Measuring Principals' Values for Environmental Budget Management: An Exploratory Study

[Running Title: Principals' Values for Environmental Management]

Glenn C. Blomquist [Contact Author]
Department of Economics and Martin School of Public Policy and Administration,
University of Kentucky, Lexington, KY 40506-0034
Phone: (859) 257-3924, fax: (859) 323-1920, gcblom@uky.edu

Michael A. Newsome
Division of Finance and Economics, College of Business, Marshall University
One John Marshall Drive, Huntington, WV 25755-2320
(304) 696-2709, newsome@marshall.edu

D. Brad Stone
Commonwealth of Kentucky, Department for Environmental Protection,
Division of Waste Management, 14 Reilly Road, Frankfort, KY 40601-1190
(502) 564-6716 x202, brad.stone@mail.state.ky.us

October 2002 version
(forthcoming in *Journal of Environmental Management*)

This research was supported in part under Memorandum of Agreement No. 13814 between the Kentucky Water Resources Research Institute and the Kentucky Natural Resources and Environmental Protection Cabinet. We acknowledge the University of Kentucky Center for Business and Economic Research for administering the telephone portion of the survey and assisting in the collection of mail survey responses. We thank Richard O'Conor, Susan Westneat, and Jim Wolf for help in developing the survey instruments and sampling frames, Jack Wilson and for his sustained encouragement of this project, and Talina Mathews for her administrative help in completing the report. For helpful comments, we thank Tim Haab, Ted McConnell, and participants in the Applied Microeconomics Workshop at the University of Kentucky. Glenn Blomquist gratefully acknowledges that final work on this paper was completed during his sabbatical at the Centre for Health Economics, Department of Economics at the Stockholm School of Economics. The views expressed in this report are the authors' only.

Introduction

Benefit Estimation and Preferences

People interested in efficient use of environmental and natural resources are keenly aware of the challenge of estimating the benefits and costs of programs which change the flow of services from these natural assets (Streever et al., 1998). The tool kit for estimating benefits has grown to include indirect methods which are based on analysis of markets in which individuals implicitly trade the good of interest. The kit also includes direct questioning methods which create hypothetical situations which state which choices they would make about the goods. While the direct questioning, contingent valuation method is not without problems, such as potential insensitivity to the scope of the good and a tendency for people to overstate actual willingness to pay, the alternative of complete reliance upon experts in an imperfect political system has led to continued, careful use of the technique (Portney, 1994). Regardless of success in benefit estimation, citizen principals can have difficulty conveying preferences to agents who work for them in public agencies in a form that is meaningful to the public managers. In this paper we offer an alternative to formal benefit estimation. We explore the usefulness of contingent, public budget increment allocation as a tool to reveal citizens' values that are relevant to public decisionmakers who manage environmental programs. We think this tool reflects the salient feature of choice in a way that is understandable to those who must use it (Shabman and Stephenson, 1996). We think it offers information that can supplement

surveys about public planning and management policies of natural resources (Trakolis, 2001).

Contingent Budget Choices for Public Programs

Despite challenges in estimating benefits, citizens' values of public programs are necessary inputs to public decisions if the decisions are going to lead to efficient provision of publicly provided goods. The purpose of this paper is to explore using a contingent choice technique for public programs and apply it to environmental programs. The primary motivation is to initiate development which will eventually enrich the tool kit available to managers who must make decisions about environmental programs. Budgets obviously matter to managers, and Helland (1998), for example, has found that budgetary considerations affect the stringency of environmental program enforcement across states. We use the contingent choice technique to systematically collect information about individuals' relative values of public programs. The information is based on specially designed questionnaires with tradeoffs and random sample surveys of residents of the state where the environmental programs exist.

Our contingent choice technique clearly is influenced by recent work in contingent valuation. It is similar in that we describe the contingent commodities and choice setting, pose tradeoff questions from which relative values will be inferred, and ask questions about the person. Our technique differs in a fundamental way in that we ask the individual to allocate a fixed increment to a government budget over the various programs funded by the budget. The budget constraint is clearly described as it is in any

contingent market valuation, but the budget is a specified, limited change in a public budget rather than the constraint of limited own income which each individual faces in making personal consumption choices.

In our contingent choice setting, everyone faces the same budget constraint rather than each individual facing his or her own personal budget constraint. The importance of this distinction is that individuals are not making tradeoffs between public program areas and their personal consumption of private goods. Because a public, and not an individual, budget constraint is used, this is not a contingent ranking with prices. We do not attempt to determine their marginal willingness to pay for the public programs out of their personal budgets. Instead, we ask people to act as the public manager.

The specified, limited increment to the public budget, leads individuals to consider the intensity of their preferences for the various public programs before allocating shares of the increment to the programs. Our contingent choice is designed to lead individual citizens to reveal their marginal willingness to tradeoff (MWTTO) additions to one public program for additions to other competing public programs. An advantage of our contingent budget choice is that it places the individual in the context which is the same as the public agent who must make decisions. For example, the MWTTO funds between, say, drinking water programs and programs for improving air quality, food safety, and conservation is elicited in the context of related programs (Blomquist et al., 2000). This context is one which is relevant for public decisionmakers. It is a holistic technique which avoids a sequencing problem which might arise from

separate valuation of each environmental program and the expected aggregate overvaluation (Hoehn and Randall, 1989). It is a technique which induces people to make tradeoffs among various environmental programs simultaneously, a characteristic employed by Neill (1995).

