NCEE

NATIONAL CENTER FOR ENVIRONMENTAL ECONOMICS

Measurement Issues and Validity Tests for Using Attitude Indicators in Contingent Valuation Research

Elizabeth McClelland.

Working Paper Series

Working Paper # 01-01
November 2001

U.S. Environmental Protection Agency
National Center for Environmental Economics
1200 Pennsylvania Avenue, NW (MC 1809)
Washington, DC 20460
http://www.epa.gov/economics

Measurement Issues and Validity Tests for Using Attitude Indicators in Contingent Valuation Research

Elizabeth McClelland

Elizabeth McClelland, a dear friend and respected NCEE colleague, died on June 24, 2000. We dedicate the inaugural paper of the NCEE Working Paper Series to her memory.

We gratefully acknowledge the efforts of Julie Hewitt, Robin Jenkins, and Cynthia Grayson in reviewing and editing this final version of Elizabeth's work.

NCEE Working Paper Series

Working Paper # 01-01
November 2001

DISCLAIMER

The views expressed in this paper are those of the author(s) and do not necessarily represent those of the U.S. Environmental Protection Agency. In addition, although the research described in this paper may have been funded entirely or in part by the U.S. Environmental Protection Agency, it has not been subjected to the Agency's required peer and policy review. No official Agency endorsement should be inferred.

Measurement Issues and Validity Tests for Using Attitude Indicators in Contingent Valuation Research

Elizabeth McClelland, National Center for Environmental Economics, US EPA

Abstract

Employing attitude measures to explain valuation responses in contingent valuation studies has the potential to improve statistical analyses as well as interpretation of response information. In this paper, four types of attitude measures are compared for their ability to provide these benefits in the context of a contingent valuation of an air quality management plan for Sofia, Bulgaria. Findings show that specific attitude measures are superior to generalized attitude measures on both counts. The use of aggregated attitude indices versus single-item measures has different implications for the results, so choice of which to employ should depend upon the specific application.

Subject Areas: Environmental Management (Ambient Air Quality, Valuation Methods); Policy Analysis Valuation)
Keywords: Factor analysis, attitudinal questions, mean willingness-to-pay.

The views in this paper are those of the author and should not be construed to represent the views or policies of the USEPA. Funding for this project was provided by Dale Whittington and Centre for Social and Economic Research on the Global Environment, UK. Any and all errors are solely the responsibility of the author.

1.0 Introduction

The term 'attitude' as it is used by sociologists and psychologists enjoys a clear, generally accepted definition. Philosophers and thinkers since the time of Plato have conceived of the concept of attitude as being comprised of three distinct aspects: cognition, affect and conation [10]. Cognition refers to the underlying beliefs a person holds about an attitude object, his perceptions and conceptualizations. Affect reflects a person's feelings towards the attitude object. Conation reflects behavioral intent, or actual behavior with regard to the attitude object. While some psychologists have attempted to empirically isolate the effects of each of these three components of attitude on behavior, the results have not been promising [10]. Others have tried to measure the concept as a composite of these three components and relate these to observed or expressed intentions of behavior, but these attempts have met with mixed success as well [14, 11, 13].

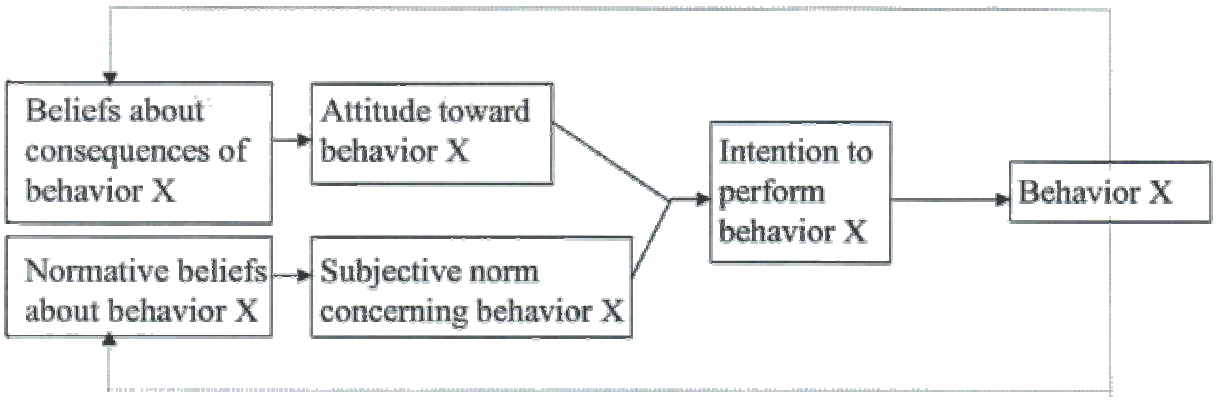
In contrast, social psychologist Martin Fishbein [6, 5] has restricted the definition of attitudes to the affective element, whose relevant antecedents are salient beliefs and whose direct consequences are behavioral intentions followed, somewhat conditionally, by the behavior itself. While this model will be elaborated below, the restriction in the definition, combined with other important features of the theory of reasoned action, has improved the predictive power of the attitude concept in explaining behavior [7,3]. For this reason, the restricted form of the attitude concept will be used in the remainder of this paper to mean an aggregate of beliefs and affective evaluations with respect to an attitude object. An *attitude object* can be anything, ranging from a person, to a policy, action or behavior.

The remainder of this paper begins with brief synopses of the theories of reasoned action and planned behavior, followed by a discussion of the implications of these theories for attitude measurement in a contingent valuation survey. This discussion lays the groundwork for a conceptual framework which is operationalized with economic variables. The remainder of the paper explains a contingent valuation survey administered in Sofia, Bulgaria in 1995 and analyzes the data from that survey to explore attitude measurement. The results of the survey regarding valuation of an air quality plan are presented before turning to analysis of factor-constructed attitude measures. In general, these attitude measures maintain stability of sign and significance across several specifications of the econometric model. Specific attitude measures are significant to respondents' willingness-to-pay. An important conclusion drawn from the Sofia data is that salient beliefs do affect respondents' reactions to a proposed commodity. More generally, the results suggest that attitude information has the potential to contribute to researchers' understanding of findings based on contingent valuation research.

1.1 The Theory of Reasoned Action

The work of social psychologists Martin Fishbein and Icek Ajzen has achieved some prominence in the literature in part because of the strong predictive power of their models in empirical applications. Their theory of reasoned action [5], is based upon the fundamental assumption that people generally behave rationally given the information that they have available; they assess expected outcomes of actions and respond accordingly. Figure 1 depicts the basic structure of the theory of reasoned action that applies particularly to volitional behavior. The primary focus of interest for these researchers is the predicted behavior, at the far right of the figure. Behavior is modeled first to be a function of intention to perform the behavior. To the degree that there is correspondence between the object of the intention and the behavior with respect to timing, content, and expected outcomes, a statement of intent should be sufficient to predict behavior [5]. Feedback loops within the model show that experience with the behavior forms the basis for beliefs that can subsequently be brought to bear in future judgments about the behavior.

