# Altruistic and Private Valuations of Risk Reduction

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## *Abstract*

*To remedy the neglect of altruism in benefit assessments for risk regulation programs, this article reports the findings of a new survey of 785 consumers regarding their valuation of two pairs of risks from insecticide. The risk-dollar tradeoffs revealed by consumers averaged $2,080 and $3,680 per injury pair prevented within the household; they were willing to pay $5.01 and $9.06 per 1000 injury pairs prevented in the rest of the state and $1.72 and $2.39 for each 1000 injury pairs avoided elsewhere in the United States. The summed altruistic values for other individuals exceeded the private valuations, which suggests that altruism may be an important benefit component.*

## INTRODUCTION

Although the appropriate valuation of risk reduction benefits has long been a matter of controversy, the methodological basis for analysis is relatively clearcut. The general principle for valuing the benefits in other policy contexts also applies to valuing risk reduction. One should assess society's willingness to pay for the reduced risk.[1] Consequently, benefits consist of two components: the private valuation consumers attach to their own health, plus the altruistic valuation that other members of society place on their health.

Although altruism is recognized as being a pertinent consideration, the magnitude of such effects has never been estimated reliably. As a practical matter, benefit assessment of risk reduction policies focuses exclusively on the private valuations. Indeed, the role of altruism is seldom even mentioned as a potentially important factor. Instead, altruism is generally ignored altogether in analyses of health risk reduction policies.

The research effort reported here provides an exploratory analysis of the role of altruism with respect to morbidity risk reduction. The specific policy context is consumers' valuation of the risks associated with an insecticide product. Since implicit market values of risk derived from studies of labor markets and other markets capture only private valuations, we employed an

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interview approach based on a quasimarket context. We thus have amended the standard risk interview study[2] to consider responses that are made in a simulated market setting by actual consumers.

The article begins with an outline of our methodological approach and a discussion of the nature of our sample, which consisted of 785 consumers. We then summarize the private valuations of reduced morbidity risk, thus establishing the baseline of comparison for the altruism results. Next we present the altruism responses both with respect to other individuals in the respondent's home state and the rest of the United States. The empirical determinants of these altruistic responses, such as the size of the private risk valuations, are also explored. As we indicate in the concluding section, consumers do not appear to have a "deep pocket" for altruistic efforts, but the role of altruism may be sufficiently consequential to give it a dominant rather than subsidiary role in policy analyses.

## METHODOLOGY AND SAMPLE CHARACTERISTICS

### The Survey Approach

The dominant empirical approach used to attach values to risk reduction has been labor market studies of the wage premiums required by workers to incur job risks. Analysis of the decisions that are made in the marketplace provides information on the tradeoffs workers actually make between dollars and risk.

Two inherent limitations of the labor market studies are fundamental to assessing altruistic valuations.[3] First, the scope of the analysis is constrained to risks captured in published data series (fatal and nonfatal injury risks) and other job risks that can be assessed by a worker responding to a survey. Risks outside the workplace and other market contexts cannot be examined because no market experiment can be observed. What, for example, is the value of reducing genetic damage or eliminating risks from nuclear reactors?

A second shortcoming of market experiments is that they generally reflect the valuation of the risk only to the individual bearing the risk. In some cases these private valuations may capture altruistic elements. For example, a father may attempt to take into account the loss that will be experienced by his family if he is killed on the job. Even in this case, however, it is not clear to what extent workers take into account such altruism in their labor market decisions. Nor is it possible to distinguish which private valuations fully reflect the altruistic concerns and which only capture altruism partially.

As a result, if one focuses on risks for which informative experiments are not available, then other techniques to assess these risks must be utilized. Our approach elicits these values from individuals through interviews. In particular, we establish a quasimarket context to make the scenario as realistic as possible and to promote thoughtful responses by the subjects. To the extent that we engage consumers in a meaningful market experiment, we are able to replicate the behavior that would be observed if such a market experiment had taken place and could be observed.

Although the use of an interview approach to elicit risk valuations has not been the dominant methodology in the risk valuation literature, it has received considerable attention. The approach has been applied for over

a decade in a variety of major studies.[4] Outside of the risk area, interview studies have long been used to value amenities such as recreation benefits for water resources projects. A sizable literature on survey procedures for valuing environmental amenities has arisen under the heading of "contingent valuation," which pertains to survey valuations that are contingent upon certain hypothetical scenarios.[5]

Although interview approaches to benefit assessment are not entirely new, a long-standing issue has been the extent to which their results reflect those that would be obtained if we could observe an actual market rather than a simulated one. In an earlier study of labor market risks, Viscusi and O'Connor[6] found that hypothetical risks generated in a chemical labeling experiment yielded wage and quit rate equations that closely paralleled those obtained with market data. The risk-dollar tradeoffs were quite similar as well.

In the precursor to this study, we found that eliciting consumer valuations of risk through direct price-risk questions that parallel those employed here produced very similar results to those obtained using conjoint analysis.[7] Under this latter technique, which is widely employed in the marketing literature, we presented to consumers several products with different price-risk combinations. Based on consumers' rankings of the products, we inferred the risk-dollar tradeoff.[8]

A final check on the validity of the results concerns the extent to which consumers responded in a meaningful manner to the particular survey instrument used. Although there is no feasible market check on the risk valuation responses, we did explore the consistency of the precautions stated for the hypothetical products with the actual precautions that currently available consumer products induce. For the products with labels that had risk warnings identical in content to those on nationally marketed brands, the stated precautionary intentions were almost identical to those reported in a telephone survey of actual usage patterns for a (different) group of consumers.[9] Since the sample sizes were quite large (roughly 2000 consumers in all), the presence of few statistically significant differences in behavior suggests that this survey was successful in engaging the consumer to provide meaningful responses.

