Innovative Approaches for Valuing
Perceived Environmental Quality

Valuing Eastern Visibility: A Field Test of the Contingent Valuation Method

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CHAPTER 1

Introduction

The main purpose of this study is to address and overcome the shortcomings of previous benefits estimations for improved visibility that have used the contingent valuation method (CVM).[1] An additional purpose is to develop a detailed understanding of potential sources of error in the CVM. There exist a number of legislative proposals – control of SO_2 and NO_x emissions from midwestern electric generating plants, fine particulate standards, and others – that could significantly improve visibility in urban areas of the eastern United States. The value that individual residents and non-residents place on such visibility changes constitutes one potential benefit that would be included in a comprehensive benefit-cost analysis (required by Executive Order 12291) of any legislative proposal. However, despite numerous attempts, the USEPA has not been successful at determining the values that individuals place on visibility improvements.

For instance, Tolley, et al. (1984, 1986) and Rae, et al. (1983) undertook studies to determine the value of improving visibility in the Eastern United States. Yet, each of these studies was subjected to severe criticism and subsequently deemed inappropriate for policy evaluation purposes. Among the criticisms of the Tolley, et al. contingent valuation method analysis in six eastern states were: inconsistency between photographic representation of visibility and the scenarios being evaluated; inadequate attention to perception and health versus aesthetic issues; and starting point bias. The Rae, et al. work, which utilized the contingent ranking method[2] in Cincinnati, was considered of insufficient quality to generalize to other

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[1]The contingent valuation method develops a hypothetical market for goods that have no existent market. Such is often the case for public goods like the environment and many natural resources. A common method for presenting the hypothetical market is through the use of surveys that ask hypothetical questions. These instruments provide respondents a situation within which the commodity of interest is described and they have an opportunity to pay for the commodity.

[2]The contingent ranking method involves having respondents rank a set of alternatives.

eastern cities. A detailed summary of issues related to visibility valuation is offered in the next subsection.

Criticisms of these previous attempts for valuing eastern visibility have left the USEPA in the difficult position (with respect to Executive Order 12291) of proposing legislative options without a clear notion of the relative benefits and costs of visibility changes. The analysis herein attempts to fill this void through a detailed examination of visibility – photographic representation, perception, and the value that individuals place on changes in visibility.

Any study of the value of visibility changes that uses either the contingent valuation or contingent ranking methods in which individual values are directly elicited must accomplish a set of common tasks. First, in order to achieve an understanding of proposed visibility changes, photographic and/or other representations (e.g., distribution information) of visibility conditions must be presented. Second, individual respondents must translate the photographic representations into perceived changes in visibility. Third, individuals must value the visibility changes, independent of other components (health, materials, effects) of air quality.

Previous studies of the value of eastern visibility have failed to accomplish these tasks successfully. Consider the first area of concern – photographic representation of visibility changes. The purpose of using photographs to portray proposed visibility changes is to heighten awareness of the non-market good, visibility, and to ensure uniform perception to enable comparison of bid values. Past contingent valuation analyses have employed actual photographs of visibility conditions and asked respondents to place a value on the various scenarios. Three important issues have arisen from review of this past work.

The first issue relates to the Tolley, et al. study. During the pre-test phase, this study found that individual bids for visibility changes were invariant with respect to the photographs shown the respondents, indicating that the content of the photographs was relatively unimportant. Thus, the Tolley study showed photographs of Chicago to residents of Atlanta and other eastern cities. Further, the photographs were of visual range distances that did not conform to the distances being valued. Tolley defended this procedure on the basis of the pre-test results and the premise that since the entire range of visibility conditions (distribution over time) could not be portrayed, no other procedure could be considered superior.

Second, the Tolley, et al. procedure has been severely criticized as biasing the results upward for the following reason: If quantity and quality of the commodity being valued do not affect

the prices individuals are willing to offer, individuals are likely not valuing the commodity of interest. In this case, it is likely that individuals were valuing all components (health, soiling of materials, visibility, etc.) of air quality rather than visibility alone.

Another issue in the use of photographs is the effect of extraneous elements such as the presence of clouds, buildings, etc. That is, two photographs that are designed to portray a change in visibility may show differences in other variables as well. Valuation may then be subject to these other influences. Thus, the third issue is the choice of the scenes depicted in the photographs. That is, using familiar everyday scenes as opposed to long vistas of landmarks may also affect the valuation results.

The study reported here attempted to overcome, in a variety of ways, these difficulties that afflicted previous studies. As described more fully in Chapter 3 on Survey Design, we used several different scenes varying in familiarity and visual range. Further, extraneous sources of variation were controlled by computer-degrading each photo, taken on a “pristine” day, to represent different levels of visibility. Finally, we provided respondents with frequency distributions of visibility linked to the photographs. The cities chosen for this study were Chicago and Atlanta.

1.1 Organization of the Report

Chapter 2 of this report discusses issues that are crucial to the design, implementation and analysis in the CVM. Much of the discussion and related insights will be drawn from the work done in the Denver Brown Cloud methods study (Schulze, et al., 1989). Emphasis will be on the possible sources of error which may be present in the CVM.

Chapter 3 describes the survey design in detail. This includes a description of the photo sheet that accompanied the survey and the source of the frequency distributions used to depict changes in visibility distributions.

The implementation of the survey and data obtained from the surveys are presented in Chapter 4. This chapter provides summary statistics on the overall response and descriptive statistics on each question asked in the surveys. Chapter 5, in turn, discusses the econometric techniques employed to estimate visibility values and the results of those estimation procedures.

CHAPTER 2

Sources of Error in Contingent Valuation: Evidence From the Denver Air Quality Value Study

2.1 Introduction

The use of surveys for valuing public goods became commonplace in the decade of the 1980's. The contingent valuation method (CVM) has, as a result of the need for damage assessments under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), now undergoing Federal Court review. The decision of the court supports use of the method as a legitimate alternative to property value or other hedonic methods and to the travel cost approach in measuring natural resource damages. In great part, acceptance of the method has been based on a series of studies in which value estimates obtained by asking respondents for their willingness to pay (WTP) were compared to values obtained from indirect approaches such as the hedonic or travel cost method (see, for example Brookshire, Thayer, Schulze, d'Arge, 1982; or Smith, Desvousges and Fisher, 1986). In several field experiments actual purchase decisions have been compared to hypothetical purchase decisions (Bishop and Heberlein, 1978 and Dickie, Fisher, and Gerking, 1987). In all of these studies hypothetical behavior was sufficiently predictive of actual behavior that researchers concluded meaningful values could be obtained for benefit-cost analysis.

However, in their extensive review of the CVM literature, Cummings, Brookshire and Schulze (1986) note that in all of the available comparison studies, respondents necessarily had obtained at least some market experience with the commodity. For example, Brookshire, et. al. (1982) compared survey values obtained for air quality improvement in the Los Angeles area with air quality values obtained from a property value study. The premium found in the home sale market for areas with cleaner air is well known by area residents who experience a trade-off between housing costs and air quality in choosing where to live. Cummings, Brookshire and Schulze argue that studies of this type do not provide evidence that respondents have the ability to provide meaningful hypothetical values for public goods for which they have little or no prior market experience. By their very nature, many public goods do not allow market experience of the type obtained for air quality in the property value market described by Brookshire, et. al. For example, many studies using the CVM have shown large existence and bequest values for preserving environmental commodities (e.g., Greenley, Walsh and Young, 1981 and Schulze et. al. 1983). Freeman (1987) has argued that only the CVM can be used to measure those values

since such preferences are not reflected in existing markets, denying both market experience and preventing use of indirect methods for valuation.

Hypothetical bias, which we define as the difference between the distribution of hypothetical bids obtained from a survey and the distribution of bids that would obtain in a real world incentive compatible market setting, has thus become the central issue in application of the CVM for commodities and types of values not captured in existing markets. In this chapter we first identify four problem areas as possible sources of hypothetical bias. These are: (1) large positive outlier bids; (2) refusals to bid; (3) embedding and (4) survey context. The overall objective of this chapter is to summarize what is known about these possible sources of hypothetical bias on the basis of our prior field application of the CVM to the Denver air quality problem (Schulze, et al., 1989). This methodological study forms the basis for the study of east coast visibility values presented here.

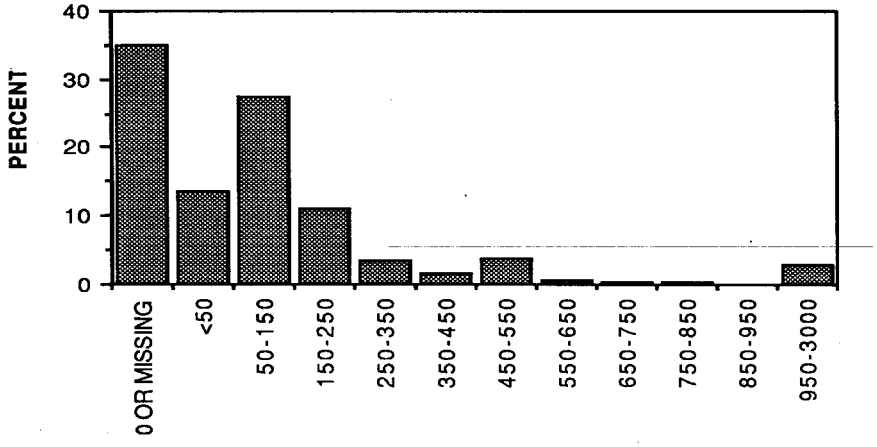
The commodity chosen for the methodological study, air quality in the Denver metropolitan area, has three features which make it appropriate for such an examination. First, a careful psychological study of how residents perceive air pollution in the region is available (Stewart et. al. 1983, 1984). Second, one of the primary features of Denver's air pollution problem, the "Brown Cloud," is that it obscures views of both the center city skyline and of the Colorado Front Range and is visible throughout the city. Thus, air pollution has relatively little affect on property value markets, so residents have had little or no market experience with the commodity. Third, a high level of awareness of the problem and a community consensus that something must be done has been achieved in the region. For example, the Chamber of Commerce has strongly supported new proposed air pollution controls and innovative measures such as use of oxygenated fuels that have received wide public support. Although residents have had little or no market experience with the commodity, most have at least thought about the problem. Our choice of commodity can thus be seen as an attempt to examine hypothetical bias by moving away from market experience while still retaining a commodity for which the public has a clear sense of both the nature and importance of the commodity itself.

The remainder of the chapter is organized as follows: Section 2.2 introduces sources of hypothetical bias. Sections 2.3 through 2.6 discusses our results from the methodological study for each potential source of bias. Section 2.7 summarizes the implications for the design of the Eastern Visibility Study.

2.2 Sources of Hypothetical Bias

Survey values obtained in the field tend to be bimodally distributed with a large number of missing or zero bids and an upper mode which is skewed, showing a thick tail of large bids. Figure 2.1 shows the distribution of bids from the Denver air quality study.

FIGURE 2.1
WTP FREQUENCIES (IN DOLLARS)



Researchers have tended to view both the large number of bid refusals and the very high bids with skepticism. Fortunately, laboratory experiments have shed considerable light on the problem of large bids which suggest a straightforward econometric solution. Refusals to bid (mostly in the form of missing bids) create a selection bias problem in estimating the true value of positive bids. Selection bias is a serious issue because a significant number of respondents in any CVM study refuse to provide bids. Although procedures for dealing with selection bias are well known, we show that understanding the source of the problem and developing an appropriate model are necessary before the methods can be reliably used to predict missing bids. Another problem receiving increasing attention (see for example papers by Kahneman and Knetsch and by Smith, both forthcoming) is embedding, which concerns the motivation behind and content of bids obtained in CVM studies. We find that many respondents have a different view of the provision of public goods than that implicit in the way CVM questions are asked. They view an additional dollar of taxes as producing a variety of public goods as joint products. It is our view that this confusion (amongst CVM researchers, not respondents) has resulted in serious errors in interpreting responses (e.g. the previous Tolley et al. study of Eastern visibility

values). Finally if context effects are important, that is, if different survey designs obtain very different values for the same commodity, then estimated values are not robust. In this chapter we consider each of these problems in turn and suggest, based on our earlier work, a specific set of procedures for each.

2.3 The Problem of Large Bids

Researchers have turned to laboratory economics experiments to understand the source of large hypothetical bids obtained in CVM studies. These laboratory experiments typically place subjects in an unfamiliar environment (either with respect to the commodity, the market, or both) and compare an initial hypothetical response to actual laboratory market responses where repeated trials are used to provide market experience. We briefly summarize what has been learned from such experiments and, drawing on these experiments, propose both a specific model of hypothetical error (a form of measurement error) and suggest an econometric approach for analysis of contingent values which may reduce such errors.

Results from laboratory experiments show a consistent and striking pattern. Hypothetical bids obtained from subjects for a commodity show an increased variance relative to bids obtained in a laboratory market. Further, increasing market experience (repeated rounds in a particular auction institution) and increasing incentives (increased payoffs for participation in a particular market institution) both tend to reduce variance in bidding.

The first experiment to compare hypothetical bids to auction behavior, undertaken by Coursey, Hovis and Schulze (1987), used a bitter tasting liquid, sucrose octa acetate, which was unfamiliar to subjects as the commodity. Subjects were first given a careful description of the commodity and then were asked how much they would pay to avoid a taste experience. Second, subjects were allowed to taste the liquid prior to being asked again for their willingness to pay (WTP). In this second stage subjects were familiar with the commodity but had no market experience. Third, subjects participated in a competitive auction submitting bids to avoid the commodity. Mean bids (variance) were as follows: Hypothetical with no experience $2.60 ($15.80); hypothetical with experience with the commodity $2.27 ($5.06); and actual auction bids with market experience $1.95 ($5.23). Note, the variance is much greater for the inexperienced hypothetical bids. However it appears that the decrease in variance was associated with experience with the commodity rather than with experience with the market institution.

Other recent experiments that allowed more rounds of actual market experience than the Coursey, Hovis and Schulze experiment show a continued decline in bidding variance both with market experience and reward size (see Irwin, McClelland and Schulze, 1989 and Cox, Smith and Walker, 1989). Figure 2.2 taken from Irwin, McClelland and Schulze shows how increasing variance in hypothetical bidding can bias estimates of actual behavior. The top panel of Figure 2.2 shows a skewed hypothetical distribution relative to the actual bidding distribution shown in the bottom panel. The extended right hand tail is the source of a large upward bias in the mean hypothetical bid as compared to the mean of actual bids. This source of error dominates the results of this experiment.

Given the experimental evidence summarized above, what model can be used to explain hypothetical bias that might result in field surveys from a lack of experience? Assume for simplicity that individuals have a true willingness to pay, W. However, the bid they reveal in response to a hypothetical question about willingness to pay is B. The laboratory data in Figure 2.2 suggests that the bids are highly skewed so, for example, a model for the revealed bid could be

$$\ln B = \ln W + \epsilon, \tag{2.1}$$

where $\epsilon \sim N(0, \sigma^2)$.