Figure 1: Schematic Diagram of the Theory of Reasoned Action
(Fishbein and Ajzen, 1975)

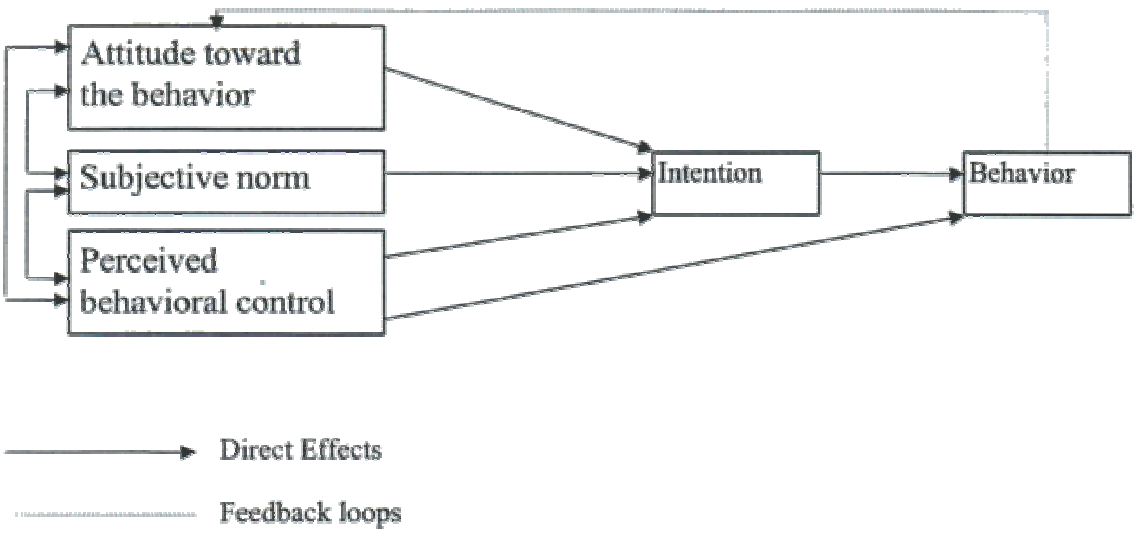


The antecedents of intent are hypothesized as twofold: 1) attitude towards the behavior and 2) the respondent's perception of the relevant social norms towards the behavior. The attitude toward the behavior in this model is made up of beliefs that the respondent holds about the behavior and its consequences coupled with his or her affective evaluations (feelings) associated with those beliefs. An example is a negative attitude towards work that is established by beliefs that reward is not related to effort, that the individual himself is ineffective or incompetent, and that he should not have to work hard for anything or anyone. Such a negative attitude might be evidenced by work behavior that is inefficient.

1.2 The Theory of Planned Behavior

When behaviors are subject to external constraints, either imposed by circumstances, resource constraints, or other individuals, the constraints themselves provide additional opportunities for the breakdown between intentions and observed behavior over and above the requisite correspondences mentioned above. The theory of reasoned action was modified to accommodate incomplete volitional control by Ajzen [1] in his theory of planned behavior. In this theory, the constraint enters not as a structural constraint but as an additional set of beliefs that influence the statement of intention. Ajzen calls the amount of control that the individual believes he or she has over the situation, *perceived behavioral control*. To the degree that an individual believes the limitations that such external constraints pose, his or her statement of intention should reflect these. Ajzen separates constraints on behavior caused by conformity to social norms from other behavioral constraints, and for the latter focuses not on actual constraints but the respondents' beliefs about the control that they have to actually carry out the behavior in question. This begs the question of the correspondence between perceived constraints and actual constraints. Ajzen [1] has found that prediction of behavior from perceived constraints is improved as the respondents' perceptions match their real circumstances. A diagram of Ajzen's theory of planned behavior is shown in Figure 2.

Figure 2: The Theory of Planned Behavior
(Ajzen, 1985)



1.3 Implications for Attitude Measurement in a CV Survey

According to the theories of reasoned action and planned behavior, an attitude is the sum of the product of 1) the intensity with which each salient belief is held (b_i) and 2) the respondents' feeling about that belief, e_i (+1 = positive, -1 = negative), over all salient beliefs about an attitude object.

The intensity with which a belief is held is defined in this context to be the strength with which an individual associates an object with an attribute (i.e., definitely, probably, not sure, probably not, definitely not) or a behavior with an outcome. The format for such questions often takes the form of Osgood's Semantic Differential Technique or a Likert scale [10]. These techniques define a format for survey questions that place two extreme conditions at the respective ends of a five or seven-point scale, with the center point on the scale defined as indifference or equivalence. An example of this technique from one of the surveys to be analyzed in the empirical portion of this paper is:

> How would you describe the air quality in your neighborhood in comparison to other neighborhoods in Sofia?
>
> _|____|_____|_____|_____|_____|_____|__
> +3 +2 +1 0 -1 -2 -3
> Much better The same Much worse

The affective evaluation of the object of the question (the respondent's feeling about the object) is built into the question format while the intensity of the belief is measured from 0 to 3 on either side of the indifference point.

The process of attitude measurement starts very early in the survey design process. Focus groups can be utilized to isolate the 5-9 *modal salient beliefs* [1] that are driving the respondent population's perceptions of an attitude object, the basic beliefs that are considered the most important aspects of the issue being

discussed. These basic beliefs can be used in the pretesting phase to evaluate the diversity of the population's views on the topic. Attitude questions developed from this set of beliefs can either be constructed to capture the intensity of the respondent's emotional or affective response to the belief, or the respondent's strength of belief towards a particular evaluative statement. For the empirical example in this paper, belief questions were posed that probed for the strength of beliefs that were expected to have uniformly positive or negative attitudinal implications for the commodity offered. When using such questions, they should be tested extensively during the pretesting phase, not only to determine the consistency of respondents' evaluations with respect to the commodity, but also to ascertain the clarity and comprehensibility of the questions themselves. Several questions can be developed for each salient belief to allow for internal validity (consistency) tests on the respondent's answers and content validity checks on the questions themselves.

Both the theory of reasoned action and the theory of planned behavior presume that only one attitude is brought to bear on the statement of intention, an attitude which is a composite of salient beliefs that a respondent holds about the consequences of the behavior in question. However in a CV survey, there are four potentially relevant attitude objects and attitude towards the behavior of responding to the survey falls into the last of these: attitude towards the survey situations itself. CV researchers attempt to simulate a market transaction which, according to Fischhoff and Furby [4], has three distinct components: the good itself, the payment or value measure, and the social context or marketplace of the transaction. These make up the first three attitude objects that are being evaluated in a CV exercise. The good itself is the hypothetical commodity described, the payment or value measure is the price of the commodity, including the description of how the amount would be collected (the payment mechanism), and the social context or marketplace is the social and political context wherein the problem to be addressed by the provision of the commodity arises. This last can also be construed to include the interview environment itself, which has been shown to influence some respondents' answers to survey questions [12]. For this reason this is expected to be the fourth attitude object that may be salient for some respondents.

Neither the theory of reasoned action nor the theory of planned behavior specifically include structural or demographic information in their models of behavior, assuming it to be incorporated into respondents' attitudes, perceptions of social norms and constraints. To include such measures within these models is seen as redundant or irrelevant. Where measures of demographic status are found to be independent of other attitudes and significant for explaining behavior, they are considered to be proxy measures of salient beliefs held by a reference group defined by the structural condition.

It should be noted that in CV studies, what is being measured/explained is not a behavior itself, but a statement of intention to perform the behavior. Nonetheless, in contrast to the psychological models described above, in most CV studies the preference decision is depicted to be a function of the price that was offered the respondent, household income, indicators that reflect active involvement or familiarity with the commodity or its context, and other socioeconomic indicators. The socioeconomic indicators could be capturing attitudes (social norms) held by referents of similar socio-economic status (a psychological interpretation) or behavior conditioned by one's place within a larger social structure (structural conditions, a sociological interpretation) that may be separate from a respondent's attitudes.

1.4 A Conceptual Framework

More formally, the Random Utility framework from the economics discipline [9] leads us to model a respondent's perceived change in utility under two states, one with the commodity but an income lowered by the amount equal to the price of the good, and the other without the commodity but also with income unchanged. The decision to purchase is based on the evaluated difference between the two states, depicted:

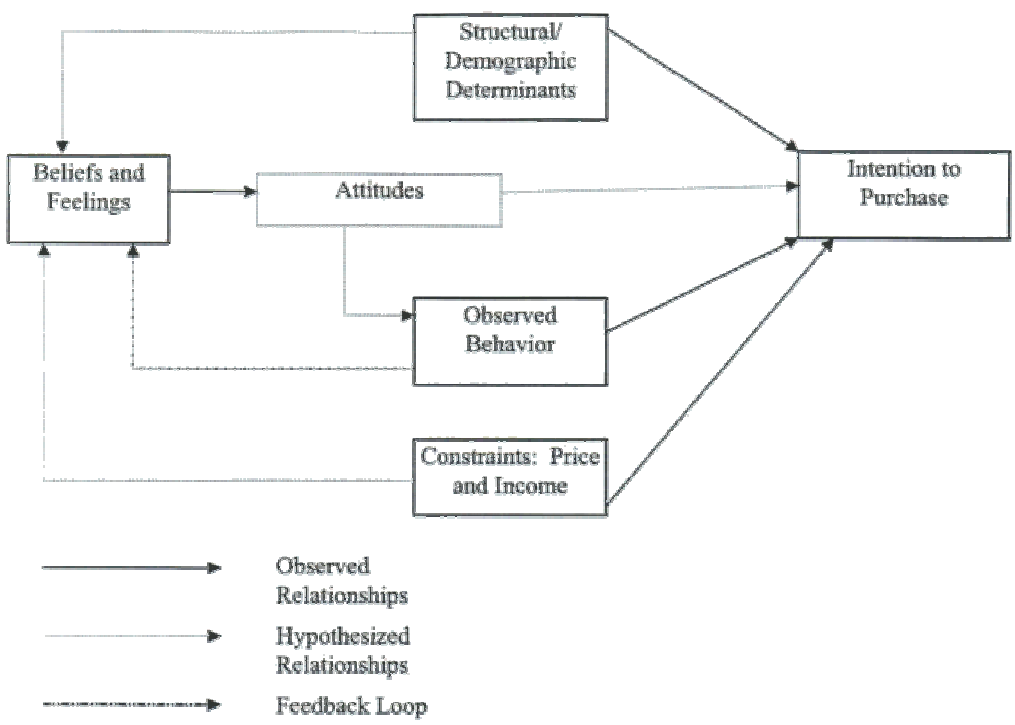
$$\Delta U = \lfloor \mu_1(y-p,1,Z)+\varepsilon_1 \rfloor - \lfloor \mu_0(y,0,Z)+\varepsilon_0 \rfloor,$$

where μ (.) is the observable component of the utility function for each state (0/1 denote the absence/presence of the commodity), and ε is the unobserved, stochastic component of the utility function. A positive value of the difference (ΔU) would correspond to a "yes" vote or purchase decision. The elements of the μ (.) function include the respondent's income (y), the price of the commodity offered to the respondent in the referendum (p), and other socioeconomic and behavioral variables that determine the utility of the individual (Z).

If this model specification is sufficient for explaining statements of preferences, attitudes should be subsumed in this standard formulation and be redundant information. If not, there may be an additional role that attitudes could play. Two other disciplines (psychology and sociology) assign attitudes a central role in determining behavior that suggest some potential importance of these measures for the economic model.

If the standard economic model is sufficient, attitudes would either be irrelevant (not statistically significant) or redundant, being already captured by variables reflecting observed behavior and demographic information. This implies two tests for the data, one a test of redundancy (or endogeneity) between attitudinal indicators and structural-behavioral variables, the other a test of significance of attitudes in multivariate models explaining valuation responses. A depiction of the conceptual framework for this analysis is shown in Figure 3.

Figure 3: Conceptual Framework



l.5 Operationalization of Conceptual Framework

In order to test the potential significance of attitude information, operationalized measures of the different components of the conceptual framework were developed. Structural and demographic determinants of intention were defined to be those identifiable traits or characteristics of individuals that define either social norm referents or explicit constraints on behavior. Examples of these structural determinants are racial and/or ethnic identification and religious affiliations.

Observed behavior is any type of expenditure of time or other resource relevant to either potential purchase of the proposed commodity or a substitute for it. For example, persons who engage in outdoor recreational activities should be expected to have some special interest in improvements in environmental conditions that support these activities.

The price and income indicators are operationalized measures of respondent's cost of the proposed project and income constraints. The price variable is that quoted to the respondent as the price for the commodity in the CV exercise. Income is measured by self-reported monthly or annual household income.

The attitude measures that will be tested, along with these measures that comprised determinants of behavior in a conventional econometric model, will be indices of aggregated belief and affect information. Aggregated measures were employed for the primary analysis instead of single measure indicators of attitudes because single measures can reflect inaccurate understanding of the question content, capture only one aspect of a complex attitude, or be too generalized to capture information relevant to the policy problem at hand. In accordance with classical test theory, a response to any given question will include both the true response as well as some measurement error [5]. As the number of items in an index increases, the assumption is that the measurement errors cancel out and the aggregated result is a better reflection of the true underlying concept than a single measure. For this reason, all standard attitude measures used in psychology are comprised of multiple response indices [5]. A second set of regressions where only single item attitude measures were included is presented subsequently, for comparison.

2.0 The Sofia, Bulgaria Contingent Valuation Study Research Design

This section describes the survey design for the contingent valuation study carried out in Sofia, Bulgaria in 1995. The objective was to assess the value of a hypothetical air quality improvement plan for the city. The plan, or commodity, that was described to respondents was a complex of initiatives aimed at reducing $S0_2$ and other particulate emissions from industry, electricity generation, public transportation, home heating briquettes, and private transportation (see Table I below, for the scenario description). The original sample size was approximately 400 households, randomly selected from households in the Greater Sofia, Bulgaria metropolitan area. The surveys were administered through in-person interviews in respondents' homes.

Table 1: Description of Hypothetical Air Quality Improvement Plan for Sofia, Bulgaria

- Installation of advanced air pollution abatement technologies on industrial facilities and power plants;
- Implement program to convert gas stations to also sell unleaded gasoline;
- Replace the old smoky buses with ecologically-friendly buses;
- Change the manufacture of briquettes used for home heating so that they emit less sulfur dioxide and particulates (short-term plan).
- Connect the majority of households to a central heating system so that they no longer have to use briquettes. This would reduce emissions of sulfur dioxide and particulates (long-term plan).

The questionnaire itself began with general social priority questions to place the issue of air pollution within the context of other important social concerns, and questions to probe respondents' perceptions of the air quality and the sources and effects of air pollution in Sofia. These questions were followed by a detailed description of the current air quality situation in Sofia and a proposed plan to alleviate the detrimental effects of air pollution. The willingness-to-pay (or valuation) question and others that probed respondent beliefs and feelings about the plan were measured subsequent to the commodity description. The final sections of the questionnaire probed for socio-economic indicators and respondent survey assessments.

The valuation question asked in this survey was a referendum style, closed end, dichotomous choice question asking respondents if they would vote for the plan or against it if it cost them a specific amount each month. Each member of the sample was randomly allocated one of five prices for the plan, ranging in magnitude between 100 and 2000 Leva (1995 US$1.47-$29.41). These prices reflect costs ranging from 1 % to 18 % of the mean sample income. Respondents were told that if the plan were implemented these costs would be incurred to their household through higher prices on goods and services affected by the new air quality standards implied by the plan.

Questions that probed for respondent beliefs and feelings about specific aspects of the context of the policy problem (air quality) and the proposed plan itself were included in the survey. Of the 24 belief questions, 18 of them employed Osgood's Semantic Differential construction reflecting both positive and negative (bipolar) sentiments about the subject of the question. Several of the remaining questions probed for belief intensity about the effects of air quality on health and several others reflected respondent's beliefs about the main causes and effects of air pollution in the city on uni-polar scales of belief strength. A description of the variables that were used to construct the attitude indices is shown in Table 2.

Table 2: Variables Used in Principal Factor Analysis, Bulgaria Study	
Variable Name	Content/Variable Definition
LIVSAV	Belief in lives saved if air quality goals reached
ACHIEVE	Likelihood that air quality goals would be achieved if plan implemented
RESULT	Belief in stated health improvements if air quality goals achieved
PUBSUPPT	Strength of public support for plan
INCRFAIR	Fairness of the payment mechanism
AQCHAR	Characterization of air quality in Sofia
AQCHG	Change in air quality over past 5 years
LIKLIPAS	Likelihood it will be approved by the parliament
GOVCONF	Confidence in government to carry out the plan
OBJECTIV	Opinion of interview objectivity
INTAGAIN	Willingness to be interviewed again
LINK	Strength of linkage between air pollution and human health in general
BELIEVE	Strength of belief in estimate that 1000 people die every year as a consequence of air pollution
INDSCAUS	Dummy indicator if respondent believes that industry is primarily to blame for air pollution in Sofia
AQCOMP	Air quality in respondent neighborhood as compared with others
WORYHLTH	Dummy indicator if respondent is most concerned about the health effects of air pollution over other consequences

In addition, two questions were included in this survey, which were to measure general attitudes toward the environment. The first probed for how important an issue air quality is to the respondent, the other how important a candidate's position on the environment is in determining the respondent's vote in forthcoming elections. These generalized measures of attitudes toward the environment were expected to provide some insight into the reliability of respondents' specific attitudes about, and statements of willingness to pay for, the plan offered to them.