## Sample Description

To make the risk valuations as realistic as possible, we selected a widely used insecticide. Only individuals who were potential users of the product participated in the experiment. We recruited our sample of consumers from shoppers at a shopping center and several hardware stores in Greensboro, North Carolina. This locale is widely used in national marketing studies for major consumer brands because of its representative population mix. In our larger report for EPA,[10] we discuss in greater detail the demographic characteristics of our sample, which closely parallels the United States population characteristics.

Professional interviewers from a North Carolina marketing firm recruited the subjects and administered the survey, and a marketing professor (Joel Huber) collaborated in our effort to ensure that the interview procedure measured the variables of interest for the project. In addition, two graduate students monitored the interview process daily.

**Table 1.** Sample characteristics.

| | Means (standard deviations) |
|---|---|
| Age | 45.83 (14.30) |
| Male (%) | 63.61 (48.14) |
| Black (%) | 13.87 (34.58) |
| Married (%) | 78.54 (41.08) |
| Children under five | 0.17 (0.49) |
| Education | 13.40 (2.54) |
| Income | 36,520 (18,855) |

To be eligible for inclusion in the sample, an individual had to be either over age 21 or else over age 20 and not a student. In addition, to ensure that the survey would involve a market context that was familiar to the respondents, we restricted the sample to actual user groups of the products. In particular, the insecticide survey included only individuals who had used an outdoor insect spray for either plants or lawns in the past year.

These age and usage screens represented the only constraints put on the sample. After a subject was recruited, we then ascertained whether the subject had children under the age of five because the under-five age group is the high-risk population for consumer poisoning risks. We gave somewhat different sets of survey questions to respondents depending on whether they had young children. The sample included 672 respondents without children under five and 113 respondents with children under five. Table 1 summarizes the sample characteristics, which are generally representative of the adult consumer population.

## Survey Procedure

The quasimarket experiment that we undertook was as follows. We gave each respondent one hypothetical consumer product to examine. This fictitious product was an outdoor insect spray similar to that of Ortho Malathion, a widely used insecticide. Interviewers showed subjects the product and asked them to examine the product as if they were about to use it for the first time. The labels for these fictitious products were prepared professionally in multiple colors, were printed on high-quality paper, and had the same general appearance as nationally marketed brands.

After examining the product for at most two minutes, the respondents answered a series of questions relating to precautionary behavior, which is the subject of a separate portion of our study. The second section of the survey addressed consumers' valuations of the health risks. The interviewer informed the consumer that product misuse could result in injuries. To motivate this section of the survey, the interviewer explained that a recent

**Table 2.** Summary of injury categories.

| Subsamples | Injury pairs | |
|---|---|---|
| No young children | Inhalation | Skin poisoning |
| With young children | Inhalation | Child poisoning |

newspaper article had identified two particuarly serious injuries from misuse.

Table 2 summarizes the injury pairs presented to each subsample. All subjects considered inhalation risks, but the second risk was varied. Respondents without young children considered risks of skin poisoning, while respondents with young children considered child-poisoning risks. These injuries comprise the major risks from using insecticide products.

The interviewer presented each consumer a single product and one pair of injuries. Each injury was explained to the consumer in detail, as the interviewer showed the consumer a card describing the consequences and the baseline risk levels for the particular injury pairs. The cards included two of the following three injury descriptions, depending on the sample group:

INHALATION POISONING

If a large amount of insect spray is inhaled, it can cause tearing, salivating, coughing, and difficulty in breathing, sometimes followed by muscle twitching, feelings of weakness, headaches, nausea, stomach pains, and diarrhea. Hospitalization may be required. Recovery usually occurs within a day, but may extend beyond a week if the dose is unusually large. There are 15 inhalation poisonings for every 10,000 bottles of insect spray that are used.

SKIN POISONING

If insect spray is left on the skin for several hours, it can cause muscle twitching, feelings of weakness, headaches, nausea, stomach pains, and diarrhea. Hospitalization may be required. Recovery usually occurs within a few hours, but may take over a week if the dose is unusually large. There are 15 skin poisonings for every 10,000 bottles of insect spray that are used.

CHILD POISONING

If children drink insect spray, it can cause nausea, stomach pains, diarrhea, headaches, blurred vision, coughing, weakness, and, for some children, seizures. Hospitalization may be required. Recovery time varies from a few hours in most cases to several weeks for children who drink large doses of the insect spray. There are 15 child poisonings for every 10,000 bottles of insect spray that are used.

In addition to specifying the baseline injury level of 15 injuries per 10,000 bottles, the interviewer told the subject the current price of the product. The interviewer then asked the respondent a series of questions designed to elicit his private and altruistic valuations.

## PRIVATE VALUATIONS OF RISK

### The Survey Instrument

The survey addressed a variety of issues pertaining to each individual's valuation of risk reductions for his or her own household. These questions

were designed to ascertain, for example, how consumer valuations of risk reductions differed and whether consumers would be willing to pay a premium over their value of risk avoidance to have a product that was completely safe. One of the questions asked the subjects to value the same risk reduction amounts that we subsequently addressed in our altruism questions. Thus, its purpose was to establish a baseline private risk valuation level that could then be compared with the altruistic responses.

Each consumer considered a single product, which had an initial price per bottle of $10 and a current poisoning rate of 15 poisonings per 10,000 bottles sold for each of the two poisoning categories (see Table 2). The interviewer then told the consumer that the product could be reformulated to make the product safer:

6.1 I want you to think about a new formulation of insect spray that a manufacturer might develop which is as effective as your current product but eliminates all chance of inhalation poisonings.