Research Method

Designing Environmental Budget Choices

To achieve maximum efficiency public budget outlays should be allocated among various public programs in such a way that the marginal return of satisfaction for each dollar outlay is equalized. If a budget is allocated this way, the last dollar spent in any program yields the same additional social benefit, and total social benefit is maximized. This total social benefit criterion is a useful benchmark regardless of whether or not it is explicitly considered in the executive and legislative fiscal processes, which eventually make policy. The budget survey technique employed here elicits public attitudes about program resource decisions and provides one way to determine people's general preferences for, and satisfaction with, each possible state program, relative to all others. An advantage of the relative values elicited by the budget survey technique is not only that the programs can be rank-ordered by priority, but also that they can be compared with respect to relative importance.

A combination telephone and mail survey approach was chosen because of the desire for a random sample survey and the study budget which precluded more expensive methods. Questionnaires were designed to motivate people to consider the choices which state government must make with respect to resources. People were asked to make allocation decisions regarding public budgets for environmental programs as well as provide socioeconomic information.

In the basic format employed in the mail surveys, people were given the opportunity to make choices concerning the allocation of "extra" state resources in the form of revenue, to various governmental program areas which address environmental matters. The extra state revenue which respondents were asked to allocate was to be in addition to any state money already allocated to the programs. If the respondents allocated no revenue to a particular program, that program's funding was to be frozen at current levels. Focus groups were used in pre-testing all questionnaires.[1]

People were asked to make hypothetical choices regarding two government budgets: 1) the state's environmental budget, and 2) the budget to protect the state's citizens from specific health and environmental risks.

The eight environmental state budget program areas are the same as those used in Kentucky Outlook 2000, the state's comparative risk study (Kentucky Natural Resources and Environmental Protection Cabinet, 1996). People were asked to allocate an extra $10

million over these areas. Figure 1 shows the budget choices elicitation page for the state environmental budget.

(Figure 1 about here)

The ten program areas for factors that affect health and the environment were selected from risk factors identified in Kentucky Outlook 2000, the Kentucky comparative risk study. Respondents were asked to allocate an extra $10 million over these areas. Figure 2 shows the budget choices elicitation page for the risk factors.

(Figure 2 about here)

Survey Sampling

Kentucky households were the target population. A random digit dialing procedure was used in initial phone surveys. The random digit dialing procedure gave each Kentucky household with a phone an equal probability of being contacted. Two surveys were conducted and combined. In the first survey, the University of Kentucky Survey Research Center was contracted to draw a random sample of at least 600 people from the target population who would be willing to participate in a mail survey. In the second survey, the University of Kentucky Center for Business and Economic Research contacted approximately 1000 people from the target population. The combination

phone/mail surveys was used to increasing response rates and in order to check for nonresponse bias and sample selection bias (Dillman, 1978).

Results

Survey Response and Representativeness

During a seven-day period beginning November 3, 1995, as part of "A Survey About Budget, Environmental, and Health Choices," the UK Survey Research Center contacted 807 households by telephone for a short telephone survey. Of the 807 contacts, 701 (87%) agreed to participate in a mail survey and provided their names and addresses. During a four-week period beginning April 20, 1997, as part of "A Survey About Budget Choices and Effectiveness," the UK Center for Business and Economic Research contacted 1322 households by telephone for a short telephone survey. Of these, 1051 (80%) agreed to participate in a mail survey. Combining the results of both surveys, there were 1752 respondents agreeing to participate in a mail survey. Of these agreeing respondents, 40% were obtained in the first survey and 60% were obtained in the second survey. Of people called in both surveys 18% refused to participate in the mail survey. The total number of replies was 990, or 56% of all surveys mailed[2].

The socioeconomic characteristics of the 990 respondents returning mail surveys can be compared to the average socioeconomic characteristics of the state population as estimated by the U.S. Census. Seven characteristics were compared in this way. Table I

lists these seven characteristics. Those respondents returning mail surveys, and thereby providing budget survey information, tended to have higher incomes, more formal education, and be more likely to vote than the general state population. Comparisons can be made using the information from the phone survey also.

(Table I about here)

Based on the phone survey characteristics comparisons were made for people who agreed to participate in the mail survey and for people who refused. For many characteristics no statistically significant difference was found. We did find that those agreeing are more likely to contribute to nature funds, to be more concerned with environmental issues, to hunt, fish, or participate in other forms of outdoor recreation, more likely to be employed, and more likely to have voted in the last general election. Also based on the phone survey characteristics, comparisons were made for people who did and people who did not return a mail survey after receiving one. Respondents returning surveys tend to be older, more educated, and are more likely to have voted in the last general election.

These values can be helpful to public decision makers in that they are more representative than many other alternative sources of information about citizen preferences. Nonetheless, average differences between the survey samples and the state as a whole should be kept in mind.

Environmental State Budget Choices

The Environmental State Budget section of the questionnaires was designed to elicit the relative values people place on various environmental programs. These categories represent the program areas addressed during Kentucky Outlook 2000, the state's comparative risk project. The mean allocations, and their significance levels, are indicated in Table II.[3]

(Table II about here)

Drinking Water was valued highly. On average, people allocated $1.67 million of the given $10 million budget increment to Drinking Water. Note in Table II that if one calculates the ratio of the Standard Deviation to the Mean Allocation for each category the (coefficient of variation) value is smaller for Waste (0.52) and Drinking Water (0.56) than for any other categories. This indicates that respondents consistently valued Drinking Water highly. The Drinking Water allocation is significantly higher than the allocation for the second-ranked group of categories: Waste, Food Safety, and Ground and Surface Water. The allocations given to these categories cannot be shown to be significantly different from one another. Categories valued less than Ground and Surface Water received less than the average (mean) allocation for the budget. Of this group, Air Quality and Land Quality received the largest allocations and were ranked significantly higher than the last two categories, Conservation and Indoor Environmental Quality.