2.1 Bulgaria Study Response Rate and Demographic Profile of Respondents

The response rate for the survey was a surprisingly low 60%. Enumerators had considerable difficulty securing agreement to participate due to a suspicious population that was often hostile to the idea of being interviewed in their homes. The demographic make-up of the 243 final survey participants is summarized in Table 3. The mean age of the respondents was 46, with 40% of those participating being male. Twenty-seven percent of respondent households reported themselves to be female-headed households.

Average household size was 3 persons with 0.9 children. Approximately 36% of respondents were either retired or unemployed, 18% were professionals or top administrative personnel, 11% factory or agricultural workers, 18% clerks, 5% self-employed, and 2% students. Respondent education levels were varied, with 37% having completed only primary schooling, 11% secondary schooling, and 52% having completed university or college training. Most of the respondents were homeowners, only 12% were renters; 46% owned at least one car, while only 3% owned rental property. The ethnic make-up of the respondent pool was primarily ethnic Bulgarian (96%), and Eastern Orthodox Catholic was the religious affiliation registered by 78% of the respondents. Another seventeen percent considered themselves atheist. Data on how this profile compares to the general population are not available but the low response rate belies some potential for incongruity.

Table 3: Respondent Profile, Bulgaria Study	
Average household size	3.14
Average number of children	0.9
Average age of respondent	45.7
Percent female respondents	60%
Percent of female headed households	27%
Respondent education levels	
Primary school only	37%
Secondary school completed	11%
College	47%
University	5%
Respondent employment	
Professional (lawyers, teachers, etc.)	14%
Administrative head	4%
Self-employed	5%
Agricultural or factory worker	11%
Clerk	18%
Unemployed	13%
Retired	23%
Student	2%
Other	11%
Respondent Ethnicity	
Bulgarian	96%
Other	4%
Respondent Religious Affiliation	
Eastern Orthodox	78%
None (Atheist)	17%
Percent homeowners	88%
Percent who own rental housing	3%
Percent owning at least one car	46%

2.2 Results of the Valuation Question

The valuation question for this survey was asked in a referendum format as is shown in Table 4, with the responses cross-tabulated with the prices offered to respondents. As may be evident from the table below, even at what were considered to be very high prices (almost 20% of the mean monthly household income for the sample) there was considerable support for the plan. Although there is a generally downward trend in the percent of respondents accepting the plan as the price is increased, at the highest price this trend is reversed quite unexpectedly. This high acceptance rate raises concerns about the validity of the survey results since it calls into question respondents' practical ability to actually realize this value. Suspicions that some respondents were “yea-saying,” relying on their affective assessments of the plan while discounting the financial commitment implied when determining their response, or voting for it because it seemed like the right thing to do, cannot be assuaged by these data except for the degree to which responses are consistent with theoretical expectations about price and income effects. On the other hand, there is a consistent rise in the percent of respondents voting against the plan as the price is increased. This suggests that respondents were indeed responding rationally.

Table 4: Referendum Results: Air Quality Plan Votes vs. Prices Offered, Bulgaria Study			
Referendum Question:	"I want you to suppose that if this plan gets into action, the monthly costs for your household (including transport, electricity, etc.) will increase by [100,200,300,500,1000,2000] levas per month. Would you vote for the plan at this price?"		
	Vote		
Price (in Levas)	Yes	No	Don't Know
100	94%	4%	2%
300	80%	14%	6%
500	65%	24%	11%
1000	46%	29%	24%
2000	52%	42%	6%
Overall	69%	21%	10%
Item non-response rate=11% of 243			

While external validation of the survey results, particularly the valuation estimates, is not available, internal validity tests can show that respondents were attentive to the details of the proposal while considering their own constraints and beliefs. These will be explored below in the context of multivariate analyses to explain respondents' determinations about the plan. Prior to presenting these analyses, a discussion of the factor-constructed attitude measures will define the content of the indices used for the analyses.

2.3 Formulation of Factor Indices

As noted in section 1.5, aggregate measures of attitudes were used in the primary analysis to supplement the usual economic variables; these were generated using factor analysis. In factor analysis, a set of responses to individual attitudinal questions is analyzed to shed light on the underlying components (factors) which explain variability in individuals' general attitudes on a subject. Factor analysis is particularly useful when the structural theory relating the components to the aggregate is not well understood though there is evidence on the components. Such is the case for attitudes towards an environmental amenity and willingness to pay for it when attitudinal questions have been included in the CV survey. Factor analysis is not a panacea for a lack of structural theory; judgement of the researcher is required to overcome the indeterminacy of the method. For this reason, factor analysis typically proceeds in two steps. First, an analysis of the factors common to the responses to individual questions determines a small set of factors that explain a large portion of the variability in responses. Then a rotation transformation relates the underlying attitudinal question responses to the reduced set of factors.

The variables shown in Table 2, above, comprise the set of measures included in the factor analysis to construct attitudinal measures for these data. The initial output of the factor model generated eight separate factors that could have been used for further analysis. An important consideration in the use of this type of factor analysis is the number of factors that will be retained for use. While there are a number of statistical tests that could be brought to bear, in the final analysis the judgment of the researcher, given the actual application, is usually the final determinant. For this analysis, I used as criteria the theoretic interpretability of the factors extracted as well as the percentage of common variance extracted from the variables by the various common factors. This is computed by dividing the amount of the common variance captured by each factor (its final commonality estimate) by the total common variance explained by all of the extracted factors. A commonly used cut-off point to stop adding factors is when 75-85% of the common variance explained has been captured [8]. Table 5 shows the percent of the common variance

explained by each of the eight factors generated by the procedure, and the cumulative common variance explained as each factor is added to the total. After Factor 4, the common variance explained by subsequent factors drops below 10% while the minimum threshold criterion of total common variance explained has been met at 78%. This justifies the use of the first four factors on the one hand, which is reinforced on the other by the paucity of substantive interpretation for the remaining four factors.

Table 5: Percent of Common Variance Explained by Each Rotated Factor, Bulgaria Study

Factor	Variance Explained	Cumulative Variance
Factor 1	0.354	0.354
Factor 2	0.165	0.519
Factor 3	0.133	0.652
Factor 4	0.124	0.776
Factor 5	0.075	0.851
Factor 6	0.073	0.924
Factor 7	0.048	0.972
Factor 8	0.027	0.999

2.4 Interpretation of Factor Indices

The factors were rotated using a VARIMAX rotation. The VARIMAX rotation is an orthogonal rotation method particularly suited to result in factor loadings that allow for more straightforward interpretation of the factors. This is because the objective function for the rotation step includes a simplicity criterion that often results in little overlap of the variables associated with each of the chosen factors (note that only the INCRFAIR response is included in two factors)

The rotated factor loadings for the four factors retained for interpretation are shown in Table 6, below. Given a salient loading cut-off test of 0.3, the first five variables in Table 6 were used to interpret the theoretical significance of Factor 1.

Table 6: Rotated Factor Loadings for First Four Full Factors, Bulgaria Study

	Factor Loadings			
Variable Name	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
LIVSAV	0.69080	-0.03241	0.00515	0.15953
ACHIEVE	0.68692	0.08361	0.08573	0.17477
RESULT	0.66423	0.02562	0.04680	0.12508
PUBSUPPT	0.39039	-0.05071	0.13846	0.07075
INCRFAIR	0.36319	-0.01537	0.31427	0.06748
AQCHAR	0.00900	0.59734	-0.00192	0.05161
AQCHG	-0.00471	0.55997	0.02293	-0.10662
LIKLIPAS	0.04235	-0.05467	0.51527	0.02605
GOVCONF	0.12279	0.15086	0.50416	0.21340
OBJECTIV	0.14613	-0.06860	0.03672	0.51219
INTAGAIN	0.12269	0.01424	0.09003	0.46066
LINK	0.12553	-0.08535	-0.03969	0.00124
BELIEVE	0.26727	-0.20516	-0.10031	0.13851
INDSCAUS	0.07498	-0.09718	-0.05285	0.01726
AQCOMP	0.05686	0.28316	-0.11604	0.05913
WORYHLTH	0.02642	-0.00790	-0.02069	-0.02262

From Tables 2 and 6 it is clear that the most heavily weighted variables in the first factor are the measures of beliefs in the outcomes of the plan. For this reason, the variable has been largely interpreted to be respondent attitudes towards the outcomes of the plan. However, there are in addition two less significant variables whose intuitive interpretation with respect to the other three is less than straightforward. Perhaps they reflect respondent acceptance of and optimism about the plan being higher when belief in those outcomes is higher. This first factor will be referred to as the COMMOUT factor.