This question provided a scenario by which the product's risk would be reduced but its efficacy would not be affected. The consumer was then asked a series of questions concerning how much he or she would be willing to pay to eliminate each risk separately as well as both risks combined. The respondent then considered the key private valuation question to be used as a comparison with the altruism responses:

6.5 Unfortunately, it is not always possible to develop a product that reduces the risks of all injuries to zero. You indicated that you would be willing to pay $ (take from 6.4) more a bottle to reduce *both* risks from 15 injuries to zero for every 10,000 bottles used. What is the most you would be willing to pay for a smaller reduction, say, to reduce risks of *both* inhalation poisoning and child poisoning from 15 to 10 for every 10,000 bottles used? (Show card. Cover the number of inhalation poisonings and child poisonings with finger and say "these numbers both become 10.")
($—more per bottle to reduce both risks to 10/10,000 bottles used).
(Cue with: Would you pay $10, $5, $2, $1, 50 cents, 25 cents, 10 cents, 5 cents, 1 penny?)

By this stage of the survey a cue was seldom needed since the respondents had become familiar with the valuation task.

A potential difficulty in answering such questions is that the consumer may not know whether purchasing the safer product for one's own household will reduce risks to other households as well by making the product safer. Such a spillover effect would presumably enhance consumers' willingness to pay for a safer product. To avoid contamination of the private valuations with such altruistic concerns, the first risk valuation question was followed by the following clarifying comment.

In asking this question, I didn't intend for you to assume that fewer inhalation poisonings would occur to other households if you purchased the insect spray.

Respondents who did have this confusion received the following clarification before the question was repeated:

Now consider the value of the safer new insect spray to your household, recognizing that your response and purchase decision have *no effect* on the number of injuries incurred by other households.

Another potential area of concern pertains to the wording of the survey question. The formulation above elicits willingness to pay amounts for risk reduction. For very small risk increments, the implied rates of tradeoff should equal the tradeoff associated with accepting a risk of equal magnitude. In our survey, the willingness-to-accept amounts that we elicited were much greater than the willingness-to-pay values and, indeed, some respondents refused to incur an increase in risk for any finite price discount. Such results are instructive by indicating the possibility of alarmist responses to risk increases, but they do not provide a reliable basis for benefit valuation, which is the focus of this article.

## Mean Effects

The willingness-to-pay amounts for the private valuations (per five injury pairs avoided per 10,000 bottles of product sold) ranged from an average of $1.04 per bottle for inhalation and skin poisoning to an average of $1.84 per bottle for inhalation and child poisoning, as is indicated by the summary of results in Table 3. In each case, the largest valuations were for the risk pairs involving child poisoning. Based on the injury descriptions, this concern with the well-being of children is reasonable, since these injuries have the greatest potential for prolonged medical treatment. Another contributing factor may be that parents are willing to pay a greater amount to prevent an injury to a child that has the same severity as an injury to themselves. While this hypothesis is quite plausible, it was not explicitly tested in our study.

The final column of Table 3 presents the mean valuations associated with eliminating one injury pair. The implicit value of an injury pair is calculated as follows:

$$\text{Implicit value of an injury pair} = \frac{\text{willingness to pay per bottle}}{\text{risk reduction achieved}}$$

where the risk education achieved was 5/10,000. Thus, to calculate the implicit value per injury pair one simply multiplies the willingness to pay per bottle by 2,000.

As is standard in the literature on the value of life and health, this measure focuses on the value of a statistical injury or, in this case, a pair of injuries.

**Table 3.** Private risk valuation responses for reduction of five injury pairs per 10,000 bottles used.

| Injury pair | Mean $ willingness to pay per bottle (standard error of mean) | Mean implicit value of risk pair |
|---|---|---|
| Inhalation-skin poisoning | 1.04 (0.09) | $2080 |
| Inhalation-child poisoning | 1.84 (0.35) | $3680 |

The value of eliminating the risk of such injuries represents the rate of tradeoff between money and injury risk; it does not indicate how much the respondent would be willing to pay to eliminate certain injuries of this type.

The general orders of magnitude of these valuations appear to be reasonable. The implicit value of the injury pairs averaged $2,080 and $3,680. Although use of the implicit value of life as a reference point is not particularly instructive, the implicit value of nonfatal injuries based on actual wage-risk tradeoffs is pertinent. The value of job injuries tends to be in the $20,000–$30,000 range,[11] and recent evidence suggests that roughly half of this amount is wage loss and the other half represents nonmonetary loss.[12] Since the average injury (for the survey year considered) lasted roughly 12 weeks in terms of the period lost from work, the value of the health loss per week is on the order of $1000. Most of the consumer injuries considered in our survey had one week as the usual upper bound for recovery time. As a result, the estimates we obtained in the consumer study are at least generally consistent with what one would expect, given available market data. There is, however, a broad range of responses that one might consider to be reasonable.

Through additional survey questions, one can also distinguish the separate valuations of the component risks in the risk pairs.[13] This task will not be our concern here, because the subsequent altruism questions focused on joint reduction of both risks. We adopted this approach on the belief that we could establish more credible scenarios for reducing both risks than for reducing one risk. In particular, most public-policy actions we envisioned would affect both risks, whereas a firm's reformulation of the product could have a more targeted influence.

## ALTRUISM FOR MORBIDITY RISKS

### The Survey Approach

The interview context for the altruistic concern was a set of questions that ascertained how much the respondent would be willing to contribute to an advertising campaign that would reduce each of two risks to the average user from 15 injuries per 10,000 bottles used to 10 injuries per 10,000 bottles. Thus, the nature of the altruism that we are exploring pertains to the health of other individuals. This formulation is different than standard economic formulations of altruistic interests in which consumption by others enters one's own utility function.[14] In our formulation it is the health status of others and the associated probabilities of entering these health states that drives the altruistic interests.

