Identification and Estimation of Socioeconomic Impacts Resulting from Perceived Risks and Changing Images: An Annotated Bibliography

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FOREWORD

This bibliography is not an exhaustive compilation of all materials published on the causes and processes of risk perception or the estimation of socioeconomic impacts. For example, a recent monograph on risk by the National Research Council is not included because it focuses on specific subtopics. Nevertheless, this bibliography is intended to be a valuable resource, since it provides a representative overview of the approaches, methods, and findings in the scientific literature on risk perception and impact estimation.

The entries in the annotated bibliography are organized alphabetically by the lead author's surname. Each entry lists key words to facilitate computer searches of the articles. The entries discuss both the methods employed and the substantive results of the studies reviewed. Many of these references are being included in a computer data base that contains information about literature on the causes and processes of risk perception.

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1 INTRODUCTION

In 1982, the U.S. Congress passed the Nuclear Waste Policy Act to initiate the process of choosing a location to permanently store high-level nuclear waste from the nation's civilian reactors. The amendments to this act, passed in December 1987, designated Yucca Mountain, Nevada, as the only location to be studied as a candidate site for such a repository. The original act and its amendments had established the grant mechanism by which the state of Nevada could finance an investigation of the potential socioeconomic impacts that could result from the installation and operation of this facility. Over the past three years, the Office of Civilian Radioactive Waste Management (OCRWM or RW) in the U.S. Department of Energy (DOE) has approved grant requests by Nevada to perform this investigation.

The studies, conducted by state researchers, cover two categories of effects: standard socioeconomic effects and special effects.* Standard effects are the impacts on output, employment, infrastructure, and public finance that result from the construction and operation of a facility. Special effects are the impacts on behavior and the consequent impacts on the state's economy that result from the perceptions of risk, image changes, and other phenomena.

The identification and estimation of special effects is a relatively new area of socioeconomic impact assessment. Because it is so new, much of the literature used as a foundation for this type of analysis may be unfamiliar to policymakers. To help acquaint RW staff members with the approaches, methods, and findings that are the theoretical underpinnings to this area of analysis, Argonne National Laboratory (ANL) conducted an extensive review of relevant research. Over the past two years, ANL has been addressing issues and reviewing methods that apply to assessing the impacts of perceived risks. A summary of this endeavor is being planned.

This annotated bibliography is a concise guide to the most applicable literature. The literature is categorized under three main topics:

1. The causes and process of risk perception,

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*These are explained in Report NWPO-SE-022-89, *An Interim Report on the State of Nevada Socioeconomic Studies*, Mountain West Research, Inc., Las Vegas, Nev., June 1989.

2. The process by which perceived risk and image affect behavior, and

3. The estimation of the economic impacts from risk perception and image changes.

This report is intended to update and enhance a literature review conducted by the Human Affairs Research Center (HARC) for the Basalt Waste Isolation Project that dealt with the psychological and sociological processes underlying risk perception (Liebow et al. 1987). It provides additional information on the HARC work, covers a subsequent step in the impact-estimation process, and translates risk perception into decisions and behaviors with economic consequences. It also covers recently developed techniques for assessing the nature and magnitude of impacts caused by environmental changes, focusing on those impacts caused by changes in perceived risks.

Section 2 of this report contains an analysis of the material covered in the ANL literature review. This is followed in Sec. 3 by a working bibliography that lists all the studies and reports that were reviewed. A topical index, which categorizes the reports by subject matter, is included as Sec. 4. Finally, Sec. 5 provides abstracts of the key reports and studies.

2 SUMMARY AND LITERATURE REVIEW

The first portion of this section describes the methods used to study the risk-perception process and discusses the major findings of recent studies. The theoretical and empirical bases for linking changes in perceived risks to economic impacts are then reviewed. This review is followed by a discussion of the economic methods used for evaluating these impacts and of these methods' relevance to assessing the special effects of perceived risks.

2.1 THE RISK PERCEPTION PROCESS

Risk perception is a process that involves the perceiver, the society and social group of which he is a member, and the perceived object. In this process, the perceiver brings a set of past experiences, learned values, attitudes, expectations, and preferences to the context in which the risk is perceived. These experiences, values, etc. often cause the perceiver to focus his attention on some particular characteristics of the risk source, which necessarily diminishes the salience of other characteristics (because individuals can focus on only a limited set of characteristics at one time). Also complicating the process is the fact that different people employ a variety of cognitive procedures for gathering and processing information about the risk, its source(s), and its potential consequences or meanings. For example, one individual may adopt a fatalistic orientation toward a risk, while another may attempt to gain control by gathering more information or taking some action to reduce its adverse consequences.

The risk perceiver's society or social group is also involved in the risk perception process in a number of ways. A risk is, for the most part, socially determined, as can be seen by the very different orientations of pacifists and National Rifle Association (NRA) members toward guns. Risks are potential threats to valued assets, but what is valued is heavily influenced by the group's culture or the society to which the individual belongs. Finally, psychometric studies suggest that the degree to which a technology is perceived as a source of concern or risk is affected by characteristics of the technology itself, such as how familiar the public is with it and how great its potential adverse effects could be. The salience of characteristics of technologies or risk sources are probably related to the cultural values and assumptions of a society.

2.1.1 Social-Psychological Methods of Studying Risk Perceptions

Three major methods have been used in past studies of risk perception: the psychometric approach, surveys, and experiments. The *psychometric method* asks small samples of respondents to compare and characterize various sources according to a variety of dimensions. Factor analysis is typically used to identify the underlying factors along which technologies or other risk sources vary. The focus of psychometricians is typically on the (perceived) characteristics of those technologies or risk sources that raise or lower the levels of perceived risk.

The *survey method* entails drawing larger, generally random, and more representative samples of the population to study the variations in the public's perception of technological risks. In some cases, the sample subjects may be stratified by their distance from a potential risk source, so the relationship between spatial proximity and risk perceptions may be tested. In other instances, residents of communities, workers in relevant occupations (e.g., farmers, businessmen) (Brody 1985), or members of activist groups may be surveyed to ascertain their attitudes toward and perceptions of risk. By correlating the variations in risk perception with differences in characteristics such as gender and education, researchers attempt to identify the sources of risk perceptions.

The *experimental approach* employs relatively small groups of participants, who are typically offered varying (but often substantively equal) problems concerning risky or uncertain choices in a variety of contexts. In some instances, the choices presented to the subjects are systematically varied. In other cases, the presentation of choices or the degree and nature of the relevant information are varied. In both cases, the purpose of the experiments is to gain an understanding of the underlying decision process and the factors that affect it.

2.1.2 Findings of Major Studies

Slovic (1987) presents a valuable summary of the major findings of the psychometric method. Slovic and his collaborators (Slovic 1987; Fischoff et al. 1978) identify two major factors underlying risk perceptions:

- *Dread risk*, in which the risk source has characteristics that can include being uncontrollable, inspiring dread, and having fatal, globally catastrophic, inequitable, and involuntary consequences;

- *Unknown risk*, in which the risk source has characteristics that can include being unobservable, being new, having delayed effects, and having effects unknown to those exposed or to science.

The psychometric approach has also compared nonexperts' and experts' risk perceptions; results indicate that nonexperts employ more different types of criteria in assessing risks than do experts.

Survey-based studies of risk perception show these results:

- Differences in perceptions of the risks(s) associated with nuclear power are important in distinguishing the proponents from the opponents of nuclear energy.

- Views on technological risks have low or no correlation with socioeconomic, demographic (except for gender), or attitudinal variables.

- Both economic benefits (and costs) and health hazards are considered by individuals in determining the levels of perceived acceptability of technological risks.

- Values and beliefs about energy and related lifestyle patterns are related to both attitudes toward nuclear power and safety issues.

- Cost is a much less important consideration than long- and short-term safety in determining respondents' assessments of the acceptability of various risky technologies.

The more significant findings of experimental studies concern individual and group dynamics and various aspects of question framing. Individuals' perceptions and decisions are influenced by whether they are making a decision by themselves or deciding with others, and if the latter, by the statements and risk-related decisions of others. People tend to take risks when they attempt to avoid losses, and they tend to avoid risks when they are concerned about gains. The degree of certainty offered by various options and the "framing" of the problem and related options affect what degree of risk is deemed acceptable in various choices. The level of detail of various decision factors introduced by the problem definition affects the weight attached to such factors by individuals making risky decisions.

2.2 RELATIONSHIP BETWEEN RISK PERCEPTION AND ECONOMIC IMPACTS

This section first defines terms and provides a theoretical base. It then presents results of some studies that have directly linked changes in risk perception with changes in behavior. A definition of welfare as used in the economic literature follows, along with a discussion of the basis for impact measurement. The primary methods available to measure and project economic impacts are covered next. These include the *travel-cost method, hedonic price models, contingent market surveys,* and *regional economic models.* Travel-cost methods, hedonic price analyses, and contingent valuation techniques are emphasized. All these methods were selected because of their collective relevance to valuing the changes in recreational activities, wages, housing prices, and the overall quality of life that could result from changes in risk perception.

If a change in the environment is of sufficient magnitude, it can influence people to change their judgments about the probability of various future events. Because the introduction of a potentially hazardous facility or activity is commonly viewed as a change in the characteristics of an area, the economic methods used to study environmental goods are viewed as an appropriate way to start evaluating the welfare changes caused by risk. If a change in the probability of an outcome occurs in a person's decision-making framework, it will affect the level of satisfaction or welfare that can be achieved. Changes in perceived risks, their translation into welfare impacts, and the basis for measuring their impacts are described below.

2.2.1 Perceived Risks

Virtually every aspect of life has some probability of an ill effect associated with it. In many cases, these risks can be quantified in terms of the probability of some level of loss by engineering or statistical techniques. Risk estimates developed by these means have been employed in estimating the physical damage functions for both technological and natural hazards and have been used in establishing safety standards. When it comes to assessing the welfare or economic impacts of an environmental or technological change, however, the technical estimates of risk can be irrelevant.

Economic impacts develop from both the changes that actually occur in the environment and the changes that are perceived by an individual or group. It is the perceived risk that causes an individual to react and that guides his or her consumption decisions. For example, a person who considers the risk of carcinogenic contamination of water supplies to be high may consistently purchase bottled drinking water, even though the technical estimates indicate that such a risk is minimal.

Several studies attempt to identify the behavioral responses associated with a particular change in perceived risk. Johnson and Ziegler (1986) document the role of risk perception in the decision to evacuate during the Three Mile Island accident period, even though there was no official evacuation advisory for the general population. Many studies have been conducted to assess people's willingness to live or perform activities at various distances from facilities that present some risk of harm. The studies of Lindell and Earle (1983) and Baker et al. (1977) are typical in that they report clearly defined gradients of locational acceptability correlated with increasing distances from a noxious site. How this type of attitudinal assessment corresponds to behavior is not clear, however. Lindell and Earle, for instance, found that 20% of a group of nonengineers felt that the minimum acceptable residential distance from a nuclear power plant was greater than 300 miles. Because most nuclear plants are located within 60 miles of a standard metropolitan statistical area (SMSA), it would be interesting to know the group's actual residential choices.

The direct linkage of risk perception to behavior has been investigated in a few studies. Brookshire et al. (1985) examined the effect of information on earthquake risks on housing prices in California. Houses located in earthquake zones were found to sell for significantly less than comparable homes outside such zones. In addition, homes in earthquake zones sold for significantly less after the provision of risk information was made mandatory than they had before, a clear manifestation of the impact of altered risk perception. Yezer and Rubin (1987) undertook a cross-sectional study of 39 SMSAs in which they examined the effect of changes in the perceived risk of disaster occurrence on property values. They found that an increase in the disaster rate over that expected from prior experience led to decreases in the housing appreciation rate.

When risks are well documented, both perceived and statistically calculated risks may be of the same magnitude. When risks are unknown or controversial, the divergence between perceived risk and engineering estimates is likely to be significant. In such cases, it is the public's perception of risk (and not the actual mathematically determined possibility of risk) that is most likely to determine the level of welfare impacts.

2.2.2 Welfare Impacts

Economists define welfare as an individual's or household's overall level of utility or well being. All economic analysis assumes that people strive to maximize their welfare by choosing among the goods available to them, given the constraint of their income and the prices and characteristics of the goods. If the price and quality of the goods are constant, an increase in income allows people to reach a higher level of welfare. Conversely, if income is constant, changes in the price or quality of goods result in welfare decreases or impacts. The changing preferences of individuals are manifested through changes in the market. Nonmarket goods (goods for which there is no organized mechanism for revealing preferences) affect the welfare level through the choices made for residential location, type of occupation, and recreational activities.

People choose goods based on their expectations of the satisfaction they will receive from that choice; this is generally referred to as the maximization of expected utility (MEU). There is an element of risk in most decisions, from marriage to purchasing shoes, that things will not work out as expected. Thus, people make decisions on the basis of some implicit probability that the desired outcome will be achieved. When an external event increases the implicit risks associated with the decisions on consumption or location being made by individuals, they experience a welfare loss because they are no longer at the MEU point, given the perceived risk associated with each good.