The second factor very clearly captures respondent attitudes about the context of the issue being explored, namely respondent perceptions of air quality and how this has changed over the past five years. For this reason it shall be hereafter referred to as the CONTEXT factor. In the third factor, the two dominant variables (GOVCONF, LIKLIPAS) reflect respondent confidence in the government to approve and carry out the plan. A third variable (INCRFAIR), whose effect is also seen in the COMMOUT factor, reflects respondent perceptions of the fairness of the payment mechanism. The underlying common feature of these three measures is that they capture respondent attitudes about the institutions and means for carrying out the plan. Hence this third factor has been termed the AGENT factor. The final factor that has been retained is comprised of respondent reactions to the interview event itself. This factor will be referred to as the INTRVIEW factor.

Bivariate correlations were run to both assist in multivariate model specification as well as to check the variables' associations with the others to test for the independence of the measures. It must be borne in mind here that these bivariate correlations do not control for the effects of other intervening variables, and as such, these results can only be considered an indication of what might be expected to come out of the more accurate multivariate analyses to be presented below.

In general, correlation patterns were observed that reinforced the substantive content of the variables included in the analysis. Correlations between the attitudinal factors and "structural" socioeconomic and demographic indicators were all well under the conservative 0.40 cut-off criterion with one exception. Of all four factor-generated attitudinal indicators, only CONTEXT was highly correlated with any of the other candidate variables to be included in the multivariate analyses. This correlation is a positive one with AQCOMP, respondents' perceptions of their own neighborhood's air quality. My criterion for exclusion is a correlation coefficient of 0.40 or greater, since such would be expected to bias the coefficients of both if included in a multivariate analysis. However, since it is just at the cut-off point, I have left it in to check the stability effect in the regressions run below.

In sum, the statistically significant Pearson Bivariate correlation coefficients lend insight into response patterns that confirm internal validity expectations, however, the correlations are not sufficiently strong to cause significant multicollinearity problems in the multivariate analyses. Hence, the data have not failed the independence test and I can cautiously proceed to include these variables in the single equation multivariate analyses.

Multivariate analyses were carried out to explain respondents' answers to the valuation question. When a referendum format is used for the valuation question, a probit or logit framework is appropriate for explaining respondents' stated preferences within a random utility framework (RUM) [9]. The dependent variable in this case is the probability of a "yes" vote for the plan as offered to the respondents.

The variables included in this regression analysis are shown in Table 7. The price of the commodity offered to the respondent, as well as respondent household income, are standard variables included in the regressions to test compatibility with expectations from economic theory. The attitude factors discussed above have been included as the main treatment for this hypothesis test. In addition, indicators of action

with respect to the environment, or other relevant indicators of contact or familiarity with the context of the good (i.e., incidence of cancer or suffer from chronic lung illness) are expected by economic theory to be significant in the prediction of a respondent's support for the plan where these have not been subsumed into the previously measured respondents' attitudes, all else equal.

To account for other possibly salient attitudes, constraints, and social norms that were not measured directly in the questionnaire, numerous additional demographic descriptor variables (the structural indicators) were also available for inclusion in various models. Correlation analyses were used to initially screen the variables for excessive intercorrelation. The variables excluded in some of the models to be presented below were dropped due to strong correlation between the RETIRED and RESPAGE variables.

Table 7: Independent Variables Used in Multivariate Analyses of Referendum Responses to Air Quality Improvement Plan, Bulgaria Study

Variable Name	Description	Expected Sign
PRICE	Continuous variable: the annual cost to the household quoted to the respondent in the referendum question [200,300,500,1000,2000] Levas	-
INCOME	Continuous variable: annual household income, In Levas	+
COMMOUT	Continuous variable: Factor indicating level of belief about plan outcomes	+
CONTEXT	Continuous variable: Factor indicating respondent perception of the air quality context	-
AGENT	Continuous variable: Factor indicating respondent confidence in the agent carrying out the plan	+
INTRVIEW	Continuous variable: Factor indicating respondent comfort with the interview itself	+
CANCER	Dichotomous variable: 1=Respondent or respondent family member has been diagnosed with cancer; 0=no cancer	+
SUFFER	Dichotomous variable: 1=Respondent or respondent family member has chronic lung illness; 0=no chronic lung illness	+
CONTPROB	Dichotomous variable: 1=Respondent has contributed money towards the solution of an environmental problem; 0=no contribution	+
AQCOMP	Continuous variable: Scale comparing air quality in respondent's neighborhood to that of others in the city	-
RESPAGE	Continuous variable: Respondent age	?
TENURE	Dichotomous variable: 1=Respondent owns home, 0=rents	?
EASTORTH	Dichotomous variable: 1=Respondent's religion is Eastern Orthodox, 0=Respondent is atheist or practices another religion	?
SCHOOL	Continuous variable: Respondent education: 1=primary, 2=secondary, 3=college or university	?
FEMHHH	Dichotomous variable: 1=Respondent household is female-headed, 0=Household head is male	?
FEMALE	Dichotomous variable: 1=Respondent is female; 0=male	?
PRIVSECT	Dichotomous variable: 1=Respondent works in the private sector; 0=public sector	?
UNEMPLYD	Dichotomous variable: 1=Respondent is unemployed; 0=not unemployed	?
RETIRED	Dichotomous variable: 1=Respondent is retired; 0=not retired	?
CLERK	Dichotomous variable: 1=Respondent works as a clerk; 0=other employment	?
PROFESSL	Dichotomous variable: 1=Respondent is a professional (lawyer, teacher, etc.) 0=other	?

2.4 Discussion of Results of Multivariate Analysis

Given the novelty of my approach using attitudinal indices in traditionally econometric analyses, I ran numerous models to check for coefficient, sign and significance stability, as well as to check the incremental improvements in explanatory power that could be achieved with the inclusion of various sets of variables. Table 8 shows the results of eight models displayed for comparative purposes. Model 1 is the base model with only the price of the commodity offered to the respondent included with a constant in the regression. Upon inclusion of the income variable, the log-likelihood function value does change significantly (see bottom of Table 8 under Model 2). A similar effect is achieved by including the reduced set of structural indicators in Model 3. Model 4, however, is not a significant improvement over Model 3 because none of the variables added in this model contribute to the probability of plan acceptance in any consistent way. Models 5 through 8 mirror these first four models with the inclusion of all four attitudinal factors.

The outcomes of the regressions show first of all, results as expected by economic theory. The price of the plan offered to the respondents is the single most significant explanatory variable in the models. Showing a consistently negative sign and stable magnitude, it accords with expectations that the higher the price, the less likely an individual will be to vote for the plan, all else equal. Similarly, respondent household income holds reasonably stable positive coefficient values and significance across the various models displayed.

Other structural independent variables that were significant and showed reasonable stability of sign, magnitude and significance across in the models were indicators of cancer or chronic lung illness in the respondent or his/her family, a dummy variable indicating that the respondent had contributed to an environmental problem and a dummy for tenure status. It is counterintuitive that the signs on SUFFER and CONTPROB are negative, nor is it intuitive why TENURE is negative to start with. This last result could simply an artifact of the highly skewed data for this variable (only 12% were renters, the rest own their homes), as could be the case with CONTPROB as well.