If we replace lnW with an econometric model $\Sigma\beta_i X_i$, where the X_i are explanatory variables, two sources of error are likely to be present in ϵ. First, measurement error in the dependent variable, B, may be present due to the hypothetical nature of the CVM. Second, model error is likely to be present because we are predicting lnW with $\Sigma\beta_i X_i$. If all error in the equation is measurement error, the predicted mean bid using the formula

$$\hat{B} = e^{\Sigma\hat{\beta}_i X_i} \tag{2.2}$$

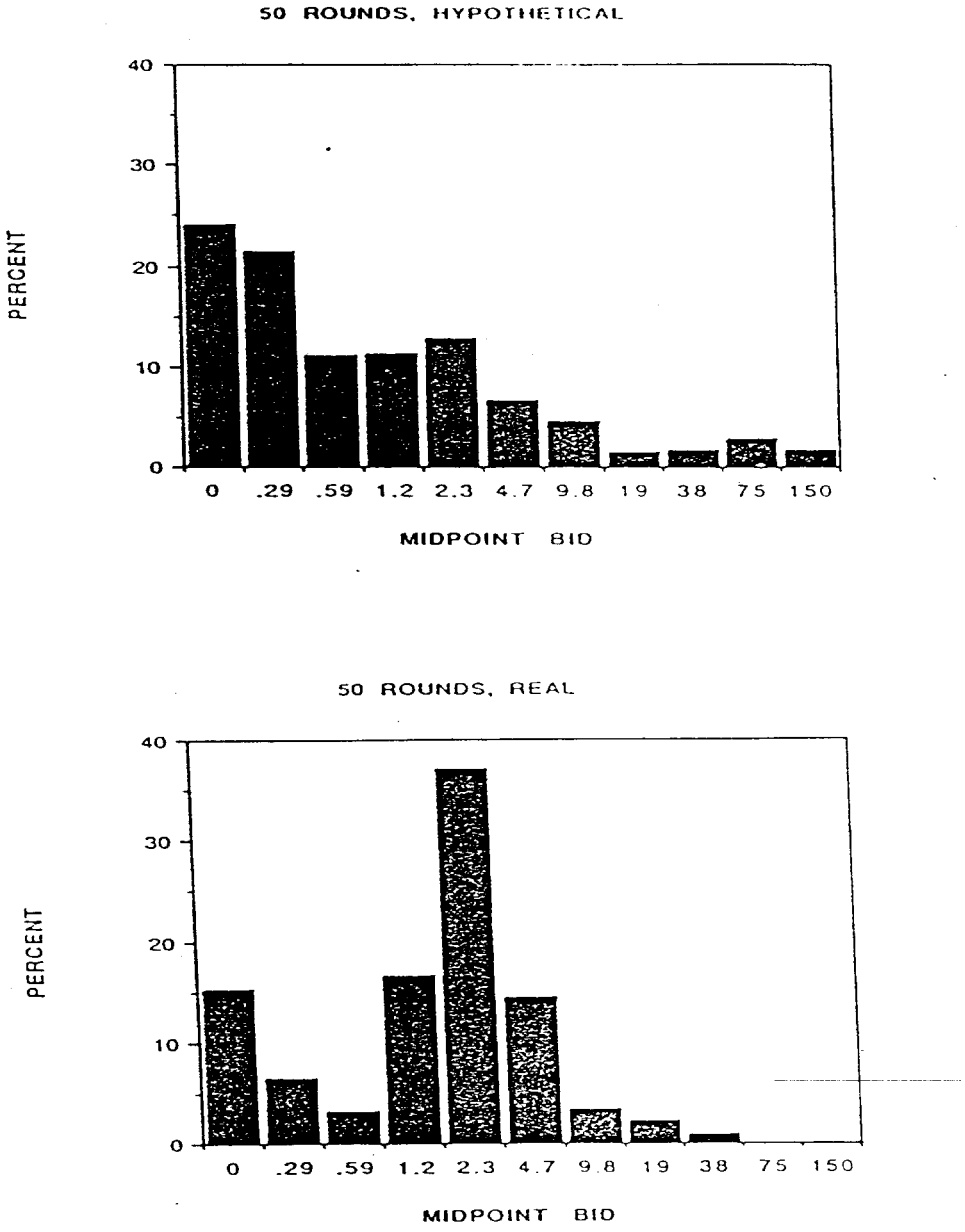
will be a consistent estimate of the true average WTP. If, on the other hand, all of the error is model error, a correction needs to be made for predicting means and the relevant formula is

$$\hat{B} = e^{\Sigma\hat{\beta}_i X_i + (1/2)\,\hat{\sigma}^2} \tag{2.3}$$

Figure 2.2

Experimental Values

Source: Irwin, McClelland, Schulze (in press)



which will give a predicted mean approximately equal to the raw mean of the contingent value bids used in the analysis. It is impossible to know *a priori* how much of the error is model error, and how much is measurement error. But from laboratory experiments we know that skewed measurement error is likely to be present, which implies that the raw mean of the CVM bids will overestimate true values. Thus, we can obtain a lower bound estimate of values by *assuming* all error is measurement error using (2.2) to predict values for comparison to an upper bound estimate of values that assumes all error is model error and uses (2.3) to predict values. Note again that this latter assumption is equivalent to using the mean of the raw bid data.

We propose use of a more general transformation than the log transformation to account for skewed measurement error. This transformation is the Box-Cox, $(B^{\alpha}-1)/\alpha$, where α is determined to normalize the error distribution in regression analysis (Box and Cox, 1964). Predicted bids from the regression analysis should then be used as a lower bound for policy analysis. Note that this transformation incorporates both the linear ($\alpha = 1$) and natural logarithm ($\alpha = 0$) transformations as possibilities. Use of this procedure has several advantages. In the past large suspect bids obtained in the CVM have been removed through trimming (e.g., Desvousges, Smith and Fisher, 1987). Trimming procedures remove large outliers which deviate from an estimated linear regression model by exceeding some predetermined statistical threshold. However, in the situation where the bid distribution shows a thick upper tail, the mean of predicted bids falls as that threshold is lowered, making final estimated values dependent on the threshold chosen. If skewed measurement error is present, the procedure we propose will also lower mean values if bids generated by the estimated regression equation are used in calculating the mean. However, the reduction in predicted mean bid will be determined by the estimated value of α, the Box-Cox parameter, so as to make the distribution of residuals as normal as possible. If measurement error dominates the residual then it is obviously desirable to use an estimating procedure which does not bias the estimated coefficients through a skewed error distribution. Predicted values from this estimated equation can then be used to calculate mean or total willingness to pay.

In the Denver air quality study, the Box-Cox procedure was employed and gave an estimated coefficient of $\alpha = 0.12$. The mean of predicted bids was a little over half of the raw mean of the bids (about \$118/per household vs. \$202/year per household), varying somewhat depending on specification of the regression equations and the treatment of the selection bias issue. The frequency distribution of residuals from a linear regression as opposed to the Box-Cox regression

explaining bids is shown in Figure 2.3. Obviously substantial skew is present in the linear regression and the Box-Cox procedure produces an essentially normal distribution of residuals. Thus, the procedure developed above can be defended on purely econometric grounds as an appropriate method for dealing with large outliers which would otherwise bias CVM studies.

However, it should be noted that the econometric model used to predict bids in the Box-Cox regression had a fairly low explanatory power since the R^2 was about .13. Thus, the predicted bids might underestimate actual values since a substantial amount of model error may be present. Thus one of the major objectives for survey design in the Eastern Visibility study was to collect data on variables which might help better explain respondents' bids.

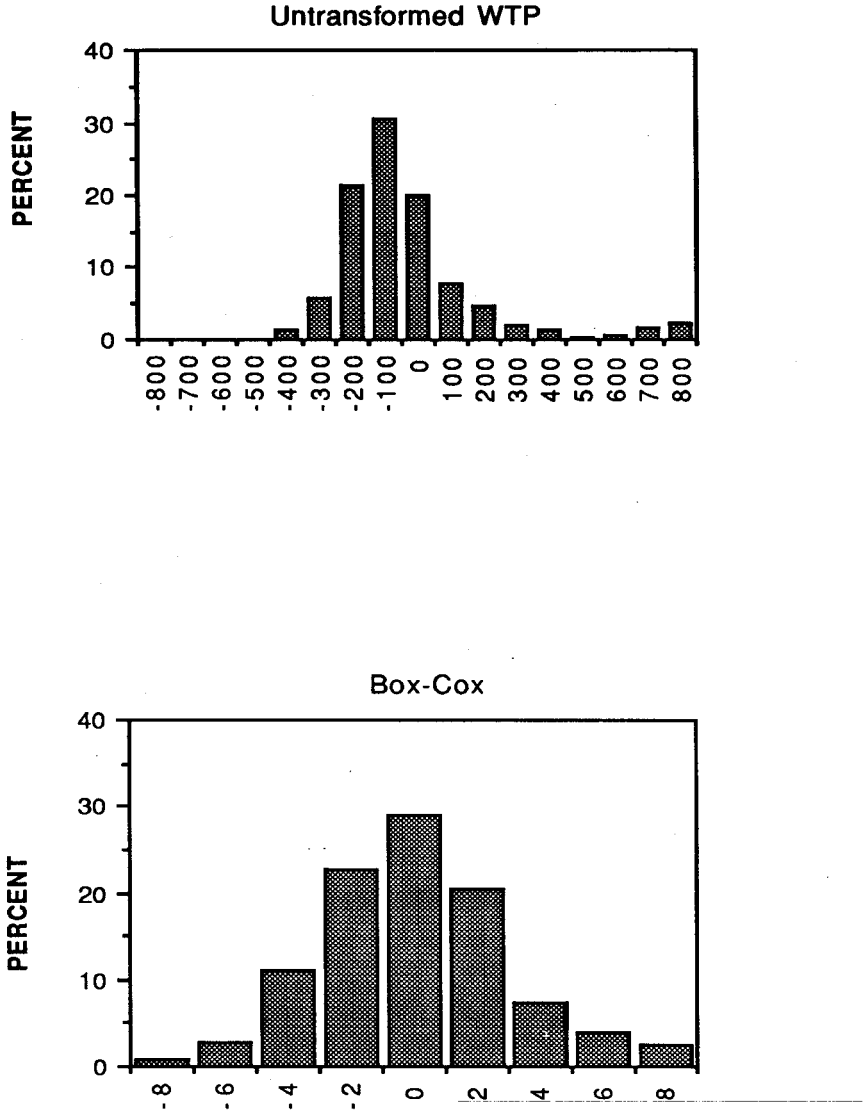
2.4 Bid Refusals

A second problem in the interpretation and analysis of contingent values is the presence of missing bids or protest zero bids when respondents are asked for willingness to pay (WTP). When pretesting survey instruments, researchers, in debriefing respondents, have often found that failures to bid or zero bids are not associated with a zero value to the respondent, but rather the respondent does not feel responsible for the problem and as a result conceals their value.

The mental process leading a respondents to conceal WTP based on the Denver air pollution study (supported by debriefings) is as follows: "Cleaner air is very valuable to me so I would have to pay a lot to reflect that value; but, fortunately, air pollution is not my fault so I should not have to pay. So, I just will not answer the question since it does not apply to me."

As argued by Smith and Desvousges (1987), the absence of bids from such respondents results in a potential selection bias problem since as many as one third of respondents may refuse to provide values. In estimating a regression model for those respondents who do provide a WTP value, selection bias must be accounted for to obtain unbiased coefficients (Heckman, 1979). However, in the Denver air pollution study we found that correcting for selection bias requires that the first stage probit equation must include identifiers, since we could not obtain reasonable predictions for missing bids. In other words, appropriate variables explaining whether a respondent gave a bid must be included in the probit equation, but excluded from or insignificant in the equation explaining WTP. We had no such variables in the Denver study but, based on debriefing questions included in the survey, determined that acceptance of responsibility (as opposed to the presence of benefits) for paying for air pollution cleanup was the missing factor.

FIGURE 2.3
RESIDUALS FOR WTP REGRESSIONS



Thus, in the Eastern visibility survey instruments we have included a number of variables attempting to measure this factor.

2.5 Embedding

Detailed debriefings of respondents obtained as part of pre-testing have often suggested that values are incorporated in WTP responses beyond those anticipated by investigators, who often struggle (unsuccessfully in our view) to limit bids to just the commodity or attribute under investigation. Our research in the Denver study suggests that some people have "mental models" of how the world functions which they maintain as a working hypotheses even in the face of "expert" evidence. These mental models usually relate to how governments raise and spend money or to the technology of environmental improvement. For example, the surveyor may promise that all the money raised by the program proposed for valuation will be spent on just the public good in question . But people with the view that governments produce services and commodities as joint products will bid for a vector of outputs rather than for the specific commodity. In debriefing respondents, we found, consistent with the arguments of Fischhoff and Furby (1987), that some respondents viewed health and visibility improvements as joint products. Further, some respondents viewed the proposed tax payments used to fund air quality improvements as providing for a much larger set of public goods consistent with Kahneman and Knetsch (forthcoming). To formally explore these issues we use the following notation:

Let Q = Air Quality,
V = Visibility,
H = Healthiness of the Air,
G = Other Public Goods,
X = Composite Commodity with a price equal to 1,
and X^o = Income.

If a respondent has a mental model such that

$$H = \alpha_H Q \text{ , } V = \alpha_V Q \text{ , and } G = \alpha_G Q,$$

where α_H, α_V, α_G are fixed coefficients, then the compensating variation measure of WTP for an improvement in visibility can be obtained by totally differentiating the constant level of utility of the consumer,

$$U(V,H,G,X^o\text{-WTP}) = U^o$$

subject to the joint product constraints listed above. The marginal willingness to pay for visibility then takes the form:

$$\frac{\partial WTP}{\partial V}\Big|_{U^o} = \underbrace{\left(\frac{U_V}{U_X}\right)}_{(a)} + \underbrace{\left(\frac{\alpha_H U_H}{\alpha_V U_X}\right)}_{(b)} + \underbrace{\left(\frac{\alpha_G U_G}{\alpha_V U_X}\right)}_{(c)} .$$

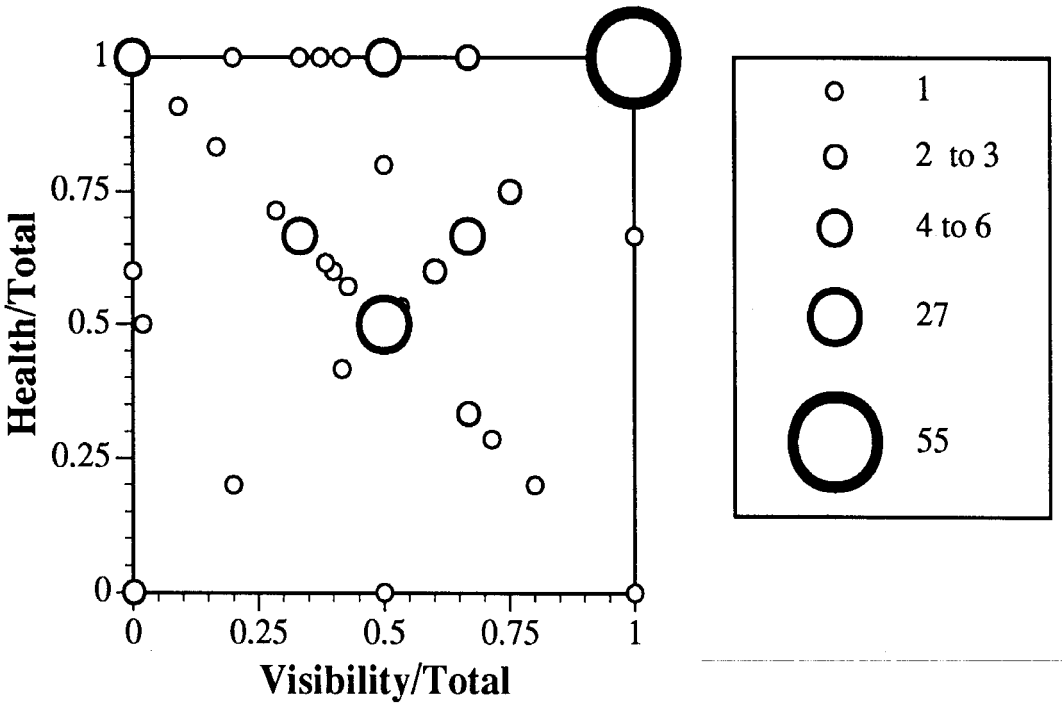
Thus, if an individual who believes that government services are produced as joint products is asked to provide a bid for a small increase in visibility, the bid will contain not only the marginal willingness to pay for visibility (term a above), but will also contain appropriately proportioned values for related health improvements (term b above) and for increases in the provision of other public goods (term c above). If an individual does not have such a mental model, i.e., accepts the possibility of only changing health or visibility in response to a particular program, then only term (a) will be present.

We tested this hypothesis in two ways. First, in one survey variant we ask respondents to provide a dollar value for visibility improvement, then a separate dollar value for health improvements, and finally a total bid for the sum of visibility and health improvements for a specific air pollution program. Some people responded with three bids in the following pattern: $50 for visibility, $50 for health, and $100 total indicating that they did not view the proposed program as providing joint products. However, a large number of respondents gave bids in the following pattern, $100 for visibility, $100 for health, $100 total, consistent with the joint product hypothesis. Data from these questions in the Denver study are presented in Figure 2.4. The vertical axis presents the ratio of health improvement bid to total bid for the stated air quality improvement. The horizontal axis shows the ratio of visibility bid to total bid for the stated air quality improvement. The size of the bubbles in the figure (as shown in the key) indicate the number of respondents whose bid pattern corresponds to the point at the center of the bubble.

First, note the clustering of respondents along the diagonal with a slope of -1 (from the upper left to the lower right hand corners of the figure). These individuals follow the first pattern discussed above, e.g., if .25 of the total bid goes to the visibility bid, .75 goes to the health bid. These individuals do not show an embedding problem (for the researcher) and correspond to 49 out of 137 individuals in this sample (36%). Another large group show what Kahneman and

Figure 2.4

Analysis of Embedding



Knetsch call "perfect embedding," consistent with the joint product model formalized above. This group consisting of 55 respondents (40% of the total sample) submitted the same bid for visibility, health and total air quality improvement and are located in the upper right hand corner of the figure. Thus, 76% of respondents are consistent with the hypothesis of no embedding or perfect embedding (joint products). However, the joint product hypothesis can account for other individuals in the sample as well. For example those on the diagonal line with a slope of +1 show a form of partial embedding in which they are unable to fully disaggregate their values into components. Other points may simply show an ordering effect, i.e., in giving a bid first for visibility and then for health, when finally coming to the total bid, the respondent may realize that the additive total was more than they wanted to pay.

A second way to examine this issue which encourages consistent answers is to incorporate a debriefing question, as we did, in one version of the Denver survey, which asks respondents only for a total bid, but then asks them to split the bid up into its possible component parts. Thus, a respondent can (as they did on average in the Denver study) plausibly state "my bid was 27% for visibility, 48% for health, and 25% for other public goods," consistent with either preferences constrained or unconstrained by a joint product mental model. This approach was extensively employed in the Eastern air quality survey design.