Desvousges and Smith (1983) developed a theoretical framework for the evaluation of hazardous-waste regulation that explicitly treats perceived risks. They use "state-dependent" utility functions to deal with the possibility that people will have different preferences affecting their income allocation depending on whether they are facing irreversible consequences. A state-dependent utility function has two separate segments that represent different preferences, including the possibility of a different marginal utility of money. The relevance of each segment depends on a state of the world. For example, an individual's preferences for goods and services may depend on whether or not a spouse or child survives. This framework can be used to predict risk-reducing behaviors in the face of the uncertainty regarding irreversible consequences associated with hazardous wastes.

When people experience a welfare loss due to some environmental change, they will, at the first opportunity, reallocate their income among goods, putting them in line with the new set of perceived risks. Thus, they will be able to reach a new MEU position in the altered environmental situation. When the major option open to people as a way to reduce their potential losses is to avoid a locality considered hazardous, their decisions are likely to affect local tourism, housing, and labor markets. These effects are referred to as the primary impacts of the environmental change. They can be projected using the travel-cost method, hedonic price models, or contingent valuation methods. Secondary impacts may also be generated through the interaction of these markets with other sectors of the regional economy. Regional economic models are generally useful in estimating secondary impacts.

Welfare impacts that occur when the quality of a consumed good deteriorates in a situation where income is constant can be mitigated by increasing income. The effect of compensation in averting avoidance behavior is implied by the Gamble et al. (1978)

study of the impact of nuclear power plants on property values. They found higher growth rates in the zones closest to the plants that made large tax payments to local governments and found no evidence of depressed property values. Swartzman et al. (1985) surveyed groups in a rural community considered to be typical of those selected as hazardous-waste disposal sites. They assessed the effects of various types of transfer payments and monitoring arrangements designed to reduce perceived risks. Both strategies were effective, doubling the acceptance rates and more than doubling the compensation for a disposal facility.

2.3 ECONOMIC METHODS AND EMPIRICAL APPLICATIONS

Valuation of negative environmental conditions (disamenities) is the concern of most of the studies reviewed; several deal with hazardous wastes in particular. The findings of the studies that apply these methods to actual environmental changes, especially changes that are generally considered undesirable, are summarized for each method. Then a summary and assessment of the relevance of methods and previous studies to the siting of a high-level radioactive-waste repository are provided.

When a change in the environment has decreased an individual's state of welfare, the magnitude of the loss incurred can be quantified monetarily. Economic analysis does this by asking the question, "What amount of money would it take to get the individual back to his original level of welfare?" In other words, the value of the change is quantified by keeping the household welfare level constant.

The approach used in such an evaluation varies, depending on who holds the legal rights to the existing state. If the affected individuals have legal rights to the existing state, the correct measure of welfare loss due to an undesirable environmental change is their willingness to accept (WTA) compensation. This is the amount of money that they feel will offset the costs they will incur and that they will accept to permit the change. If they lack the rights to the status quo, the correct measure is their willingness to pay (WTP) to prevent the change. WTP may be thought of as a measure of the benefit of not being affected by the environmental change. Those who are not located at the site of the change also have preferences that are reflected in WTP or WTA measures, although individual values are generally much smaller for them than for those who are closer to the site. If the aggregate WTP for an environmental change is greater than the aggregate WTA for the impacts of the change, the benefits of the change exceed costs, and those impacted could be fully compensated.

WTP and WTA are typically estimated using hedonic and contingent valuation methods and approximated using the travel-cost method. An overview of each of these methods and some relevant empirical applications are presented below. Regional economic models are also mentioned briefly because of their role in estimating secondary impacts.

2.3.1 Travel-Cost Method

The travel-cost method involves the estimation of an ordinary demand cu. ? for an environmental amenity, in which the visits and expenditures of people using the amenity serve as proxies for quantities and prices. This procedure is generally carried out by collecting data from users of recreational sites on their point or zone of origin, travel costs, trip purposes, frequency of visits, and use of alternative sites. To avoid bias in the demand estimation, information about use of substitute sites must be included.

Some studies have treated travel costs as including both direct expenditures like gasoline and indirect expenditures like the value of travel time. Estimating the value of travel time can be a fairly complex effort in itself. Problems in apportioning travel costs to sites arise when trips are multipurpose; for example, a business trip to Los Angeles with a stopover in Las Vegas. Studies vary considerably in the comprehensiveness of their travel-cost estimates.

The type of demand curve developed when the travel-cost method is used is not the theoretically correct measure for use in measuring the impacts of welfare changes. It is, however, a close approximation to the correct measure when expenditures on the environmental good are a small fraction of total household income. Results of the method are the most reliable when the majority of the visits are for a single purpose and when visitors have come from locations a wide variety of distances away.

Only one study of travel patterns associated with the Las Vegas tourist industry was identified for this review (Malamud 1973). Further effort is needed to identify more recent travel-based analyses of the Las Vegas tourist economy and/or demand curves for organized gambling estimated for othe- locations. This information could be useful in assessing the potential sensitivity of demand (in the form of number of visitors) to changes in environmental factors.

2.3.2 Hedonic Models

Hedonic models are an important tool for valuing environmental goods (or bads) that are not themselves traded in markets. They provide a means of discovering the implicit value that people ascribe to the goods in a related market. Since the 1970s, hedonic models have been used to value the impacts on property values of a variety of disamenities. Most hedonic-model applications have been for markets with single-family residences, although there have been a few studies involving rental housing markets. A number of hedonic studies have also related environmental amenities or disamenities to the equilibrium wage rates in a number of cities.

The hedonic approach assumes that consumers perceive goods as bundles of features and that goods are available in this market with all possible combinations of these features. For housing, the relevant features are attributes such as age, number of rooms, air conditioning, fireplaces, neighborhood, and location. Regressing data for these attributes on price reveals the implicit market price of the characteristics. This implicit price may be interpreted as the representative household's willingness to pay for an additional unit of that attribute. Hedonic models have been commonly used to value

attributes such as air-pollution concentration levels, location in flood or earthquake zones, and proximity to noxious facilities.

The development of a hedonic model for the housing market assumes that households maximize an expected utility as a function of housing attributes. These include environmental amenities and disamenities and a composite of all other goods. The household utility function is assumed to be quasi-concave and weakly separable. In nontechnical terms, this feature implies, among other things, that housing costs are in a separate subcategory of the household budget. This utility maximizing (MEU) is subject to a budget constraint in which the price function of the housing attributes is nonlinear. For example, the value attached to the number of bathrooms in a house may vary with the total number of rooms.

When a hedonic model is estimated for multiple markets, an inverse demand function for the attribute, such as distance from a waste-disposal facility, can be derived. In an inverse demand function, the price of the characteristic is defined in terms of the quantity taken. Identification of the inverse demand function is complicated by the fact that exogenous shift variables, such as income, tend to be highly correlated with some housing attributes.

Empirical applications of the hedonic method, in which the model specification is inconsistent with the theoretical base, are numerous. One of the most common errors has been the inclusion of buyer characteristics in the price function along with housing characteristics. In addition, many studies have overlooked another point: Because the hedonic model is based on the household budget constraint, the dependent variable should be the housing expenditure per time period rather than the sales price. Ideally, detailed, cross-sectional time-series data for both the good and the buyers are needed for multiple markets. If households do not fully perceive the risks associated with a characteristic, the hedonic method will understate WTP for avoidance. In addition, if people value a risk change that affects areas other than those in which they live, WTP will be underestimated by the hedonic method.

Hedonic methods have been found to produce relatively consistent results across locations (Freeman 1979) in spite of the potential pitfalls in their implementation. In the studies reviewed, no effects on property prices were measured further than 20-25 miles from the hazard investigated. This result is partially an artifact of sample design, but it is consistent with a nonlinear decline in property-value impacts that occurs as the distance from a hazard increases. When the impacts of point, rather than area-wide, disamenities have been estimated, these effects have been significant within a zone of less than a five-mile radius (Baker 1986; Brookshire et al. 1985; Palm 1981; Schmalensee et al. 1975; Skaburskis 1989).

Studies of area-wide environmental conditions -- such as Yezer and Rubin's (1987), which deals with disasters, and Roback's (1982), which deals with a variety of both amenities and disamenities -- have found significant effects on price. Roback's work is especially important because it examines the relationship between land and labor markets and shows that environmental attributes have simultaneous price impacts in both markets. Generally, a disamenity will result in both lower property values and higher wages. Most efforts to estimate the economic impacts of risks or disamenities have not addressed this issue and have thus produced biased estimates of disamenity values.

Some hedonic property-value studies have not found any negative effects on prices because of a property's proximity to a noxious facility. These include a study that deals with nuclear power plants in the Northeast (Gamble et al. 1978); a post-Three Mile Island accident study (Gamble and Downing 1981); a study of Three Mile Island (Nelson 1981); and an analysis of the Fernald, Ohio, Feed Materials Production Center's releases of radioactive materials (Real Estate Counseling Group of Connecticut, Inc., and Financial Consulting Group of Ohio 1987).

In the Northeastern power plant study, Gamble et al. note that the compensation to the local communities may more than offset any negative impacts. Compensation expectations may have also affected the results in the Three Mile Island and Fernald cases. A floodplain study by MacDonald et al. (1987) provides empirical support for the hypothesis that compensation in excess of losses will increase residential prices in higher flood-risk zones. The lack of identifiable proximity impacts in these studies probably results from both the effect of compensation expectations and the fact that wage market impacts were not evaluated.

2.3.3 Contingent Valuation

Contingent valuation is the general term applied to the surveys that ask people to place monetary values on goods or on environmental changes for which no markets exist. It generally involves interviewer-administered questions about the amount that a household would be willing to pay for an improvement in environmental quality or be willing to accept for a decrease in quality. Questions can also be framed in terms of behavioral responses, such as changes in the number of visits to a site or in the choice of a housing location given changes in quality or price.

As Randall et al. (1983) note in their review of contingent valuation methods, because the situation that the respondent must evaluate is hypothetical, a precise specification of the environmental change, its organizational framework, and means of monetary transfers is required. The hypothetical nature of contingent market valuation is also the reason for its value, in that it provides a method of *ex ante* evaluation of environmental changes. Brookshire and Crocker (1981) indicate that the degree to which the resulting impact estimate corresponds to the actual impact is dependent on the accuracy of the descriptive information provided to the respondents.

In spite of the fact that there are numerous empirical applications of contingent market studies, many questions still need to be resolved about the effect of the survey's design on the results. Several types of potential bias have been identified. The most serious is probably strategic bias. This occurs when people state bids that do not reflect their personal willingness to pay but seek to influence the study's outcome. This situation is most likely to occur when the respondent expects to be personally affected by the environmental change and feels strongly about the outcome. Several studies have examined the potential for strategic bias. Brookshire and Crocker (1981) and Randall et al. (1983) concluded that there was no clear evidence of it. Seller et al. (1985) suspected its presence, and Cronin (1982), in a study designed to explicitly test for strategic bias, found significant evidence of it.

Smith and Desvousges (1986) used a contingent market survey to obtain bids for the changes in risk that are associated with a hypothetical hazardous-waste landfill. The findings were inconsistent with those of many of the other studies conducted, in that the respondents were willing to pay more to reduce the risk than they were to avoid an equivalent incremental increase in risk. The authors attribute this finding to a property rights effect -- a belief on the part of the respondents that they are entitled to the status quo and should not have to pay to limit increased risk.

Even with the difficulties inherent in the contingent market survey's design, it is rapidly gaining acceptance as a credible valuation tool on both theoretical and empirical grounds. When properly implemented, it produces theoretically correct, income-compensated demand measures in the form of WTP or WTA compensation for a change. In addition, a review of major surveys found that the results were generally consistent with theory (Randall e* al. 1983). When contingent valuation has been used in addition to another valuation method, the resulting estimates have been consistent. In a comparison of contingent and hedonic valuation methods, Brookshire et al. (1982) found that survey estimates of WTP for air-quality improvement were bounded by $0 on one end and by hedonic price estimates on the other. The comparison of the travel-cost method and contingent valuation by Seller et al. (1985) was somewhat inconclusive.

2.3.4 Regional Economic Modeling

An environmental change that results in changing risk perception may result in altered consumption and investment behavior. These behavior changes can have primary impacts in markets such as those for labor, land, or tourist services. Because the markets interact, primary impacts can generate secondary impacts on related markets and on other sectors of the economy. The total of both primary and secondary impacts can be estimated by a regional economic model that embodies a detailed specification of the relevant sectors of the economy. The major problem likely to be found in developing a total-impact estimate through this method lies in accurately quantifying those behavioral changes likely to be associated with a change in a perceived risk.

2.3.5 Summary of Economic Methods

There is a strong theoretical basis that links perceived risks and economic behavior, and there a solid core of empirical studies that have measured the welfare impacts associated with specific changes in environmental risks. However, there are no measures available of the change in risk perception that would accompany the siting of a high-level radioactive-waste repository in a specific locality. Therefore, an *ex ante* evaluation is needed, for which there is no fully comparable historical experience.