Additional money to Ground and Surface Water was valued 1.7 times as much as additional money to Indoor Environmental Quality.

Choices for the Factors Which Affect Health and the Environment

The budget for Factors Which Affect Health and the Environment was used in the first survey (and first survey only) to elicit the relative values people place on programs designed to protect Kentucky citizens from risks associated with ten factors. The factors were based on categories chosen in the Kentucky Outlook 2000 comparative risk study. The average allocations, and their significance levels, are found in Table III. Increments to programs to address Untreated Sewage were the most valued. On average, people allocated 18.9 percent ($1.89 million) of the given budget to Untreated Sewage. This allocation was significantly higher than the 16.1 percent of the budget allocated to address Poor Drinking Water, the second most valued category. Increments to Poor Drinking Water were valued significantly more than increments to Hazardous Waste, the third most highly ranked category.

(Table III about here)

Note that additional money to programs which address Untreated Sewage is valued 3.9 times as much as additional money to programs which address Radon in Homes. Note also that additional money to address Second-hand Tobacco Smoke is in the least valued group, and that the ratio of mean to standard deviation (1.37) is highest of all

categories. The low average value and degree of disagreement are interesting results for a state in which the tobacco crop is perceived to be economically important.

Simple Tests of Random Values

One indication of successful revelation of individual preferences for changes in the provision of the publicly provided goods is that they are not random. We test allocations for both budgets to determine whether or not the hypothetical allocations within the budgets are significantly different than what would be expected if the allocations had been made according to a simple arbitrary rule.

Each observed average allocation in each budget was tested to see if it was significantly different from the simple average allocation for the given budget. T-tests were used to compare observed mean allocations against these (simple) average allocations. The simple average allocation for the Environmental State Budget shown in Table II was $1.25 million, $10 million divided evenly across the eight budget areas. The mean observed allocations ranged from $1.67 million for Drinking Water to $0.77 million for Indoor Environmental Quality, and for each budget category the mean observed allocation was found to be significantly different from the simple average allocation at the 0.95 level.

The simple average for the Factors which Affect Health and the Environment shown in Table III was $1.00 million, $10 million divided evenly across ten budget areas.

The mean observed allocations ranged from $1.89 million for Untreated Sewage Discharged into Rivers and Streams to $0.49 million for Radon in Homes. For 9 of the 10 budget categories the mean observed allocation was found to be significantly different from the simple average at the 0.95 level. This result is an indication that individuals are valuing the program categories, and not simply allocating equal amounts to each of the program categories.

A Reliability Test - Effectiveness

One way to test reliability of the budget choice values is to ask a closely related question and check for similarity of results. Through the second mail survey people were asked to rate the effectiveness of each program category in the State Environmental Budget. Effectiveness was defined in the questionnaires to be: “How well a task or goal is accomplished.”

Based on their own experiences, respondents could rate each category as "Not Effective", "Somewhat Effective", or "Very Effective."[4] The budget choices responses point to programs to which people want more resources directed. They want more money devoted to the program because they want more progress toward the policy goal. So, in this context a program which has not accomplished as much as people want will be rated as "Not Effective."

(Table IV about here)

Table IV shows the effectiveness ratings for the Environmental Budget. The categories are listed in the table by average effectiveness, based on assigning the numbers 1, 2, and 3 to Not Effective, Somewhat Effective, and Very Effective, respectively. The weighted average effectiveness rating is shown in the right-most column. They are listed from the most highly rated at the top to the lowest rated at the bottom. A cursory glance at this table and Table II for the budget choices indicates that the effectiveness rating for any particular budget category tends to be inversely related to the budget allocation it received. In other words, the larger is the amount allocated to the budget category, the lower is the effectiveness rating.

For the State Environmental Programs Budget, Indoor Environmental Quality was given only $0.77 million (of an additional $10 million), which is the smallest amount, but it was given a 2.12 effectiveness rating, which is the highest. For the State Environmental Budget programs the correlation between the amounts allocated by individuals and the effectiveness ratings is -0.47.[5]

The negative correlation between the budget values for programs and the effectiveness rating is an indication that the budget choice elicitation is reliable. So, if people think a goal is met (highly effective), they allocate little additional money to it. A budget program to which additional resources are valued highly gets a low effectiveness rating because people want more progress.

Budget Allocation Functions: Tests for Effects of Personal Characteristics and Format

Another test for randomness of elicited MWTTO values is to estimate the increment devoted to a particular program as a function of questionnaire format aspects and personal characteristics of the respondents. There are two simple ideas. One is that innocuous differences in format should not influence the MWTTO values. The other is that some systematic relationship between personal characteristics and the values should exist; the allocations of incremental funds should not be random.