By this stage of the survey, the respondent had acquired substantial information about the appropriate precautions from previous questions about precautionary behavior. Thus, these advertisements presumably would have little or no private value to them as new information. If such a value did exist, then the altruism results will overstate somewhat the true magnitude of the altruism values. It should also be noted also that many respondents who were willing to pay a positive amount for a safer product were not willing to contribute to the advertising program, which is consistent with the program being viewed as an altruistic venture. In each case, the

product and the risk pair corresponded to those present earlier in the questionnaire. Respondents with children answering the insecticide questions therefore considered the risks of inhalation and child poisoning, whereas those without children focused on the risks of inhalation and skin poisoning.

The questionnaire first addressed respondents' willingness to pay for an advertising program within their own state, North Carolina. A private organization was presented as the mechanism of influence rather than a state agency so that consumers would not believe their taxes had already paid for the program. The specific wording of the question clearly stated the magnitude of the risk reductions in terms of absolute numbers of injuries, thus eliminating the task for the respondent to calculate these numbers. This calculation would have introduced additional error both because of subjects' possibly imperfect knowledge of the state's size and because of their limited abilities to carry out such calculations mentally. The specific wording of the insecticide question follows:

6.8 The number of injuries from insect spray misuse can also be reduced through a public advertising program. A nonprofit organization in North Carolina is considering running a public advertising program about insect-spray safety. To be effective, the program needs to be administered once a year. The advertising campaign will reduce the risks of both inhalation poisonings and child poisonings from 15 to 10 injuries for every 10,000 bottles of insect spray that are used. This means the number of both types of injuries for the 2 million household bottles used in North Carolina would drop from 3,000 to 2,000. Suppose the sponsoring organization asked *you* and others in the state to contribute to this advertising program. Although in this interview I will *not* ask you for money, would you contribute to the program?

(_____ Yes _____ No)

(If yes continue. If no, proceed to 6.10).

6.9 What is the *very most* you would contribute this year to support this public advertising program?

($_____ per year contribution to NC advertising campaign)

(Cue with: Would you contribute $50, $25, $10, $5, $2, $1?)

After addressing the willingness to pay for this reduced rate of risk in North Carolina, the survey then ascertained the willingness to pay for the same rate of risk reduction for the entire United States population. The U.S. altruism question was as follows:

6.10 Suppose the advertising campaign included the rest of the United States. Would you contribute anything (more)?

(_____ Yes _____ No)

6.11 How much *more* would you contribute?

($____ more per year contribution to U.S. advertising campaign)

(Cue with: Would you contribute $50, $25, $10, $5, $2, $1?)

The results for altruism toward the entire United States population should not simply be the North Carolina altruism amounts multiplied by the ratio of the United States to the North Carolina populations. The nature of the altruism will differ, and consumers should have a willingness to pay for altruistic causes that diminishes with the level of such expenditures, as with other valued commodities. In the case of altruism for North Carolina

residents, the respondents probably have family members and friends within the state. As a result, the contrast between the North Carolina and the United States responses captures both the difference in the nature of the relationships with the beneficiaries of the program and the diminishing willingness to pay for altruism.

Ideally, we would have liked to separate out the first change in the relationship issue from the second absence of a "deep pocket" hypothesis. One approach to making this distinction would have been to ask respondents about their willingness to pay for risk reduction in some state other than North Carolina where they resided. In pretesting of the questionnaire, we asked respondents about their willingness to pay for risk reduction in Missouri. An additional group of subjects was asked for their willingness to pay for risk reduction in the state of Georgia, which should have had more regional appeal. In each instance, the respondents indicated that they did not believe that a contribution to some other state's problems was appropriate. "It's their problem" was the most frequent response. The reactions were so strong that including such a question in the survey threatened the viability of the rest of the questionnaire by casting doubt upon the seriousness of our exercise. As a result, the survey moves directly from North Carolina to the entire U.S. population for which the precedent of federal income taxes establishes the plausibility of the respondent's broader interests.

It should be noted that the survey did not indicate to respondents whether the contributions would be tax deductible. This omission may influence how one interprets the results. The average member of the sample faced a combined State and Federal marginal tax rate of about 32 percent so that each dollar of contributions had an after-tax cost of $0.68. Because the private valuation amounts were in terms of after-tax dollars, the altruism results should be scaled down by about one-third to make them comparable. If, however, the tax benefits were not considered or the individual did not plan to itemize his charitable deductions, then no such adjustment is necessary.

## Mean Effects

Table 4 reports the results regarding the altruistic concerns for each of the risk pairs considered. The first two columns give the overall means and standard errors for contributions to reduce injuries in North Carolina and in

**Table 4.** Summary of altruistic responses.

| | Means (standard errors of the means) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Contribution level (dollars) | | Probability of contributing | | Conditional contribution (dollars) | |
| Injury pair | N.C. | U.S. | N.C. | U.S. | N.C. | U.S. |
| Inhalation-skin poisoning | 5.01 (0.35) | 1.72 (0.33) | 0.57 (0.02) | 0.14 (0.01) | 8.75 (0.55) | 12.13 (2.01) |
| Inhalation-child poisoning | 9.06 (1.27) | 2.39 (0.74) | 0.79 (0.04) | 0.21 (0.04) | 11.53 (1.51) | 11.14 (2.83) |

the United States. Since not all individuals were willing to contribute to the risk reduction, the third and fourth columns summarize the fraction of respondents willing to make a nonzero contribution to reduce injuries in the two situations. The fifth and sixth columns give the contribution levels conditional upon making a nonzero contribution.