Travel-cost studies could be used to ascertain the current demand for recreational, gambling, and convention activities in the region of the proposed site. If substitute recreational sites were identified and properly included in the demand estimation, elasticity estimates could be derived that would permit the evaluation of the degree to which people might tend to choose substitute sites. This approach could be

supplemented by attitudinal measures of perceived risk and current behavioral strategies for coping with risks among the population who come to the region frequently.

Hedonic methods can be used to measure wage and property-price responses to locational or situational risk perception. Most studies using hedonic methods have shown significant negative impacts from environmental disamenities, unless households are receiving adequate compensation for their exposure. None of the empirical studies, to date, has demonstrated any effects on prices when sites are more than 20-25 miles from a hazardous site or facility. Although findings of hedonic studies could be used to infer the impacts for the region immediately adjacent to a waste-disposal facility, there is no basis in previous studies for projecting impacts for more distant areas.

Because contingent valuation methods involve hypothetical markets, they are ideally suited for the evaluation of those situations that lack historical behavioral measures. The hypothetical nature of contingent valuation, however, makes it extremely sensitive to the informational content and structure of the survey instrument. In addition, contingent market survey measures are needed to explicitly ascertain whether a significant number of respondents are answering strategically rather than giving their true bid for the environmental change. Well-designed surveys have been shown to produce value estimates consistent with market-based methods.

Contingent market surveys are well suited to the development of comprehensive, aggregate estimates of WTA on the part of those located near a waste repository site and WTP on the part of those who prefer to have a repository located elsewhere. Such surveys could be used to identify the locational incidence and magnitude of potential impacts and to ascertain the amount of compensation required to avoid secondary impacts on the regional economy.

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KEY WORDS

Risk preference. Gambles. Presentation mode.

ABSTRACT

This experimental study examines Coombs and Avrunin's theory of conflict in individual
decision making. It examines the subjects' choices as they relate to two presentation
modes (final outcome presentation and stake presentation). The theory predicts that the
players will have single-peaked preferences over efficient stake sets. If the gambles are
transformed into a final-outcome presentation, they will not form efficient sets, and the
theory would not predict single-peaked preferences in this presentation mode. This
theory is the first mathematical theory of preferences that implies that changes in the
aspects of presentation can make a big difference in preferences.

Thirty volunteer university students were used in this study. They compared gambles
composed in the efficient stake-presentation mode with the same gambles in the
nonefficient final-outcome presentation mode. The results show that nearly all the
students had single-peaked preference orders for the gambles in the efficient stake-
presentation mode. Approximately half the subjects had single-peaked orders when the
gambles were presented in terms of final outcomes. Thus, the results support Coombs
and Avrunin's theory.

Author(s)	Baker, E.J., D.J. Moss, S.G. West, and J.K. Weyant
Date	1977
Reference	*Impact of Offshore Nuclear Generating Stations on Recreational Behavior at Adjacent Coastal Sites* Nuclear Regulatory Commission Report NUREG-0394, prepared by Florida Resources and Environmental Analysis Center, Florida State University, Tallahassee, Fla.

KEY WORDS

Risk perception. Recreation. Nuclear plants.

ABSTRACT

The goal of this study was to assess the potential impact of an offshore nuclear plant on the recreational use of nearby beaches. From a review of the literature on the perception of and adjustment to risk, the authors had concluded that "most behavioral aspects of adjustment to hazards apply across hazards."

Beachgoers in Florida, New Jersey, and Massachusetts (Cape Cod) were interviewed about their willingness to return to a beach if a nuclear plant were to be located at various distances from that beach. Most of the respondents were repeat visitors to the same beach area every year. They indicated that proximity to a nuclear plant would be a less important factor than other beach characteristics in their choice of a beach. The percentage expressing an unwillingness to return to a beach declined exponentially with its increasing distance from the hypothetical plant.

An attempt to assess the actual effects of existing coastal nuclear plants on beach use was limited by a lack of data. In a survey of beach users, less than 5% indicated a feeling of increased reluctance to use the beach because of the presence of an adjacent and, in some cases, visible plant.

KEY WORDS

Risk perception. Property values. Hedonic. Hazardous facilities.

ABSTRACT

The Kanawha Valley is a major chemical-manufacturing center that encompasses the Charleston, West Virginia, standard metropolitan statistical area, an area where there has been a long history of accidents, leaks, and evacuations associated with the chemical plants. One of the author's hypotheses is that this history has made people well aware of risks, and this awareness has been capitalized into property values. In addition, Union Carbide's Kanawha Valley plant is similar in design to the Bhopal, India, plant, where a devastating accident occurred in December 1984. The author also analyzes the possibility that information about that leak has further depressed property values.

Multiple-listing service sales and property-description data for January 1984 through July 1985 are used (N = 950). A limited number of housing-characteristic variables are used in the analysis, along with data that measure distance to a chemical plant, air pollutant levels, and the visibility of industrial structures. Median family income is also included in the hedonic regression equations. To examine the effect of the Bhopal accident, a dummy is employed for post-January 1, 1985, sales.

Both log-log and semilog functional forms are estimated. The finding is that, *ceteris paribus*, price increases with distance from a chemical plant. The price effect was most pronounced when distance to a plant was treated as a dummy variable for a housing location either in or out of a three-mile-radius zone around a chemical plant. The implicit price of a location in an area with a higher level of air pollution was also found to be negative. Information on the Bhopal accident does not appear to have significantly depressed prices.

KEY WORDS

Base-rate fallacy. Bayesian inference. Decision making.

ABSTRACT

This study attempts to provide a dynamic account for the base-rate fallacy. The author feels that subjects ignore base-rate information because they feel it is irrelevant to the judgments they are making. Thus, he proposes that people may be ordering information by its perceived degree of relevance to the problem they are judging. Specific information normally supercedes more general information. Specificity may be brought on by:

- Giving information about some subset of the population or

- Implying causality. (Causality provides a means of obtaining specific characteristics from population characteristics.)

In this study, problem prototypes that manifested the base-rate fallacy were presented to 1,500 subjects who were predominantly Hebrew University applicants but who also included a small number of undergraduate volunteers. They answered these questions as part of their university entrance exams.

This study presents an explanation for the base-rate fallacy that is built on the notion of relevance, in which people integrate two items of information only if they both seem equally relevant. Otherwise, high-relevance information renders low-relevance information extraneous. One item of information is more relevant to a judged case than another if it somehow pertains to it more specifically. This relevance may be achieved by two means:

1. The dominating information may refer to a set smaller than the overall population or

2. The dominating information may be causally linked to the judged outcome.

The author's approach to enhancing relevance was to manipulate the contents of the problem faced by the subjects, which is called internal relevance. An alternative process is to make people aware of the relevance of some item externally; e.g., by letting the same subject make judgments on a series of problems that differ only in the value of some item of information. This strategy increases the salience of the information, making it more externally relevant.

The problems used in this study achieved these results:

- Established the robustness of the base-rate fallacy by replicating the results over many variations;

- Provided counter examples to the accuracy or generality of some possible accounts of the fallacy; and

- Directly confirmed some implications of the base-rate fallacy, most significantly that base rates can be made to influence subjective probability statements.

KEY WORDS

Real world cues. Television news. Public concern.

ABSTRACT

This paper examines the interrelationships between real-world cues, television news coverage, and public concern for the issues of energy, inflation, and unemployment. Two areas are examined:

1. Public concern about television news coverage and prevailing conditions or events and

2. The reciprocal relationships between the impact of television news on public concern and the impact of public concern on levels of news coverage.

Three different sources of data were used: Gallup, Yankelovich, and University of Michigan surveys. Each of these surveys asked a similar, open-ended question on the importance of national problems. Combining the three sets of polls, a measure of the problem's importance was obtained for every two-month period between 1974 and 1980. The television news coverage indicators were the total number of stories, as well as the number of lead stories, aired on the weekday CBS national news between 1974 and 1980. In addition, indicators of current conditions were collected within each issue area. These indicators reflected the economic health of the nation. Presidential addresses on each issue were also included to supplement indicators of current conditions.

The results show that television news coverage is at least partially determined by real-world conditions and events in all three issue areas. For unemployment, nearly two-thirds of the variance in news coverage is explained by economic conditions. News coverage is largely unaffected by public opinion, supporting the assumption that agenda setting is a recursive process. The President is a major contributor to the network agenda. Presidential activity appeared to cause an increase in news coverage of an issue.

The investigation results also show that television news sets the public agenda in two of the three issue areas -- inflation and energy. This effect appears to be unidirectional, meaning that news coverage raises public concern, but public concern does not, for the most part, alter the level of coverage. The results also suggest that news stories are not equally effective in shaping the public agenda: The lead story in the newscast has the strongest effect on viewers' perceptions of issue importance.

Author(s)	Brody, J.
Date	1989
Reference	*Panhandle Residents' View of High-Level Nuclear Waste Storage*
	Texas Dept. of Agriculture, Austin, Texas

KEY WORDS

Repository. Survey. Nuclear waste.

ABSTRACT

The purpose of this research is to:

1. Provide an additional avenue for public participation in the site-selection process,

2. Document local expectations about the socioeconomic effects of the repository, and

3. Establish baseline data for monitoring future socioeconomic change throughout the course of the nuclear waste repository program.

The Texas Department of Agriculture has documented views about the potential socioeconomic effects of a high-level radioactive nuclear-waste repository in Texas. Telephone surveys were conducted in the rural areas of Deaf Smith, Swisher, Crosby, Moore, and two other Panhandle counties. A special survey of farm operators in Deaf Smith and Swisher counties was also conducted.

Residents in Deaf Smith and Swisher counties were asked for their general attitudes toward the proposed nuclear-waste repository and their expectations about the effects of the repository on the economy, health, and community life in their counties. In Cosby and Moore counties, the overall attitudes toward the repository, socioeconomic and health expectations, and perceived stress were assessed.

Overall, the results show that the residents, regardless of their distance from the proposed sites, are opposed to a high-level nuclear-waste repository in Texas. They believe that such a repository could lead to water, air, and soil pollution as well as health problems for the residents. They also expect the repository to have negative effects on the economy and on property values in general. A slim majority feel there will be an

increase in the number of jobs, but they do not expect an increase in industrial or commercial development. Most farmers expect their land values to decline if their county is chosen for the repository. A majority also feel that the repository would threaten irrigation water and cause a decline in mineral leases and the sale of farm products. There also may be an increase in insurance rates and greater difficulty in obtaining credit.

KEY WORDS

Contingent valuation. Methodology.

ABSTRACT

Contingent valuation is an *ex ante* method of valuing the expected utility of alternatives. It measures choices under a given set of informational conditions at a certain point in time. If actual siting conditions, pollution levels, etc. differ from those specified in the survey, the actual utility will not be the same as expected utility. Contingent market surveys have an advantage over other methods because they can be used to measure behavioral responses to changes in property rights. Questions can be framed so that, for example, the respondent either has, or lacks, the right to a waste-free environment.

To estimate the value of an environmental good, its quantity, quality, location, and timing must be described. In addition, the respondent must be given information regarding the operating rules of the market. Bids may be made for either price or quantity changes for the nonmarketed good.

Empirical testing of the method has shown that the respondents' bids can be affected by information about others' choices. This supports the common concern about the effects of strategic bias. However, the estimated values of a decrease in air pollution levels from a contingent market survey and from a hedonic property value analysis were of similar magnitude.

One of the areas in which contingent valuation techniques are useful is in reducing the dimensions to be dealt with in analyzing the response to environmental change. This technique can simplify the estimation procedure through strategies such as controlling variable increments or controlling confounding variables.

KEY WORDS

Hedonic. Methodology. Disamenities. Contingent valuation. Air quality.

ABSTRACT

Hedonic methods have produced internally consistent results in the studies that value environmental disamenities. In situations in which hedonic estimation is not feasible, a contingent market survey may be the best technique available. Because of concerns about bias in survey results, the authors seek to validate the survey method relative to hedonic-price estimation.

Two consistent samples were selected from 12 census tracts in the Los Angeles metropolitan area to provide data for comparable survey and hedonic estimates of air pollution impacts. The survey sample, based on interviews conducted in March 1978, consisted of 290 households in which the people were asked about their willingness to pay for a change in air quality, assuming that they continue living in the same location. Three air-quality categories -- poor, fair, and good -- were defined. The respondents were not asked if they were willing to accept worse conditions because evidence contained in the literature showed that responses to such questions were biased. Data for the hedonic analysis were collected for 634 home sales occurring between January 1977 and March 1978. These analyses were employed in estimating a hedonic rent gradient using a log-linear form.

A comparison of the results from the two approaches indicated that average survey bids for air-quality improvement to a higher category was greater than $0 and less than the implicit price of a change in home location to a zone with higher air quality. The findings show that the survey results are bounded by zero, and the hedonic estimate was consistent with the theoretical framework developed by the authors.

KEY WORDS

Expected utility. Risk perception. Property values. Hedonic. Earthquake.