Seemingly unrelated regression analysis is used to analyze the effects of format differences and personal characteristics on MWTTO values. Since allocating more to one program necessarily implies less will be allocated to other programs, error terms associated with the dependent variables are expected to be correlated. Seemingly unrelated regression analysis allows the error terms to be correlated by estimating the full variance-covariance matrix of estimators, leading to more efficient coefficient estimates.[6]

Tables V and VI display the effects of changes in socioeconomic characteristics on the allocations to the Environmental State Budget and the Budget for Factors which Affect Health and the Environment. These effects are shown in percentage terms.

(Table V about here)

Table V shows the percentage differences in allocations to the Environmental State Budget that can be attributed to changes in various socioeconomic characteristics.

The most significant variables in explaining contributions across all budget categories were the respondent's gender and environmental health concerns. *Males* tended to contribute more to Land Quality and Waste and less to Food Safety and Indoor Environmental Quality. Higher *environmental health concerns* tended to be associated with increased allocations to Drinking Water, and decreased allocations to Air Quality and Land Quality.

There were other statistically significant results. For example, *non-whites* allocated more to Air Quality than did whites. *Married* people allocated more to Indoor Environmental Quality and less to Conservation. People *with children* contributed more to Drinking Water. A 10% increase in respondent education is associated with a 3.4% decrease in allocations to Food Safety. Similarly, a 10% increase in *income* is associated with a 1.3% increase in allocations to Conservation and a 1.1% decrease in allocations to Food Safety. Residents of the *eastern and western coal fields* regions allocated more to Indoor Environmental Quality. Residents of *rural non-farm* areas tended to allocate more to Ground and Surface Water and less to Air Quality, than did residents of either rural farm areas or urban areas.

It is possible to use the information in the table to determine a profile of respondents. Consider the effects of changes in socioeconomic characteristics on allocations to Drinking Water. People tending to allocate more to Drinking Water were older, married, non-white males with children. They tended to be more highly educated, have higher environmental health concerns, and be from western and southern Kentucky.

Furthermore, respondents allocating more to Drinking Water were unlikely to be from an urban area or to have higher incomes.

(Table VI about here)

Personal characteristics which were statistically significant across budget categories, shown in Table VI, were Income, Sex, Marital Status, and Education. People with higher income, for example, wanted a larger share of the increment to the budget to go to addressing Untreated Sewage and smaller shares to go to addressing Radon. Allocations to addressing Radon, for example, were smaller for males and people with more education and income and larger for people in the southwestern "Plateau" region of Kentucky.

Survey and Format Controls

The variables used in the seemingly unrelated regression analysis included socioeconomic variables and survey control variables. Survey control variables were used to control for different types of influence that might have been unintentionally induced by the questionnaire format. Split-sample surveying allowed testing for several potential sources of bias.

While only the first survey included the budget allocation for Factors which Affect Health and the Environment, both mail surveys were used to collect information for the Environmental State Budget (Table II). In Table V the variable, Survey #2, equals

one if the value is from survey 2 and zero if the value is from survey 1. It was not found to be significant at the 0.95 level across all budget categories.

The variable, Reverse Order of Categories, captured information concerning whether or not particular responses were collected in forward or reverse alphabetical-ordered surveys. Split samples were done for the Environmental State Budget and the Factors which Affect Health and the Environment. The order of categories was not found to be significant in either case. This is an indication that respondents take particular care in considering each category in the survey, and are not biased by the order of responses.

The variable, No Category Headings, was used in the Seemingly Unrelated Regression for the Environmental State Budget to test if people read only the headings. This variable was not found to be significant at the 0.95 level across categories. This is an indication that respondents are not terribly influenced by the "labels" applied to the budget categories.

Conclusions

In this paper an initial attempt at developing a budget choices technique was made and applied to state management of environmental programs. The distinguishing feature of the technique is the hypothetical allocation of a public budget surplus amount among various environmental program categories. Individuals are asked to act as if they are the director of all environmental programs. Marginal willingnesses to tradeoff (MWTTO)

among program categories are the information public decision makers can get from this technique. Several advantages over existing sources of information are inherent. The values reflect the budget limits faced by public managers. The values reflect the current activity and output of the public programs. The values are superior to priority rankings. The values can be elicited from a more representative sample than interest groups which present themselves at public hearings.

The contingent budget choices technique was applied to a random sample of people in Kentucky for choices in the environmental budget for the state, and a budget for factors which have been identified as risks to health and the environment. Of the 2129 people contacted and interviewed by phone 990 (47%) agreed to participate and returned completed mail surveys. Indications of the validity of the responses are that they are not strictly random. People did not simply allocate across the board. Estimates of budget allocation functions with personal characteristics using seemingly unrelated regressions show systematic differences in allocations. Survey format differences such as reversing the order of budget categories do not matter. High (negative) correlation of the MWTTO values with a measure of how well a goal has been achieved indicates reliability of the elicited budget values.

Results from this initial study suggest further development of the budget choices technique is promising. Further development of the theoretical relationships among individual preferences for environmental changes, productivity of public programs, and budget changes is warranted. In the meantime, the MWTTO values from this study of

citizens' preferences can be information which is useful in managing environmental programs in Kentucky. The technique might well be useful for estimating citizens' values for environmental programs at the national level and for other states. Public decision makers might well value such future studies as a complement to their existing sources of information.