The additional amount that individuals are willing to spend to extend this rate of injury reduction nationally averages around $2 per respondent in both cases (see column 2 of Table 4). This dropoff in valuations reflects both the diminishing altruism for additional health risk reduction as well as the more remote nature of the respondents' ties to individuals outside the state. The lower willingness to pay for a U.S. contribution was not greatly affected by whether one had contributed to the North Carolina injury reduction effort. In particular, we generated an additional set of statistics (not shown) to analyze the level of the United States contribution contingent upon making a positive contribution to injury reduction in North Carolina. The differences between the full sample's United States altruism and the altruism toward the United States of those willing to make a North Carolina contribution averaged under $1. For example, the entire sample was willing to contribute an average of $2.39 for a U.S. injury reduction effort, and the sample that had made a positive contribution to the North Carolina advertising program was willing to contribute $2.78.

In all instances, a substantial portion of the population had no altruistic interests at all in reducing risks outside the household (see column 3 of Table 4). For the case involving child poisonings in the respondent's state, about three-fourths of the respondents indicated a positive willingness to pay, whereas for the injury pairs not involving children just over half of the respondents indicated a willingness to make a positive contribution for state-wide injury reduction. The relative pattern is similar for the probability of contributing to U.S. risk reduction (see column 4 of Table 4), except that the frequency of positive contributions is much less (21 percent and 14 percent for the two injury pairs). Viewed somewhat differently, about 80 percent of the population was unwilling to contribute to a risk reduction effort outside their state. If the remaining 20 percent reflects in part a floor effect of the survey approach rather than the respondent's actual willingness to pay, the fraction who would actually make positive contribution if called upon may be less.

Columns 5 and 6 of Table 4 summarize the level of the contribution, given that one is made. It is striking that these conditional contribution levels do not differ greatly whether the population being considered is the state of North Carolina or the entire U.S. population. The source of the overall differences in the average North Carolina and U.S. contributions stems from the differing frequency of making a contribution rather than its magnitude. Once committed to making a contribution, the respondents generally have a willingness to pay of about $10.

The contribution amounts in columns 1 and 2 of Table 4 can be translated into implicit values per injury pair, as in the case of the private valuation statistics in Table 3. Two different measures are of potential interest. First, how much is the consumer willing to pay per injury prevented outside his household? Second, how much are all consumers collectively willing to pay for such a risk reduction? These two measures are given for both the North Carolina valuations and the U.S. valuations in Table 5.

**Table 5.** Summary of implicit altruistic values.

| | Willingness to pay per injury pair prevented (dollars) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | North Carolina | | Rest of states | |
| | Per household | Collective | Per household | Collective |
| Inhalation-skin poisoning | $5.01 \times 10^{-3}$ | $1.00 \times 10^{4}$ | $3.91 \times 10^{-5}$ | $3.07 \times 10^{3}$ |
| Inhalation-child poisoning | $9.06 \times 10^{-3}$ | $1.81 \times 10^{4}$ | $5.43 \times 10^{-5}$ | $4.26 \times 10^{3}$ |

Calculating the value placed by the particular household on each pair of injuries reduced is straightforward. In the case of the North Carolina altruism scenario, 1000 injury pairs would be prevented by the advertising program. For concreteness, consider the inhalation-skin poisoning results. The average consumer is willing to pay \$5.01 to reduce 1000 injury pairs, so that the willingness to pay per pair of injuries avoided is $\$5.01 \times 10^{-3}$, or \$0.0051. Assuming that this response represents the response for the entire household, we have the result that the average North Carolina household would be willing to contribute half a cent for each inhalation-skin poisoning prevented in the state. Similarly, households in North Carolina are willing on average to pay slightly less than one cent for each inhalation-child poisoning prevented in the state. A similar calculation yields the household's valuation of each injury pair prevented in the country, except that the number of injuries involved is considerably larger. As a result, the per-household willingness to pay per injury avoided ranges from only $\$3.91 \times 10^{-5}$ to $\$5.43 \times 10^{-5}$, or under one hundredth of a cent per injury pair avoided.

The second set of statistics of interest represents the collective willingness of society to pay in order to reduce injuries. In the case of North Carolina, we multiply the value per household of each injury pair prevented by the number of households in the state, which was 2.0 million in 1980.[15] Even if each household is willing to contribute under a penny per injury pair prevented, the altruistic effect is substantial. The values per injury pair range from \$10,000 for inhalation-skin poisoning to \$18,100 for inhalation-child poisoning.

Two considerations must be taken into account when interpreting these calculations. First, even very small altruistic concerns of under a penny per household will generate altruism benefit measures that far exceed the private valuations. Second, the precision of the willingness-to-pay estimates becomes a substantial matter of concern when these numbers are extrapolated to the population at large. Before such numbers are utilized in an actual policy evaluation, we suggest that the robustness of these results be explored with respect to different risk reduction increments, other wordings and formats for the questions, different interview contexts, and other pertinent factors likely to influence the responses.

In the case of altruism toward the entire country, the collective willingness to pay relative to the North Carolina willingness to pay tends to follow the relative pattern of the mean values per bottle in Table 4. This correspondence results because while the total number of households contributing is greater, the number of injuries prevented by the altruistic contribution has risen as

well. Thus, the value *per injury* will be determined by these two offsetting influences. If the overall United States contributing population exceeds the North Carolina contributing population by the same ratio as the overall U.S. number of injuries prevented exceeds the number of injuries prevented in North Carolina, then the collective willingness to pay for the country will lead to results that are below the North Carolina altruism figures by the same ratio as is implied by comparing columns 1 and 2 in Table 4.