ABSTRACT

This study was conducted on the basis of the premise that people maximize a utility function in which safety is explicitly considered. They may purchase insurance as a means of limiting losses, or self-insure by choosing less risky goods from a set of alternatives, such as houses in locations that are less earthquake prone. The question of whether earthquake risks are perceived and affect the housing market is addressed in this research. An estimate is then developed to determine the premium people must pay to obtain housing that is not situated in the most earthquake-prone zones.

In California, there is a legal requirement stating that prospective buyers must be notified if the property they are interested in lies within a "special study zone," or an area within a specified distance from an identified fault. Hedonic housing price equations were estimated by measuring earthquake risk using the dichotomous variable for an in/out-zone location. Data for 1978 from a computerized appraisal service were used to identify housing characteristics and locations. The sample size in special studies zones was 292 homes for Los Angeles and 745 homes for San Francisco, and it was 5,000 homes for each metropolitan area not located in a high-risk zone.

A variety of functional forms were evaluated with a semilog form having the best fit (R^2). Regardless of the model form, the dummy for zone location was significant at the 1% level.

The model was also estimated using data from 1972, which was before the passage of the law requiring the earthquake-zone information provision. In that analysis, the zone-location dummy was insignificant at even the 10% level. Thus, the authors conclude that the information on relative risks, although it had not previously affected prices, was incorporated in the market once it became readily available.

For comparative purposes, the value of living outside earthquake zones was estimated using an expected-utility model. The results are quite consistent with the hedonic price estimates.

Author(s)	Catton, W.
Date	1989
Reference	*Cargoism and Technology and the Relationship of These Concepts to Important Issues such as Toxic Waste Disposal Siting* Psychosocial Effects of Hazardous Toxic Waste Disposal on Communities, D. Peck, ed., C.C. Thomas, Springfield, Ill., pp. 99-117

KEY WORDS

Hazardous waste. Technology. Environment.

ABSTRACT

This article describes the potential hazards that may occur as the amount of hazardous material increases with increasing population. The author describes a trip taken to Times Beach, a small Missouri town. The spraying of dioxin here forced the Environmental Protection Agency (EPA) to buy out the entire community and close the town to the public. The author states that "the demise of this innocent, working-class town epitomizes the dread made endemic by our era."

Today there is much confusion about the limits of human progress and its effects. One reason for this is the failure to recognize that the environment serves three different purposes for all living creatures. It serves as a place in which to carry on activities, a place from which to make withdrawals of material goods, and a place into which the ecological end-products, known as waste, can be put. The author points out that humans are not exempt from the ecological constraints that apply to all other living things. Thus, the more "from which" withdrawals humans make because of advanced technology, the more "into which" waste must follow.

The author concludes that the disposal of hazardous waste has become a problem no longer solvable by site segregation. Mistakes may worsen the human condition, but there is no way to escape this modern predicament, short of reducing the population and foregoing progress. In the end, people must understand what can be changed and what cannot.

Author(s)	Cohen, M., J.Y. Jaffray, and T. Said
Date	1985
Reference	*Individual Behavior under Risk and under Uncertainty: An Experimental Study*
	Theory and Decision, 18:203-288

KEY WORDS

Risk. Uncertainty. Decision making.

ABSTRACT

Two issues are examined in this article:

1. Do people in the situation of choice under risk take probabilities into account precisely; do they take them into account only roughly; or do they merely ignore them?

2. In what respect does peoples' behavior under risk or uncertainty in the domain of gains differ from their behavior in the domain of losses? Are there simply differences in attitudes or more fundamental differences? Is behavior in one domain related at all to behavior in the other domain?

The 134 undergraduate students who participated in this study had some background in probability theory but no background in decision theory.

The experimental results showed that:

1. The attitude of a decision maker, when faced with negative prospects under either risk or uncertainty, is very different from his attitude when faced with positive prospects. There was no trace of any reflection effect, and no correlation between attitudes on the gain or loss side.

2. In the case of positive possibilities, the precise probabilities are considered by almost all decision makers. Only categories of belief (unlikely to occur, fairly likely to occur, etc.) seem to be distinguished by most decision makers in the case of negative prospects. These categories appear to be extremely coarse for many of the participants.

KEY WORDS

Decision analysis. Risk. Cost-benefit analysis. Health and safety.

ABSTRACT

This paper reviews the concept of decision analysis and its use in risk-management decision making. Decision analysis has eight steps:

1. Identifying all relevant decision alternatives and structuring decision problems;

2. Defining decision objectives;

3. Defining performance measures or variables for quantifying decision objectives;

4. Identifying critical, uncertain variables;

5. Assessing probabilities;

6. Specifying value judgments, preferences, and tradeoffs;

7. Evaluating alternative actions or policies; and

8. Conducting sensitivity analyses and value of information analyses.

Decision analysis is distinguished by several features. Many of them differ from the characteristics of cost-benefit analysis. For example, the primary objective of cost-benefit analysis is to decide which alternative course of action will maximize net benefits. The primary objective of decision analysis is to determine which alternative course of action will maximize the expected value of the utility. Also, cost-benefit analysts give little explicit attention to uncertainties; decision analysts treat uncertainties comprehensively and explicitly.

Decision analysis has several limitations. Some of the drawbacks include these:

- Assuming that all significant decision alternatives and consequences can be enumerated in advance,

- Difficulties in handling disagreements among experts in assessing probabilities, and

- Failing to recognize or control for the possibility that decision makers may be inconsistent in their responses.

Decision analysis also has several strengths, by providing a means for:

1. Handling highly complex decisions that are characterized by multiple objectives and high degrees of uncertainty;

2. Systematically, logically, explicitly, and comprehensively considering and integrating all relevant factors and data relevant to a decision; and

3. Evaluating decision alternatives in a consistent and comprehensive manner.

Author(s)	Cronin, F.J.
Date	1982
Reference	*Valuing Nonmarket Goods through Contingent Markets*
	Pacific Northwest Laboratory Report PNL-4255, Richland, Wash., prepared for the U.S. Environmental Protection Agency

KEY WORDS

Contingent valuation. Methodology. Water quality. Bias.

ABSTRACT

The author conducted a contingent market survey of households in the metropolitan Washington, D.C., area to ascertain their willingness to pay for improved Potomac River water quality. The sample size was larger than most, being 1,579 households. Bids for quality change that were zero or greater than 5% of the respondent's income were excluded from the analysis on the grounds that they represented "protest" bids.

Because various types of bias have been a concern in the application of contingent-valuation methods, this survey was designed to test explicitly for strategic information and interviewer bias. This was accomplished in the first two cases by partitioning the sample and using survey instruments in which the question structure varied.

To test for strategic bias, groups within the sample were provided with different incentive structures, and the data were tested for between-group differences in the mean bids. Those who were informed that local taxes would pay for water quality improvement had a significantly lower mean bid than those who were informed that the federal government would pay.

A similar procedure was followed to test for information bias, and results were also significant. In addition, differences between interviewers proved to be significant.

KEY WORDS

Consumer decisions. Risk reduction. Seat belts. Automobiles

ABSTRACT

This paper examines consumer decisions with respect to risk reduction and ascertains the risk response by risk seekers and risk avoiders. The article focuses on consumer risk response with respect to automobiles and the use of seat belts as a risk-reduction strategy.

Risk response is determined by three major factors:

1.   The consumer's attitude toward risk,

2.   The change in expected loss from the adoption of the risk reduction strategy, and

3.   The costs of the strategy.

The change in subjective loss is based on the consumer's subjective probability of an accident and the perceived economic consequences of the accident.

A utility analysis of a decision involving risk indicated that risk-averse consumers would assume a risk-reduction strategy, because the change in expected loss from the strategy was equal to or greater than the costs of the strategy. When this hypothesis was tested, the results demonstrated that the drivers of all size classes of automobiles would gain from using seat belts in the case of low user costs. Drivers of the two smaller-size classes also would gain in the case of high user costs. Another finding was the divergence between private and societal costs of automobile accidents. Individual drivers do not shoulder all accident costs, which means that they do not gain all the benefits. Thus, there may be a market failure that may result in a less than optimal level of protection for society as a whole.

KEY WORDS

ABSTRACT

This paper investigates the role of risk-benefit analysis in assessing the risks associated with using a variety of consumer products. Automobiles, apparel, household appliances, and recreational activities were chosen for the inquiry. The results of this study provide policymakers with a risk-assessment method. This type of assessment may be used in three ways:

1. To determine the level of risk to which consumers are exposed,

2. To rank consumption activities with respect to risk, and

3. To determine consumption activities that should be addressed by risk-reduction strategies.

The results show a considerable difference between the various risk-benefit ratios, which are based on the value of foregone production. The ratios are highest for subcompact and compact automobiles; the next highest ratio is for bicycles; the other ratios, in order of highest to lowest, are for intermediate-sized automobiles, standard-sized automobiles, nightwear, skiing, daywear, and ranges.

Certain aspects of this study are of particular interest. First, the proposed method of assessing risk appears to be feasible. Second, risk-benefit analysis provides valuable insights about the level of risk to which consumers are exposed. Last, risk-benefit analysis is only part of the risk-reduction process. Once the need for intervention is perceived, the selection of an appropriate strategy requires additional analysis, in which the marginal costs of risk reduction are compared with its marginal benefits.

Author(s)	Desvousges, W.H., and V.K. Smith
Date	1983
Reference	*An Overview: The Benefits of Hazardous Waste Management Regulations*
	U.S. Environmental Protection Agency, Research Triangle Park, N.C.

KEY WORDS

Hazardous waste. Risk perception. Expected utility. Hedonic. Contingent valuation. Methodology.

ABSTRACT

The authors provide a detailed examination of the theoretical basis and methodological approaches to evaluate the benefits of reducing risks associated with hazardous-waste materials. Both the issues of technical uncertainty related to risks and variations in an individual's perception of risk are explicitly addressed in a theoretical context.

The expected utility theory is reviewed and augmented to deal with the maximization of a utility in a market with contingent claims. A contingent claim consists of two or more probabilistically weighted outcomes that depend on the occurrence of a "state of the world" (i.e., probabilities of illness or health, given toxic exposure or lack of it.) This framework can be used to predict risk-reducing behavior under conditions of uncertainty.

The authors develop state-dependent utility functions, in which the individual's preferences and marginal utility of income vary with a state of the world. This reflect a situation in which something essential to a person, such as a spouse's health or a child's death, is affected. The resulting theoretical framework is suited to the evaluation of environmental changes with uncertain, and possibly irreversible, consequences. Willingness to pay (WTP) and willingness to accept (WTA) measures are developed for state-dependent utility functions.

Three methods of valuing environmental change are evaluated: damage functions, hedonic models, and contingent market surveys.

Damage functions are found to be inadequate for valuing the impacts of hazardous-waste policies because of both theoretical and methodological considerations. They lead to the establishment of values for a specified physical effect and not the total value to the individual. It would be extremely difficult to specify the physical risk/consequence relationships.

Hedonic models provide the basis for estimating the implicit prices of various property characteristics, such as the distance from a noxious facility. These models are based on the theory of expected utility maximization, which is subject to budget constraint, and they are nonlinear with regard to property attributes. They are estimated in a two-step procedure. The price is estimated as a function of characteristics, then the derivative of the price function with respect to the attribute of interest is taken. This procedure results in an estimate of one point on the demand function for that attribute. The inverse demand function (WTP) can be estimated from hedonic price information, possibly by estimating the same model for several markets if a common market structure can be assumed. Estimation by a hedonic model of a marginal WTP for a reduction in risk is based on the assumption that all individuals have identical preferences as well as identical perceptions of probable losses. The authors note the problem of determining the relationship of a site attribute, such as a distance interval, to a hazardous-waste exposure risk. An empirical application of the hedonic model to a site in New Jersey contaminated by hazardous waste is reviewed.

Contingent market survey is the third valuation technique examined. Five survey formats are reviewed:

1. Direct question,

2. Bidding game,

3. Payment card,

4. Bidding game with a budget constraint, and

5. Ranked choice.

Each of these has pros and cons in terms of possible introduction of bias to the estimates, and there are unresolved questions about the potential extent of bias. For instance, one hazardous-waste-related study reviewed by the authors found that explicit inclusion of the respondent's budget constraint greatly reduced bids for risk reduction. On the positive side, the authors point out that contingent valuation provides a fuller measure of the value of an environmental change than does the hedonic method, which only indicates the portion of total value that is reflected in property prices. Contingent valuation methods have the greatest potential for theoretically sound estimates of WTP for risk reduction.

KEY WORDS

Risk communication.   Risk regulation.   Multiattribute utility.   Public values.   Value conflicts.

ABSTRACT

This article describes a tool used for issue clarification and option invention that may help improve the quality of debates involving risk regulation.   During risk-regulation debates, risk managers want to discuss the nature and extent of a hazard, while many stakeholder groups (members of the public involved in the risk-regulation debates) want to discuss the nature of their concerns.   The communication process during these debates should be a two-way process.   However, the two groups (risk managers and stakeholders) often end up lobbying for media attention rather than looking for compromises.