References

Blomquist, G.C., Newsome, M.A., and Stone, D.B. (1998). Technical Paper: *Kentucky budget choices and environmental values: results from two state-wide surveys*. Division of Water, Kentucky Natural Resources and Environmental Protection Cabinet, Frankfort, Kentucky 40601. Available on the Internet at URL: http://water.nr.state.ky.us/survey/

Blomquist, G.C., Newsome, M.A., and Stone, D.B. (2000). Public marginal willingness to tradeoff among water quality programs: estimates of statewide and watershed-specific budget values. *Water Resources Research* 36, 1301-1313.

Dillman, D.A. (1978). *Mail and Telephone Surveys--The Total Design Method*. New York: Wiley.

Helland, E. (1998). The revealed preferences of state EPAs: stringency, enforcement, and substitution. *Journal of Environmental Economics and Management* 35, 242-261.

Hoehn, J.P. and Randall, A. (1989). Too many proposals pass the benefit cost test. *American Economic Review* 79, 544-551.

Kentucky Natural Resources and Environmental Protection Cabinet. (1996). Technical Report: *Kentucky Outlook 2000: a strategy for Kentucky's third century*. Kentucky Natural Resources and Environmental Protection Cabinet, Frankfort, Kentucky 40601.

Neill, H.R. (1995). The context for substitutes in CVM studies: some empirical observations. *Journal of Environmental Economics and Management* 29, 292-297.

Portney, P.R. (1994). The contingent valuation debate: why economists should care. *Journal of Economic Perspectives* 8, 3-17

Shabman, L. and Stephenson, K. (1996). Searching for the correct benefit estimate. *Land Economics* 72, 433-449

Streever, W.J., Callaghan-Perry, M., Searles, A., Stevens, T., and Svoboda, P. (1998). Public attitudes and values for wetland conservation in New South Wales, Australia. *Journal of Environmental Management* 54, 1-14, doi: 10.1006/jema.1998.0224.

Trakolis, D. (2001). Local people's perceptions of planning and management issues in Prespes Lakes National Park, Greece. *Journal of Environmental Management* 61, 227-241, doi: 10.1006/jema.2000.0410.

US Bureau of the Census. (1995). *Statistical Abstracts of the US: 1995*. Washington D.C.: US Bureau of the Census.

Whitehead, J.C., Groothuis, P.A., and Blomquist, G.C (1993). Testing for non-response and sample bias in contingent valuation. *Economics Letters* 41, 215-220.

Table I: Comparison of Selected Respondent Characteristics in Budget Survey Sample to U.S. Census Statistics for Kentucky

	Budget Survey Variable	Census Statistic[a]
Age[b] (years) N=964	**48.0**	**47.8**
Income[c] (1996 $1000) N=862	**41.6**	**24.8**
Race (% White) N=917	**92.2**	**92.0**
Education:		
% Less than High School	**11.8**	**32.9**
% High School	**36.9**	**30.2**
% College	**39.6**	**31.2**
% Graduate n=968	**11.7**	**5.7**
Registered to Vote[d] (% Yes) N=561	**88.2**	**87.6**
Vote Nov. General Election (% Yes Given Registered) n=554	**76.5**	**59.3**
Physiographic Region (%)		
Blue Grass	**43.2**	**48.0**
Eastern Coal Fields	**22.5**	**16.4**
Embayment	**5.6**	**5.7**
Plateau	**17.7**	**23.0**
Western Coal Fields n=966	**11.1**	**6.9**

[a] The state population averages are from 1990 Census Data from the Kentucky State Data Center, Urban Studies Institute, University of Louisville, and the 1995 Statistical Abstract of the US (US Bureau of the Census, 1995).

[b]Because survey respondents were required to be 18 years of age or older, the Age used for the State Population average is for Kentucky residents above 18 years old.

[c]Because survey respondents were asked their household income for the previous year in two surveys conducted two years apart, the Income used for State Population average is 1990 Census Data (1989 income), corrected to 1996 using the CPI-U from the Bureau of Labor Statistics.

[d]The Voter Registration information was obtained from the Kentucky State Board of Elections World Wide Web site at http://www.state.ky.us/agencies/sbe/sbehome.htm.

Table II: Choices for Kentucky's Environmental State Programs, $10 million increment[a]

Budget Category	Mean Allocation ($Millions)	Standard Deviation
Drinking Water	**1.67**	**0.93**
Waste	**1.43**	**0.94**
Food Safety	**1.36**	**1.03**
Ground And Surface Water	**1.33**	**0.95**
Air Quality	**1.19**	**0.89**
Land Quality	**1.16**	**0.93**
Conservation	**0.90**	**0.93**
Indoor Environmental Quality	**0.77**	**0.84**

[a]The shaded spaces between rows separate Mean Allocations which are significantly different from each other at the 0.95 level. The t-test is conducted for equality between each category and the next higher category. All categories above the double line receive more than the average allocation ($1.25 million) for all categories. All categories below the double line receive less than the average allocation.
n=812

Table III: Choices for Factors Which Affect Health and the Environment, $10 million increment[a]

Budget Category	Mean Allocation ($Millions)	Standard Deviation
Untreated Sewage Discharged into Rivers and Streams	**1.89**	**1.21**
Poor Drinking Water Quality	**1.61**	**0.96**
Hazardous Waste Disposed in Landfills	**1.32**	**0.81**
Chemicals Used on Crops and Lawns	**0.95**	**0.69**
Air Emissions from Waste Incinerators	**0.94**	**0.67**
Erosion and Habitat Loss	**0.82**	**0.78**
Exhaust Emissions from Motor Vehicles	**0.76**	**0.69**
Second-hand Tobacco Smoke	**0.62**	**0.85**
Storm Water Runoff from Roadways and Farms	**0.56**	**0.62**
Radon in Homes	**0.49**	**0.57**

[a]These Allocations were obtained entirely from Survey #1. The shaded spaces between rows separate Mean Allocations which are significantly different from each other at the 0.95 level. The t-test is conducted for equality between each category and the next higher category. All categories above the double line receive more than the average allocation ($1.00 million) for all categories. All categories below the double line receive less than the average allocation.