We used the following specific procedure to capture the national injury valuation. To calculate the household's willingness to pay per U.S. injury prevented, we divided the willingness-to-pay responses by the total reduction in the U.S. injuries. Suppose that the U.S. injury reduction relative to North Carolina follows the ratio of the two populations, so that the advertising campaign would reduce an additional 44,000 injuries. Whereas the values per within state injury pair prevented averaged under a cent, the value per out-of-state injury pair prevented is under a hundredth of a cent.

Even very small altruistic amounts will be consequential, however, when taken on a collective basis. Suppose that each household outside of North Carolina is willing to pay the amounts in column 3 of Table 5 to prevent each such injury pair in North Carolina. Then the out-of-state benefit tally for the 78.4 million households[16] in the rest of the country would range from $3,070 for inhalation-skin poisoning to $4,260 for inhalation-child poisoning. The United States valuation numbers are smaller than the within state collective altruism because the increase in the number of contributors is offset by the dampening of the willingness to pay per injury pair prevented.

## ALTRUISM REGRESSION RESULTS

From an economic standpoint one would expect the altruistic responses to vary systematically across the population. Two classes of factors should be particularly instrumental. First, households with large private valuations should be willing to contribute more for the altruistic cause to the extent that this private valuation reflects a higher private risk-dollar tradeoff. It may be the case, however, that households have higher willingness to pay for safer products not because they regard the health outcome as being more severe, but because they consider their households to be above average in risk. Thus, while the correlation between private and altruistic valuations will not be perfect, one might expect a higher private valuation to boost the size of the altruistic contribution. The individual's private valuation amount can thus be included as a principal variable that is likely to affect altruistic behavior.

The second class of concerns pertains to individual wealth. If altruism is a normal good, then richer consumers should be more likely to contribute to charitable causes. The most refined measure of household wealth that we will include is household family income. In addition, several of the demographic variables are also wealth related, such as the respondent's age (positive effect on wealth early in the life cycle, negative effect later), race (blacks tend to be less wealthy), and years of schooling (positive lifetime wealth effect).

In addition, several demographic variables were also included to capture other differences in the willingness to contribute to altruistic causes. These variables were the respondent's sex, marital status, and whether the respon-

dent had children under the age of five in the household. Because of the strong positive correlation of marital status and children under the age of five in the household, both variables were not simultaneously included in the regressions.

Tables 6–9 present four sets of regressions. Tables 6 and 8 report the logit equation estimates for the logistic transformation of the probability that the respondent was willing to make a positive contribution to North Carolina and U.S. injury prevention, respectively. Thus, the dependent variable has been transformed to reflect the log of the relative odds of making a contribution. This procedure ensures that the estimation technique will not lead to predicted values of probabilities that lie outside of the range from 0 to 1. Tables 7 and 9 report the regressions for the amounts of such contributions, conditional on making a nonzero contribution.

Since the expected signs are the same across equations, we will discuss the results variable by variable rather than equation by equation. In each case two sets of equations (where the differences stem from the nature of the private valuation variable) are reported. Equation (1) results pertain to the private valuation analog of the altruism variable—the private value of reducing injuries from 15 injury pairs to 10 per 10,000 bottles. Equation (2) results utilize a somewhat different private valuation variable—the valuation of reducing the risk level from 15 injury pairs per 10,000 bottles to zero. Because the results of Eq. (2) are typically much stronger, this private valuation variable may be a superior measure of the respondent's private risk-dollar tradeoff.

**Table 6.** Maximum-likelihood estimates of the probability of contributing to injury reduction in North Carolina.

| Independent variable | Coefficients (asymptotic standard errors) Inhalation-skin poisoning | | Inhalation-child poisoning | |
|---|---|---|---|---|
| | 1 | 2 | 1 | 2 |
| Intercept | 1.528 | 1.786 | 0.815 | 3.997 |
| | (0.625) | (0.596) | (1.326) | (1.891) |
| Private valuation | 0.238 | 0.090 | 0.026 | 0.081 |
| | (0.105) | (0.022) | (0.093) | (0.051) |
| Family income | −5.74E-6 | 3.29E-6 | 6.70E-6 | 2.34E-5 |
| | (5.83E-6) | (4.89E-6) | (1.22E-5) | (1.93E-5) |
| Age | −0.021 | −0.020 | 0.012 | −0.054 |
| | (0.004) | (0.006) | (0.027) | (0.032) |
| Male | −0.310 | −0.436 | −1.673 | 0.308 |
| | (0.258) | (0.175) | (0.480) | (0.550) |
| Black | 0.172 | 0.315 | 0.669 | −0.111 |
| | (0.220) | (0.256) | (0.417) | (0.593) |
| Married | 0.082 | 0.311 | . . . | . . . |
| | (0.197) | (0.207) | | |
| Children under five | . . . | . . . | 0.109 | −0.208 |
| | | | (0.317) | (0.432) |
| Years of schooling | −0.015 | −0.074 | −0.037 | −0.142 |
| | (0.037) | (0.036) | (0.075) | (0.135) |
| −2 Log likelihood | 651.8 | 860.1 | 199.6 | 104.6 |