The authors propose two means to improve the communication process.   One is to find a better way to help risk managers communicate about the risks, options, and their rationales for decisions made.   The second method (and the focus of this paper) is to help stakeholder groups articulate their values and concerns in a way that is useful to both the regulator and other stakeholders.

The technique suggested to help stakeholders is the multiattribute utility technique (MAUT).   This procedure can be conceptualized as a six-step process:

1. Identifying stakeholder groups,

2. Identifying a set of decision options,

3. Structuring stakeholders' values,

4. Building a common value structure,

5. Building quantitative value models for each stakeholder group, and

6. Using the value models for communication, conflict diagnosis, or conflict resolution.

The authors conclude by discussing the three uses of MAUT in regulatory decision making. The three uses are as follows:

1. Helping regulators to structure criteria and to assess tradeoffs while evaluating regulatory options,

2. Aiding regulators in diagnosing the nature and extent of a value controversy about a regulatory decision, and

3. Assisting regulators in the resolution of such conflicts.

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KEY WORDS

Hazardous waste. Siting. Risk perception. Risk management.

ABSTRACT

This study was designed to ascertain the nature of the risk perception underlying the opposition to siting a hazardous-waste facility. It uses a gaming simulation based on issues actually raised during siting disputes. Two groups of 18 people from two communities participated in the process. These groups included public officials, businessmen, environmentalists, and land owners.

Descriptions were developed for three firms that proposed to site a facility in the community. In all cases, the basic plant design was the same and would meet regulatory requirements. However, the firms differed in their basic approaches to risk management by emphasizing one of the following methods:

1. Risk prediction and technological prevention,

2. Monitoring systems and mitigation planning, or

3. Community oversight and corporate accountability.

When asked which approach would be most acceptable, 15% chose the first option, 37% chose the second, and 48% chose the third. The author concludes that the public prefers strategies of risk detection and mitigation rather than strategies of prediction and prevention. In general, social control is preferred to technological control.

Author(s)	Fesenmaier, D.R.
Date	Fall 1985
Reference	*Modeling Variation in Destination Patronage for Outdoor Recreation Activity*
	J. of Travel Research, 23(2):17-23, fall

KEY WORDS

Recreation. Destination choice. Methodology.

ABSTRACT

The diversification of households' recreation patronage, and the various aspects that affect the decision of where to recreate, are examined in this study. Its purpose is to evaluate the assumption that the failure to acknowledge these diversification strategies can lead to inaccurate recreation-behavior models. These models are universally developed under the same assumptions that:

1. Maximization of total utility from the activity is sought by the decision maker,

2. Alternative destinations are judged by the decision maker using adequate knowledge,

3. The selection of alternative destinations is independent,

4. Separability of attributes exists, and

5. The same destination will always be chosen when the decision maker is faced with the same opportunities.

The data used in this study were gathered during a 1981 telephone survey conducted by the Oklahoma Department of Tourism, using a random-digit dialing technique. There were 1,801 completed surveys. The respondents were asked a series of questions relating to 11 specific outdoor recreation activities and were then asked questions concerning the household. Another survey was conducted (tabulating 38 characteristics) that included all outdoor recreation facilities in the state. In addition to these data, seven new variables that relate to travel zones and distance were added.

This study indicates that behavioral differences exist between households that consistently visit one recreation facility and households that visit a number of facilities. It also shows that the failure to include second and third choices in demand studies based on destination-specific information leads to the underestimation of participation levels. In addition, the exclusion of choices also leads to substantially inaccurate recreation-behavior models, thus causing further problems in policy development. Another result in the regression analysis shows that certain characteristics of the household and the facility visited are representative predictors of household fishing activity. Last and most important, the study results indicate that these models should be restructured to account for the conscious choice of households to diversify recreation activity.

KEY WORDS

Public perceptions. Racial opinions. Looking glass perception.

ABSTRACT

The focus of this paper is the perception of the opinions of others. The assumption tested is that the attitudes assessed in surveys are often not manifested in later behavior because individuals believe that significant others will be disturbed. The data were drawn from surveys on the perception of racial opinions conducted by the Detroit Area Study in 1956, 1969, and 1971.

The dominant pattern found was the "looking glass perception," which is the belief that others think the same as oneself. Thus, when there is a lack of strong counter forces, many people feel that most other people in the world agree with their opinions on public issues. One such example was found in the data. In 1971, less than 3% of the population completely disapproved of black and white children playing together, yet more than 50% of this minority believed their views were shared by most others.

Two trends were also found.

1. A limited amount of evidence indicates that under certain circumstances, the actual distribution of opinion is vaguely perceived. However, the mechanism is probably not any direct awareness of broad public trends.

2. On racial and civil liberty issues, liberals show less tendency to perceive others as agreeing with them than does the population as a whole. Instead, they perceive others as being more conservative than they actually are.

Explanations for these findings follow here. Public perception may lag behind reality when rapid changes occur in social attitudes. Respondents may recognize that American ideals are incompatible with racial prejudice and try to place themselves in a better light by characterizing others as prejudiced. Thus, racial conservatives perceive themselves as no worse than others, and racial liberals present themselves as closer to the ideal than the average.

KEY WORDS

Hazardous waste. Case studies.

ABSTRACT

This paper summarizes the general findings about community responses to exposure to hazardous wastes. Twenty-five waste-contamination case studies were analyzed using systematic case-review methodology. The systematic review involves three steps:

1. Selection of a set of comparable cases for review,

2. Development of an information questionnaire and the scoring of one questionnaire for each case based on a review of available case materials, and

3. Statistical analysis of the results.

Toxic-waste contamination episodes can be divided into five phases:

1. *Predisposal.* This phase was typified by inadequate and minimal regulatory systems governing the disposal and storage of toxic wastes.

2. *Disposal.* In this phase, polluters did not use sound disposal practices, although many of them acted legally and used state-of-the-art disposal methods.

3. *Discovery.* In this phase, the victims were usually confused and ignorant of the danger they faced. They were usually aware that something was wrong before the authorities were, but they did not understand the danger.

4. *Reaction.* This phase found the victims complaining and demanding some action from the authorities, who usually acted slowly and inadequately. Citizen activism is generally a response to government inactivity or failure.

5. *Resolution/outcome.* This phase usually involved the removal of danger but little actual removal of the toxins.

Several cases, such as Love Canal and the Stringfellow Quarry case, are described and are shown to have followed the steps cited above. The author concludes by classifying community responses to toxic-waste-contamination episodes as local, social movements. Ten resources are needed to mobilize a social movement. Three tangible ones are money, space, and publicity. Three resources categorized as specialized are expertise, access to networks, and access to decision makers. The remaining four resources are status in the polity, status among the mobilized constituencies of the toxic-waste victims, time, and commitment. These resources are what is minimally needed to successfully mobilize community response.

KEY WORDS

Judgment. Decision making.

ABSTRACT

This article reviews recent psychological research in judgment and decision making and discusses the feasibility and advisability of various approaches to incorporate the human aspect into societal decision making. Two concerns are also discussed. One is how to ensure that the public gives its informed consent for decisions made by experts and officials in its behalf. The other is how to reduce the judgmental problems encountered by technical experts when they run out of relevant data.

Research suggests that judgments involving risk-benefit decisions are subject to systematic biases. Such judgmental problems can be handled in a variety of ways when designing decision-making systems. The author discusses the division of labor as a way to leave people in the system without ignoring their limitations. He also raises the possibility of training people to correct their judgments.

Author(s)   Fischoff, B.

Date   1985

Reference   *Managing Risk Perceptions*

                 Issues in Sciences and Technology, pp. 83-96, fall

KEY WORDS

Risk perception. Psychology. Bias.

ABSTRACT

In this summary of the major conclusions of risk-perception studies, the psychology of judgment and decision making is discussed. The conclusions suggest that there are some basic limitations to many commonly accepted techniques for managing the public perception of risk. One aspect is the tendency for people to simplify the issues. These simplifications may help people to cope, but they may also obscure many facts. Another is the inclination for people to maintain faith in their current belief until they are confronted with overwhelming evidence to the contrary.

There are biases in risk perception. People are unable to easily detect omissions in the information they receive. Thus, people's risk perception can be controlled by the selective presentation of data about hazards. One obstacle in determining what people know about specific risks is the disagreement about the definition of risk. People also have difficulty finding inconsistencies in a risk dispute and in evaluating expert opinions.

The author presents some common, simple strategies for dealing with risk controversies:

- Give the public the facts.

- Sell the public the facts. Here the assumption is that the public needs to be persuaded, not educated.

- Give the public more of what it has gotten in the past. In other words, the public will accept in the future the kinds of risk it has accepted in the past.

- Give the public clear-cut, noncontroversial statements of regulatory philosophy.

- Let the marketplace decide. Allow the people to decide independently what risks they are willing to accept.

- Let the responsible risk manager do the explaining. The public needs to deal with risk issues by hearing a coherent story from a credible source.

- Let local communities resolve their own risk-management problems.

The author feels each of these strategies has its flaws and its merits.

By using these observations about risk perception, a better procedure for dealing with risk controversies can be designed. The risk manager must begin by creating a detailed description of the decision-making problems faced by each party involved in the controversy. From a psychological perspective, a risk manager must engage in an intensive effort to describe the different decisions facing the various parties, identify the public's information needs, use the best available techniques to address them, create a comprehensive protocol for organizing and reporting the manager's own decision-making process, and listen to what the public is trying to say.

KEY WORDS

Risk. Consequence.

ABSTRACT

The definition of risk is discussed in this article. Some key issues in defining risk relate to what defines risk objectivity, the dimensionality of risk, and how much risk is created by a technology. Determining the answers to these issues requires bounding the technology, such as counting delayed fatalities caused by a technology or a technology's partial contribution to the consequences. The concern about a risk may or may not be proportional to the physical risk.

When defining risk, the first step is to decide which consequences should be included. One must also distinguish whether the risks affect the public or workers in the technology. The dimension of perceived risk must be examined. Do the involved individuals have a feeling of dread, or is the risk feared because it is an unknown quantity? The attributes used to describe a risk create a vector, where each element expresses a dimension of consequence. The elements may then be combined into an aggregate measure of risk so that the costs, errors, and vagueness that come with intuitive integration can be eliminated.

KEY WORDS

Risk-benefit analysis. Expressed preferences approach. Questionnaires.

ABSTRACT

This paper addresses the primary question that must be resolved by risk-benefit analysis: When is a particular technology or product acceptably safe? Also, how safe is safe enough?

There are two approaches to answer these questions. One is the *revealed preference method*, which is is based on the assumption that through trial and error, society has reached an essentially optimum balance between the risks and benefits associated with an activity. The second approach, and the one examined in this paper, is known as the *expressed preferences* approach, which uses questionnaires to measure public attitudes toward the risks and benefits of various activities. The study discussed here was conducted to evaluate the usefulness of questionnaire techniques when examining the tradeoffs between risk and benefit issues.

Members of the League of Women Voters and their spouses participated in this study. In return, they received a contribution for their organization. A total of 76 men and women completed anonymous questionnaires. The participants evaluated 30 different activities and technologies with respect to four tasks:

1.   Its perceived benefit to society,

2.   Its perceived risk,

3.   The acceptability of its current level of risk, and

4.   Its position on each of nine dimensions of risk.

The nine dimensions of risk include:

1. The degree of voluntary acceptance of the risk,

2. The immediacy of a possible negative effect,

3. Knowledge about the risk,

4. Control over the risk,

5. The degree of familiarity with the risk,

6. The risk's classification as chronic or catastrophic,

7. The commoness of the risk,

8. The degree to which people dread the risk, and

9. The severity of the risk's consequences.

Participants were randomly selected to perform one of two task combinations. They performed either tasks 1, 3, and 4 or tasks 2, 3, and 4.

This study demonstrated that it was possible to ask people about complex judgments concerning societal problems and receive interpretable responses. Also, for many activities and technologies, the current risk levels were seen as unacceptably high. There also appeared to be little systematic relationship between the perceived, existing risk and the benefits of the activities and technologies examined in this paper. There was, however, a consistent, although not very large, relationship between the perceived benefit and acceptable level of risk. The nine dimensions of risk noted earlier were highly correlated.

KEY WORDS

Hedonic. Property values. Disamenities. Methodology.

ABSTRACT

In this paper, Freeman provides a detailed consideration of the assumptions and methods required to estimate the demand for an environmental good (or bad) using property prices. A two-step procedure is involved. First, a hedonic model is developed to estimate the implicit price of the good; second, the implicit price is used to estimate a demand function.

To formulate a hedonic price function, price is specified as a function of property characteristics. Buyer characteristics should not be included in this function. The marginal implicit price of the characteristic of interest is found by taking the differential of the function with respect to the characteristic. This marginal implicit price is also the household equilibrium marginal willingness to pay for the characteristic. At least one study has indicated that because of housing market segmentation, some urban areas may require several hedonic models to provide the greatest possible explanatory power.