Table IV: Effectiveness Ratings for Kentucky's Environmental State Programs[a]

Budget Category	Not Effective (%)	Somewhat Effective (%)	Very Effective (%)	Average Effectiveness Rating
Indoor Environmental Quality	**15.2**	**57.8**	**27.0**	**2.12**
Food Safety	**12.0**	**65.7**	**22.2**	**2.10**
Conservation	**18.6**	**59.3**	**22.1**	**2.04**
Drinking Water	**20.1**	**61.1**	**18.7**	**1.98**
Land Quality	**17.3**	**69.3**	**13.5**	**1.96**
Air Quality	**21.3**	**65.0**	**13.6**	**1.92**
Waste	**27.8**	**56.3**	**15.9**	**1.88**
Ground And Surface Water	**30.3**	**58.2**	**11.5**	**1.81**

[a]These categories are ranked by the Average Effectiveness Rating (using Not=1, Somewhat=2, and Very=3). The spaces between columns separate Effectiveness Categories which are significantly different from each other at the 0.95 level. The t-test is conducted for equality between each category and the next higher category.

Table V: Changes in Socioeconomic Variables and Environmental State Budget Choices[a]

Change in Socioeconomic Variables	Resulting Percentage (%) Change in Each Budget Category			
	Drinking Water	Food Safety	Ground and Surface Water	Waste
Age (10% increase in years)	1.1	0.5	0.5	0.1
Sex (male instead of female) * *	1.4	-10.6 *	1.2	10.4 * *
Race (non-white instead of white)	5.8	-0.3	-1.7	-5.7
Marital Status (married instead of not) *	3.6	4.7	0.8	1.6
Children (do have instead of do not)	13.2 * *	-0.2	-7.5	-0.1
Education (10% increase in years)	0.2	-3.4 * *	2.7 *	2.0
Income (10% increase in $)	-0.3	-1.1 * *	0.5	0.1
Physiographic Region (Base: Bluegrass)				
Eastern Coal Fields	-5.6	-11.0	3.9	7.9
Embayment	6.8	-12.8	-4.7	-2.8
Plateau	4.3	6.3	-11.4	3.8
Western Coal Fields	-8.0	13.0	-0.4	1.2
Residence (Base: Non-Farm Rural) *				
Farm	1.9	-1.0	-15.4 * *	-0.5
Urban	-3.3	-5.0	-15.9 * *	4.0
Living in Kentucky All-life (yes instead of no)	-4.5	-2.0	-4.9	-4.5
Environmental Health Concern (Base: Low) * *				
Medium	13.0 * *	10.5 *	2.9	-4.6
High	13.7 *	10.2	8.8	1.0
Contribute to Nature Funds (yes instead of no) *			-4.0	
Hunting and Fishing (Base: Never) *				
Occasionally			11.9 * *	
Frequently			15.5 * *	
Survey Control Variables				
Survey #2 (1997) Used	-11.4 * *	-15.0 * *	-2.2	10.4
Reverse Order of Categories Used	-4.4	-10.8	7.5	13.1 *
No Category Heading Used	4.6	14.7	1.5	7.7
R^2	0.05	0.06	0.06	0.02

Continued on next page (notes are at the end of the table)

Continued from last page (Table V)

Change in Socioeconomic Variables	Resulting Percentage (%) Change in Each Budget Category			
	Air Quality	Land Quality	Indoor Env. Quality	Conservation
Age (10% increase in years)	-0.4	-0.5	0.4	-2.5 *
Sex (male instead of female) * *	-5.2	23.3 * *	-21.5 * *	-12.0
Race (non-white instead of white)	29.7 * *	-20.3	11.3	-20.1
Marital Status (married instead of not) *	-1.1	-5.5	23.7 * *	-28.1 * *
Children (do have instead of do not)	4.6	-1.9	-12.6	-6.5
Education (10% increase in years)	-2.6 *	0.8	-0.9	0.6
Income (10% increase in $)	0.0	0.2	-0.5	1.3 * *
Physiographic Region (Base: Bluegrass)				
Eastern Coal Fields	-5.3	-0.3	23.9 *	-3.6
Embayment	16.5	-21.8	12.1	13.8
Plateau	-11.5	-2.4	20.5	-5.3
Western Coal Fields	-11.4	-5.4	34.9 * *	-11.9
Residence (Base: Non-Farm Rural) *				
Farm	15.6 * *	6.5	-8.5	-1.3
Urban	21.1 * *	-4.1	16.9	-5.7
Living in Kentucky All-life (yes instead of no)	10.3 *	3.0	-0.9	8.5
Environmental Health Concern (Base: Low) * *				
Medium	-16.3 * *	-6.9	6.5	-9.8
High	-14.3	-21.9 *	25.1	-26.1 *
Contribute to Nature Funds (yes instead of no) *		-6.5		19.5 * *
Hunting and Fishing (Base: Never) *				
Occasionally		-0.5		-11.5
Frequently		0.1		-17.3 *
Survey Control Variables				
Survey #2 (1997) Used	-0.9	16.8 * *	8.1	2.5
Reverse Order of Categories Used	-8.9	8.1	-6.0	-1.0
No Category Heading Used	-23.8	-18.8	23.1	-10.1
R^2	0.06	0.05	0.05	0.06