2.6 Context

A potential problem in the design of any survey instrument is the degree to which the wording of the survey can affect respondents' answers. Both the wording of the valuing question and the information surrounding the question, which we term the *context* of the question, can affect the value given. Hogarth (1982) in an edited volume presents a number of papers that confirm the notion that context can affect people's responses, even in situations in which the context should logically have no effect. For example, researchers (e.g., Noell-Neumann, 1970) have found that the order in which (independent) questions are asked can affect people's answers to the questions. Other researchers (e.g., Tversky and Kahneman, 1986, Lichtenstein and Slovic, 1971, 1973) have found that how the question is expressed (e.g., in terms of losses versus gains, or in terms of percentages instead of fractions) can affect people's responses.

In order to understand context effects, it is helpful to think of values as being more or less *crystallized* (Schuman and Presser, 1981). If a person has had the opportunity to think about and/or obtain a choice experience with a commodity (in a marketplace or through a public decision process such as an actual referendum, for example) to such an extent that the value is

"set" in the mind, then it is unlikely that the manner in which the value is elicited will affect the value. In such a case, we would say that the commodity's value is *crystallized*, and relatively impervious to context effects. If, on the other hand, the commodity is one for which the person does not have a set value, because the commodity is not traded in a marketplace or has not been subjected to public debate and the person has not thought of the commodity in monetary terms, then the value for that commodity is less crystallized. In such a case, context difference could affect the value in two ways.

One way in which context can have an effect is in the process of evaluating the commodity. For example, when a respondent reads the words "air quality", many components of the concept "air quality" may come to mind. Context such as photographs used to represent air quality can help clarify the concept of air quality, or place emphasis on different aspects of the problem. Evidence has shown (Tversky and Kahneman, 1974) that whatever components of a commodity are most cognitively available to the respondent will figure most strongly in the evaluation of the commodity. For example, if respondents only see scenic photos and not realistic outdoor representations of daily life, biased values may result as has been suggested by Fischhoff and Furby (1989).

Another type of context effect is rooted in the difficulty that people have in assigning values to commodities such as *air quality.* Context can help respondents understand how the general concept of "air quality" can be translated to a monetary scale, especially since it is likely that many respondents have not thought of environmental commodities in monetary terms. It is important, for that reason, that CVM questions be given enough context so that respondents believe and understand that their money would actually buy the commodity they are evaluating. Some researchers (Fischhoff and Furby, 1989) have suggested that even seemingly minor wording differences in CVM questions could result in respondents valuing essentially different commodities, thus making interpretation of the results impossible. The disadvantage to giving too much contextual information of this kind is the danger that the respondents will have a response to the contextual information that is unrelated to their actual values for the commodity.

In order to test the degree to which values are crystallized, as well as the degree to which respondents need contextual information to make sense of CVM questions, we varied the context across different versions of the Denver CVM survey. Values obtained across survey versions were quite robust with respect to changes in context, suggesting that values were crystallized and that bias from this source was not a severe problem for this particular commodity. In the Denver study

we tested for context effects by implementing seven different designs of the survey which in some versions (1) varied the way the improvement in air quality is described, (2) provided additional information describing the health effects of air pollution, (3) used a referendum format as opposed to a straightforward WTP question, and (4) asked respondents to value other private commodities before valuing air quality. None of these treatments had a substantial effect on stated values.

2.7 Implications for the Design of the Eastern Air Quality Study

As noted throughout this review of our prior research, several issues must be addressed in the Eastern air quality study. These are:

(1) Better explanatory variables must be identified to explain WTP to reduce model error.
(2) Better explanatory variables must be found to identify the probit equation (explaining refusals to bid) in the selection bias model used to predict missing bids.
(3) Embedding problems must be accounted for or component values (such as that for visibility) associated with air quality improvement will be overestimated.
(4) Although context showed little effect in the Denver study, a city with scenic vistas available almost everywhere, the effect of showing visibility impacts in a realistic way for Eastern cities (i.e., short visual range situations are more common than scenic vistas) must be used in a study of air quality values in the Eastern United States.

CHAPTER 3

Survey Design

This section presents an overview of the basic survey design for assessing values for improved air quality in the Chicago and Atlanta metropolitan areas. The same basic survey, with appropriate local name changes, was sent to both metropolitan areas. Further, as described below, half the respondents in each area received a version of the survey that used a scenic photograph to assess values for air quality while the other half received a version that used several more typical views in addition to the scenic view to assess values. Except for this manipulation, the two versions were otherwise identical. The survey was printed as a booklet containing a photo insert sheet (see facsimile surveys in Appendix A and photosheets in the pocket at the back of this report). Details of the basic survey and the variations are described below.

Section I: The Issues

The introductory section, identical across survey versions, had the function of introducing the topic of the survey and encouraging respondents to think about air quality and what it meant to them. These questions asked about air quality concerns with respect to health and visibility. Other questions in this section assessed familiarity with media reports about air quality, attention paid to visibility range, and general attitudes about spending to improve air quality.

Section II: How Do You Rate Chicago's/Atlanta's Air?

The survey booklet included a sheet of color photographs depicting varying levels of air quality for actual scenes in Chicago and Atlanta, as appropriate. The three-by-three array of photographs consisted of three scenes (rows) at three levels of air quality (columns). The top row of each sheet was a "picture postcard" skyline view (of either Chicago or Atlanta, as appropriate) that a commuter might see driving to work. The middle row was a photograph of a typical residential street with a limited distant view, and the bottom row was a photograph of a vista in a park setting. All photos were originally taken on a day with excellent air quality affording maximal visibility range. The columns were then produced by computer degradation of visibility to depict specific visibility ranges for each row photograph.[3] The photos in the leftmost column were degraded to depict a visibility range of approximately five miles, those in the middle column

[3]The computer-degraded photographs were produced by John Molenar of the Cooperative Institute for Research in the Atmosphere at Colorado State University.

were degraded to depict a visibility range of approximately 15 miles, and those in the rightmost column were the undegraded original photographs representing visibility ranges of 40 or more miles. Pilot studies using a larger array of photographs revealed that people could easily perceive visibility changes of these magnitudes and that the photographs spanned the range from what most people considered to be very poor to very good visibility.

Respondents first rated the visual air quality of each photo and the healthiness of the air on a seven-point rating scale (one meant "visual air quality [healthiness] of the air is as bad as it could be" in the local area and seven meant "visual air quality [healthiness] of the air is as good as it could be" in the respective area. To help disentangle ratings of visual air quality from ratings of healthiness, respondents were reminded that:

> *A day with air that **looks bad** is not always more harmful to your health than a day that looks good*. For example, health impacts may occur when invisible air pollutants such as carbon monoxide or ozone are present. Other pollutants, such as particles in the air, can affect both health and visibility, as well as cause soiling and damage to certain materials and vegetation.

The order in which the photos were rated was randomized so that respondents would not, say, rate all the "dirty" photos before all the "clean" photos.

The next set of questions asked about personal beliefs and actions with respect to air quality. Did they think air pollution would get better or worse if no further actions were taken over the next 5-10 years? Had they undertaken one or more specific pollution control actions (such as car pooling)? What did they think were the relative sources of air pollution (mobile sources versus industry versus home heating, etc.). The final questions in this set of questions asked how long they had experienced the local air quality and what they thought about the amount of attention begin given to the air quality issue.

In the last part of this section, the photos were linked to representative frequency distributions. How this was done is the key distinction between versions of the survey. Respondents in both versions were shown a distribution (bar chart) of the frequency of days for which the visual range was "short," "medium," or "long." In the "typical views" version of the survey, respondents were told that the leftmost *column* of photos corresponded to days with short visual range, those in the middle column represented typical days of medium visual range, and those in the rightmost column depicted days of long visual range where visual range was defined as "the farthest you can clearly see an object if your view is not obstructed." After being reminded that it was reasonable

for people to perceive differences in the visual air quality across different scenes even though they had objectively the same measured air quality, respondents in the "typical views" version were asked to rate the overall or average visual air quality and then the overall or average healthiness of each *column* of photographs.

In the "scenic view" version of the survey, only the top row of photographs (the scenic skyline view) was linked to the frequency distribution of short, medium, and long visual range days. The survey versions are summarized in Table 3.1 below.

Table 3.1

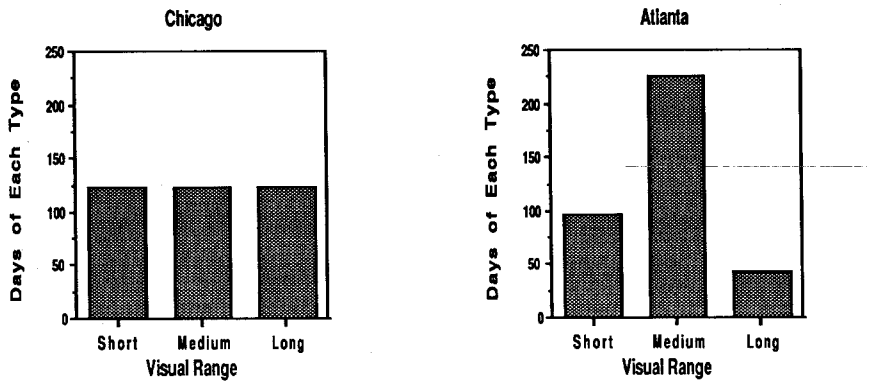
Summary of Survey Versions

Version	City	Photos Used to Characterize Frequency Distribution of Visibility
A	Chicago	Typical Views/All Scenes
B	Chicago	Scenic View/ Top Row Only
C	Atlanta	Typical Views/All Scenes
D	Atlanta	Scenic View/ Top Row Only

Using information on how the degree of computer degradation corresponded with pollutant levels and how pollutant levels varied across days in the respective cities, we provided respondents with the respective frequency distributions in Figure 3.1. These frequency distributions approximately correspond to average (for a year) visibility ranges of 20 miles for Chicago and 15.2 miles for Atlanta.

Figure 3.1

Frequency Distributions of Air Quality for Chicago and Atlanta



Section III: The Value Of Clean Air To You

This section contained three parts. The first part described how federal and state programs might reduce air borne pollutants, how such programs might be paid for through taxes, and the effect that reductions in air borne pollutants would have on the frequency distribution of days with short, medium or long visual range. For each city, the improvement was depicted in a frequency distribution as a decrease of 25 days with short visual range, no change in the number of days with medium visual range, and a resulting increase of 25 days with long visual range . These changes correspond to an increase in annual mean visibility of about 2.4 miles in both metropolitan areas; the resulting mean visibility would be 22.4 miles in Chicago and 17.6 in Atlanta.

Separate questions asked respondents how important it was to have fewer short visual range days, and, independently, how important it was to have more long visual range days.

The second part of this section assessed respondents' values for an improvement in air quality of the magnitude described by asking, in a referendum format, how much they would be willing to pay for a program of the type described. Specifically, respondents were asked if they would vote for a referendum that guaranteed the type of improvement outlined in the first part of the section but that would cost a certain amount in taxes in higher prices. If they responded positively, they were then asked to specify the most those taxes and higher prices could be on an annual basis before they would switch to a negative vote. Respondents were reminded that the amount they indicated would be the measure of the true worth to their household of receiving such an improvement.

The questions in the final part of this section attempted to get respondents to think about changes in the healthiness of air. To this end, respondents were asked to what extent they believed the healthiness of the air would change as a consequence of the described change in the frequency of days with short, medium, and long visual ranges. Then, respondents who answered positively to the referendum question, split their total willingness-to-pay value into percentages attributable to separate benefits that would result from cleaner air; less soiling, materials damage and vegetation effects; better visual air quality; healthier air; and unspecified other benefits they believed would result.) Respondents also allocated their total willingness-to-pay values to the separate benefits of reducing the number of short visual range days and of increasing the number of long visual range days. Finally, all respondents were asked to answer the question: "Do you feel at all responsible for the air pollution problem of the Chicago(Atlanta) Metro Area?"

Section IV: Demographics

The final section of the survey asked standard demographic questions about age, gender, composition of household, education, employment, and income. Also included were questions asking voter registration status, if the residence had a view, the type of residence, and ownership status. Finally, questions attempting to measure preferences with respect to the environment were incorporated into this section.

CHAPTER 4

Survey Implementation and Summary Statistics

4.1 Survey Implementation

The mailing procedures used in the implementation of this study were designed following the Dillman Total Design Method (TDM) (Dillman, 1978). The TDM procedure aims to maximize response rates through specific design and implementation strategies. For example, personalizing the mailing to include a hand-signed cover letter, hand-stamped envelope, and follow-up postcard are key factors for encouraging responses. Examples of these are presented in figures 4.1-4.3. (The facsimiles are examples of the correspondence used in the Chicago area, the only difference in the case of the Atlanta area is the change in city name.) The cover letter (Figure 4.1) is designed to introduce the respondent to the topic of the questionnaire. It describes in general what the survey is about, who should fill it out and who is conducting the research. Inside the cover of the survey is a second statement of what the survey is about, and who should fill it out. Figures 4.2 and 4.3 present the reminder postcard and follow-up letter, respectively.

Consistent with TDM, the survey was printed as a booklet measuring 8 inches by 6 inches. The surveys that we sent were 12 pages long, including the cover and the space for comments. One version of the survey, a cover letter, and a self-addressed, stamped envelope were mailed to each individual in the survey.

The mailout package also included a two dollar bill. This was enclosed to encourage the household to fill out and return the survey. This monetary incentive is not part of TDM, but we have found it increases response rates by about 20 percent (see Doane, et al., 1989).

The households surveyed constitute a random sample from the Atlanta and Chicago Metro areas. Five hundred households from each area were selected, from the five counties that make up the Atlanta Metro area and the three counties that constitute the Chicago (IL) Metro area. There were two-hundred and fifty households selected for *each* of the four survey variants for a total sample size of 1000. Residents were selected by Survey Sampling Inc. of Fairfield, CT from listed telephones such that each household had an equal probability of being sampled.

In an effort to maximize response rates, the TDM specifies follow-up mailing procedures. One week after initial mailing, a postcard was sent reminding respondents of the importance of completing and returning the survey. If a response was not received after three weeks, a second survey, cover letter and self-addressed, stamped envelope were sent out. However, this second mailing package did not contain another two dollar bill.

4.2 Summary Statistics

Of the 1000 surveys mailed there were 163 bad addresses, and a 59% response rate was obtained, resulting in 494 completed surveys to be used in the analysis. Survey procedures were identical to those used in the Denver air quality study, which obtained a 71% response rate.

Mean responses for each question of each survey version are presented with facsimile surveys in Appendix A. The mean response for the WTP measure for air quality depended on survey type. Predictive models of the WTP measure are presented in Chapter 5. None of the mean responses depended on the respondents' city of residence.

Figure 4.4 shows mean visibility and health ratings for the nine air quality photos (questions 6.1-6.9 and 7.1-7.9). As the figure indicates, there were high correlations between the visibility and health ratings for the photos. The correlations between health and visibility ratings ranged from .4 to .68. The mean correlations between health and visibility ratings were .54 for Atlanta and .58 for Chicago. The residential photo for Chicago showed less difference in air quality ratings across the three air quality levels than did the other photos; otherwise, there were no large differences in rating due to photo or city.

Figure 4.1

Cover Letter

July 30, 1990

The air pollution problem in the Chicago Metro Area is an issue of increasing concern. However, little is known about what people think about air pollution and how they respond to the impacts it may have in their lives. In order to better assess what should be done about air pollution in the Chicago area, we need the benefit of your experience.

You are one of a small number of households who are being asked what they think about Chicago's air pollution problem. Your name was drawn randomly from a list of households in the Chicago Metro Area. In order for the results to truly represent the opinions and experience of those people who live in the Chicago area, it is important that each questionnaire be completed and returned. It will take you about 15 minutes. Your answers will be combined with others in the city of Chicago and its surrounding suburbs to form a profile of the area's views of air pollution issues.

Since this questionnaire asks specifically about your household's perceptions of Chicago's air pollution, we ask that it be filled out by an adult in your household. You can be assured of complete confidentiality. In fact, your name will never be associated with this information. The number on the questionnaire is only so your name can be checked off the list when it is returned.

Since your responses are so valuable to us, we enclose $2 for your time and effort.

If you would like to receive a free summary of the survey results, please write "send results" on the back of the return envelope.

Many thanks for your help with this important effort.

Sincerely,

Gary McClelland
Project Director

Figure 4.2

Postcard

August 7, 1990

Last week a questionnaire was mailed to you seeking information which is crucial in evaluating what people think about the air pollution issues of the Chicago area.

If you have already completed and returned the questionnaire, accept our sincere thanks. If not, please do so today. Chicago's air pollution problem is a matter of increasing concern. Therefore, it is extremely important that your answers also be included in the study.

If by some chance you did not receive the questionnaire, or it was misplaced, please write us and we will get another one in the mail to you immediately.