The one structural variable that did not maintain stability under the different model specifications was the AQCOMP, or the neighborhood air quality comparison indicator. Without the attitudinal indicators, it showed reasonably strong significance at 5% and 6% in Models 3 and 4, respectively. When the attitudinal factors were added, in the reduced model, Model 7, it is no longer significant at all, whereas in Model 8, the full model, it retains a marginal significance. This result is due to the high correlation between the CONTEXT factor and the AQCOMP indicator. In other regressions (not shown) the AQCOMP variable was left out of Models 7 and 8, and this caused no significant effect on any of the remaining variables including CONTEXT, but the important information captured in this indicator was lost.

The four attitudinal indicators discussed above show consistent results in the multivariate analyses. The factor comprised of respondent beliefs (and their associated feelings) about the consequences of the plan (COMMOUT) was positive, stable, and significant for all four models where it was included. The interpretation of this is the more closely a respondent's beliefs about the plan's outcomes corresponded to those described in the survey, the more likely he or she was to vote for the plan. Similarly, AGENT, the factor comprised of respondent beliefs about the fairness of the payment mechanism and the ability of the government to carry out the plan, was also positive and significant. Hence, people who held negative assessments of these features were more likely to vote against the plan, whereas those who had positive assessments, would be more likely to vote for the plan, again, all else equal.

Neither the variable CONTEXT nor INTRVIEW was significant in any model. Upon closer inspection of the data, the distribution (mean and variance) of how respondents perceived the air quality (the main

ingredient of CONTEXT) was statistically different between those who thought that environmental issues were very important versus those who gave them the lowest importance ratings. This signals a common distribution of respondents' perception of the problem, though some, particularly those who are more personally affected by it (e.g., by cancer, or it is worse in their neighborhoods) are clearly more willing to support the public provision of the good. In addition, a negative attitude towards the interview itself does not seem to have significantly conditioned respondent answers in any particular direction although, if respondents were motivated by a negative attitude to answer randomly this could not be determined by this test.

Log-likelihood ratio (LR) tests were performed to assess the increment improvements in the models that might obtain with inclusion and exclusion of he various sets of variables. The likelihood ratio tests are shown at the bottom of Table 8 comparing different pairs of models. Model 1 is compared with Model 2 for the improvement of the likelihood function value when the income indicator is added to the equation. Model 3 is compared with Model 2, and Model 4 with Model 3 for the potential incremental improvements offered by these models. Model 5 was compared with Model 1 because they differ by only the inclusion of the attitude variables. Models 6, 7, and 8 were compared with Models 2, 3, and 4 respectively.

The models where the attitudinal indicators were included yielded significantly higher log-likelihood function values than the others, as shown in likelihood ratio tests at the bottom of Table 8. In particular, Models 3 and 7 differ by only the inclusion of the attitudinal factors and the LR test shows a very strong statistically significant improvement in the explanatory power of the model with the inclusion of these indicators. Similarly, the LR test between Models 4 and 8 shows the same pattern.

The other effect of adding the attitude variables to the models was an improvement in the percent of observations correctly predicted by some of the models. For example, in Model 1, 68% of the observations were correctly predicted, whereas Model 5 (which mirrored Model 1 except for the inclusion of the attitude measures) correctly predicts 77% of the observations, an improvement of 9%. As more covariates are added, this effect is diminished so that there is virtually no difference in the percent of observations correctly predicted between Models 3 and 7, and 4 and 8, respectively.

Table 8: Results of Multivariate Probit Models for Air Quality Improvement Plan, Bulgaria Study Models Using Factor-Analysis Generated Attitude Indices

Variable Name	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	0.9556	0.74129	2.3922	2.7578	0.9823	0.76688	2.8117	2.8176
	(0.00000)	(0.00006)	(0.00004)	(0.00009)	(0.00000)	(0.00008)	(0.00001)	(0.00014)
PRICE	- 0.000617	-0.000675	-0.000824	-9.84E-04	-0.000683	-0.000742	-0.000963	-1.09E-03
	(0.00001)	(0.00000)	(0.00000)	(0.00000)	(0.00001)	(0.00000)	(0.00000)	(0.00000)
INCOME	.	. 2.467E-05	2.861E-05	3.72E-05	.	2.426E-05	3.247E-05	4.13E-05
		(0.04550)	(0.04856)	(0.0257)		(0.06841)	(0.04409)	(0.02518)
COMMOUT	.	.	.	.	0.4679	0.44513	0..56326	0..55078
					(0.000.81)	(0.00173)	(0.00071)	(0.00137)
CONTEXT	.	.	.	.	-0.12023	-0.1162	-0.046324	-6.22E-02
					(0.38290)	(0.40199)	(0.78174)	(0.71633)
AGENT	.	.	.	.	0.38709	0.37944	0.52715	0.46755
					(0.01742)	(0.02298)	(0.00704)	(0.01964)
INTRVIEW	.	.	.	.	-0.076339	-0.041666	0.018018	3.23E-02
					(0.65311)	(0.81191)	0.92809)	(0.87812)
CANCER	.	.	0.53787	0.60437	.	.	0.70548	0.71738
			(0.013.20)	(0.00737)			(0.00326)	(0.00366)
SUFFER	.	.	-0.43702	-0.44329	.	.	–0.50873	-0.50217
			(0.03540)	(0.04818			(0.02349)	(0.03352)
CONTPROB	.	.	-1.2012	-1.3595	.	.	–1.4017	-1.5493
			(0.01261)	(0.00574)			(0.00405)	(0.00221)
AQCOMP	.	.	-0.10683	-0.121	.	.	-0.14017	-0.12713
			(0.05952)	(0.0447)			(0.14003)	(0.09012)
RESPAGE	.	.	-0.007673	.	.	.	-0.010018	.
			(0.28299)				(0.19160)	
TENURE	.	.	-1.0084	-1.0679	.	.	-1.2107	-1.2314
			(0.01119)	(0.00977)			(0.00484)	(0.0056)
EASTORTH	.	.	-0.2728	-0.3025	.	.	-0.39559	-0.42611
			(0.30426)	(0.27566)			(0.17661)	(0.16229)
SCHOOL	.	.	.	-0.24676	.	.	.	-0.17947
				(0.21151)				(0.39684)
FEMHHH	.	.	.	-3..23E-02	.	.	.	5.10E-02
				(0.89921)				(0.8525)
FEMALE	.	.	.	-7.96E-02	.	.	.	-3.23E-03
				(0.74319)				(0.99013)
PRIVSECT	.	.	.	0.47457	.	.	.	0.47412
				(0.19081)				(0.21054)
UNEMPLYD	.	.	.	-0.14136	.	.	.	-0.18951
				(0.70317)				(0.63159)
RETIRED	.	.	.	-0.12919)	.	.	.	-0.12228
				(0.68618)				(0.72884)
CLERK	.	.	.	0.40341	.	.	.	0.25915
				(0.22397)				(0.47632)
PROFESSL	.	.	.	-0.31804	.	.	.	-0.35346
				(0.42282)				(0.39962)

Unrestricted Log Likelihood	-124.17	-119.24	- 103.92	- 99.25	-113.50	-109.85	-91.34	-89.013
Restricted Log L	-133.76	-131.84	-131.84	131.84	-133.76	-131.84	-131.84	-131.844
Chi-sq statistic	19.17	25.21	55.86	64.99	40.52	43.99	81.00	85.66
Chi-sq. Significance	1.20E-05	3.36E-06	7.62E-09	7.31E-08	1.17E-07	7.35E-08	1.00E-07	1.00E-06
% correctly predicted	68%	69%	78%	77%	74%	75%	77 %	79%
N	216	213	213	213	216	213	213	213

The numbers in parentheses below the estimated coefficients are the p values for the ratio of the coefficients to their standard errors

2.5 Single-item Attitude Indicators

Parallel analyses to those presented above were carried out to determine the differences in the results that would obtain if single-item attitude measure were used, instead of the factor analysis-generated composite attitude indices. These results are presented in Table 9. For the single item measures of attitudes, I selected one from each of the four factors in order to minimize the colinearity among the measures. The four that are shown in the models here are LIVSAV, AQCHAR, INCRFAIR, and OBJECTIV.