n=671

[a]These percentage changes (elasticities) in allocations are evaluated at the mean allocation for each program area and at the mean value for each continuous socioeconomic variable. The symbols * and ** designate those values which are significant at the 0.90 and 0.95 levels, respectively. A symbol, * or **, placed after any independent variable found in the first column indicates that variable is significant in the seemingly unrelated regression over all budget categories. A symbol, * or **, placed after any particular elasticity value under a budget category heading indicates the associated variable is significant in the individual regression for that particular budget category.

Table VI: Changes in Socioeconomic Variables and Factors Which Affect Health and the Environment[a]

Change in Socioeconomic Variables	Resulting Percentage (%) Change in Each Budget Category				
	Untreated Sewage	Poor Drinking Water	Hazardous Waste	Chemicals on Crops/Lawns	Air Emissions from Waste
Age (10% increase in years)	1.0	-0.2	-1.4	0.8	0.3
Sex (male instead of female) * *	11.8*	10.5*	0.9	8.7	-0.5
Race (non-white instead of white)	-18.0	1.4	-1.5	4.0	-5.8
Marital Status (married instead of not) * *	4.7	12.9*	8.5	-10.5	15.7*
Children (do have instead of do not)	-18.6**	-8.1	9.2	11.4	1.2
Education (10% increase in years) * *	0.8	3.7**	1.6	-3.1	1.0
Income (10% increase in $) * *	2.0**	-0.6	-0.6	-0.3	-0.8
Physiographic Region (Base: Bluegrass)					
Eastern Coal Fields	5.5	-9.7	-11.3	-0.4	-1.3
Embayment	-8.3	-10.6	-19.2	20.0	-0.4
Plateau	-4.0	0.2	-7.2	1.0	-7.3
Western Coal Fields	2.2	-14.5	-12.0	7.7	8.5
Residence (Base: Non-Farm Rural)					
Farm	-5.2	-10.6	-1.5	-29.3**	16.7
Urban	5.2	-19.1**	-2.0	-8.7	7.6
Living in Kentucky All-life (yes instead of no)	8.9	-1.5	-7.9	-11.9	6.0
Contribute to Nature Funds (yes instead of no) *					
Survey Control Variables					
Reverse Order of Categories Used	6.8	-5.7	-0.1	0.5	-16.1**
R^2	0.11	0.06	0.04	0.05	0.04

Continued on next page (notes are at the end of the table)

Continued from last page (Table VI)

Change in Socioeconomic Variables	Resulting Percentage (%) Change in Each Budget Category				
	Erosion and Habitat Loss	**Exhaust Emissions**	**Second Hand Tobacco Smoke**	**Storm Water Runoff**	**Radon**
Age (10% increase in years)	-1.2	2.2	-3.4	3.3	-1.0
Sex (male instead of female) * *	-0.3	-4.3	-51.8**	29.3**	-39.7**
Race (non-white instead of white)	-20.9	30.9	66.7*	-0.2	-21.3
Marital Status (married instead of not) * *	-34.4**	-18.4	10.2	-12.9	-13.7
Children (do have instead of do not)	2.2	10.9	-20.3	17.9	20.9
Education (10% increase in years) * *	-4.0	1.6	-0.9	-3.1	-10.1**
Income (10% increase in $) * *	0.1	0.3	0.1	-0.4	-2.6**
Physiographic Region (Base: Bluegrass)					
Eastern Coal Fields	-8.2	-10.4	30.4	31.4*	12.5
Embayment	21.3	6.0	25.5	23.9	-7.9
Plateau	6.2	-11.6	5.1	17.9	45.4**
Western Coal Fields	-10.5	-13.9	60.4**	22.2	-2.6
Residence (Base: Non-Farm Rural)					
Farm	26.3	5.4	28.1	4.0	3.7
Urban	3.1	18.6	16.2	-5.2	16.3
Living in Kentucky All-life (yes instead of no)	-13.4	22.0**	-10.7	-11.9	7.7
Contribute to Nature Funds (yes instead of no) *	19.0*				
Survey Control Variables					
Reverse Order of Categories Used	22.7**	0.9	-6.3	1.8	10.1
R^2	0.06	0.04	0.07	0.05	0.14

n=355

[a]These percentage changes (elasticities) in allocations are evaluated at the mean allocation for each program area and at the mean value for each continuous socioeconomic variable. The symbols * and ** designate those values which are significant at the 0.90 and 0.95 levels, respectively. A symbol, * or **, placed after any independent variable found in the first column indicates that variable is significant in the seemingly unrelated regression over all budget categories. A symbol, * or **, placed after any particular elasticity value under a budget category heading indicates the associated variable is significant in the individual regression for that particular budget category.

CHOICES FOR KENTUCKY'S ENVIRONMENTAL STATE BUDGET

Budget choices are made all the time within state agencies. If you were making the choices and an **extra** **$10 million** were available to add to existing environmental programs shown below, **how much of the $10 million would you put in each program area?** If you put money into a given area, the programs in that area can be expanded. If no money is allocated to a given area, the programs would be frozen at current levels. The total should add up to 10.