Sincerely,

Gary McClelland
Project Director

Figure 4.3

Follow-up Letter

August 21, 1990

I am writing to you about our study of what people think about Chicago's air pollution problem. To date, we have not yet received your completed questionnaire.

The large number of questionnaires returned is very encouraging. But whether we will be able to describe accurately what people think about air pollution in the Chicago area depends on you and the others who have not yet responded. This is because our past experiences suggest that those of you who have not yet sent in your questionnaire may have very different opinions compared to those who have responded.

This study has been undertaken in the belief that people's attitudes towards air pollution should be incorporated into public management policies. Your opinions will be extremely valuable towards evaluating the worth of such programs. The usefulness of our results depends on how accurately we are able to describe the perceptions of the people in the Chicago area.

In case our previous correspondence did not reach an adult in your household whose response is needed, a replacement questionnaire is enclosed. We urge you to complete and return it as quickly as possible.

We'll be happy to send you a copy of the results if you want one. Simply put your name, address, and "copy of results requested" on the back of the return envelope.

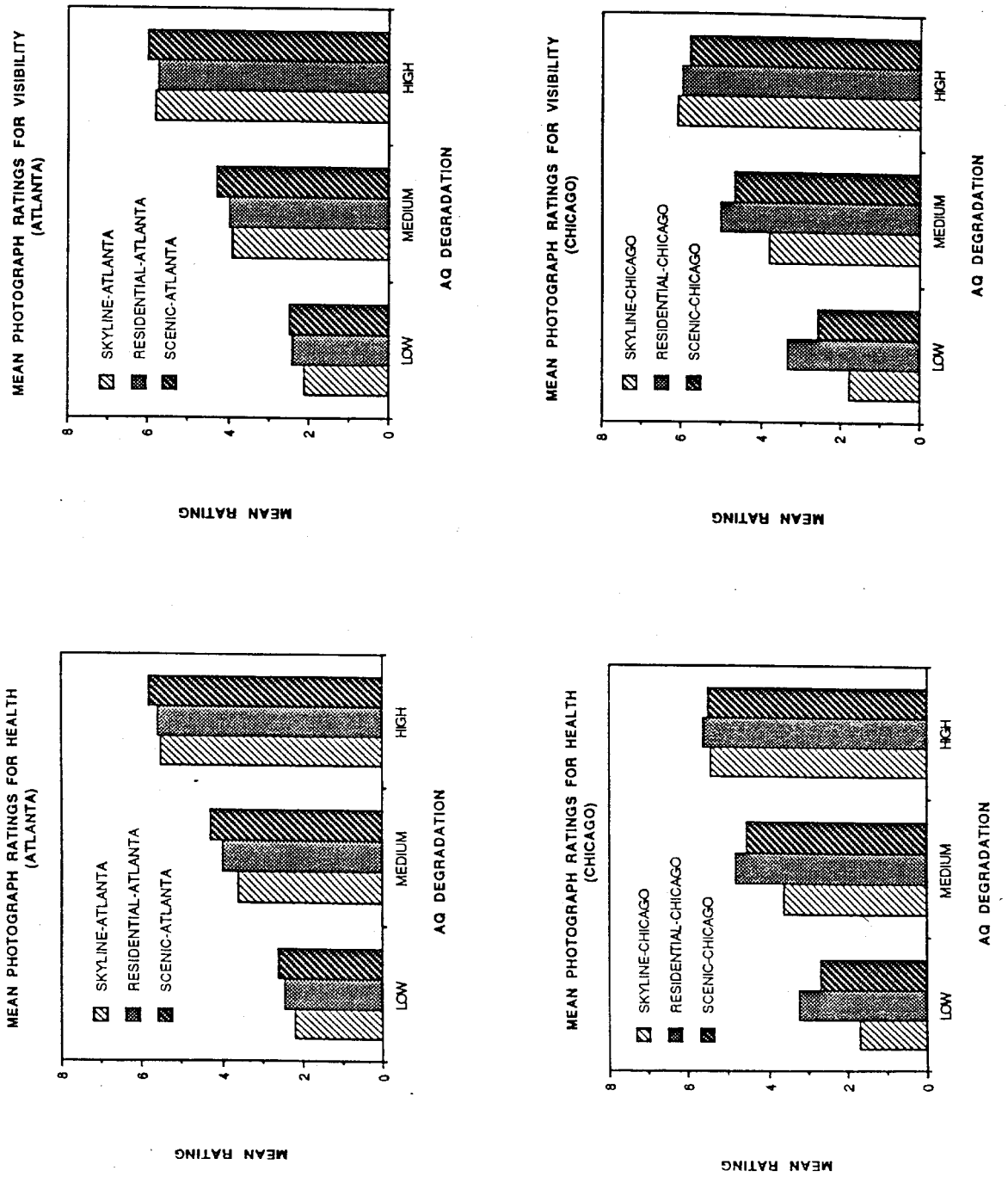
Your contribution to the success of this study will be appreciated greatly.

Most sincerely,

Gary McClelland
Project Director

Figure 4.4

Mean Health & Visibility Ratings of Photos



CHAPTER 5

Econometric Analysis

5.0 Overview

The econometric analysis employs a two-stage procedure to analyze the field data and to estimate willingness-to-pay (WTP) values for improved air quality. The first step in this procedure was to model missing bids using a probit analysis. The probit analysis allowed us to identify characteristics of households that are more likely to provide a WTP bid for the CVM instrument we implemented. The second step was to model non-missing WTP values, transformed[4] according to a Box-Cox procedure (Box and Cox, 1964), using multiple regression analysis with a predictor added from the probit analysis to account for selection bias. It should be noted that this is a new procedure developed for this study. Inclusion of the calculated inverse Mill's ratio (derived from the probit equation) in the multiple regression analysis of WTP allows us to make predictions for WTP, which are corrected for selection bias.

In our sample, 441 respondents provided complete data for all necessary variables; 184 of the 441 respondents had missing WTP bids, 256 gave a positive WTP, and one gave a zero WTP. Descriptive statistics for all the variables used in the analyses are listed in Table 5.1

The first two sections of this chapter will discuss these analyses and their results. The last part presents predictions of willingness-to-pay and the share attributable to improved visibility, healthiness of the air, and soiling.

5.1 Probit Analysis

This first step in the procedure provides information about which household characteristics predict a positive bid (WTP>0) as opposed to a missing bid. This information is then used to construct an inverse Mill's ratio (represented by λ in Table 5.2, which presents our econometric analysis), that in turn is used in the second step of the analysis to correct for sample selection bias.

[4]The transformation was empirically estimated because economic analysis provides little guidance as to appropriate functional form.

Table 5.1

Description of Variables

Variable	Description	Mean	Variance
VERSION	1 = column info., -1 = no column info.	0.020	1.00
RESYRS	Years residence in city	31.763	409.259
INCOME	Respondents' income	8.914	15.887
EDUC	Respondent's education level	7.131	3.290
RETIRED	1 = retired, 0 if not	0.240	0.183
GENDER	1 = Female, 2 = Male	1.658	0.304
AGE	Age of respondent	48.889	266.331
VIEW	A view from home: 1 = yes, 2 = no	1.295	0.203
OUTDRS	Degree to which respondent is one who spends time outdoors, on a scale from 1 (not at all) to 7 (definitely)	4.932	2.391
ENVIRON	Degree to which respondent is an environmentalist, on a scale from 1 (not at all) to 7 (definitely)	4.102	2.242
UNEMPLOY	Employment status: employed = 0, other = 1	0.036	0.035
CHICAGO	Chicago respondent = 1, Atlanta respondent = 0	0.549	0.248
VIS	Concern about visibility in respondent's area. on a scale from 1 (not at all concerned) to 7 (extremely concerned)	5.236	2.316
HEAL	Concern about healthiness of the air in respondent's area, on a scale from 1 (not at all concerned) to 7 (extremely concerned)	5.970	1.704
ME	Sum of ranks on the degree to which individual actions (use of cars and fireplaces) contribute to air pollution on a scale from 1 (no contribution at all) to 7 (extremely high contribution)	8.932	7.541
THEM	Sum of ranks on the degree to which industry and power plants contribute to air pollution, on a scale from 1 (no contribution at all) to 7 (extremely high contribution)	10.243	13.043
NATURE	Degree to which weather conditions contribute to air pollution, on a scale from 1 (no contribution at all) to 7 (extremely high contribution)	3.744	3.664
MONEY	Should more or less money be spent on pollution reduction 1 =more, 2 = the same, 3 = less	1.333	0.263
RESPONS	Degree to which respondent feels responsible for the pollution problem in their area, on a scale from 1 (not at all responsible) to 7 (very responsible)	3.395	2.522

The probit equation estimating the probability of providing a positive WTP is presented in the left-hand two columns of Table 5.2. Neither version nor city (represented by a dummy variable for Chicago) was a significant predictor of who would provide non-missing WTP values. The probit analysis also highlights some significant identifying variables for the selection model. These identifying variables characterize aspects of the sample that influence the likelihood that the respondent will provide a WTP value, but they do not necessarily influence the magnitude of the resulting WTP values. Such variables are particularly important for understanding the inherent self-selection bias induced by differential responding to the WTP question. We now turn to these identifying variables.

The ME variable is a composite of measures of the perceived importance of characteristics of individual households that can contribute to air pollution. Specifically, households were asked to indicate the degree to which the use of automobiles and fireplaces contribute to the pollution problem in their area. The results show that the more they thought that individual actions contributed to air pollution the more likely they were to provide a WTP value. Likewise, a separate question in the latter part of the survey asked whether the respondent felt responsible for the air pollution problem in their area. This measure of responsibility (RESPON) shows that the more responsible a household felt, the more likely it was to provide a WTP value for improving air quality[5]. A third identifier variable was whether the respondent felt that more, the same, or less money (MONEY) ought to spent on air quality in the respective cities. Those indicating that more money ought to be spent (they had low values on the coding of the MONEY variable) were more likely to provide WTP values for improving air quality.

A number of standard demographic variables and one residential characteristic also were significantly related to providing WTP values. In particular, higher income, more education, being male, being younger (marginally significant), and having a view made responding to the WTP question more likely.

[5]In order for the regression model to be both identifiable and to include the inverse Mills ratio (λ), at least one of the explanatory variables from the probit model of selection bias must be omitted from the regression. In this analysis, RESPON was omitted from the regression analysis.

Table 5.2:

Estimation

	Positive WTP Probit		WTP Regression Box-Cox	
	Coeff	t-stat	Coeff	t-stat
CNST	-2.201	-3.170	4.282	1.490
VERSION	-0.052	-0.815	-0.194	-1.496
RESYRS	0.001	.251	0.000	-0.036
INCOME	0.043	2.338	0.102	2.407
EDUC	0.130	3.032	0.237	1.836
RETIRED	0.300	1.323	0.779	1.564
GENDER	0.320	2.364	0.304	0.880
AGE	-0.012	-1.805	-0.029	-1.774
VIEW	0.284	2.022	-0.098	-0.304
OUTDRS	0.050	1.082	0.052	0.494
ENVIRON	0.028	0.569	0.074	0.744
UNEMPLOY	-0.021	-0.061	0.971	1.331
CHICAGO	0.113	0.821	-0.254	-0.872
VIS	-0.118	-1.868	-0.137	-0.991
HEAL	0.110	1.539	0.178	1.080
ME	0.93	3.140	0.035	0.390
THEM	-0.021	-0.917	-0.036	-0.692
NATURE	-0.011	-0.312	-0.017	-0.212
MONEY	-0.502	-3.779	-0.793	-1.713
RESPONS	0.106	2.289		
λ			0.642	-0.480
			α =.11	
			R^2 =.14	

5.2 Regression Analysis

The right-hand set of columns in Table 5.2 presents the Box-Cox regression analysis. One of the theoretically most important explanatory variables that has an influence on WTP is VERSION. VERSION represents the way that the surveys directed respondents through the accompanying photo sheet. In versions A and C, respondents rate the visual air quality and healthiness of the air of each *column* of photos or in terms of "typical" views. The other version type, "scenic view," associated the frequency distribution of visual range days to only the top *row* of the photo sheet. Thus, the "scenic view" version associated the frequency distribution to only one view – the city scape . "Typical views" reduce WTP values by having the distribution of visual range days tied to all three types of views. The difference in WTP was marginally significant (.06 with a one-tailed test). Although not overwhelming, this result is consistent with the related criticism made of the Tolley et al. study which used only a scenic view.

The second most important explanatory variables, in terms of theory, is the inverse Mill's ratio (λ). That the coefficient for λ is not significantly different from zero implies that the imputed predicted WTP values for those with missing values are not significantly different from those who did provide WTP values in the survey. Thus, there is effectively no selection bias with respect to WTP values.

Respondents' income was positively related to the measure of willingness to pay. Education and age had marginally significant positive effects on WTP values. However, there were few reliable predictors of WTP so the overall R^2 is only .14. Consistent with the previous data and the theoretical analysis of Chapter 2, there were a few very large WTP values which produced a very skewed distribution of errors. The estimated coefficient for the Box-Cox transformation was .11, close to logarithmic, representing a fairly severe pulling in of the extreme tail of the distribution of WTP values.

5.3 WTP Predictions

Using the Box-Cox regression model, Table 5.3 provides predictions for those that actually gave positive bids (E(WTP>0)) and that portion of the sample population that had *missing* values (E(WTP=0)).

Table 5.3
Model Predictions for WTP

Variable	Mean	Std Dev	Variance	Minimum	Maximum	Valid
WTP (Raw Mean)	211.67	298.25	88951.6	2.00	3000.00	256
E(WTP>0)	132.26	65.10	4237.4	37.89	539.77	257[6]
E(WTP=0)	49.06	28.22	796.5	6.46	241.03	184

The model predicts that the portion of the sample population that did not respond to the WTP question (42% of the sample) would pay approximately $83.20 less, on average, than would those respondents who gave a positive WTP value.[7] Taking the weighted average of these two portions of the sample population gives a predicted mean of (132.262 x 0.583 + (49.060 x 0.417) = $97.57. This is $114.10 less than the reported raw mean for all those households that provided positive values (WTP>0). The reduction is due both to the selection bias correction and the Box-Cox transformation for hypothetical bias.

Component values based on percent splits for apportioning WTP values by (1) the four concerns listed in the survey or (2) for cleaning up short visual range days versus obtaining more long visual range days are summarized Table 5.4.

[6]The difference of 1 in the number of valid responses between WTP (Raw Mean) and E(WTP>0) is due to the single actual $0 bid in our sample.

[7]Note that because of the failure to identify the selection bias model in our earlier Denver work, predicted WTP for missing values was as much as ten times the predicted value for those who gave a bid, on average.

Table 5.4

	Average Percent	Percent of Raw Mean ($211.67)	Portion of E(WTP>0) ($132.26)	Portion of E(WTP = 0) ($49.06)	Portion of weighted average of E(WTP>0) and E(WTP=0) ($97.57)
Soil	21.6	$45.72	$28.57	$10.60	$21.08
Health	48.7	103.08	64.41	23.89	47.52
Visibility	18.6	39.37	24.60	9.13	18.15
Other	11.0	23.28	14.55	5.40	10.73
Long Visual Range	50.3	$106.47	$66.53	$24.68	$49.08
Short Visual Range	49.7	105.20	65.73	24.38	48.49

Depending on the mean value of WTP considered, the amount attributable to the benefit of having less soiling, materials damage and vegetation effects ranges from approximately $10 to $45. For healthier air the range is from $24 to $103, and for better visual air quality from $9 to $39. The category “Other” comprised about 11 percent of average WTP for improvements in air quality, resulting in a component value ranging from about $5 to $23. Non-health benefits, reduced soiling and increased visibility, range from $19 to $85 or from $25 to $108 if “other” is included.

Breaking down the measures of mean WTP by the average percent respondents placed on reducing short visual range days provided a component value that ranges from $24 to 105.

Several limitations of the study should be noted. First, limited funding was available for final implementation. As a result, small samples in only two cities could be obtained . Further, funds were not available to conduct a telephone survey of non-respondents (approximately 40% of the sample). Such a telephone survey could obtain data on the significant explanatory variables in the model, including taste variables, allowing predictions for their WTP values (albeit not accounting for a possible additional selection bias issue).

In defense of the study, several major problems have been clearly resolved and a useful model has been developed for predicting values for benefit-cost analysis.

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APPENDIX A

I. THE ISSUES

We would like to find out how air pollution in the Chicago area affects you and your household.

Q-1 How concerned are you about visibility in the Chicago Metro Area?

(5.23)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-2 How concerned are you about the healthiness of the air in the Chicago Metro Area?

(6.09)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-3 How often have you read or heard about air pollution issues from these sources? (Coded as 1 for NEVER, 2 for ONCE OR TWICE, and 3 for MANY TIMES)

Please circle the appropriate response for each category.