What is apparent from these results is that the significance of the attitude variables in Models 5-8 (Table 8) loaded solely on the INCRFAIR variable in these new models. Referring back to the factor analysis results (Table 6), this variable had been allocated between the Factors 1 and 3, the significant attitude factors for Models 5-8. This might imply that the INCRFAIR variable consisted of two separate motivations, the first was respondents' perceptions about whether the money would actually be spent to realize the plan (and hence its association with beliefs about the outcome of the plan), and the second being their sense of equity in how the costs would be divided among the population. In contrast, it might be argued that respondents' attitudes about the fairness of the mechanism influenced their perceptions of the plan's potential efficacy. The strength of this variable's influence can be seen in the percents correctly predicted from the model.

The value of compiling an index to reflect the attitude sentiments compared with single item measures is that a large amount of somewhat overlapping information can be combined in an index construction, whereas single item measures may require deletion of overlapping attitude indicators to minimize the multicollinearity among the regressors. Single item attitude measures may allow for better interpretation of the variable's impact or the outcome, however, they are expected to include more error than a multi-item index of the same underlying concept.

More important than the use of single versus multiple item indices is the level of specificity of the attitude measures and the degree of correlation that exists among the various indicators desired for the model. In this case, the two generalized attitude measures of topic importance (ENVPLAT and IMPISSUE) were subsumed into the specific attitude indices in this example, evidenced by the strong correlations between these variables and the attitude factors and their components. However, the generalized topic importance indicators were not significant in any model where they were included to explain valuation statements, presumably because they were too general to capture the specific elements of the valuation exercise that were really driving responses.

Table 9: Results of Multivariate Probit for Air Quality Improvement Plan, Bulgaria Study Models Using Single-Item Attitude Measures

Variable Name /	Model 9 /	Model 10 /	Model 11 /	Model 12
Constant	0.94261	0.87286	2.41650	3.25560
	(0.00051)	(0.00535)	(0.00072)	(0.00013)
AQPRICE	-6.86E-04	-7.49E-04	-1.03E-03	-1.20E-03
	(0.00002)	(0.00002)	(0.00000)	(0.00000)
INCOME	.	1.46E-05	3.16E-05	4.49E-05
	.	(0.29938)	(0.06793)	(0.03050)
LIVSAV	0.07279	0.06127	0.08288	0.08696
	(0.32125)	(0.41183)	(0.32571)	(0.32534)
AQCHAR	-0.03474	-0.01556	0.06504	0.06530
	(0.70113)	(0.41183)	(0.32571)	(0.32534)
INCRFAIR	0.31151	0.31525	0.38276	0.40666
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
OBJECTIV	-0.04030	-0.01973	0.08815	0.09193
	(0.78518)	(0.89775)	(0.62162)	(0.62480)
CANCER	.	.	0.78246	0.87375
	.	.	(0.00178)	(0.00118)
SUFFER	.	.	–0.53163	-0.58234
	.	.	(0.02379)	(0.02163)
CONTPROB	.	.	-1.43212	-1.60391
	.	.	(0.00730)	(0.00352)
AQCOMP	.	.	-0.14195	-0.16115
	.		(0.03301)	(0.02459)
RESPAGE	.	.	0.00266	.
	.	.	(0.74947)	.
TENURE	.	.	-1.29473	-1.40433
	.	.	(0.00376)	(0.00261)
EASTORTH	.	.	-0.35908	-0.37128
	.	.	(0.24741)	(0.26454)
SCHOOL	.	.	.	–0.30620
	.	.	.	(0.17995)
FEMHHH	.	.	.	-0.21963
	.	.	.	(0.46086)
FEMALE	.	.	.	0.15954
	.	.	.	(0.57315)
PRIVSECT	.	.	.	0.46816
	.	.	.	(0.24561)
UNEMPLYD	.	.	.	-0.30811
	.	.	.	(0.45234)
RETIRED	.	.	.	0.32918
	.	.	.	(0.41373)
CLERK	.	.	.	0.19211
	.	.	.	(0.62149)
PROFESSL	.	.	.	-0.21306
	.	.	.	(0.63579)
Unrestricted Log L	-104.37	-101.03	-84.32	-80.64
Restricted Log L	-133.76	-138.84	-131.84	-131.84
Chi-Sq Statistic	58.77	61.63	95.05	102.41
Chi-Sq. Significance	0.00000	0.00000	0.00000	0.00000
% Correctly predicted	77%	78%	79%	82%
N	216	213	213	213

2.6 Willingness-to-pay Estimates Compared

Mean willingness to pay was calculated from the multivariate model results of the three best reduced models, Models 3, 7, and 11, are compared in Table 10. Model 3 represents a reduced model whose criterion for variable inclusion is based on economic theory and standard practice alone, whereas Models 7 and 11 represent augmented models, ones enriched by the use of psychological as well as economic theory. In Model 7 the factor-generated indices were used, whereas in Model 11 only single question indicators were employed. The results do not show a statistically significant difference among the WTP estimates derived from each of the models.

Table 10: Mean Willingness to Pay for Air Quality Improvement Plan, Sofia, Bulgaria (in Bulgarian Leva)

	Mean	Standard Deviation	95% Confidence Interval	Median
Model 3	1473	181.38	(1830,1116)	1419
Model 7	1454	170.71	(1790,1117)	1340
Model 11	1493	163.03	(1813,1171)	1412

One conclusion that could be drawn from this presentation is that the attitude measures do not make a significant difference in the willingness-to-pay results obtained so they add little practical value to the analysis of CV survey responses. However, the insight into the respondents' motivations allowed by the attitude measures improves understanding of important policy variables that are weighing on respondents minds as they consider the commodity. This information about the acceptability of the payment mechanism and agent responsible for the implementation as well as the degree to which a given initiative is expected by the constituency to be effective, affords a greater amount of democratic feedback about the policy in question than a simple valuation estimate alone. A valuation estimate, reinforced by strong positive beliefs about an initiative can increase the political leverage for the initiative by showing conformity between the valuation estimate and constituent support for important aspects of the plan.

3.0 Conclusion

What has been learned from this inquiry for contingent valuation both as an academic research tool and as a means of informing public policy decisions? The lessons for CV as a research tool focus on the methodological issues of attitude measurement and reliability, those for CV as a means of informing policy debates revolve around the value of attitude information to augment willingness-to-pay estimates and to provide an opportunity for public feedback in the policy formulation process.

3.1 Lessons for CV as a Research Tool

The fact that specific attitude measures were highly significant for explaining willingness-to-pay responses in the study undertaken for this inquiry (without being significantly correlated with structural information) provides some confidence that attitude information has some value for the contingent valuation method. While the significance of attitudes in this research is consistent with other CV studies where attitude measures have been included, the focus on measurement techniques and tests of the attitude measures in this inquiry provides some deeper insight into the use of attitudes than has previously been allowed.

One important methodological observation that can be taken from this work is the necessity of carefully pretesting for the specific salient beliefs that are driving respondents' reactions to the proposed commodity. Clearly determining respondents' acceptance of the commodity's sufficiency and feasibility, their beliefs about its outcomes, their reactions to the payment mechanism used and the property relation implied by the commodity description are at least important aspects to have measured and controlled for. Other possible salient beliefs should be explored with reference to Table 11 (see Appendix 1) during the early stages of survey design.

The use of indices of beliefs to measure attitudes, as opposed to single item measures used in previous studies, has both benefits and drawbacks. The benefits are that the indices can summarize a lot of specific, highly correlated belief and affect information about different aspects of a valuation exercise, allowing for more robust measures of attitudes than single item measures allow. The biases that are introduced by single-item measures can arise from respondent misinterpretation of the question content or from a single question not correctly capturing the complex attitude desired. Aggregating several measures that attempt to capture attitude toward the same underlying concept can reduce the opportunities for the biases that arise with single-item measures, but comes at a cost as well. With the aggregated measures, interpretation of the content of the resulting variables can be difficult, especially when the aggregation method combines the variables together in a way that makes their intuitive meaning obscure. Nonetheless, the indices have allowed a large amount of specific belief information to be included in multivariate analyses that was lost by the use of very general attitude measures of topic salience and single-item measures.

One important criticism that could be made of this work is that respondents' attitudes could be construed as being endogenous to their decision to purchase the commodity. While I cannot prove that they are not endogenous, I have shown that they are not the only determinant of the decision, in fact the price of the commodity offered is the most important factor in this case. Along with income and other important circumstantial indicators, specific attitudes are members of the set of determinants that influence respondents' decisions. Had they been the sole determinants or had price and income not been significant, then concern about endogeneity would have more weight. For this analysis, at least, it is not a significant concern.