An inverse demand function is estimated by regressing the marginal price on the quantity of the characteristic, income, and other variables such as age, family size, and education. This estimation assumes that the market is in equilibrium and that preferences are identical across households. All relevant taste variables that would differentiate among preference structures must be included in the demand function. It is generally assumed that the utility from housing, or even from the studied amenity, is separable from that of other goods.

A review of hedonic-model applications found that almost all of them show significant effects of disamenities on price. Moreover, the results are consistent across studies and locations. The hedonic price functions are sensitive to alternative specifications, however.

Author(s)   Freudenburg, W., and R.K. Baxter

KEY WORDS

Three Mile Island. Host communities. Nuclear power.

ABSTRACT

Before the Three Mile Island (TMI) accident in March 1979, surveys conducted about the favorability of constructing nuclear plants showed a favorability margin of almost 2 to 1. In the first two years after the accident, the same question brought about an almost equal division between supporters and opponents of the technology. Since 1981, the opposition has continued to grow; the same question has shown majority opposition by a 5-to-3 margin. Those opposing the construction of nuclear power plants near their homes or communities have also become even stronger since the TMI accident. Historically, host communities (communities at or near the nuclear power facilities) have been more favorable toward nuclear power development than have cross sections of the U.S. population.   This article assesses the opposition to nuclear plants by host communities.

When assessing the pre-TMI attitudes of host community residents by survey methods, an overall pattern was found. It appears that the residents held a favorable opinion toward nuclear power.   After the TMI accident, the surveys conducted found very different results.   Four months after the TMI accident, 50% of the respondents felt there were more disadvantages than advantages in having a nuclear power plant in their area. A poll conducted a year later showed that 65% opposed the construction of a nuclear power plant in the respondents' area. Other surveys found similar results.

Regression analyses of pre-TMI host community surveys and the post-TMI surveys provide strong support for the hypothesis that host community support for nuclear power facilities would decline significantly in association with an accident.

Author(s)	Gamble, H.B., and R.H. Downing
Date	1981
Reference	*Effects of the Accident at Three Mile Island on Residential Property Values and Sales*
	Nuclear Regulatory Commission Report NUREG/CR-2063, prepared by the Institute for Research on Land and Water Resources, Pennsylvania State University, April

KEY WORDS

Property values. Hedonic. Nuclear power.

ABSTRACT

After the Three Mile Island (TMI) accident in March 1979, there were many claims of economic impacts. This study attempts to ascertain whether there were effects on the market for residential housing, either in price, turnover rate, or the demographics of in- and out-migrants.

The study area was defined as being within a 25-mile radius of TMI, and within this area, a more detailed analysis was conducted of homes within 5 miles of TMI. Homes in parts of Lycoming and Lehigh counties in central Pennsylvania were used as the control group. Sales data for 1977-1979 were used to develop a data base, from which 38 characteristics of single-family residences were used to estimate hedonic price equations. Both linear and log/log forms were estimated.

Estimates for 1977 through the first quarter of 1979 were compared with estimates from the remainder of 1979. Before the accident, homes within 5 miles of TMI were selling for an average of $1,860 less than comparable homes in the control area. After the accident, there was no significant difference in the selling prices. Prices of homes that were 10-25 miles from TMI showed no significant difference from the prices of the control group, either before or after the accident. The lower prices in the 0-5 mile zone were found to exist as early as 1970 -- before the nuclear plant had become operational.

This analysis was hampered by several problems. There is evidence of multicollinearity in the large number of variables used in the hedonic estimation. It is also confounded by the fact that many, if not most, of the homes closest to TMI are also located on a floodplain and are subject to airport noise. In addition, the size of the postaccident data set is inadequate to support a full analysis.

Author(s)	Gamble, H.B., R.H. Downing, and O.H. Sauerlender
Date	1978
Reference	*Effects of Nuclear Power Plants on Community Growth and Residential Property Values*
	Nuclear Regulatory Commission Report NUREG/CR-0454

KEY WORDS

Property values. Hedonic. Growth rates. Nuclear power.

ABSTRACT

The authors conducted a literature review, which revealed consistent, empirical evidence of negative impacts on land prices associated with the proximity of this land to noise and air pollution, landfills, and fossil-fueled electricity generating plants. Ascertaining the comparable effects of nuclear-fueled electricity generating plants was the goal of this study.

Areas near four nuclear plants in the Northeast were studied using time-series data starting at least one year prior to the siting announcement. In selecting the study and control areas, it was assumed that towns 15-20 miles away from the power plants would not have any proximity effect.

Growth rates for the total assessed value for 1960-1976 were analyzed for the towns surrounding each plant. In general, the growth rate for the operational period exceeded the growth rate for the preoperational period. Also, the growth rate within a 10-mile radius of the plant exceeded the rate for the area within a 10- to 20-mile radius.

Cross-sectional data were used in estimating separate and pooled (four plants) hedonic price models. In both linear and log/log forms, whether separate or pooled, the distance-to-plant variable was not significant. The authors suggest that this lack of negative property-value impacts, as well as the higher growth rates closer to the plants, may have resulted from the effect of the plants on tax rates. Because of the plants' large tax payments, government expenditures were higher and tax rates were lower near the plants than in the surrounding areas. Thus, the positive capitalization from tax rates may have exceeded any negative capitalization from risks or other attributes of the plants.

KEY WORDS

Personal action. Risk-benefit perceptions. Nuclear power.

ABSTRACT

This paper investigates some social-psychological correlates of direct personal action, either favoring or opposing commercial nuclear power. When assembled in small groups, 367 people were given a questionnaire covering some of these topics:

- The salience of risk concerns,

- Trust in risk-management and other institutions,

- The acceptability of risks associated with a variety of technologies,

- Current levels of risk and benefits for those technologies,

- Qualitative characteristics of the risks and benefits,

- Subjective fatality estimates,

- Self-reported action,

- Sources of information,

- Voting preference for hypothetical political candidates, and

- Sociodemographic characteristics.

Results showed that the degree of self-reported action systematically correlated with the rated acceptability of risk, benefits, and qualitative characteristics of nuclear power. They also showed there are other major correlates of personal action, including confidence in various risk-management institutions and organizations. The desired restrictions and standards correlated substantially with perceived risk and correlated somewhat negatively with perceived benefits.

KEY WORDS

Risk. Society.

ABSTRACT

This paper assumes that a socially acceptable level of risk has been established, either theoretically or practically, for reconciling society's conflicting demands. The conflicting demands come from the different viewpoints involved. These viewpoints include those of the companies, the workers, the ecologist, and society.

Through a discussion of economics and risk evaluation, safety regulations, cost-benefit analysis, and rational public claims, the authors conclude that if society as a whole is to resolve a socially acceptable level of risk, all implications must be considered. The agreed-upon safety level cannot be modified through unilateral analyses. Regulations should be able to impose monitoring the agreement. In the amount of compensation society claims should be given for risk, there should be a relationship between the penalties imposed on the companies and the costs for preventing the damages.

Author(s)	Gill, D., and S. Picou
Date	1989
Reference	*Toxic Waste Disposal Sites as Technological Disasters* Psychosocial Effects of Hazardous Toxic Waste Disposal on Communities, D. Peck, ed., Charles C. Thomas, Springfield, Ill., pp. 81-97

KEY WORDS

Toxic waste. Technological disasters.

ABSTRACT

Toxic wastes can be conceptualized as actual technological disasters. This paper examines this idea and reviews relevant literature on the topic.

Technological disasters involve several aspects. One such aspect is that these disasters usually lack forewarning and involve hazardous materials. Toxic-waste disposal sites become technological disasters when the impacts of exposure to toxic substances seriously disrupt the host community. Currently, most toxic-waste sites are not considered to be disaster areas. However, many sites do pose an active risk, and other sites may emerge as disaster situations.

An overview of the basic findings of disaster research shows that the distinguishing characteristic of a disaster is its consequences. These consequences include death, injury, and various types of stress, and there is an association between the disaster structure (characteristics of a disaster agent) and disaster impacts.

Findings suggest that those living closest to a disaster site are more likely to experience higher levels of stress, have a higher perception of health risk, and permanently leave the area. Disaster impacts also vary according to the social characteristics of the affected community. It has been found that victims with greater social and economic resources suffer fewer negative consequences than do victims with fewer resources. Also, the greater the integration of individuals into the community, the less negative the social and psychological consequences of the disaster will be. Demographics indicate that women and adolescent children are more prone to psychological disturbances because of disaster impacts than are other groups.

Many of the impacts of toxic-waste disposal sites remain unidentified. The difficulty in identifying and estimating social impacts from these waste sites is a direct result of the lack of consensus among scientists, government officials, industry executives, public health officials, and the lay public. The resolution of some of these issues, such as accurate identification and measurement of toxins, procedures for determining which sites are dangerous, and legal responsibilities, require an awareness of the toxic-waste storage problem in society.

KEY WORDS

Residential mobility. Demographics. Nuclear power.

ABSTRACT

This study was performed to determine the effects of the Three Mile Island (TMI) nuclear reactor accident. Specifically, the main focus of study was residential mobility -- the decision of local residents to move away from the accident area. Three questions were asked about the residents living within five miles of TMI:

1.   Was there a change in their annual mobility rate in the year after the accident?

2.   How great a role did the accident play in their decisions, such as whether to move or how far to move?

3.   Were the demographic characteristics of those who moved out of the area different from those who moved in?

Data were gathered shortly after the accident by state and federal agencies through a census of the five-mile study area. The annual updates of the data base allowed mobility calculations to be performed, answering the first question. To obtain data for answering the second and third questions, a telephone survey was conducted one and one-half years after the accident.

Answers to the questions follow.

1.   The accident did not greatly change the mobility rate the first year after the accident. In fact, the rate of in-migration in the year after the accident was 3.4%, while the average rate from 1970 to 1979 was 2.2%.

2. TMI played a minimal role in peoples' determination whether to move or how far to move. Most of those who did move were people with high-mobility characteristics unrelated to the accident.

3. Only two major differences in demographic characteristics could be found in those people who moved out and those who moved into the area. For in-movers, the job of the chief wage earner was likely to be related to TMI; a number of people moved in to clean up after the accident. The age of the oldest in-migrant was younger than that of the oldest out-migrant. This result was harder to explain but could also be job related.

In conclusion, it was found that the accident at TMI had a very minimal effect on migration.

KEY WORDS

Multiattribute utility analysis. Nuclear waste repository. Risk management.

ABSTRACT

This paper is a commentary on two Department of Energy (DOE) reports that discussed the selection of sites as candidates for an intensive study on which one should be the nation's first high-level nuclear-waste repository. The three sites chosen for this study were Yucca Mountain, Nevada; Deaf Smith County, Texas; and Hanford, Washington. They were chosen because they were the bottom three sites in a multiattribute utility analysis (MUA) of five sites.

The first DOE report described an MUA of five sites. Although the authors felt that the MUA was well done, they expressed concern about several areas. They felt that the probability assessment of potential problems may have been underestimated. When judging health and safety problems, the scales that were used excluded nonfatal health effects. The authors also believed that the view of socioeconomic effects was too narrow. They thought that the possible "stigma" effects of a nuclear-waste repository were ignored by the scales used. When they were making value assessments with the MUA, the authors were disappointed to find that critical tradeoff values between the utility scales for individual attributes were made by only four project managers in DOE's Office of Civilian Radioactive Waste Management. They would have preferred that the analysts would have defined public values by working with a *variety* of stakeholders.

The authors also looked at another DOE report that formally recommends the three sites chosen for intensive study. They felt that the logic of this second report was weak and unconvincing.

Author(s)   Grether, D.M., and P. Mieszkowski

Date   1980

Reference   *The Effects of Nonresidential Land Uses on the Prices of Adjacent Housing: Some Estimates of Proximity Effects*

J. of Urban Economics, 8:1-15

KEY WORDS

Hedonic. Property value. Nonresidential land use.

ABSTRACT

This hedonic study analyzes sale price and structural data for 16 neighborhoods in the area of New Haven, Connecticut. These neighborhoods were selected because they consisted of relatively homogeneous single-family homes surrounding a nonresidential land use area. Various types of nonresidential land uses were represented in the sample, including a public housing project, a highway, industry, and point and strip commercial development.

A semilog hedonic model was employed, in which dummies for the time period of the sale controlled the changes in the housing price level. Most of the coefficients for structural characteristics were of a reasonable magnitude. The coefficients on the distance from the nonresidential land use area were inconsistent, both in coefficient sign and magnitude. Overall, low-density apartments and point commercial developments do not appear to affect the housing prices. Public housing projects and industrial sites generally have a negative effect on the hedonic models.

Author(s)	Hallman, W., and A. Wandersman
Date	1989
Reference	*Perception of Risk and Toxic Hazards*
	Psychosocial Effects of Hazardous Toxic Waste Disposal on Communities, D. Peck, ed., Charles C. Thomas, Springfield, Ill., pp. 31-55

KEY WORDS

Risk perception.