1) Television	NEVER	ONCE OR TWICE	MANY TIMES	(2.70)
2) Newspaper	NEVER	ONCE OR TWICE	MANY TIMES	(2.58)
3) Radio	NEVER	ONCE OR TWICE	MANY TIMES	(2.58)
4) Family	NEVER	ONCE OR TWICE	MANY TIMES	(2.15)
5) Friends	NEVER	ONCE OR TWICE	MANY TIMES	(2.21)
6) Other	NEVER	ONCE OR TWICE	MANY TIMES	(2.16)

Please specify_____

Q-4 Generally speaking, how much attention do you pay to how far you can see on a given day? (4.60)

NOT AT ALL					A LOT	
1	2	3	4	5	6	7

Q-5 Do you think more or less money should be spent trying to reduce air pollution in the Chicago area? (1.33)

1) More money
2) Same amount of money
3) Less money

II. HOW DO YOU RATE CHICAGO'S AIR?

Please look at the fold-out sheet of photos included in your survey package. *A day with air that **looks bad** is not always more harmful to your health than a day that looks good.* For example, health impacts may occur when invisible air pollutants such as carbon monoxide or ozone are present. Other pollutants, such as particles in the air, can affect both health and visibility, as well as cause soiling and damage to certain materials and vegetation.

Your Air Quality Ratings

Q-6 On your photo sheet you will see 9 photos, labeled A through I, that depict some scenes of Chicago. We would like you to rate the photos in terms of visual air quality. **Please give each photo a rating between 1 and 7**. A rating of **1** means the visual air quality is **as bad as it could be in the Chicago Metro Area**. A rating of **7** means the visual air quality is **as good as it could be in the Chicago Metro Area**. For each photo, just circle the number that represents your rating. (Please note that the photos listed below are in no particular order.)

	Visual Air Quality							
	Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(3.36)
2) Photo I	1	2	3	4	5	6	7	(5.73)
3) Photo B	1	2	3	4	5	6	7	(3.83)
4) Photo H	1	2	3	4	5	6	7	(4.52)
5) Photo C	1	2	3	4	5	6	7	(5.92)
6) Photo E	1	2	3	4	5	6	7	(4.98)
7) Photo G	1	2	3	4	5	6	7	(2.63)
8) Photo A	1	2	3	4	5	6	7	(1.84)
9) Photo F	1	2	3	4	5	6	7	(5.91)

Q-7 Again, using the 1 to 7 scale, how would you rate the healthiness of the air in each of the photographs?

	Healthiness of the Air: Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(3.36)
2) Photo I	1	2	3	4	5	6	7	(5.70)
3) Photo B	1	2	3	4	5	6	7	(3.62)
4) Photo H	1	2	3	4	5	6	7	(4.62)
5) Photo C	1	2	3	4	5	6	7	(5.49)
6) Photo E	1	2	3	4	5	6	7	(4.83)
7) Photo G	1	2	3	4	5	6	7	(2.91)
8) Photo A	1	2	3	4	5	6	7	(1.78)
9) Photo F	1	2	3	4	5	6	7	(5.62)

Q-8 In your opinion, if nothing further is done about air pollution in the Chicago area over the next 5-10 years, the problem is likely to (1.58)

1) get much worse.
2) get somewhat worse.
3) stay about the same.
4) get somewhat better.
5) get much better.

Q-9 Among the following actions that can reduce air pollution, which have you and your household taken? (Please circle all that apply.)

1) Reduced the use of your fireplace and/or wood-burning stove. (21%)
2) Taken some other form of transportation (the train, bus, bicycle, walk, etc.) rather than your car to work or shopping. (42%)
3) Car-pooled. (23%)
4) Reduced the number of days you used your car (to work or other places). (34%)
5) Other (please specify) _____

Q-10 To what degree do you think the following causes contribute to the air pollution problem in the Chicago Metro Area?

	No Contribution At All						Extremely High Contribution	
1) Automobiles	1	2	3	4	5	6	7	(5.82)
2) Fireplaces	1	2	3	4	5	6	7	(3.50)
3) Power plants	1	2	3	4	5	6	7	(5.52)
4) Industry	1	2	3	4	5	6	7	(6.11)
5) Weather Conditions	1	2	3	4	5	6	7	(3.93)
6) Other (please specify)	1	2	3	4	5	6	7	(6.20)

_____

_____

Q-11 How long have you lived in the Chicago Metro Area?

_____ YEARS (37.28) _____ MONTHS (5.00)

Q-12 How do you feel about the amount of attention given to the air pollution problems of the Chicago Metro Area? (3.12)

TOO LITTLE						TOO MUCH
1	2	3	4	5	6	7

Please look at the column on the left side of your photo sheet, which consists of photos **A, D, G**. Although people may see differences in visual air quality between photos of each scene within that *column*, these photographs have identically measured air quality in terms of visual range and pollutants in the air. Visual range is defined as "the farthest you can clearly see an object if your view is not obstructed." Thus, the left-hand column shows scenes which have a **short** visual range. Similarly, the air quality in the photos of the middle column (photos **B, E, H**) is identical and these photos show a **medium** visual range. The photos in the right hand column (**C, F, I**) also have an identical air pollution level and show a **long** visual range.

Q-13 Overall, how do you rate the visual air quality of the scenes in each of the columns on the photo sheet?

	Worst						Best	
1) The left hand column (Photos A, D, G) (short visual range)	1	2	3	4	5	6	7	(2.05)
2) The middle column (Photos B, E, H) (medium visual range)	1	2	3	4	5	6	7	(4.14)
3) The right hand column (Photos C, F, I) (long visual range)	1	2	3	4	5	6	7	(6.15)

Q-14 Overall, how do you rate the healthiness of the air in the scenes in each of the columns on the photo sheet?

	Worst						Best	
1) The left hand column (Photos A, D, G) (short visual range)	1	2	3	4	5	6	7	(2.02)
2) The middle column (Photos B, E, H) (medium visual range)	1	2	3	4	5	6	7	(4.02)
3) The right hand column (Photos C, F, I) (long visual range)	1	2	3	4	5	6	7	(5.89)

The bar chart below shows how many days of the year fall into the categories of short, medium, and long visual ranges in the Chicago area.

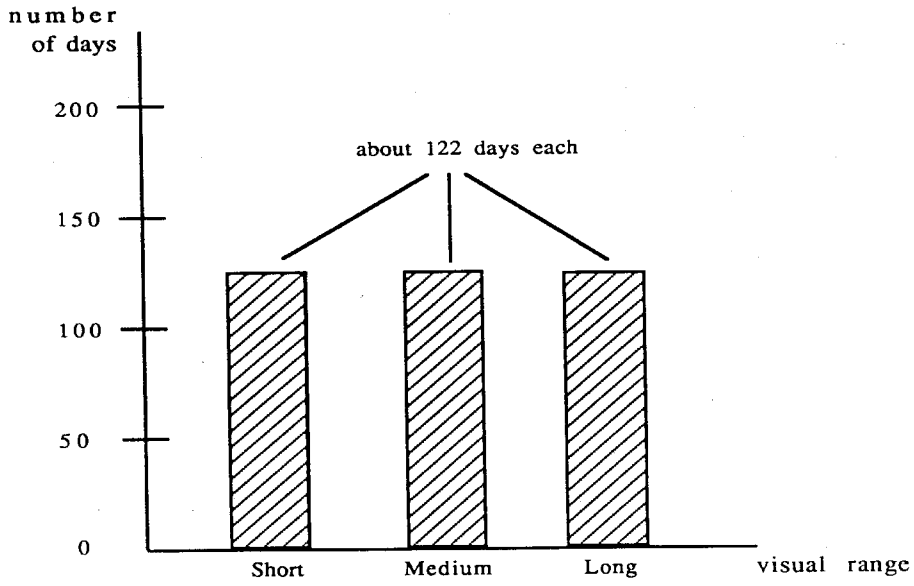

FIGURE 1

Short visual range days (photos A, D, G) occur about one-third of the time during the year. Medium visual range days (photos B, E, H) and long visual range days (photos C, F, I) each also occur about one-third of the time.

III. THE VALUE OF CLEAN AIR TO YOU

Additional federal legislation is currently pending on programs that would be required for high air pollution areas. If implemented, the legislation now being considered in congress would further reduce air pollution from automobiles, factories, and power plants. Such programs will change the number of days that fall into each category of short, medium, and long visual range as represented by the photos in the left-hand, middle, and right-hand columns, respectively.

The graph below shows how many days of the year would fall into each category if additional reductions occur in airborne pollutants. There would be an improvement of 25 fewer short visual range days, and 25 more long visual range days.

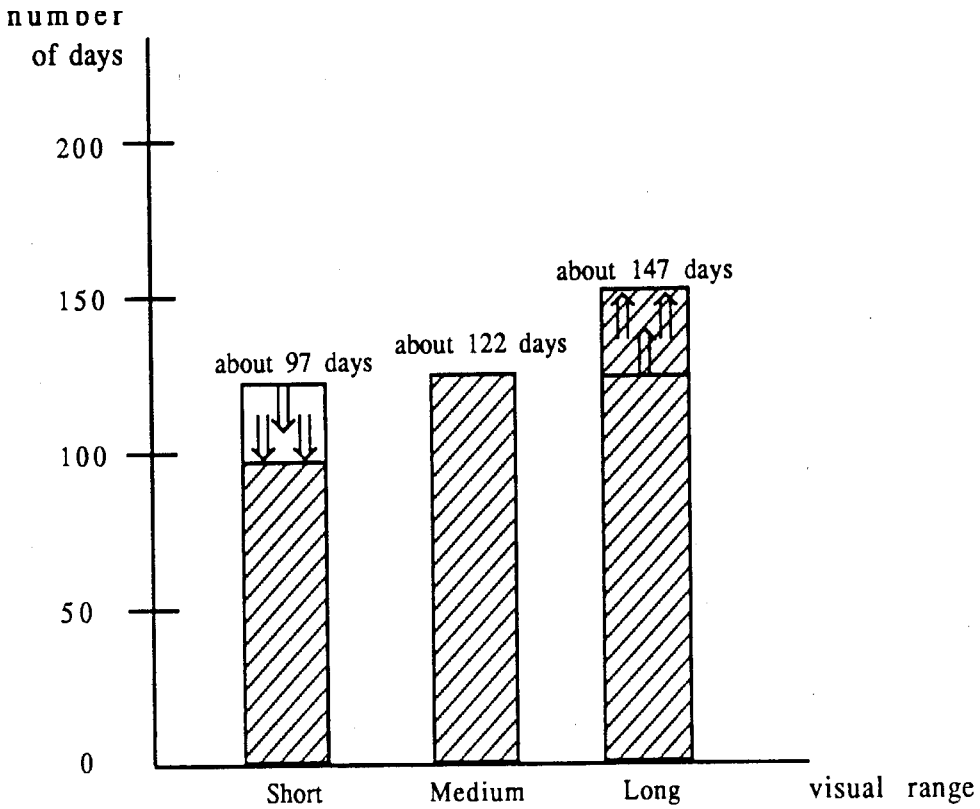

FIGURE 2

However, the actions necessary to accomplish this improvement in air quality will lead to higher prices. One example would be more expensive pollution control equipment on cars, trucks, and buses. Another example would be higher prices for goods, such as electricity, produced by industries that would be required to install better air pollution control equipment.

Q-15 If visual air quality can be improved, how important is it to you to have fewer short visual range days? (4.98)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Q-16 If visual air quality can be improved, how important is it to you to have more long visual range days? (5.34)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Suppose that there is a referendum proposed to voters. This referendum would call for the use of cleaner vehicles and stricter emission standards for industry and individual households. If the referendum was passed and the pollution control program was put into effect, everyone would pay higher prices.

Q-17 Health, visibility, and other impacts often occur together with an air pollution problem. If the improvements in air quality shown in Figure 2 could be **guaranteed** in the Chicago Metro Area, would you consider voting YES for this referendum?

1. NO → WHY ?

GO TO Q-18

2. YES →

At this time we don't know how much the improvements in overall air quality represented in Figure 2 will cost. To help decide if such a program should be undertaken, we need to know what is the MOST your household is willing to pay EACH YEAR, in higher prices, before you would vote NO on such a referendum. (206.47)

$_____

The amount you indicate will tell us what it is <u>really</u> <u>worth</u> to your household to get such an improvement. If the improvement actually costs less than people are willing to pay, you would only have to pay what it would cost. If the gain turned out to cost more than people are willing to pay, it would not be carried out.

The change in air quality presented in Figure 2 can be thought of as having two parts. One part would clean up short visual range days to become medium days. The other part would clean up medium days to make them long visual range days. The next two questions ask about these two different changes in air quality.

Q-18 How much do you think the healthiness of the air improves when short visual range days are cleaned up to become medium visual range days? (4.83)

NONE A LOT
1 2 3 4 5 6 7

Q-19 How much do you think the healthiness of the air improves when medium visual range days are cleaned up to become long visual range days? (5.22)

NONE A LOT
1 2 3 4 5 6 7

(PLEASE GO TO Q-22 IF YOU ANSWERED "**NO**" TO Q-17)

Q-20 Given the value you provided above (in Q-17), what percentage is for better visual air quality, what percentage is for healthier air, and what percentage is for other concerns you may have about air quality?

a) Less soiling, materials damage, and vegetation effects		(25.12)
b) Better visual air quality	+	(23.94)
c) Healthier air	+	(54.69)
d) Other (please specify below)	+	
_____	_____%	(12.90)
_____		= 100%

Q-21 Again, given the total amount of higher prices you would be willing to spend for the cleanup programs, what percentage would you place on reducing short visual range days, and what percentage on getting more long visual range days?

a) For fewer short visual range days	_____%	(49.09)
	+	
b) For more long visual range days	_____%	(51.13)
	= 100%	

Q-22 Do you feel at all responsible for the air pollution problem of the Chicago Metro Area? (3.34)

Not at All Responsible						Very Responsible
1	2	3	4	5	6	7

IV. ABOUT YOU

Q-23 Your age: _____ YEARS (47.89)

Q-24 Your gender?

1) Female (36%)
2) Male (64%)

Q-25 Including yourself, how many members in your household are in each age group? (If none, write "0")

_____ Under 18 years of age (1.24)
_____ 18-64 (2.01)
_____ 65 and over (0.54)

Q-26 How much formal education have you completed? (7.22)

1) No formal education
2) Some grade school
3) Completed grade school
4) Some high school
5) Completed high school
6) Trade school
7) Some college
8) Completed college
9) Some graduate work
10) Advanced college degree

Q-27 Are you presently: (circle number of the best answer)

1) Employed (61.7%)
2) Unemployed (2.3%)
3) Retired (24.1%)
4) Full-time homemaker (6%)
5) Student (3%)
6) Other _____ (3%)

Q-28 What was the approximate annual gross income (before taxes) received last year by you and adult (18 years or older) family members living with you? (8.76)

1) Under $5,000
2) $5,000-9,999
3) $10,000-14,999
4) $15,000-19,999
5) $20,000-24,999
6) $25,000-29,999
7) $30,000-34,999
8) $35,000-39,999
9) $40,000-49,999
10) $50,000-59,999
11) $60,000-69,999
12) $70,000-79,999
13) $80,000-89,999
14) $90,000-100,000
15) $100,000-109,000
16) $110,000-119,000
17) $120,000-129,000
18) $130,000-139,000
19) $140,000-149,000
20) $150,000-150,000
21) $160,000-169,000
22) $170,000-179,000
23) $180,000-189,000
24) $190,000-199,000
25) More Than $200,000

Q-29 Are you registered to vote?

1) YES (85%)
2) NO (15%)

Q-30 Does your home have a view?

1) YES (76%)
2) NO (33%)

Q-31 Below is a list of phrases that describe different kinds of interests and activities. As you read each one, please indicate the degree that it applies to you.

	NOT AT ALL						DEFINITELY
1. "...someone who spends a lot of time out of doors on weekends."	1	2	3	4	5	6	7 (4.91)
2. "...a birdwatcher."	1	2	3	4	5	6	7 (2.51)
3. "...someone who trusts what experts say about science and technology."	1	2	3	4	5	6	7 (4.22)
4. "...someone who is an environmentalist."	1	2	3	4	5	6	7 (4.20)
5. "...someone who always votes in city elections."	1	2	3	4	5	6	7 (4.81)

Q-32 What type of residence do you live in?

1) House (61.4%)
2) Apartment (24.2%)
3) Condominium (9.1%)
4) Townhouse (2.3%)
5) Mobile Home (0.8%)
6) Other _____ (2.3%)

Q-33 Do you own or rent your residence?

1) Own (72%)
2) Rent/lease (28%)

Is there anything we may have overlooked? Please use the space below for any additional comments you would like to make concerning the Chicago Metro Area's air quality and its influence in your life.

I. THE ISSUES

We would like to find out how air pollution in the Chicago area affects you and your household.

Q-1 How concerned are you about visibility in the Chicago Metro Area?

(5.12)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-2 How concerned are you about the healthiness of the air in the Chicago Metro Area?

(5.82)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-3 How often have you read or heard about air pollution issues from these sources? (Coded as 1 for NEVER, 2 for ONCE OR TWICE, and 3 for MANY TIMES)

Please circle the appropriate response for each category.