One serious methodological concern that cannot be resolved in the context of this research is the stability of respondents' attitudes and valuations and the reliability of the measures over time. This weakness can be primarily attributed to the use of a cross sectional research design in contingent valuation research. Longitudinal studies that reassess attitudes and willingness to pay for a good over time can offer insight into which attitudes or whose attitudes are most unstable. This could potentially lead to means of correcting for the biases that unstable responses can yield.

Another aspect of reliability, different from measurement replicability, which is also germane, is the correspondence between attitudes, stated intentions and actual behavior. Hypothetical-real experiments, where a CV study is followed up with the actual offering of the good are crucial for understanding the relative weight of attitudes in hypothetical versus real situations. This information could lead to a means of using attitudes to calibrate hypothetical responses so that they more accurately reflect expected behavior.

3.2 Lessons for CV as a Policy Tool

Until there is a means of calibrating responses to CV questions that anchors valuation estimates from hypothetical surveys to actual behavior, CV results will remain highly suspect and subject to arbitrary discounting rules.[1] The extremely high acceptance rate for the commodity at prices which reflected nearly 20% of the sample mean income in the Bulgaria study make the valuation estimates from the analysis highly questionable from the standpoint of practically realizing such a value.

Since the in-person survey results reviewed here appeared to have high rates of acceptance of the commodity at the highest prices, there is concern that setting unrealistically high prices in the referendum may be causing some of the problem. When respondents are approached with what appears to be a serious proposal but one which is offered at an unrealistic price, their desire to see the project implemented may override their consideration of the price, undermining the validity of the study.

The fact that specific attitudes were highly correlated with acceptance of the commodity in this and other studies from the literature validates the strong support for the commodity shown by respondents even though their acceptance of the commodity at high prices seems unreasonable. It may be the price of the commodity itself that is most difficult for respondents to assess correctly or seriously, especially when it is to be collected in taxes or other means whose effects are spread out and less tangible than lump sum payments. The information that constituents are in agreement with or against a proposal (for a moment suspending the question of price) is important policy information, made even more valuable if it is corroborated by beliefs about specific aspects of the commodity and its provision that have clear preference implications. It may be informative to ask respondents to consider separately their support for the plan as a device to solve a specific policy problem first and then whether or not they would pay a given price for it. This would allow respondents to register their political support for the initiative and then explicitly consider a price they would be willing to pay for it.

These concerns reflect the state of the art of the contingent valuation method. Until accuracy and reliability functions can be established for the method, the credibility of the method to produce accurate valuation estimates will always be in question. The measurement of attitudes may have an important role to play in the development of these functions because of their significance in explaining respondents' preference statements. These will probably be most useful in research involving time-series or hypothetical-real experiments. However, even before such calibrating methods are available this information can be of value not only for its methodological potential but also for the highly relevant content of attitude information in a policy context.

By collecting not only valuation responses but also a variety of belief and affect information, the policy process can be enriched by this constituent input. If the policy process can be made flexible enough to allow for feedback in the design process, determining the salient features of the context and proposed good during pretesting of a CV survey could allow the constituency's preferences about payment mechanisms, agents, plan components, etc. to be measured and considered explicitly in the policy formulation phase. The valuation exercise itself would come after those elements that could be feasibly adjusted to reflect constituent preferences were integrated into the proposed policy, so that the valuation estimate could reflect the most acceptable configuration of policy attributes.

While measurement concerns remain, the policy significance of including specific attitude information in CV analyses should not be discounted. The value that this information provides can not only help to overcome questions about the validity of survey responses but also bring deeper insight into the policy

[1] For example, NOAA, in their guidelines for contingent valuation research, recommends dividing the valuation estimate in half before applying it in a policy context (NOAA, 1994).

preferences of a constituency. If valuation responses can be corroborated by attitudes, this should strengthen the confidence of researchers and policy makers alike that the overall policy proposal is supported.

References

1. Ajzen, Icek. 1988. *Attitudes, Personality and Behavior*. (Chicago: Dorsey).

2. Ajzen, Icek. 1985. "From Intentions to Actions: A Theory of Planned Behavior," in J. Kuhl and J.Beckrnann, eds., *Action-Control: From Cognition to Behavior*. (Heidelberg: Springer) pp. 11-39.

3. Ajzen, Icek and Martin Fishbein. 1977. "Attitude-Behavior Relation: A Theoretical Analysis and Review of Empirical Research," *Psychological Bulletin*, Vol. 84, No. 5, pp.888-918.

4. Fischhoff, Baruch and Lita Furby. 1988. "Measuring Values: A Conceptual Framework for Interpreting Transactions with Special; Reference to Contingent Valuation of Visibility," *Journal of Risk and Uncertainty*, Vol. 1, pp. 147-184.

5. Fishbein, Martin, and Icek Ajzen. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. (Reading, Ma: Addison-Wesley).

6. Fishbein, Martin., ed. 1967. *Readings in Attitude Theory and Measurement*. (New York, NY: John Wiley & Sons, Inc.)

7. Foxall, Gordon. 1984. "Evidence for Attitude-Behavioral Consistency: Implications for Consumer Research Paradigms," *Journal of Economic Psychology*, Vol.5, pp.71-92.

8. Gorsuch, Richard L. 1983. *Factor Analysis*. Second Edition. (Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers)

9. Hanemann, W. Michael. 1984. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses." *American Journal of Agricultural Economics*, Vol. 66, pp.333-341.

10. Lemon, Nigel. 1973. *Attitudes and Their Measurement*. (London: B.T. Batsford LTD)

11. Schuman, Howard, and Michael P. Johnson. 1976. "Attitudes and Behavior," in Alex Inkeles, ed., *Annual Review of Sociology*, Vol. 2, (Palo Alto, CA: Annual Reviews, Inc.) pp. 161-207.

12. Schuman, Howard. and Stanley Presser. 198 1. *Questions and Answers in Attitude Surveys*. (New York, NY: Academic Press)

13. Seibold, D.R., 1980, "Attitude-Verbal Report-Behavior Relationships Causal Processes," in D. Chushman and R. McPhee, eds., *Message-Attitude-Behavior Relationship*. (New York, NY: Academic Press.) pp. 195-244.

14. Wicker, A.W., 1969. "Attitudes v. Actions: The Relationship of Verbal and Overt Responses to Attitude Objects," *Journal of Social Issues*, Vol. 25, pp.41-78.

Appendix 1: Table 11: A Typology of Possible Salient Beliefs Influencing Preference Statements in CV Studies		
	Beliefs About Attributes of:	Beliefs About Consequences of:
THE POLICY CONTEXT		
	Geographic extent of problem	Health effects (morbidity and mortality)
	Dispersion/fairness in effects	Environmental damage
	Direction and magnitude of change	Cost increases for maintenance
	Uniqueness/substitutability of resource	
	Type of amenity: recreation, life support, employment	
	Source of change (problem): Natural/human (responsibility)	
	Existing property relations/property rights/precedents	
	Existing environmental laws and institutions	
	Population's technical expertise/ability	
	Priority weight of problem with respect to other social issues	
	Social norms with respect to pollution/environment/government (macro-social and micro-personal)	
THE COMMODITY		
	Action steps related to stated outcomes	Sufficiency to address problem
	Timing/duration/extent of intervention	Feasibility to be implemented
	Agency appropriateness and effectiveness	Magnitude and direction of proposed change
	Default assumptions/substitutes for resource and commodity	Externalities (unforeseen)
		Precedents (concern)
THE VALUE MEASURE		
	Agent reliability	Sufficiency of revenues
	Acceptability of mechanism (tax, voluntary payment, entrance fee, etc.)	
	Acceptability of duration and periodicity of payment mechanism	
	Sufficiency of constituency/physical extent	
	Payment equity: equivalent/prorated by use/location/severity, etc.	
	Feasibility of elicitation mechanism (referendum)	
	Certainty of payment/believability	
THE INTERVIEW ENVIRONMENT		
	Interviewer cues	
	Instrument bias	
	Respondent receptivity to interview	
	Sponsor acceptability	