_____ **AIR QUALITY**: These programs are targeted at reducing the effects of airborne toxins from smokestacks and motor vehicles, including limited visibility and odors

_____ **CONSERVATION**: These programs are targeted at preserving scarce habitats for threatened and endangered plants and animals

_____ **DRINKING WATER:** These programs are targeted at reducing the risks associated with contamination of Kentucky's drinking water from chemical, biological, solid and hazardous wastes

_____ **FOOD SAFETY**: These programs are targeted at protecting the food we eat from chemical, microbial, and radiological contamination

_____ **GROUND AND SURFACE WATER:** These programs are targeted at reducing the effects on the quality and quantity of ground and surface water from waste discharges into streams, rivers, lakes, and soil: this includes accidental spills of hazardous material, runoff from highways and farms, and wetland loss

_____ **INDOOR ENVIRONMENTAL QUALITY:** These programs are targeted at protecting indoor air and reducing the effects of radon, lead, asbestos, tobacco smoke, and other hazards in residential, commercial, and public buildings

_____ **LAND QUALITY**: These programs are targeted at activities associated with agriculture, forestry and mining. These activities include abandoned mine lands, lost productivity of the land, contamination resulting from petroleum products, chemicals and biological products, and pesticides

_____ **WASTE**: These programs are targeted at reducing the risks associated with what we throw away: contamination of the land and soil (urban and rural) from hazardous materials, solid waste (garbage) disposal and recycling, radioactive waste, incineration and hazardous material transport

_____

10 TOTAL <<Please check to see that your total is equal to 10>>

Factors Which Affect Health and the Environment

Your Quality of Life depends on such things as your opportunity to live and work in a safe environment. Many factors affect the Quality of Life of the citizens of Kentucky. Below is a listing of ten factors which cause human health and environmental risks. This list probably does not contain all the risks affecting your Quality of Life.

Please consider that an **extra $10 million** is available for helping Kentucky citizens protect themselves from risks associated with the factors listed below. If you were making the choices, **how much of the $10 million would you use to reduce the risk posed by each situation?** The extra money you give will be in addition to any State money already used to reduce risk. If you give no extra money to reduce the risk posed by a situation, the State will continue its activities in that area at the present level. The total should add up to 10.

_____ **Air emissions from waste incinerators**

_____ **Chemicals used on crops and lawns**

_____ **Erosion and habitat loss**

_____ **Exhaust emissions from motor vehicles**

_____ **Hazardous waste disposed in landfills**

_____ **Poor drinking water quality**

_____ **Radon in homes**

_____ **Second-hand tobacco smoke**

_____ **Storm water runoff from roadways and farms**

_____ **Untreated sewage discharged into rivers and streams**

10 TOTAL << Please check to see that your total is equal to 10>>

Figure Legends for the Figures Found on the Previous Two Pages

Figure 1: Environmental State Budget Choices Page

Figure 2: Factors Which Affect Health and the Environment Budget Choices Page

[1] Two focus groups were conducted for each survey: Survey #1 (September 1995, Natural Resources and Environmental Protection Cabinet (NREPC), Division of Water employees and University of Kentucky undergraduates); Survey #2 (March 1997, NREPC Division of Water employees and University of Kentucky Center for Business and Economics Research employees).

[2] Each person who agreed to participate was sent a mail survey. Mail survey procedures generally followed Dillman's (1978) total design method, with follow-up mailings, including a replacement questionnaire. In the original mailings (Survey #1: November 13, 1995; Survey #2: May 20, 1997), each questionnaire was mailed with a cover letter, a stamped and labeled return envelope, and a one-dollar bill as appreciation for participation. Follow-up cards were sent to each of the mail survey participants (Survey #1: December 13, 1995; Survey #2: June 20, 1997) thanking them for their participation and asking them to write or call if they had not responded and needed another copy of the questionnaire. The follow-up mailing was sent to each mail survey participant who had not returned a survey (Survey #1: January 30, 1996; Survey #2: July 15, 1997). The follow-up survey was mailed with a cover letter and a stamped and labeled return envelope. In the first survey, the last questionnaire returned was received on April 19, 1996. In the second survey, the last was received on December 1, 1997.

[3] Some respondents allocated amounts which did not sum to the specified increment. Their allocated amounts were rescaled so that the sum equaled the specified increment. The share rescaled is 7.6% for the Environmental State Budget and 8.3% for the Factors which Affect Health and the Environment. A dummy variable was created to test for these responses being different from the responses which were not rescaled in one version of seemingly unrelated allocation functions reported below in Tables V and VI. The dummy variable was not statistically significant at usual levels in either of the hypothetical budget allocations.

[4] The survey instrument is available at the NREPC web site at http://water.nr.state.ky.us/survey/

[5] There is another indication that effectiveness varies inversely with the value of additional money to a program. If Effectiveness is included as an explanatory variable in a Seemingly Unrelated Regression analysis of budget choices, its effect is found to be significantly negative in explaining allocations across all categories in every budget at the 0.95 level. This negative coefficient shows that the inverse relationship between value and the measure of effectiveness, which is seen in the simple correlations reported above, exists even when the other factors in the regression are held constant.

[6] Ordinary least squares and seemingly unrelated regression analysis were both used to estimate coefficients. The difference between the standard errors for the two techniques was large enough to affect the individual and joint significance of the independent variables.