1)	Television	NEVER	ONCE OR TWICE	MANY TIMES	(2.61)
2)	Newspaper	NEVER	ONCE OR TWICE	MANY TIMES	(2.60)
3)	Radio	NEVER	ONCE OR TWICE	MANY TIMES	(2.37)
4)	Family	NEVER	ONCE OR TWICE	MANY TIMES	(2.10)
5)	Friends	NEVER	ONCE OR TWICE	MANY TIMES	(2.09)
6)	Other	NEVER	ONCE OR TWICE	MANY TIMES	(1.74)

Please specify _____

Q-4 Generally speaking, how much attention do you pay to how far you can see on a given day? (4.74)

NOT AT ALL					A LOT	
1	2	3	4	5	6	7

Q-5 Do you think more or less money should be spent trying to reduce air pollution in the Chicago area? (1.35)

1) More money
2) Same amount of money
3) Less money

II. HOW DO YOU RATE CHICAGO'S AIR?

Please look at the fold-out sheet of photos included in your survey package. *A day with air that **looks bad** is not always more harmful to your health than a day that looks good*. For example, health impacts may occur when invisible air pollutants such as carbon monoxide or ozone are present. Other pollutants, such as particles in the air, can affect both health and visibility, as well as cause soiling and damage to certain materials and vegetation.

Your Air Quality Ratings

Q-6 On your photo sheet you will see 9 photos, labeled A through I, that depict some scenes of Chicago. We would like you to rate the photos in terms of visual air quality. **Please give each photo a rating between 1 and 7**. A rating of **1** means the visual air quality is **as bad as it could be in the Chicago Metro Area**. A rating of **7** means the visual air quality is **as good as it could be in the Chicago Metro Area**. For each photo, just circle the number that represents your rating. (Please note that the photos listed below are in no particular order.)

	Visual Air Quality Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(3.77)
2) Photo I	1	2	3	4	5	6	7	(5.79)
3) Photo B	1	2	3	4	5	6	7	(3.81)
4) Photo H	1	2	3	4	5	6	7	(4.90)
5) Photo C	1	2	3	4	5	6	7	(5.86)
6) Photo E	1	2	3	4	5	6	7	(4.91)
7) Photo G	1	2	3	4	5	6	7	(2.90)
8) Photo A	1	2	3	4	5	6	7	(1.78)
9) Photo F	1	2	3	4	5	6	7	(5.64)

Q-7 Again, using the 1 to 7 scale, how would you rate the healthiness of the air in each of the photographs?

	Healthiness of the Air							
	Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(3.40)
2) Photo I	1	2	3	4	5	6	7	(5.69)
3) Photo B	1	2	3	4	5	6	7	(3.83)
4) Photo H	1	2	3	4	5	6	7	(4.65)
5) Photo C	1	2	3	4	5	6	7	(5.46)
6) Photo E	1	2	3	4	5	6	7	(4.88)
7) Photo G	1	2	3	4	5	6	7	(2.94)
8) Photo A	1	2	3	4	5	6	7	(1.78)
9) Photo F	1	2	3	4	5	6	7	(5.64)

Q-8 In your opinion, if nothing further is done about air pollution in the Chicago area over the next 5-10 years, the problem is likely to (1.52)

1) get much worse.
2) get somewhat worse.
3) stay about the same.
4) get somewhat better.
5) get much better.

Q-9 Among the following actions that can reduce air pollution, which have you and your household taken? (Please circle all that apply.)

1) Reduced the use of your fireplace and/or wood-burning stove. (23%)
2) Taken some other form of transportation (the train, bus, bicycle, walk, etc.) rather than your car to work or shopping. (36%)
3) Car-pooled. (27%)
4) Reduced the number of days you used your car (to work or other places). (11%)
5) Other (please specify) _____

Q-10 To what degree do you think the following causes contribute to the air pollution problem in the Chicago Metro Area?

	No Contribution At All						Extremely High Contribution	
1) Automobiles	1	2	3	4	5	6	7	(6.01)
2) Fireplaces	1	2	3	4	5	6	7	(3.33)
3) Power plants	1	2	3	4	5	6	7	(5.45)
4) Industry	1	2	3	4	5	6	7	(6.15)
5) Weather Conditions	1	2	3	4	5	6	7	(3.98)
6) Other (please specify)	1	2	3	4	5	6	7	(5.52)

_____

_____

Q-11 How long have you lived in the Chicago Metro Area?

_____ YEARS (36.49) _____ MONTHS (6.27)

Q-12 How do you feel about the amount of attention given to the air pollution problems of the Chicago Metro Area? (3.02)

TOO LITTLE						TOO MUCH
1	2	3	4	5	6	7

Please look at the top row of your photo sheet, which consists of photos **A, B, C**. These photographs have different measured air quality, in terms of visual range and pollutants in the air. Visual range is defined as "the farthest you can clearly see an object if your view is not obstructed." The bar chart below shows how many days of the year fall into the categories of **short, medium**, and **long** visual rangers in the Chicago area.

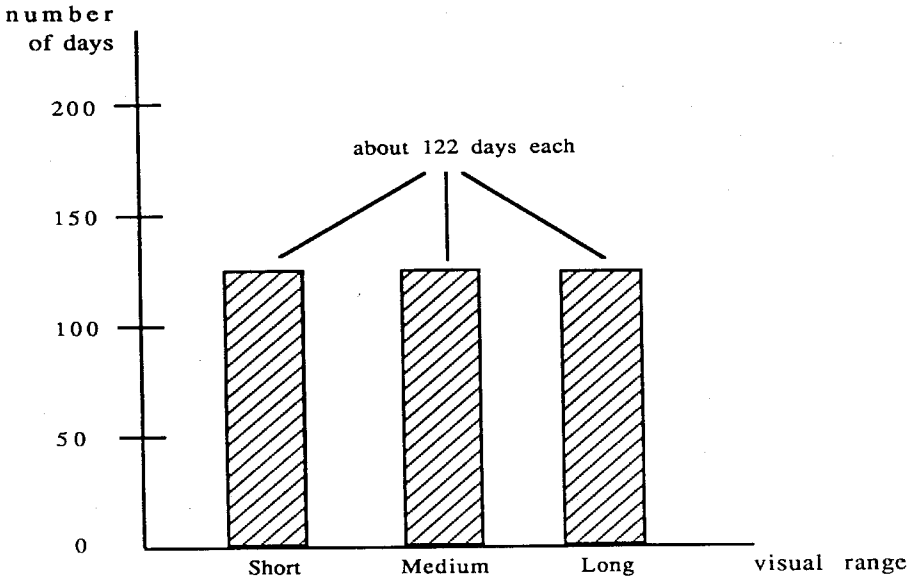

FIGURE 1

Photo **A** shows the scene of a short visual range day, which occurs about one-third of the time during the year. Medium days and long days each also occur about one-third of the time. Similarly, the air quality of the photo in the middle (photo **B**) shows a medium visual range and the photo on the right hand side (photo **C**) shows a long visual range.

II. THE VALUE OF CLEAN AIR TO YOU

Additional federal legislation is currently pending on programs that would be required for high air pollution areas. If implemented, the legislation now being considered in congress would further reduce air pollution from automobiles, factories, and power plants. Such programs will change the number of days that fall into each category of short, medium, and long visual range as represented by the photos in the left-hand, middle, and right-hand columns, respectively.

The graph below shows how many days of the year would fall into each category if additional reductions occur in airborne pollutants. There would be an improvement of 25 fewer short visual range days, and 25 more long visual range days.

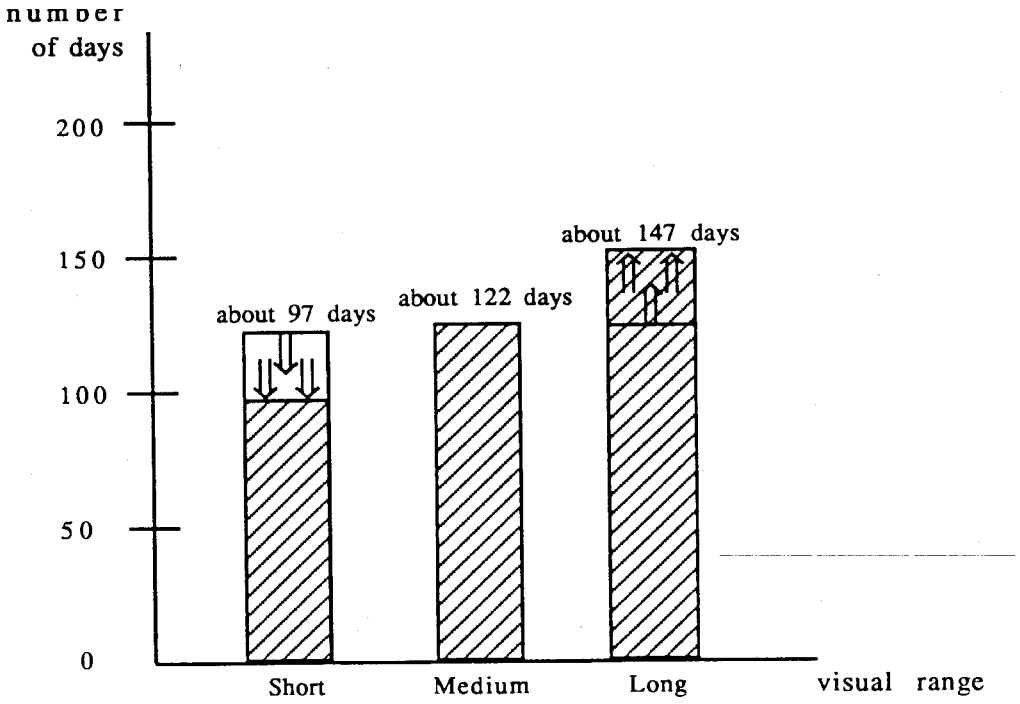

FIGURE 2

However, the actions necessary to accomplish this improvement in air quality will lead to higher prices. One example would be more expensive pollution control equipment on cars, trucks, and buses. Another example would be higher prices for goods, such as electricity, produced by industries that would be required to install better air pollution control equipment.

Q-13 If visual air quality can be improved, how important is it to you to have fewer short visual range days? (4.98)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Q-14 If visual air quality can be improved, how important is it to you to have more long visual range days? (5.29)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Suppose that there is a referendum proposed to voters. This referendum would call for the use of cleaner vehicles and stricter emission standards for industry and individual households. If the referendum was passed and the pollution control program was put into effect, everyone would pay higher prices.

Q-15 Health, visibility, and other impacts often occur together with an air pollution problem. If the improvements in air quality shown in Figure 2 could be **guaranteed** in the Chicago Metro Area, would you consider voting YES for this referendum?

1. NO → WHY ?

GO TO Q-16

2. YES →

At this time we don't know how much the improvements in overall air quality represented in Figure 2 will cost. To help decide if such a program should be undertaken, we need to know what is the MOST your household is willing to pay EACH YEAR, in higher prices, before you would vote NO on such a referendum.

$_____ (201.39)

The amount you indicate will tell us what it is <u>really worth</u> to your household to get such an improvement. If the improvement actually costs less than people are willing to pay, you would only have to pay what it would cost. If the gain turned out to cost more than people are willing to pay, it would not be carried out.

The change in air quality presented in Figure 2 can be thought of as having two parts. One part would clean up short visual range days to become medium days. The other part would clean up medium days to make them long visual range days. The next two questions ask about these two different changes in air quality.

Q-16 How much do you think the healthiness of the air improves when short visual range days are cleaned up to become medium visual range days? (4.70)

NONE A LOT

1 2 3 4 5 6 7

Q-17 How much do you think the healthiness of the air improves when medium visual range days are cleaned up to become long visual range days? (4.92)

NONE A LOT

1 2 3 4 5 6 7

(PLEASE GO TO Q-20 IF YOU ANSWERED "**NO**" TO Q-15)

Q-18 Given the value you provided above (in Q-15), what percentage is for better visual air quality, what percentage is for healthier air, and what percentage is for other concerns you may have about air quality?

a) Less soiling, materials damage, and vegetation effects _____ (24.68)

b) Better visual air quality _____ (21.28)

c) Healthier air _____ (56.01)

\+

d) Other (please specify below) _____ (10.00)

= 100%

_____

_____

Q-19 Again, given the total amount of higher prices you would be willing to spend for the cleanup programs, what percentage would you place on reducing short visual range days, and what percentage on getting more long visual range days?

a) For fewer short visual range days _____ % (49.72)

\+

b) For more long visual range days _____ % (52.71)

= 100%

Q-20 Do you feel at all responsible for the air pollution problem of the Chicago Metro Area? (3.16)

Not at All Responsible						Very Responsible
1	2	3	4	5	6	7

IV. ABOUT YOU

Q-21 Your age: _____ YEARS (49.04)

Q-22 Your gender?

1) Female (39%)
2) Male (61%)

Q-23 Including yourself, how many members in your household are in each age group? (If none, write "0")

_____ Under 18 years of age (0.77)
_____ 18-64 (1.70)
_____ 65 and over (0.77)

Q-24 How much formal education have you completed? (6.96)

1) No formal education
2) Some grade school
3) Completed grade school
4) Some high school
5) Completed high school
6) Trade school
7) Some college
8) Completed college
9) Some graduate work
10) Advanced college degree

Q-25 Are you presently: (circle number of the best answer)

1) Employed (61.9%)
2) Unemployed (1.6%)
3) Retired (27.8%)
4) Full-time homemaker (4.8%)
5) Student (1.6%)
6) Other _____ (2.4%)

Q-26 What was the approximate annual gross income (before taxes) received last year by you and adult (18 years or older) family members living with you? (8.95)

1) Under $5,000
2) $5,000-9,999
3) $10,000-14,999
4) $15,000-19,999
5) $20,000-24,999
6) $25,000-29,999
7) $30,000-34,999
8) $35,000-39,999
9) $40,000-49,999
10) $50,000-59,999
11) $60,000-69,999
12) $70,000-79,999
13) $80,000-89,999
14) $90,000-100,000
15) $100,000-109,000
16) $110,000-119,000
17) $120,000-129,000
18) $130,000-139,000
19) $140,000-149,000
20) $150,000 -150,000
21) $160,000-169,000
22) $170,000-179,000
23) $180,000-189,000
24) $190,000-199,000
25) More Than $200,000

Q-27 Are you registered to vote?

1) YES (87%)
2) NO (13%)

Q-28 Does your home have a view?

1) YES (70%)
2) NO (30%)

Q-29 Below is a list of phrases that describe different kinds of interests and activities. As you read each one, please indicate the degree that it applies to you.

	NOT AT ALL						DEFINITELY	
1. "...someone who spends a lot of time out of doors on weekends."	1	2	3	4	5	6	7	(4.85)
2. "...a birdwatcher."	1	2	3	4	5	6	7	(2.87)
3. "...someone who trusts what experts say about science and technology."	1	2	3	4	5	6	7	(4.28)
4. "...someone who is an environmentalist."	1	2	3	4	5	6	7	(3.79)
5. "...someone who always votes in city elections."	1	2	3	4	5	6	7	(4.88)

Q-30 What type of residence do you live in?

1) House (58.6%)
2) Apartment (28.9%)
3) Condominium (7.8%)
4) Townhouse (2.3%)
5) Mobile Home (0.8%)
6) Other _____ (1.6%)

Q-31 Do you own or rent your residence?

1) Own (69%)
2) Rent/lease (31%)

Is there anything we may have overlooked? Please use the space below for any additional comments you would like to make concerning the Chicago Metro Area's air quality and its influence in your life.

I. THE ISSUES

We would like to find out how air pollution in the Atlanta area affects you and your household.

Q-1 How concerned are you about visibility in the Chicago Metro Area?

(5.38)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-2 How concerned are you about the healthiness of the air in the Atlanta Metro Area?

(6.12)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-3 How often have you read or heard about air pollution issues from these sources? (Coded as 1 for NEVER, 2 for ONCE OR TWICE, and 3 for MANY TIMES)

Please circle the appropriate response for each category.

1)	Television	NEVER	ONCE OR TWICE	MANY TIMES	(2.70)
2)	Newspaper	NEVER	ONCE OR TWICE	MANY TIMES	(2.38)
3)	Radio	NEVER	ONCE OR TWICE	MANY TIMES	(2.13)
4)	Family	NEVER	ONCE OR TWICE	MANY TIMES	(2.09)
5)	Friends	NEVER	ONCE OR TWICE	MANY TIMES	(1.99)
6)	Other	NEVER	ONCE OR TWICE	MANY TIMES	(1.73)

Please specify _____

Q-4 Generally speaking, how much attention do you pay to how far you can see on a given day? (5.06)

NOT AT ALL					A LOT	
1	2	3	4	5	6	7

Q-5 Do you think more or less money should be spent trying to reduce air pollution in the Atlanta area? (1.32)

1) More money
2) Same amount of money
3) Less money

II. HOW DO YOU RATE ATLANTA'S AIR?

Please look at the fold-out sheet of photos included in your survey package. *A day with air that **looks bad** is not always more harmful to your health than a day that looks good*. For example, health impacts may occur when invisible air pollutants such as carbon monoxide or ozone are present. Other pollutants, such as particles in the air, can affect both health and visibility, as well as cause soiling and damage to certain materials and vegetation.