**Table 7.** Regression estimates of the magnitudes of nonzero contributions to injury reduction in North Carolina.

| Independent variable | Coefficients (standard errors) Inhalation-skin poisoning | | Inhalation-child poisoning | |
|---|---|---|---|---|
| | 1 | 2 | 1 | 2 |
| Intercept | 12.387 | −2.659 | 8.708 | 5.305 |
| | (12.133) | (3.846) | (8.052) | (11.858) |
| Private valuation | 4.795 | 0.680 | 0.301 | 0.172 |
| | (1.709) | (0.102) | (0.551) | (0.117) |
| Family income | 1.81E-4 | 7.17E-5 | 1.30E-4 | 1.81E-4 |
| | (1.08E-4) | (3.09E-5) | (0.76E-4) | (1.04E-4) |
| Age | −0.101 | 0.023 | 0.013 | 0.034 |
| | (0.135) | (0.039) | (0.168) | (0.213) |
| Male | −0.836 | 0.233 | 0.149 | 1.530 |
| | (4.904) | (1.064) | (4.350) | (3.412) |
| Black | −2.877 | 0.632 | 3.483 | −3.498 |
| | (3.967) | (1.501) | (2.433) | (3.937) |
| Married | −2.837 | 0.747 | . . . | . . . |
| | (3.608) | (1.314) | | |
| Children under five | . . . | . . . | 0.542 | −0.445 |
| | | | (1.964) | (2.496) |
| Education | −0.408 | 0.292 | −0.465 | −0.205 |
| | (0.733) | (0.236) | (0.479) | (0.860) |
| $R^2$ | 0.04 | 0.14 | 0.03 | 0.09 |

**Table 8.** Maximum-likelihood estimates of the probability of contributing to injury reduction in the U.S.

| Independent variable | Coefficients (asymptotic standard errors) Inhalation-skin poisoning | | Inhalation-child poisoning | |
|---|---|---|---|---|
| | 1 | 2 | 1 | 2 |
| Intercept | −0.672 | −0.622 | 0.180 | 2.846 |
| | (0.729) | (0.844) | (1.355) | (1.977) |
| Private valuation | 0.304 | 0.082 | 0.091 | 0.015 |
| | (0.096) | (0.020) | (0.085) | (0.021) |
| Family income | 7.4E-7 | 7.93E-6 | −1.98E-5 | 4.53E-5 |
| | (6.6E-6) | (6.45E-6) | (1.39E-5) | (1.96E-5) |
| Age | −0.000 | −0.016 | −0.011 | −0.018 |
| | (0.008) | (0.009) | (0.028) | (0.031) |
| Male | 0.038 | −0.483 | 0.095 | −0.181 |
| | (0.300) | (0.236) | (0.518) | (0.555) |
| Black | −0.391 | 0.320 | 0.405 | 2.161 |
| | (0.270) | (0.323) | (0.382) | (0.596) |
| Married | −0.126 | 0.362 | . . . | . . . |
| | (0.228) | (0.296) | | |
| Children under five | . . . | . . . | 0.024 | 0.388 |
| | | | (0.328) | (0.432) |
| Education | −0.052 | −0.086 | −0.051 | −0.349 |
| | (0.043) | (0.052) | (0.077) | (0.159) |
| −2 Log likelihood | 530.9 | 513.1 | 194.3 | 93.4 |

**Table 9.** Regression estimates of the magnitudes of nonzero contributions to injury reductions in the U.S.

| Independent variable | Coefficients (standard errors) | | | |
|---|---|---|---|---|
| | Inhalation-skin poisoning | | Inhalation-child poisoning | |
| | 1 | 2 | 1 | 2 |
| Intercept | −1.834 | −12.766 | 14.663 | −1.173 |
| | (11.227) | (15.720) | (10.174) | (15.121) |
| Private valuation | 2.250 | 0.567 | 0.287 | 1.300 |
| | (1.410) | (0.282) | (0.476) | (0.358) |
| Family income | 1.24E-4 | 3.42E-4 | −1.65E-5 | −1.20E-4 |
| | (0.94E-4) | (1.06E-4) | (2.39E-4) | (2.15E-4) |
| Age | 0.034 | 0.128 | −0.088 | −0.117 |
| | (0.107) | (0.164) | (0.229) | (0.203) |
| Male | −0.891 | −1.104 | −1.216 | −8.213 |
| | (4.254) | (3.997) | (4.200) | (4.692) |
| Black | −5.441 | 4.428 | −0.508 | 0.013 |
| | (3.838) | (5.366) | (3.013) | (5.628) |
| Married | 1.358 | −3.891 | . . . | . . . |
| | (3.160) | (5.268) | | |
| Children under five | . . . | . . . | −1.465 | −1.722 |
| | | | (2.746) | (3.431) |
| Education | 0.351 | 0.446 | −0.181 | 1.199 |
| | (0.721) | (0.944) | (0.613) | (0.984) |
| $R^2$ | 0.08 | 0.20 | 0.03 | 0.62 |

The private valuation variable has the expected positive coefficient in all cases considered, and it is statistically significant (at the 5-percent level) in two cases in Table 6, two cases in Table 7, two cases in Table 8, and two cases in Table 9. Because included variables other than the private valuation may capture some of this variable's influence, these results may understate the variable's actual impact. When these other variables are omitted and only a constant term and the private valuation variable are included, there are 10 statistically significant private valuation coefficients (two more than in Tables 6–9).

Particularly when compared with the other patterns in the tables, there is very strong evidence that high private valuations of risk are positively associated with individuals' altruistic tendencies. Both the probability of contributing and the contribution amount are affected. The greatest difference in the results is that the inhalation-skin poisoning results are more likely to be statistically significant than the inhalation-child poisoning results. This discrepancy may stem from sample-size differences, as the inhalation-skin poisoning sample is considerably larger (672, as compared with 113).

The second key variable of interest is family income, which has the expected positive sign in 12 of 16 cases and is negative (but not statistically significant) in the other instances. Only one of the positive family-income variables is statistically significant in the probability of contributing equations (Tables 6 and 8), but five of the positive family-income coefficients in the

contribution-amount equations (Tables 7 and 9) are statistically significant. In the case of the insecticide-contribution results (Table 7), the family-income variable is positive and statistically significant in all but one instance. Stronger results, consistent with the hypothesized direction of influence, are apparent for the equations pertaining to the total amount of the contribution.