ABSTRACT

This paper helps to explain the diversity in risk perception. The authors discuss the conceptual approaches to risk perception, explore the empirical literature on community and individual differences that influence residents' perceptions of risk, and suggest the directions for future research.

Taxonomies of hazards have been developed to compare, understand, and predict the responses to particular risks. One method compares natural versus man-made disasters; another compares hazards according to their potential to reduce life expectancy. Another approach examines the relationship between the costs and benefits derived from a particular risk. The psychometric paradigm is also a way of creating a taxonomy of hazards. Other existing risk perceptions are based largely on literature reviews.

The literature describing the differences that influence risk perceptions examines variables other than an individual's psychological makeup to explain the differences among people's perceptions of risk. Some of these differences depend on the following:

- Cultural beliefs, which are presumed to be an important factor in determining the perception of risk;

- The plausibility of a threat, which affects the way a community will respond to a potential risk;

- Whether there has been any previous experience with a threat;

- Age, length of residence, and the presence of young children in the home, which have also been hypothesized as a way to predict a perceived risk;

- Socioeconomic status, which has been found to have a moderately positive correlation with general environmental concerns; and

- Social networks -- individuals who have better social networks tend to be more aware of potential dangers.

It has also been suggested that public objections to hazardous-waste facilities stem from a disparity in the risk/benefit calculations made by potentially affected individuals. Also, there is a strong correlation between a perceived health status and psychological distress.

The authors conclude that much of the theory that surrounds risk perception has failed to influence empirical studies, and that most of the empirical studies have failed to advance existing theories. As a result, neither the theory nor the empirical research has been sufficient to properly inform the professionals who deal with the public's perceptions of risk. Future directions should include field studies that (1) have sound methodologies; (2) examine the relationship of cognitive, emotional, and demographic variables to specific hazards; and (3) use a large number of randomly selected subjects who are likely to be affected by that threat.

KEY WORDS

Benefit perceptions. Risk perceptions. Health. Behavioral decisions.

ABSTRACT

This article examines previous work on perceived risk, primarily a study that was conducted by Fischoff et al. (1978), with reference to its applicability to specific health-related issues. The authors feel there is much ambiguity about whether any relationships that were suggested by the methods of revealed or expressed preference can be generalized, either to more homogenous sets of items or to individual differences in attitudes toward any single item. They attempt to clarify this ambiguity.

The sets of activities that are presented for comparison are all health related, and the goal was to determine whether an adaptation of the expressed-preference method might provide an informative representation of the people's perception of the risk that is inherent in certain health-related procedures and activities. The analyses of the data include information on the respondents' occupation, sex, smoking habits, seat belt use, and their position in the family. These personal characteristics are included to estimate their influence on risk perception.

The 159 college students who participated in this study completed the questionnaire in a classroom. They made judgments about 15 health-related items in terms of perceived risk, benefit, and a number of risk characteristics that were based on the Fischoff et al. research.

To investigate the risk-benefit relationship within activities, a regression analysis was performed. The results show that the correlation and the slope are negative in almost every case. Also, risk was found to be explained better by the ratings of the likelihood of a mishap, and the likelihood of death as a consequence of a mishap. Benefit was not well explained by the risk characteristics and demographic data. Overall, the inclusion of the subject group's characteristics did not improve the prediction of perceived risk or benefit. However, the respondents' sex, expert status, and smoking status appeared to play a large role in the prediction of specific situations.

Author(s)	Harrison, D., Jr., and J.H. Stock
Date	1984
Reference	*Hedonic Housing Values, Local Public Goods, and the Benefits of Hazardous Waste Cleanup*
	Energy and Environmental Policy Center, Harvard University, Cambridge, Mass., Nov.

KEY WORDS

Hedonic. Perceived risk. Hazardous wastes. Property values.

ABSTRACT

This evaluation describes the benefits from cleaning up hazardous-waste sites. The authors develop separate estimates on the disamenity values of the industrial nature of these sites and describe the hazardous wastes stored there. To do this, they estimated a log-linear hedonic price function for housing sales outside the city of Boston. A total sample size of 2,182 (sales between November 1977 and March 1981) was used in the estimation. Sale prices were converted to 1980 dollar values, and the calendar quarter of the sale was included in the equation to account for the price effects of changing interest rates. Dummies for each town were included to account for local amenity and disamenity effects other than those associated with the sites.

The structure of the hedonic price function was determined by the requirements of a state-dependent expected utility model. This type of model is one in which the choices depend on a person's state of health or illness due to his or her exposure to hazardous wastes. The sites evaluated were divided into three categories: 11 hazardous-waste storage sites, 41 nonhazardous industrial sites, and 49 sanitary landfills. For the hazardous sites, the inverse value of the distance to the house, squared and weighted by the area of the site, was used as a proxy for determining perceived risk. Effects on housing prices were estimated for each site type. Proximity to industrial sites had a positive coefficient, and proximity to hazardous-waste sites had a negative one.

The benefits of removing hazardous wastes from a site were determined by taking the difference between predicted house prices using two scenarios, one with the site treated as hazardous and one with it treated as industrial. Proximity to a hazardous-waste site had a greater effect on the price of higher-priced homes. From this value for each house, a weighted-average aggregate value was calculated for each site. The value determined for cleaning up a particular site varies with the site size (which served as a proxy for the volume of chemicals located on the site) and surrounding housing values. Negative effects on prices were not found for houses beyond one mile from the sites.

KEY WORDS

Public perceptions. Chemical pesticide.

ABSTRACT

This paper assesses the public's perception of risks that were related to the use of a chemical pesticide during the 1981-1982 Mediterranean fruitfly eradication campaign in the San Francisco Bay area.

Both attitude assessments and behavioral measures are used to appraise public perceptions of risk. It hypothesizes that risk perception and acceptability are influenced by knowledge of and experience with pesticides, parental status, age, sex, and education. It also proposes that there should be less perceived risk among those individuals who experienced fewer sprayings, who are conservative, who have higher confidence in the experts, and who perceive a greater benefit. It is also expected that there should be a higher perceived risk and less acceptance among those people who were interviewed after there had been a surge in media coverage.

The sample in this study consisted of 126 residents of Milpitas, California, where there was an infestation and spraying. The subjects were selected randomly from a telephone list.

The results show that those people who perceived the highest risk were primarily liberals. This group was also distinguished by the fact that the members had little faith in the experts in charge of the operation and a low expectation of success. As a group, they were also exposed to more critical media coverage of the event. Those who perceived a low risk were primarily conservatives, had a great deal of faith in the experts, and expected that the program would be successful. They were also exposed to less media coverage.

KEY WORDS

Nuclear power. Safety.

ABSTRACT

This paper states that nuclear power is in trouble. The authors attribute most of nuclear power's problems to safety issues. A brief history of nuclear power and weapons is discussed. Recent fear of nuclear power is based on the perception that it is a threat to the environment, and it is to be feared because of its high level of technology.

The authors conclude by stating that their bias is to keep the nuclear option open but to proceed cautiously -- to press vigorously for solutions to immediate problems but to forgo the implementation of plutonium recycling and the breeder reactor. They feel that time is needed to complete the risk assessment of the light-water-reactor fuel cycle, to validate experimentally the computer codes that serve as substitutes for experience, and to resolve problems concerning spent-fuel transport and waste disposal. Time is also needed to consider scientific issues, such as plutonium toxicity, and to evaluate long-term energy alternatives.

KEY WORDS

Nuclear power. Expectations. Host community.

ABSTRACT

This study describes the changes in the attitudes and expectations about a nuclear power plant located in Hartsville, Tennessee. Hartsville residents were surveyed over a five-year period that began at the time of initial siting and continued through the peak construction phase. The focus of this study was to examine how the community residents reacted to the nuclear plant after they had some experience with the full-scale construction.

The residents were very much in favor of the plant before and during the very early stages of construction. They also believed that the construction and operation of the plant would bring economic benefits to the community. Other anticipated outcomes (such as radiation) represented negative outcomes that the residents expected from having to live near such a large facility.

The authors found that some of the largest changes occurred in the community's expectations for positive outcomes, and they were always in a downward direction. Thus, the residents became more pessimistic over time about the potential for the expected economic benefits. No such lowering of the expectation for projected negative outcomes occurred. These findings contrast with earlier studies of nuclear power plant siting, which found the host communities to be pleased with the economic effect of the plants. The authors conclude that many individuals in the community were no longer willing to make the cognitive tradeoff between the potential benefits and the costs of the nuclear plant.

KEY WORDS

ABSTRACT

This study examines risk perception using a multitask, multimethod approach. Perceived relationships among the prevalent causes of death are investigated using three types of data: judgments of similarity, conditional predictions, and ratings of risks on evaluative dimensions. These data result in different measures of proximity between risks and are used to compare three classes of representations: hierarchical and nonhierarchical trees, ordinal multidimensional scaling, and principal-components factor analysis.

The risk items used in this study were generated by 68 undergraduate students. They were asked to list the major risks that they determined to be the primary causes of death in the United States at this time. Another 245 subjects were recruited from another university. Each subject was assigned randomly to a group that (1) judged the similarity of risks; (2) judged which risk estimates should be increased, assuming that the target risk had been underestimated; or (3) evaluated each risk using a seven-point scale on nine dimensions.

The major findings of this study deal with the relationships among the types of tasks performed by the subjects, the proximities that were induced by these tasks, and the formal representations that were conducted on the basis of these data. It was found that comparative tasks (similarity judgments and conditional predictions) tend to agree with each other, but agreement among these data and the dimensional evaluations is low. Also, comparative tasks are better described in terms of discrete-feature models, although evaluation data are better accounted for by multidimensional scaling.

The authors conclude that the present tasks and the formal representations derived from them do not adequately capture the complexity of the people's conception of risk. They feel that some limitations of specific tasks and models can be partly reduced by a multitask, multimethod approach. In this approach, a domain is explored by different tasks that are analyzed by different models. The application of this approach to the representation of risk suggests that the combination of psychometric methods and cognitive task analysis offers a viable method to study complex, conceptual domains.

KEY WORDS

Nuclear power. Evacuation. Demographics. Risk perception.

ABSTRACT

On March 28, 1979, a nuclear reactor accident occurred at the Three Mile Island (TMI) nuclear power plant near Harrisburg, Pennsylvania. It caused the spontaneous evacuation of nearly 200,000 people. The actual advisement announced by the governor of Pennsylvania called for pregnant women and preschool children within five miles of the site to evacuate and for all others within 10 miles of the site to stay indoors. This advisement should have resulted in the evacuation of about 3,500 people. This paper reports on the results of a model of the public's behavior (specifically, its evacuation tendencies) during a nuclear reactor accident.

The research focuses on five major factors that are hypothesized to influence the decision to evacuate:

1. The location of the residence in relationship to the location of the plant,

2. The household's stage-in-life cycle,

3. The head of the household's social status,

4. The head of the household's preaccident attitude toward nuclear power, and

5. The head of the household's perception of the risk that is associated with a nuclear accident.

The data used in this model were taken from the National Regulatory Commission (NRC) sponsored "Three Mile Island Telephone Survey," which was designed to assess the social, economic, and psychological effects of the TMI accident. The survey was administered three months after the accident to a random sample of 1,500 households within a 55-mile

radius of the plant. To determine the decision-making process used during the accident, a modified version of path analysis was implemented using a logit formulation to solve the equations for the hypothesized relationships in a log-linear causal model.

The results of the regression analysis support the hypotheses that those who live closer to a nuclear power plant and those who live further North or West are more likely to evacuate. Households that have a head of household under 35 years of age or those that have children are more likely to evacuate than those households with a head of household over 35 years of age or those with no children. Households with a head of household who had completed 12 or more years of school showed a greater propensity to evacuate than those with a head of household with less than 12 years of schooling. And heads of household who that felt that a TMI-reactor accident presented a risk to their families were more inclined to evacuate.

This paper proposes revisions to present regulations on the "preparation and evaluation of off-site emergency preparedness and response plans." It suggests including more people in public information programs and using a social survey (including locational, social background, and demographic characteristics) to gather information to use in evaluating a resident's risk perceptions, attitudes towards nuclear power, and evacuation tendencies.

KEY WORDS

Utility theory. Prospect Theory. Risk.

ABSTRACT

This paper evaluates expected utility theory as a descriptive model of decision making under risk. Based on their observations, the authors feel that utility theory is not an adequate model, and they propose an alternative theory known as prospect theory.

A criticism of utility theory is that it does not capture common attitudes toward risk. In addition, it does not account for the certainty effect, which occurs when people underweigh probable outcomes in comparison with certain outcomes. Finally, it does not consider the isolation effect, which occurs because people generally discard components that are shared by all prospects under consideration.

Prospect theory is distinguished by two phases in the choice process: an early editing phase and a subsequent evaluation phase. The major operations that occur during the editing phase are coding, combination, segregation, and cancellation. Following the editing phase, the decision maker evaluates each edited prospect and chooses the prospect with the highest value. It is proposed that the value function is defined by a deviation from a reference point that is generally concave for gains and convex for losses but steeper for losses than for gains. The value of each outcome is multiplied by a decision weight that may be inferred from choices among prospects. Decision weights are generally lower than their corresponding probabilities, except for those in the low-probability range.   Overweighing of low probabilities may contribute to the attractiveness of both insurance and gambling.