Your Air Quality Ratings

Q-6 On your photo sheet you will see 9 photos, labeled A through I, that depict some scenes of Atlanta. We would like you to rate the photos in terms of visual air quality. **Please give each photo a rating between 1 and 7**. A rating of **1** means the visual air quality is **as bad as it could be in the Atlanta Metro Area**. A rating of **7** means the visual air quality is **as good as it could be in the Atlanta Metro Area**. For each photo, just circle the number that represents your rating. (Please note that the photos listed below are in no particular order.)

	Visual Air Quality Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(2.42)
2) Photo I	1	2	3	4	5	6	7	(6.01)
3) Photo B	1	2	3	4	5	6	7	(4.01)
4) Photo H	1	2	3	4	5	6	7	(4.34)
5) Photo C	1	2	3	4	5	6	7	(5.70)
6) Photo E	1	2	3	4	5	6	7	(3.97)
7) Photo G	1	2	3	4	5	6	7	(2.48)
8) Photo A	1	2	3	4	5	6	7	(2.08)
9) Photo F	1	2	3	4	5	6	7	(5.42)

Q-7 Again, using the 1 to 7 scale, how would you rate the healthiness of the air in each of the photographs?

	Healthiness of the Air							
	Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(2.38)
2) Photo I	1	2	3	4	5	6	7	(5.75)
3) Photo B	1	2	3	4	5	6	7	(3.75)
4) Photo H	1	2	3	4	5	6	7	(4.34)
5) Photo C	1	2	3	4	5	6	7	(5.27)
6) Photo E	1	2	3	4	5	6	7	(4.00)
7) Photo G	1	2	3	4	5	6	7	(2.59)
8) Photo A	1	2	3	4	5	6	7	(2.09)
9) Photo F	1	2	3	4	5	6	7	(5.36)

Q-8 In your opinion, if nothing further is done about air pollution in the Atlanta area over the next 5-10 years, the problem is likely to (1.53)

1) get much worse.
2) get somewhat worse.
3) stay about the same.
4) get somewhat better.
5) get much better.

Q-9 Among the following actions that can reduce air pollution, which have you and your household taken? (Please circle all that apply.)

1) Reduced the use of your fireplace and/or wood-burning stove. (33%)
2) Taken some other form of transportation (the train, bus, bicycle, walk, etc.) rather than your car to work or shopping. (22%)
3) Car-pooled. (18%)
4) Reduced the number of days you used your car (to work or other places). (9%)
5) Other (please specify) _____

Q-10 To what degree do you think the following causes contribute to the air pollution problem in the Atlanta Metro Area?

	No Contribution At All						Extremely High Contribution	
1) Automobiles	1	2	3	4	5	6	7	(5.96)
2) Fireplaces	1	2	3	4	5	6	7	(3.38)
3) Power plants	1	2	3	4	5	6	7	(4.93)
4) Industry	1	2	3	4	5	6	7	(5.50)
5) Weather Conditions	1	2	3	4	5	6	7	(4.36)
6) Other (please specify)	1	2	3	4	5	6	7	

_____

_____

Q-11 How long have you lived in the Atlanta Metro Area?

_____ YEARS (22.98) _____ MONTHS (4.58)

Q-12 How do you feel about the amount of attention given to the air pollution problems of the Atlanta Metro Area? (3.20)

TOO LITTLE TOO MUCH

1 2 3 4 5 6 7

Please look at the column on the left side of your photo sheet, which consists of photos **A, D, G**. Although people may see differences in visual air quality between photos of each scene within that *column,* these photographs have identically measured air quality in terms of visual range and pollutants in the air. Visual range is defined as "the farthest you can clearly see an object if your view is not obstructed." Thus, the left-hand column shows scenes which have a **short** visual range. Similarly, the air quality in the photos of the middle column (photos **B, E, H**) is identical and these photos show a **medium** visual range. The photos in the right hand column (**C, F, I**) also have an identical air pollution level and show a **long** visual range.

Q-13 Overall, how do you rate the visual air quality of the scenes in each of the columns on the photo sheet?

	Worst						Best	
1) The left hand column (Photos A, D, G) (short visual range)	1	2	3	4	5	6	7	(1.95)
2) The middle column (Photos B, E, H) (medium visual range)	1	2	3	4	5	6	7	(3.87)
3) The right hand column (Photos C, F, I) (long visual range)	1	2	3	4	5	6	7	(5.82)

Q-14 Overall, how do you rate the healthiness of the air in the scenes in each of the columns on the photo sheet?

	Worst						Best	
1) The left hand column (Photos A, D, G) (short visual range)	1	2	3	4	5	6	7	(1.99)
2) The middle column (Photos B, E, H) (medium visual range)	1	2	3	4	5	6	7	(3.75)
3) The right hand column (Photos C, F, I) (long visual range)	1	2	3	4	5	6	7	(5.70)

The bar chart below shows how many days of the year fall into the categories of short, medium, and long visual ranges in the Chicago area.

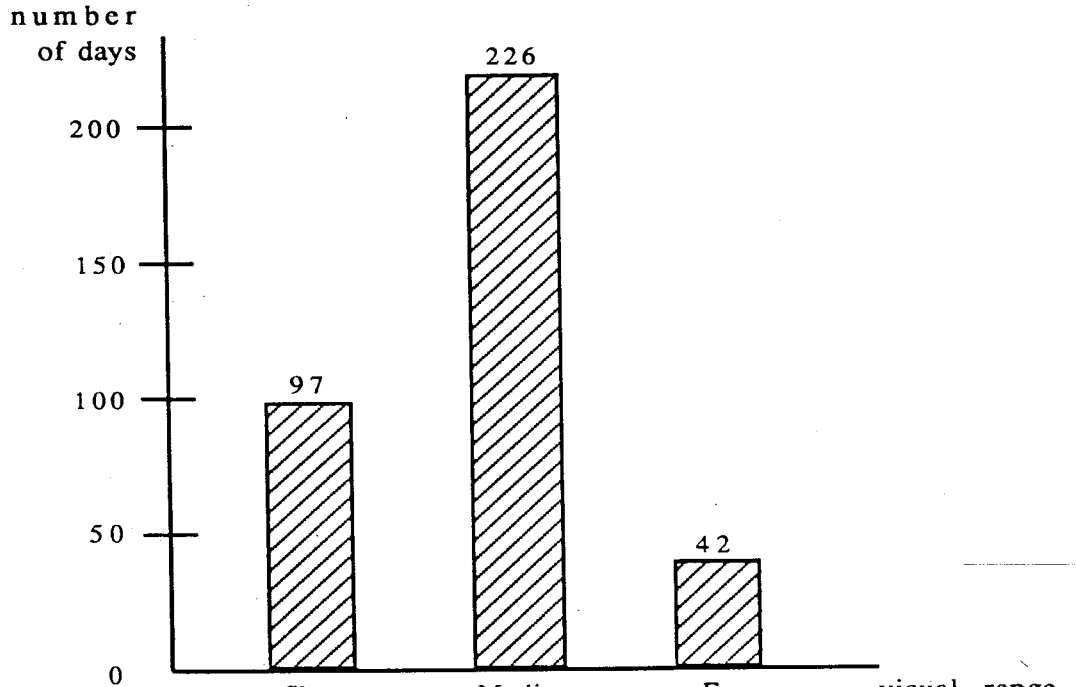

FIGURE 1

Short visual range days (photos A, D, G) occur about one-third of the time during the year. Medium visual range days (photos B, E, H) and long visual range days (photos C, F, I) each also occur about one-third of the time, respectively.

II. THE VALUE OF CLEAN AIR TO YOU

Additional federal legislation is currently pending on programs that would be required for high air pollution areas. If implemented, the legislation now being considered in congress would further reduce air pollution from automobiles, factories, and power plants. Such programs will change the number of days that fall into each category of short, medium, and long visual range as represented by the photos in the left-hand, middle, and right-hand columns, respectively.

The graph below shows how many days of the year would fall into each category if additional reductions occur in airborne pollutants. There would be an improvement of 25 fewer short visual range days, and 25 more long visual range days.

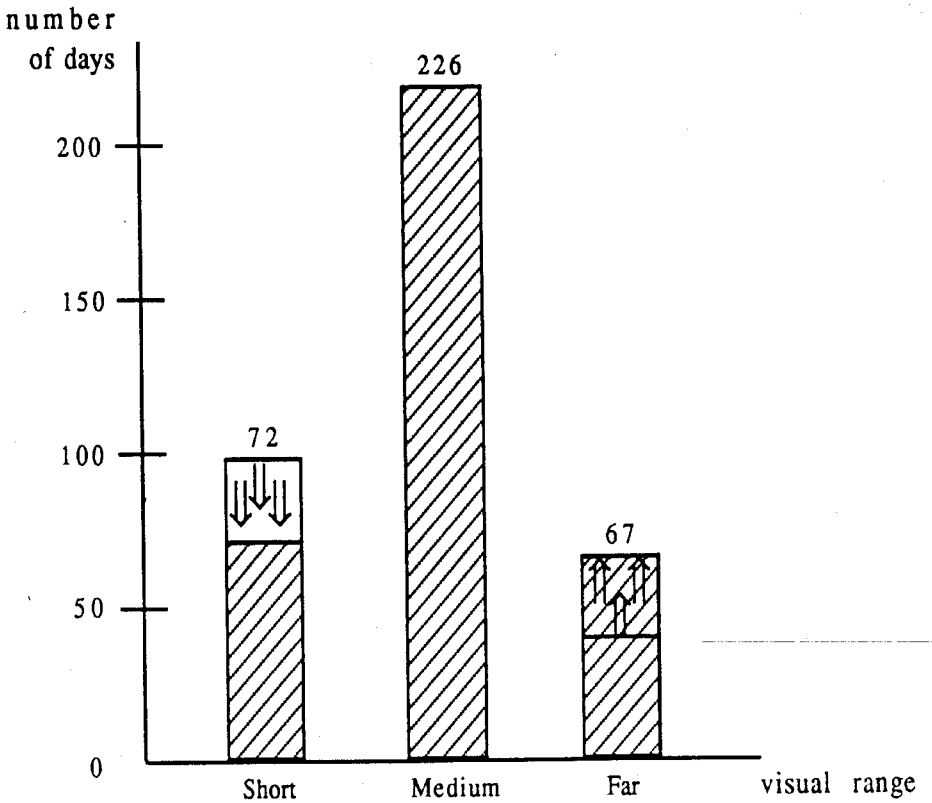

FIGURE 2

However, the actions necessary to accomplish this improvement in air quality will lead to higher prices. One example would be more expensive pollution control equipment on cars, trucks, and buses. Another example would be higher prices for goods, such as electricity, produced by industries that would be required to install better air pollution control equipment.

Q-15 If visual air quality can be improved, how important is it to you to have fewer short visual range days? (5.04)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Q-16 If visual air quality can be improved, how important is it to you to have more long visual range days? (5.29)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Suppose that there is a referendum proposed to voters. This referendum would call for the use of cleaner vehicles and stricter emission standards for industry and individual households. If the referendum was passed and the pollution control program was put into effect, everyone would pay higher prices.

Q-17 Health, visibility, and other impacts often occur together with an air pollution problem. If the improvements in air quality shown in Figure 2 could be **guaranteed** in the Atlanta Metro Area, would you consider voting YES for this referendum?

1. NO → WHY ?

GO TO Q-18

2. YES →

At this time we don't know how much the improvements in overall air quality represented in Figure 2 will cost. To help decide if such a program should be undertaken, we need to know what is the MOST your household is willing to pay EACH YEAR, in higher prices, before you would vote NO on such a referendum. (271.65)

$_____

The amount you indicate will tell us what it is <u>really worth</u> to your household to get such an improvement. If the improvement actually costs less than people are willing to pay, you would only have to pay what it would cost. If the gain turned out to cost more than people are willing to pay, it would not be carried out.

The change in air quality presented in Figure 2 can be thought of as having two parts. One part would clean up short visual range days to become medium days. The other part would clean up medium days to make them long visual range days. The next two questions ask about these two different changes in air quality.

Q-18 How much do you think the healthiness of the air improves when short visual range days are cleaned up to become medium visual range days? (4.75)

NONE						A LOT
1	2	3	4	5	6	7

Q-19 How much do you think the healthiness of the air improves when medium visual range days are cleaned up to become long visual range days? (5.15)

NONE						A LOT
1	2	3	4	5	6	7

(PLEASE GO TO Q-22 IF YOU ANSWERED "**NO**" TO Q-17)

Q-20 Given the value you provided above (in Q-17), what percentage is for better visual air quality, what percentage is for healthier air, and what percentage is for other concerns you may have about air quality?

a) Less soiling, materials damage, and vegetation effects	(22.32)	%
		+
b) Better visual air quality	(21.22)	%
		+
c) Healthier air	(61.11)	%
		+
d) Other (please specify below)	(6.25)	%
		= 100%

_____

_____

Q-21 Again, given the total amount of higher prices you would be willing to spend for the cleanup programs, what percentage would you place on reducing short visual range days, and what percentage on getting more long visual range days?

a) For fewer short visual range days	_____	%	(50.04)
		+	
b) For more long visual range days	_____	%	(49.56)
	= 100%		

Q-22 Do you feel at all responsible for the air pollution problem of the Atlanta Metro Area? (3.48)

Not at All Responsible						Very Responsible
1	2	3	4	5	6	7

IV. ABOUT YOU

Q-23 Your age: _____ YEARS (46.62)

Q-24 Your gender?

1) Female (40%)
2) Male (60%)

Q-25 Including yourself, how many members in your household are in each age group? (If none, write "0")

_____ Under 18 years of age (1.05)
_____ 18-64 (1.95)
_____ 65 and over (0.60)

Q-26 How much formal education have you completed? (7.22)

1) No formal education
2) Some grade school
3) Completed grade school
4) Some high school
5) Completed high school
6) Trade school
7) Some college
8) Completed college
9) Some graduate work
10) Advanced college degree

Q-27 Are you presently: (circle number of the best answer)

1) Employed (65.2%)
2) Unemployed (4.5%)
3) Retired (19.6%)
4) Full-time homemaker (4.5%)
5) Student (2.7%)
6) Other _____ (3.6%)

Q-28 What was the approximate annual gross income (before taxes) received last year by you and adult (18 years or older) family members living with you? (8.72)

1) Under $5,000
2) $5,000-9,999
3) $10,000-14,999
4) $15,000-19,999
5) $20,000-24,999
6) $25,000-29,999
7) $30,000-34,999
8) $35,000-39,999
9) $40,000-49,999
10) $50,000-59,999
11) $60,000-69,999
12) $70,000-79,999
13) $80,000-89,999
14) $90,000-100,000
15) $100,000-109,000
16) $110,000-119,000
17) $120,000-129,000
18) $130,000-139,000
19) $140,000-149,000
20) $150,000-150,000
21) $160,000-169,000
22) $170,000-179,000
23) $180,000-189,000
24) $190,000-199,000
25) More Than $200,000

Q-29 Are you registered to vote?

1) YES (99%)
2) NO (11%)

Q-30 Does your home have a view?

1) YES (73%)
2) NO (27%)

Q-31 Below is a list of phrases that describe different kinds of interests and activities. As you read each one, please indicate the degree that it applies to you.

	NOT AT ALL						DEFINITELY	
1. "...someone who spends a lot of time out of doors on weekends."	1	2	3	4	5	6	7	(4.96)
2. "...a birdwatcher."	1	2	3	4	5	6	7	(2.85)
3. "...someone who trusts what experts say about science and technology."	1	2	3	4	5	6	7	(4.19)
4. "...someone who is an environmentalist."	1	2	3	4	5	6	7	(4.33)
5. "...someone who always votes in city elections."	1	2	3	4	5	6	7	(4.43)

Q-32 What type of residence do you live in?

1) House (79.5%)
2) Apartment (12.5%)
3) Condominium (3.6%)
4) Townhouse (1.8%)
5) Mobile Home (2.7%)
6) Other _____

_____

_____ (0%)

Q-33 Do you own or rent your residence?

1) Own (78%)
2) Rent/lease (22%)

Is there anything we may have overlooked? Please use the space below for any additional comments you would like to make concerning the Atlanta Metro Area's air quality and its influence in your life.

I. THE ISSUES

We would like to find out how air pollution in the Atlanta area affects you and your household.

Q-1 How concerned are you about visibility in the Atlanta Metro Area?

(5.21)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-2 How concerned are you about the healthiness of the air in the Atlanta Metro Area?

(5.84)

NOT AT ALL CONCERNED					EXTREMELY CONCERNED	
1	2	3	4	5	6	7

Q-3 How often have you read or heard about air pollution issues from these sources? (Coded as 1 for NEVER, 2 for ONCE OR TWICE, and 3 for MANY TIMES)

Please circle the appropriate response for each category.

