	$95	11 tons	5 %	15%	5 %
Plan C	$15	6 tons	25%	5 %	15%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 8

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	11 tons	5 %	25%	15%
Plan B	$95	16 tons	25%	5 %	5 %
Plan C	$15	6 tons	15%	15%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 9

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	6 tons	15%	25%	5 %
Plan B	$15	16 tons	5 %	15%	25%
Plan C	$95	11 tons	25%	5 %	15%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 10

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	16 tons	5 %	15%	15%
Plan B	$95	11 tons	15%	25%	5 %
Plan C	$15	6 tons	25%	5 %	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 11

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$5	6 tons	15%	15%	15%
Plan B	$45	16 tons	25%	25%	5 %
Plan C	$15	11 tons	5 %	5 %	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 12

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	11 tons	5 %	15%	25%
Plan B	$95	16 tons	15%	5 %	15%
Plan C	$15	6 tons	25%	25%	5 %
Plan D	$0	0 tons	0 %	0 %	0 %

Set 13

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$15	16 tons	15%	15%	5 %
Plan B	$95	6 tons	5 %	25%	15%
Plan C	$45	11 tons	25%	5 %	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 14

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$15	11 tons	15%	5 %	15%
Plan B	$95	16 tons	25%	15%	5 %
Plan C	$45	6 tons	15%	25%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

Set 15

Given the plans listed below, please circle your most preferred plan ***(A,B, C, or D)***:

	Increase Monthly Mortgage Payments by	Reduce Greenhouse Gas Emission by	Reduce Air Pollution by	Reduce Water Pollution by	Reduce Solid Waste Production by
Plan A	$45	11 tons	15%	5 %	5 %
Plan B	$5	16 tons	25%	25%	15%
Plan C	$95	6 tons	5 %	15%	25%
Plan D	$0	0 tons	0 %	0 %	0 %

APPENDIX G: RESULTS OF FINAL BEST-FIT MODELS

G.1

Data Set: combined general mail and real estate agents

Model: quadratic, water linear

Equation: clog dependan ghg air water solid payments ghgq airq solidq if select4==0, group(set)

Note: multiple positive outcomes within groups encountered.
Iteration 0: log likelihood = -379.27195
Iteration 1: log likelihood = -264.18856
Iteration 2: log likelihood = -233.36627
Iteration 3: log likelihood = -225.1479
Iteration 4: log likelihood = -223.73133
Iteration 5: log likelihood = -223.65604
Iteration 6: log likelihood = -223.65576

Conditional (fixed-effects) logistic regression Number of obs = 759
LR chi2(8) = 419.42
Prob > chi2 = 0.0000
Log likelihood = -223.65576
Pseudo
R2 = 0.4839

Variable	Coefficient	Standard Error	z	P>|z|	95% Confidence Interval	
ghg	1.381716	.285208	4.845	0.000	.8227188	1.940713
air	.7891995	.1202475	6.563	0.000	.5535187	1.02488
water	.1825837	.0287868	6.343	0.000	.1261626	.2390049
solid	1.241015	.1709997	7.257	0.000	.9058621	1.576169
payments	-.0703939	.0072529	-9.706	0.000	-.0846093	-.0561785
ghgq	-.0585703	.0131156	-4.466	0.000	-.0842764	-.0328642
airq	-.0203349	.0035752	-5.688	0.000	-.0273421	-.0133277
solidq	-.0356877	.0050521	-7.064	0.000	-.0455896	-.0257858

G.1

Data Set: combined general mail and real estate agents

Model: Linear

Equation: clog dependan air water solid payments if select4==0, group(set)

Note: multiple positive outcomes within groups encountered.
Iteration 0: log likelihood = -393.98329
Iteration 1: log likelihood = -310.07135
Iteration 2: log likelihood = -299.62199

Iteration 3: log likelihood = -298.91542
Iteration 4: log likelihood = -298.91036

Conditional (fixed-effects) logistic regression Number of obs = 759
LR chi2(4) = 268.91
Prob > chi2 = 0.0000
Log likelihood = -298.91036
Pseudo R2 = 0.3103

Variable	Coefficient	Standard Error	z	P>|z|	95% Confidence Interval	
air	.060379	.0132372	4.561	0.000	.0344345	.0863235
water	.0521069	.0138644	3.758	0.000	.0249331	.0792807
solid	.0681936	.0126438	5.393	0.000	.0434122	.0929751
payments	-.0473249	.0047257	-10.014	0.000	-.0565871	-.0380626

G.2
Data Set: general mail
Model: quadratic, water linear
Equation: clog dependan ghg air water solid payments ghgq airq solidq if select4==0, group (set)