The demographic variables other than household income are inconsequential. Three of these variables (marital status, children under the age of 5, and years of schooling) are never statistically significant, and the black race variable is statistically significant in only one case. The age and male variables are occasionally statistically significant with a negative sign. Older consumers and male consumers appear to have lower altruistic interests, but this effect is relatively sporadic when compared with the more consistent results for the private valuation and family income variables.

The weak influence of the demographic variables and the somewhat poor overall fit of some of the equations does not imply that altruistic concerns are random and unpredictable. Omitted variables such as religious affiliations and participation in charitable activities may be influential. What the results do suggest is that the role of private valuations and household income follow the theoretical predictions but should not be regarded as the sole driving force behind the altruism responses.

## CONCLUSION

The results presented here for two pairs of morbidity effects suggest that consumers have a significant private valuation of these health outcomes averaging $2,080 for inhalation-skin poisoning and $3,680 for inhalation-child poisoning. The altruistic valuations per household are much smaller, but the collective altruistic valuations are considerable. For inhalation-skin poisoning, the within-state collective altruism is $10,000 and the altruism from individuals outside the state is $3,070, for a combined altruistic amount of $13,070. Similarly, for inhalation-child poisoning, the within-state collective altruism is even greater—$18,000—and the out-of-state collective altruism is $4,260, leading to a total altruistic value of $22,360.

These patterns suggest that consumers' altruism is much greater for residents within their home state than in the nation at large. Since they are willing to contribute only modest additional amounts for injury prevention outside of their home states, there does not appear to be a "deep pocket" for altruism. The principal determinants of variations in the altruistic contributions among the population follow the expected patterns, with the private valuations of the risk and household income being most instrumental.

Although our results suggest that altruism values may comprise an important component of the benefits from risk reduction programs, we must emphasize the exploratory nature of our study. Consumers gave the interviewers stated willingness-to-pay values but were not required to make actual contributions. The caveats that we placed on our results at various junctures in the article become especially important when one extrapolates to the collective willingness-to-pay values.

Despite these qualifications, the fundamental implications of our results are clearcut. The stated willingness to pay for altruistic concerns exceeded

the stated willingness to pay for private risk reduction. Even if some experimental bias exists, if the bias affects both private and altruistic responses similarly then the relative importance of altruism will not be affected.

We do not believe, however, that altruism will necessarily play the same relative role in other risk contexts. One should not, for example, use the ratio of our altruistic to private valuation numbers to scale up the value of other classes of risk reduction benefits. The altruism-private valuation relationship is not a universal constant. Additional studies are needed to explore the role of altruism in a variety of policy contexts. Altruism does, however, appear to be of sufficient consequence to emerge from the regulatory analysis footnotes and to become an integral part of such policy analyses.

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## NOTES

1. Although the willingness-to-pay principle has been used for decades in the benefit-cost analysis literature, its applicability to risk valuation was first articulated by Thomas Schelling, "The Life You Save May Be Your Own," in S. Chase, ed., *Problems in Public Expenditure Analysis* (Washington: Brookings Institution, 1968), pp. 127–162. His concern was primarily with private rather than public risk valuation.
2. See, for example, the seminal investigation by Jan P. Acton, *Evaluating Public Programs to Save Lives: The Case of Heart Attacks* (Santa Monica: The Rand Corporation, 1973).
3. In addition, market imperfections such as imperfections in worker information could limit the usefulness of this approach. See W. Kip Viscusi, *Risk by Choice* (Cambridge: Harvard University Press, 1983), for a discussion of the importance of these imperfections.
4. In addition to Acton, *op. cit.*, see W. Kip Viscusi and Charles O'Connor, "Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers?" *American Economic Review*, 74(5) (1984): 942–956; M. W. Jones-Lee, M. Hammerton, and P. R. Philips, "The Value of Safety: Results of a National Sample Survey," *Economic Journal*, 95 (1985): 49–72; and W. Kip Viscusi and Wesley A. Magat, *Learning about Risk: Consumer and Worker Responses to Hazard Information* (Cambridge: Harvard University Press, 1987).
5. For a review of this approach for nonrisk issues, see R. G. Cummings, D. S. Brookshire, and W. D. Schulze, "Valuing Environmental Goods: A State of the Art Assessment of the 'Contingent Valuation Method,'" Draft Report Prepared for the U.S. EPA (1984).
6. See Viscusi and O'Connor, *op. cit.*
7. See Viscusi and Magat, *op. cit.*

8. We did not adopt the conjoint approach here since it requires much more interview time and produced results that are similar to those obtained with more directive questions.
9. See W. Kip Viscusi and Wesley A. Magat, *Analysis of Economic Benefits of Improved Information: Project Period 2 Report,* Report to the U.S. EPA under CR-811057-02-0 (1986).
10. See Viscusi and Magat, *supra* note 9.
11. For a review of these studies, see W. Kip Viscusi, "The Valuation of Risks to Life and Health: Guidelines for Policy Analysis," in J. Bentkover, V. Covello, and J. Mumpower, Eds., *Benefit Assessment: The State of the Art* (Dordrecht: Reidel Publishers, 1986), pp. 193–210.
12. See W. Kip Viscusi and Michael Moore, "Workers' Compensation: Wage Effects, Benefit Inadequacies and the Value of Health Losses," *Review of Economics and Statistics,* 69(2), (1987): 249–261.
13. These results appear in a larger EPA report. See Viscusi and Magat, *supra* note 9.
14. An excellent example of a more traditional economic analysis of altruism is Russell Roberts, "A Positive Model of Private Charity and Public Transfers," *Journal of Political Economy,* 92(1), (February 1984): 136–148.
15. U.S. Department of Commerce, Statistical Abstract of the United States (Washington: U.S. Government Printing Office, 1985), p. 43.
16. *Ibid.*