1)	Television	NEVER	ONCE OR TWICE	MANY TIMES	(2.64)
2)	Newspaper	NEVER	ONCE OR TWICE	MANY TIMES	(2.38)
3)	Radio	NEVER	ONCE OR TWICE	MANY TIMES	(2.14)
4)	Family	NEVER	ONCE OR TWICE	MANY TIMES	(2.04)
5)	Friends	NEVER	ONCE OR TWICE	MANY TIMES	(2.04)
6)	Other	NEVER	ONCE OR TWICE	MANY TIMES	(1.75)

Please specify _____

Q-4 Generally speaking, how much attention do you pay to how far you can see on a given day? (4.62)

NOT AT ALL					A LOT	
1	2	3	4	5	6	7

Q-5 Do you think more or less money should be spent trying to reduce air pollution in the Atlanta area? (1.37)

1) More money
2) Same amount of money
3) Less money

II. HOW DO YOU RATE ATLANTA'S AIR?

Please look at the fold-out sheet of photos included in your survey package. *A day with air that **looks bad** is not always more harmful to your health than a day that looks good*. For example, health impacts may occur when invisible air pollutants such as carbon monoxide or ozone are present. Other pollutants, such as particles in the air, can affect both health and visibility, as well as cause soiling and damage to certain materials and vegetation.

Your Air Quality Ratings

Q-6 On your photo sheet you will see 9 photos, labeled A through I, that depict some scenes of Atlanta. We would like you to rate the photos in terms of visual air quality. **Please give each photo a rating between 1 and 7**. A rating of **1** means the visual air quality is **as bad as it could be in the Atlanta Metro Area**. A rating of **7** means the visual air quality is **as good as it could be in the Atlanta Metro Area**. For each photo, just circle the number that represents your rating. (Please note that the photos listed below are in no particular order.)

	Visual Air Quality Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(2.33)
2) Photo I	1	2	3	4	5	6	7	(6.01)
3) Photo B	1	2	3	4	5	6	7	(3.80)
4) Photo H	1	2	3	4	5	6	7	(4.35)
5) Photo C	1	2	3	4	5	6	7	(5.67)
6) Photo E	1	2	3	4	5	6	7	(3.93)
7) Photo G	1	2	3	4	5	6	7	(2.50)
8) Photo A	1	2	3	4	5	6	7	(2.09)
9) Photo F	1	2	3	4	5	6	7	(5.51)

Q-7 Again, using the 1 to 7 scale, how would you rate the healthiness of the air in each of the photographs?

	Healthiness of the Air							
	Worst						Best	
1) Photo D	1	2	3	4	5	6	7	(2.33)
2) Photo I	1	2	3	4	5	6	7	(5.97)
3) Photo B	1	2	3	4	5	6	7	(3.90)
4) Photo H	1	2	3	4	5	6	7	(4.45)
5) Photo C	1	2	3	4	5	6	7	(5.53)
6) Photo E	1	2	3	4	5	6	7	(4.03)
7) Photo G	1	2	3	4	5	6	7	(2.65)
8) Photo A	1	2	3	4	5	6	7	(2.09)
9) Photo F	1	2	3	4	5	6	7	(5.53)

Q-8 In your opinion, if nothing further is done about air pollution in the Atlanta area over the next 5-10 years, the problem is likely to (1.43)

1) get much worse.
2) get somewhat worse.
3) stay about the same.
4) get somewhat better.
5) get much better.

Q-9 Among the following actions that can reduce air pollution, which have you and your household taken? (Please circle all that apply.)

1) Reduced the use of your fireplace and/or wood-burning stove. (38%)
2) Taken some other form of transportation (the train, bus, bicycle, walk, etc.) rather than your car to work or shopping. (15%)
3) Car-pooled. (25%)
4) Reduced the number of days you used your car (to work or other places). (11%)
5) Other (please specify) _____

Q-10 To what degree do you think the following causes contribute to the air pollution problem in the Atlanta Metro Area?

	No Contribution At All						Extremely High Contribution	
1) Automobiles	1	2	3	4	5	6	7	(6.29)
2) Fireplaces	1	2	3	4	5	6	7	(3.44)
3) Power plants	1	2	3	4	5	6	7	(4.88)
4) Industry	1	2	3	4	5	6	7	(5.39)
5) Weather Conditions	1	2	3	4	5	6	7	(4.17)
6) Other (please specify)	1	2	3	4	5	6	7	(5.31)

_____

_____

Q-11 How long have you lived in the Atlanta Metro Area?

_____ YEARS (26.12) _____ MONTHS (4.05)

Q-12 How do you feel about the amount of attention given to the air pollution problems of the Atlanta Metro Area? (3.11)

TOO LITTLE						TOO MUCH
1	2	3	4	5	6	7

Please look at the top row of your photo sheet, which consists of photos **A, B, C**. These photographs have different measured air quality, in terms of visual range and pollutants in the air. Visual range is defined as "the farthest you can clearly see an object if your view is not obstructed." The bar chart below shows how many days of the year fall into the categories of **short, medium**, and **long** visual rangers in the Atlanta area.

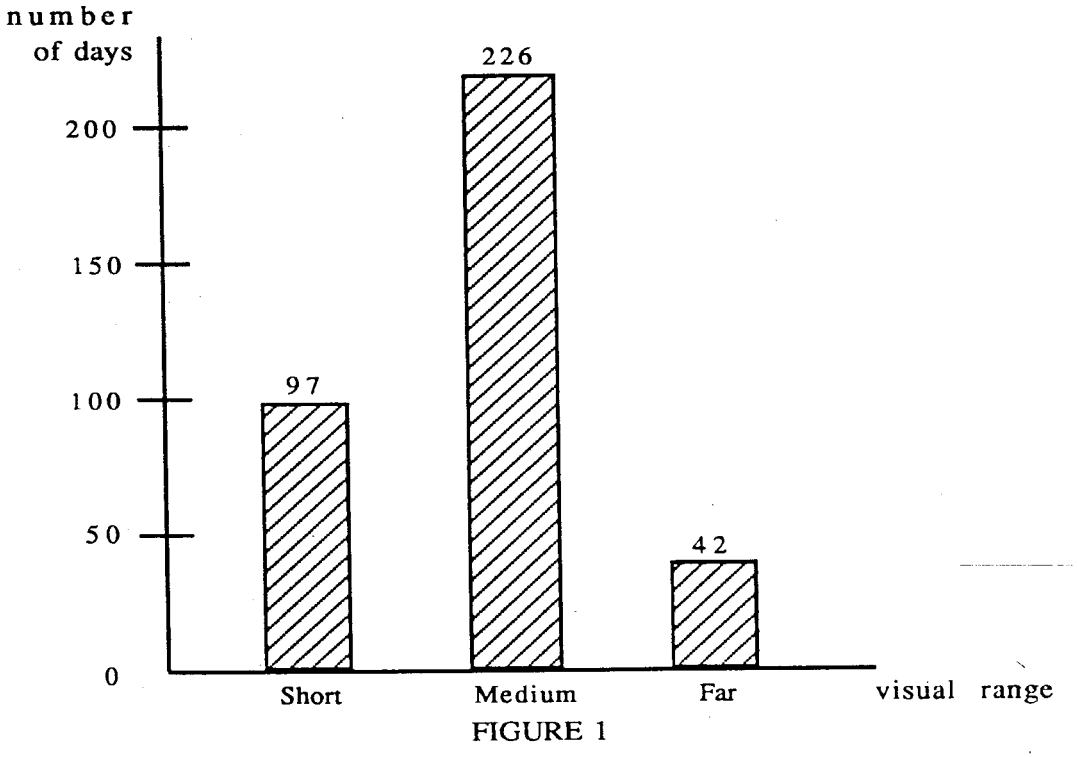

FIGURE 1

Photo **A** shows the scene of a short visual range day, which occurs about one-third of the time during the year. Medium days and long days each also occur about one-third of the time. Similarly, the air quality of the photo in the middle (photo **B**) shows a medium visual range and the photo on the right hand side (photo **C**) shows a long visual range.

II. THE VALUE OF CLEAN AIR TO YOU

Additional federal legislation is currently pending on programs that would be required for high air pollution areas. If implemented, the legislation now being considered in congress would further reduce air pollution from automobiles, factories, and power plants. Such programs will change the number of days that fall into each category of short, medium, and long visual range as represented by the photos in the left-hand, middle, and right-hand columns, respectively.

The graph below shows how many days of the year would fall into each category if additional reductions occur in airborne pollutants. There would be an improvement of 25 fewer short visual range days, and 25 more long visual range days.

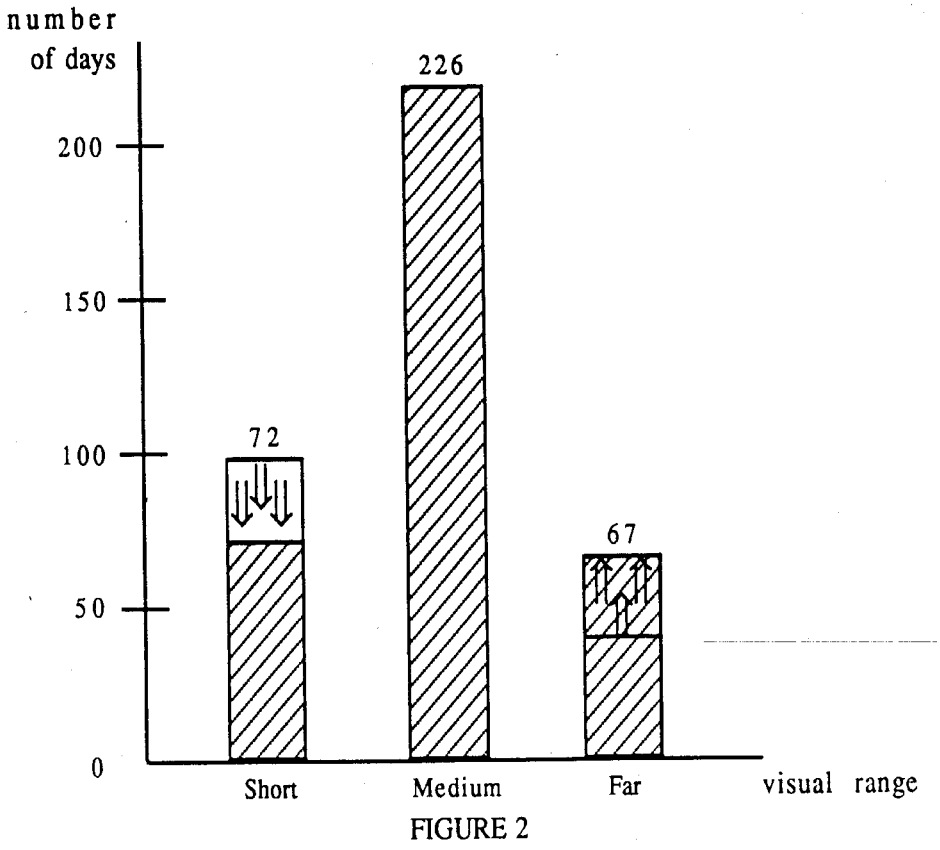

FIGURE 2

However, the actions necessary to accomplish this improvement in air quality will lead to higher prices. One example would be more expensive pollution control equipment on cars, trucks, and buses. Another example would be higher prices for goods, such as electricity, produced by industries that would be required to install better air pollution control equipment.

Q-13 If visual air quality can be improved, how important is it to you to have fewer short visual range days? (4.89)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Q-14 If visual air quality can be improved, how important is it to you to have more long visual range days? (5.24)

NOT AT ALL IMPORTANT					EXTREMELY IMPORTANT	
1	2	3	4	5	6	7

Suppose that there is a referendum proposed to voters. This referendum would call for the use of cleaner vehicles and stricter emission standards for industry and individual households. If the referendum was passed and the pollution control program was put into effect, everyone would pay higher prices.

Q-15 Health, visibility, and other impacts often occur together with an air pollution problem. If the improvements in air quality shown in Figure 2 could be **guaranteed** in the Atlanta Metro Area, would you consider voting YES for this referendum?

1. NO ⟶

WHY ?

GO TO Q-16

2. YES ⟶

At this time we don't know how much the improvements in overall air quality represented in Figure 2 will cost. To help decide if such a program should be undertaken, we need to know what is the MOST your household is willing to pay EACH YEAR, in higher prices, before you would vote NO on such a referendum.

$_____ (229.13)

The amount you indicate will tell us what it is <u>really</u> <u>worth</u> to your household to get such an improvement. If the improvement actually costs less than people are willing to pay, you would only have to pay what it would cost. If the gain turned out to cost more than people are willing to pay, it would not be carried out.

The change in air quality presented in Figure 2 can be thought of as having two parts. One part would clean up short visual range days to become medium days. The other part would clean up medium days to make them long visual range days. The next two questions ask about these two different changes in air quality.

Q-16 How much do you think the healthiness of the air improves when short visual range days are cleaned up to become medium visual range days? (4.63)

NONE A LOT

1 2 3 4 5 6 7

Q-17 How much do you think the healthiness of the air improves when medium visual range days are cleaned up to become long visual range days? (4.89)

NONE A LOT

1 2 3 4 5 6 7

(PLEASE GO TO Q-20 IF YOU ANSWERED "**NO**" TO Q-15)

Q-18 Given the value you provided above (in Q-15), what percentage is for better visual air quality, what percentage is for healthier air, and what percentage is for other concerns you may have about air quality?

a) Less soiling, materials damage, and vegetation effects (27.98)

\+

b) Better visual air quality (19.47)

\+

c) Healthier air (54.60)

\+

d) Other (please specify below) (23.55)

= 100%

_____

_____

Q-19 Again, given the total amount of higher prices you would be willing to spend for the cleanup programs, what percentage would you place on reducing short visual range days, and what percentage on getting more long visual range days?

a) For fewer short visual range days _____ % (52.94)

\+

b) For more long visual range days _____ % (45.85)

= 100%

Q-20 Do you feel at all responsible for the air pollution problem of the Atlanta Metro Area? (3.50)

Not at All Responsible						Very Responsible
1	2	3	4	5	6	7

IV. ABOUT YOU

Q-21 Your age: _____ YEARS (48.14)

Q-22 Your gender?

1) Female (32%)
2) Male (68%)

Q-23 Including yourself, how many members in your household are in each age group? (If none, write "0")

_____ Under 18 years of age (1.13)
_____ 18-64 (1.93)
_____ 65 and over (0.68)

Q-24 How much formal education have you completed? (7.09)

1) No formal education
2) Some grade school
3) Completed grade school
4) Some high school
5) Completed high school
6) Trade school
7) Some college
8) Completed college
9) Some graduate work
10) Advanced college degree

Q-25 Are you presently: (circle number of the best answer)

1) Employed (63.6%)
2) Unemployed (5.5%)
3) Retired (20.0%)
4) Full-time homemaker (5.5%)
5) Student (0.9%)
6) Other _____ (4.5%)

Q-26 What was the approximate annual gross income (before taxes) received last year by you and adult (18 years or older) family members living with you? (8.95)

1) Under $5,000
2) $5,000-9,999
3) $10,000-14,999
4) $15,000-19,999
5) $20,000-24,999
6) $25,000-29,999
7) $30,000-34,999
8) $35,000-39,999
9) $40,000-49,999
10) $50,000-59,999
11) $60,000-69,999
12) $70,000-79,999
13) $80,000-89,999
14) $90,000-100,000
15) $100,000-109,000
16) $110,000-119,000
17) $120,000-129,000
18) $130,000-139,000
19) $140,000-149,000
20) $150,000 -150,000
21) $160,000-169,000
22) $170,000-179,000
23) $180,000-189,000
24) $190,000-199,000
25) More Than $200,000

Q-27 Are you registered to vote?

1) YES (83%)
2) NO (17%)

Q-28 Does your home have a view?

1) YES (73%)
2) NO (27%)

Q-29 Below is a list of phrases that describe different kinds of interests and activities. As you read each one, please indicate the degree that it applies to you.

	NOT AT ALL						DEFINITELY	
1. "...someone who spends a lot of time out of doors on weekends."	1	2	3	4	5	6	7	(5.11)
2. "...a birdwatcher."	1	2	3	4	5	6	7	(3.10)
3. "...someone who trusts what experts say about science and technology."	1	2	3	4	5	6	7	(4.14)
4. "...someone who is an environmentalist."	1	2	3	4	5	6	7	(4.01)
5. "...someone who always votes in city elections."	1	2	3	4	5	6	7	(4.64)

Q-30 What type of residence do you live in?

1) House (82.7%)
2) Apartment (10.0%)
3) Condominium (3.6%)
4) Townhouse (1.8%)
5) Mobile Home (1.8%)
6) Other _____ (0.0%)

Q-31 Do you own or rent your residence?

1) Own (82%)
2) Rent/lease (18%)

Is there anything we may have overlooked? Please use the space below for any additional comments you would like to make concerning the Atlanta Metro Area's air quality and its influence in your life.