Note: multiple positive outcomes within groups encountered.
Iteration 0: log likelihood = -159.29666
Iteration 1: log likelihood = -114.54884
Iteration 2: log likelihood = -105.60613
Iteration 3: log likelihood = -104.00719
Iteration 4: log likelihood = -103.8763
Iteration 5: log likelihood = -103.87463
Iteration 6: log likelihood = -103.87463

Conditional (fixed-effects) logistic regression Number of obs = 354
LR chi2(8) = 152.78
Prob > chi2 = 0.0000
Log likelihood = -103.87463
Pseudo R2 = 0.4238

Variable	Coefficient	Standard Error	z	P>|z|	95% Confidence Interval	
ghg	1.760458	.4239225	4.153	0.000	.9295849	2.591331
air	.6539239	.1599352	4.089	0.000	.3404567	.9673912
water	.1183013	.0361527	3.272	0.001	.0474432	..1891594

solid	.6008789	.1866639	3.219	0.001	.2350244	.9667333
payments	-.056798	.0092715	-6.126	0.000	-.0749699	-.0386261
ghgq	-.0787735	.0199678	-3.945	0.000	-.1179098	-.0396373
airq	-.0177496	.0049082	-3.616	0.000	-.0273695	-.0081297
solidq	-.0166491	.0055641	-2.992	0.003	-.0275546	-.0057436

G.3

Data Set: general mail

Model: linear

Equation: clog dependan air water solid payments if select4==0, group(set)

Note: multiple positive outcomes within groups encountered.
Iteration 0: log likelihood = -165.06322
Iteration 1: log likelihood = -132.16964
Iteration 2: log likelihood = -128.6894
Iteration 3: log likelihood = -128.49691
Iteration 4: log likelihood = -128.49598

Conditional (fixed-effects) logistic regression Number of obs = 354
LR chi2(4) = 103.54
Prob > chi2 = 0.0000
Log likelihood = -128.49598
Pseudo R2 = 0.2872

```
------------------------------------------------------------------------------
dependan |      Coef.   Std. Err.       z     P>|z|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
     air |   .0479683    .0194172      2.470   0.013        .0099113    .0860252
   water |   .0439194    .0204661      2.146   0.032        .0038066    .0840322
   solid |   .0625687    .0188255      3.324   0.001        .0256713    .0994661
payments |  -.0412706    .0070033     -5.893   0.000       -.0549967   -.0275445
------------------------------------------------------------------------------
```

Variable	**Coefficient**	**Standard Error**	**z**	**P>|z|**	**95% Confidence Interval**	
air	.0479683	.0194172	2.470	0.013	.0099113	.0860252
water	.0439194	.0204661	2.146	0.032	.0038066	.0840322
solid	.0625687	.0188255	3.324	0.001	.0256713	.0994661
payments	-.0412706	.0070033	-5.893	0.000	-.0549967	-.0275445

G.4

Data Set: real estate agents

Model: quadratic – water linear

Equation: clog dependan ghg air water solid payments ghgq solidq airq if select4==0, group(set)

Note: multiple positive outcomes within groups encountered

Iteration 0: log likelihood = -219.67669

Iteration 1: log likelihood = -140.97432

Iteration 2: log likelihood = -113.3652

Iteration 3: log likelihood = -100.48074

Iteration 4: log likelihood = -94.863371

Iteration 5: log likelihood = -92.715056

Iteration 6: log likelihood = -92.424884

Iteration 7: log likelihood = -92.418585

Iteration 8: log likelihood = -92.418575

Conditional (fixed-effects) logistic regression Number of obs = 450

LR chi2(8) = 331.71

Prob > chi2 = 0.0000

Log likelihood = -92.418575

Pseudo R2 = 0.6422

Variable	**Coefficient**	**Standard Error**	**z**	**P>|z|**	**95% Confidence Interval**	
ghg	1.331646	.5133856	2.594	0.009	.3254286	2.337863
air	1.479824	.3127727	4.731	0.000	.8668004	2.092847
water	.4093023	.0807474	5.069	0.000	.2510403	.5675644
solid	3.069885 .	.5505863	5.576	0.000	1.990756	4.149014
payments	-.1389646	.0222475	-6.246	0.000	-.1825689	-.0953603
ghgq	-.0512777	.0234986	-2.182	0.029	-.097334	-.0052213
airq	-.0899337	.0161409	-5.572	0.000	-.1215694	-.0582981
solidq	-.0355919	.0085007	-4.187	0.000	-.052253	-.0189309

G.5

Data Set: real estate agents

Model: linear

Equation: clog dependan ghg air water solid payments if select4==0, group(set)

Note: multiple positive outcomes within groups encountered.

Iteration 0: log likelihood = -229.28777

Iteration 1: log likelihood = -172.14589
Iteration 2: log likelihood = -163.37733
Iteration 3: log likelihood = -162.59002
Iteration 4: log likelihood = -162.58007
Iteration 5: log likelihood = -162.58007
Conditional (fixed-effects) logistic regression Number of obs = 450
LR chi2(5) = 191.39
Prob > chi2 = 0.0000
Log likelihood = -162.58007
Pseudo R2 = 0.3705

Variable	**Coefficient**	**Standard Error**	**z**	**P>|z|**	**95% Confidence Interval**	
ghg	.1051684	.0379956	2.768	0.006	.0306984	.1796383
air	.0933935	.0193263	4.832	0.000	.0555147	.1312722
water	.0574111	.0179129	3.205	0.001	.0223023	.0925198
solid	.0804826	.0167165	4.815	0.000	.0477187	.1132464
payments	-.0520901	.0061872	-8.419	0.000	-.0642167	-.0399634

APPENDIX H: RESULTS OF ALL HOUSEHOLD QUESTIONS

1. What best describes the type of residence in which you are currently living?

	Number of Responses	Percentage of Total
Apartment	3	2.6
Duplex	11	9.7
Single family house	96	8.5
Mobile home	1	<1
Other	2	1.8

2. Do you rent or own your current residence?

	Number of Responses	Percentage of Total
Rent	15	12.5
Own	105	87.5

3. If you own your home, was your house new when you purchased it?

	Number of Responses	Percentage of Total
Yes	33	28.4
No	69	59.5
Don't know	13	11.2
Not applicable	1	< 1

4. Do you plan to purchase a newly constructed house within the next five years?

	Number of Responses	Percentage of Total
Yes	13	10.9
No	78	65.5
Don't Know	28	23.5

5. What type of frame does your house have?

	Number of Responses	Percentage of Total
Wood	103	89.5
Steel	3	2.6
Concrete	9	7.8
Don't know	2	1.7

6. How old is your home?

	Number of Responses	Percentage of Total
Less than five years	7	6.3
5 to 10 years	10	9.0
10 to 20 years	20	18
20 to 30 years	20	18
30 to 40 years	22	19.8
40 to 50 years	16	14.4
More than 50 years	21	18.9
Don't know	3	2.7

7. What is your gender?

	Number of Responses	Percentage of Total
Male	96	81.4
Female	22	18.6

8. Are you currently employed?

	Number of Responses	Percentage of Total
Yes	81	67.5
No	39	32.5

10. What is your annual household income, before taxes?

	Number of Responses	Percentage of Total
$25,000 or less	6	6.1
$25,001 to $50,000	19	19.4
$50,001 to $75,000	24	24.5
$75,001 to $100,000	29	29.6
$100,001 to $125,000	5	5.1
$125,001 to $150,000	7	7.1
$150,001 to $175,000	4	4.1
Above $175,000	4	4.1

11. What is the highest level of education you have received?

	Number of Responses	Percentage of Total
High school graduate	22	19.1
Some college	24	20.9
Associate's Degree	9	7.8
Bachelor's Degree	33	28.7
Master's Degree	21	18.3
Ph.D, M.D. or J.D.	6	5.2

12. What is your occupation?

Listed exactly as written in response

driver
abstractor
teacher
maintenance super
business owner
architect
field service engineer
teacher
electrical engineer
electrician
machine operator
accountant
sherriff
engineer
self employed
engineer
self employed
mechanic
carpenter
oilfield
human resource officer
teacher
management consultant
purchasing dir
elevator mechanic
computer technician
financial sales
bank manager
truck driver
carpenter
consultant
physician
appliance service technician
mechanic
water plant operator
manager
corrections officer
public health
sales

engineer
home remodeler
cpa controller
psychologist
general contractor
invest banker
cook
aircraft prodiuction
forest technician
firefighter
system programmer
law enforcement
building materials
law enforcement
fileman
farmer
general manager
middle management
executive
self employed
teacher
journalist
insurance underwriter
teacher
x-ray technician
customer services
engineer
photographer
health care provider
labor
government
construction surveyor
packer weaver
military
healthcare marketing
human resource manager

13. How many people are in your household?

	Number of Responses	Percentage of Total
1	21	18.3
2	44	38.2
3	19	16.5
4	18	15.6
5	9	7.8
6	3	2.6
7	1	<1