KEY WORDS

Psychophysics. Decision problems. Risk averse. Risk seeking.

ABSTRACT

The authors discuss the cognitive and psychophysical determinants of choice in risky and riskless situations. *Risk aversion* is a preference for a sure outcome over a gamble that has a higher or equal expectation. *Risk seeking* is the rejection of a sure thing in favor of a gamble of lower or equal expectations. The psychophysics of value induce risk aversion in the domain of gains and risk seeking in the domain of losses. The psychophysics of chance encourage people to weigh "sure things" and improbable events more than events of an average probability.

Decision problems that lead to different preferences can be described or set up in many ways that conflict with the invariance criterion of rational choice. Invariance requires that the order of preference among prospects should not depend on the way they are described.

The process of mental accounting, in which people organize the outcomes of transactions, explains some of the irregularities of consumer behavior, especially the acceptability of an option, which can depend on whether a negative outcome is evaluated as a cost or an uncompensated loss. The overall value of an option is a balance of its advantages and disadvantages in relationship to the reference state.

The authors conclude by discussing the concepts of utility and value used in two different senses. *Experience value* is the degree of pleasure, pain, satisfaction, or anguish in one's experience of an outcome. *Decision value* is the combination of an anticipated outcome and the overall attractiveness or aversiveness of an option within a choice. The common mismatch of decision values and experience values introduces an additional element in solving decision problems.

KEY WORDS

ABSTRACT

This paper has three objectives:

1. To explore the nature of the problem implicit within the term "risk acceptability,"

2. To examine the possible contributions of scientific information to risk standard-setting, and

3. To argue that societal response is guided best by considerations of the process rather than the formal methods of analysis.

Risk acceptability communicates the impression that society purposely accepts risks as the reasonable price for some beneficial activity or technology. Risk acceptance is predicated on several important factors. The subject must be provided with full information about all potential risks, there must be evidence that the subject understands the information, the subject must have genuine freedom of choice on whether to enter the experiment, and the subject must have the option to terminate participation. It is increasingly apparent that making judgments of appropriate risk levels is inherently a problem of ethics and politics.

The role of experts in making judgments on risk levels and distributions is to provide information and analyses to inform the decision process. The purpose of these analyses is to support a draft standard that will then be tested in the political process.

Three types of analyses are essential for sound decisions: contextual analysis, equity analysis, and public preference analysis. According to contextual analysis, risk should be placed in its appropriate contexts to shed light on its social meaning. Equity analysis focuses on distributional inequities and value problems (specifically, those people who enjoy the benefits of a technology may not bear the risks). Public preference analysis

attempts to anticipate likely preferences and identify any large departures that exist between expert and lay public assessments of risk.

Effective risk-setting decisions will involve attention to the process used, especially regarding the requirements of procedural justice and democratic responsibility. Five considerations for such a process are noted:

1. "Best solutions" involve choices that take competing societal values and multiple goals into account.

2. Attempts to find an analytic fix for the risk-tolerability problem are misguided.

3. Risks cannot be made fully voluntary if society is to realize the potential good associated with existing and new technologies.

4. Since risks tend to be imposed rather than accepted, the burden of proof to show the need for the technology should be on the risk creator.

5. Fairness in risk imposition is best achieved by the active participation of risk bearers acting in their own behalf in making decisions about the tolerability of particular risk levels.

KEY WORDS

ABSTRACT

This paper assesses the implication of current trends in the public's acceptance of nuclear energy. It reviews the emergence of public opposition to nuclear energy. Also, on the basis of the authors' and other recent comparative studies of public attitudes and organized opposition, it examines the validity of the assumptions that underlie alternative explanations of the sources and the future of public discontent.

Before 1955, there was little concern about the risks posed by the various experimental reactors in operation at that time. Between 1955 and 1961, concern abou. nuclear safety increased because of the occurrence of many accidents. Between 1961 and 1968, the nuclear energy industry grew rapidly and public concern declined. Beginning in 1968, the environmental movement revived public concern, which shifted from a fear of adverse environmental impacts to a concern about safety issues. By 1976, the protests over nuclear power shifted from a series of isolated clashes to a coordinated, national campaign.

There is substantial evidence that environmental activists are spearheading the opposition to the development of nuclear energy. Support for the environmental movement shows a remarkable consistency across all groups classified by age, region, sex, income, and education. Environmentalists see accidents, nuclear explosions, and the escape of radioactivity as major problems. They are also concerned about sabotage and the theft of plutonium.

Until recently, U.S. public opinion surveys indicated that most Americans consistently favored the development of nuclear power. Slippage was apparent before the Three Mile Island accident; however, it has been accelerated by that event. Central to public risk assessment is suspicion about industry, utility, and regulatory commitment to reduce and minimize risks.

Nuclear proponents feel that those decisions made by the uninformed threaten policy and regulatory decisions about nuclear energy. Proponents are even more concerned that

nuclear critics are playing on the public's fears by exaggerating dangers, thereby causing irrational decisions to be made.

This analysis suggests that the continued growth of the environmental movement is likely to sustain public opposition to nuclear power.

KEY WORDS

Perceived risk. Noxious facilities.

ABSTRACT

The authors seek to identify a gradient of acceptable levels of perceived risks associated with the various types of noxious facilities. This gradient is measured in terms of the minimum acceptable distance of a residence from each type of facility. The study is based on two surveys using purposive samples. These surveys were conducted in 1978 and 1980. The groups surveyed were selected to represent the full spectrum of attitudes toward nuclear facilities and they included nuclear engineers and environmentalists.

In each survey, the respondents were asked to consider health and safety concerns when specifying the minimum distance that they would be willing to live, or work, from each type of facility. The facilities included several types of power plants and liquefied natural gas (LNG) storage, oil refinery, toxic chemical disposal, and nuclear-waste disposal facilities.

Fifty percent of the nuclear engineers surveyed expressed a willingness to live within a three-mile radius of a nuclear plant. Of the other groups that were surveyed, more than 50% were unwilling to live even 30 miles away. About 20% of the nonengineers indicated the minimum acceptable distance from a nuclear power plant would be greater than 300 miles.   When the acceptability of facilities within 10 miles was ranked across all groups, the natural-gas power plant was acceptable to the highest percentage of the respondents, and the nuclear-waste disposal facility was acceptable to the lowest. The toxic-chemical disposal facility was the next least acceptable. The results, in terms of rankings, were consistent and stable over the two surveys. An attempt to relate the characteristics of perceived risk to the rankings of facility acceptability was inconclusive.

Author(s)	Lopes, L.L.
Date	1983
Reference	Observations
	J. of Experimental Psychology: Human Perception and Performance, 9(1):137-144

KEY WORDS

Risk. Risky choice. Risk preference.

ABSTRACT

This article implies that the psychological concept of risk has been limited by experimenters' reliance on simple, static lotteries or gambles. The author discusses the distinction between risk and uncertainty, the problem of ambiguity in risky choice, and the relationship between risk preference and planning.

Decisions are made under risk if the decisionmaker knows the possible outcomes of the decision and the probabilities that are attached to each. Decisions are made under uncertainty or ignorance if the decision maker knows the possible outcomes but lacks a way to attach probabilities to them.

The problem of ambiguity in risky choice is that the people eventually make choices, and although they may not acknowledge that they have assigned numerical probabilities to uncertain events, it is often possible, given certain assumptions about the decision-making process, to infer from their choice what those probabilities may have been. It has also been found that people prefer explicit risks to ambiguous risks.

The author feels that the most crucial characteristic of decision making under risk is that it is a future-oriented activity, related to the decision-maker's assessment not only of what the future is likely to be but also of what it is likely to require. The author states that it is not a new idea to say that risky decision making involves the decision-maker's goals and aspirations.

KEY WORDS

Property values. Floods. Risk perception. Hedonic.

ABSTRACT

This study uses residential property values to estimate peoples' willingness to pay for a reduced probability of a house flooding. It differs from most other hedonic housing price studies because it employs state-dependent utility functions in an expected utility framework. A model was developed to estimate the willingness to pay for a reduction in the probability of flooding using three cases:

1.   A residential market without the threat of flooding,

2.   A market with the flooding hazard but without flood insurance, and

3.   A market that has both the flood hazard and flood insurance.

The hedonic price function was estimated by using a Box-Cox transformation on the selling price, with the independent variables in linear form.

The data were collected from 217 homes in Monroe, Louisiana, an urban area of 120,000 residents that has experienced flooding and is involved in the Federal Flood Insurance Program.   Housing characteristics (living space, number of bathrooms, number of bedrooms) and selling characteristics (selling price, listing price, type of financing) were determined from those houses sold between January 1 and March 31, 1985. Flood-zone and flood-insurance data were also obtained.

The conclusions developed from testing the model show that a discount rate of 2.8%-2.9% will equalize the differential of the capitalized flood insurance premium with the implicit price of the location in the lower-flood-probability zone for the three different types of homes. If a higher discount rate were considered more appropriate, the results indicate that home buyers would expect some compensation to exceed their losses and would expect to pay a premium for floodplain location.

Author(s)	Malamud, B.
Date	1973
Reference	*Gravity Model Calibration of Tourist Travel to Las Vegas*
	J. of Leisure Research, 5:23-33, fall

KEY WORDS

Tourism. Las Vegas. Influential factors.

ABSTRACT

This paper examines the factors influencing travel to Las Vegas using a model developed to explain the number of tourists from different geographical areas. The variables used in this model include distance from Las Vegas, a surrogate of alternative travel opportunities (population potential), and the "cosmopolitanism" of each area. Resort locations (hotels and motels) are separated into two areas: "casino center" and "the strip."

The data used in this model were compiled by the Las Vegas Convention Authority. Tourists who were registered at strip and casino center hotels and motels during May and June 1970 were categorized by their region, thus providing the data. Fifty-three "observations" (the home regions of tourists to Las Vegas) were available for each regression run performed: 49 states, 3 California regions, and the District of Colombia. By aggregating the data for contiguous states that supplied only a few tourists to Las Vegas, the observations were reduced to 44.

Eight regressions were run to distinguish between the tourists at strip hotels and motels and those at casino center hotels and motels for May and June 1970 as they related to the above variables. The results show that distance greatly discourages tourism in Las Vegas. The economic condition of a region also has a major effect on tourism, as do alternative travel opportunities. The emergence of other gaming resorts that are similar to Reno and Lake Tahoe resorts could harm Las Vegas tourism.

Author(s)   Manning, D.T.

Date   1982

Reference   *Post-TMI Perceived Risk from Nuclear Power in Three Communities*

             Nuclear Safety, 23(4):379-384, July/Aug.

KEY WORDS

Survey. Risk perception. Nuclear power.

ABSTRACT

This study looks at the perception of risk from nuclear power and the possible emergency situations that arise from nuclear plants in three communities. This study also seeks to discover whether risk perception of nuclear power and nuclear emergencies depends on the nearness of a community to a nuclear reactor.

The sample consisted of two Massachusetts communities. One is located at the site of a nuclear power plant (nuclear group); the other is 50 miles away from a nuclear power plant (nonnuclear group). These two groups were surveyed by telephone, and the results were compared with the results of an earlier survey of the Three Mile Island (TMI) area.

Attitudes toward nuclear power plants were found to depend on where the respondents live. TMI respondents gave the most negative responses. The nuclear group gave the most positive responses, and the nonnuclear group gave responses similar to those of the TMI group.

The authors give several reasons for the positive response of the nuclear group:

1. The most fearful and antagonistic people had already moved away from the reactor.

2. The nuclear group may have responded the way it did to avoid cognitive dissonance.

3. The people living closer to a nuclear reactor are better informed about the tradeoffs between the risks and benefits of nuclear power and are more aware of the safeguards being used.

Author(s)	Mazur, A.
Date	1989
Reference	*Communicating Risk in the Mass Media*
	Psychosocial Effects of Hazardous Toxic Waste Disposal on Communities, D. Peck, ed., C.C. Thomas, Springfield, Ill., pp. 119-137

KEY WORDS

Hazardous waste. Media coverage.

ABSTRACT

The premise of this article is that the quantity of news coverage about a waste site rather than details of its content is the primary vehicle of communication about waste sites. Most of the impact from news on the public follows directly from intense media coverage. It is hypothesized that news coverage of a waste site not only raises public concern but also pushes it toward opposition to the site, raising fears in the adjacent community, which generally works against the siting of waste-disposal communities.

The paper proposes that media coverage helped Love Canal homeowners not because their case won on its merits, but because media coverage usually works to the advantage of the protestors involved in environmental cases. It argues that a collection of stories about a waste site, taken as a whole, is balanced. Both the industrial and medical uses of radioactive material are explained, as are the need for disposal and the hazards of radiation. In spite of this, the overall impression created by the collection of articles is negative.

Journalists are not being asked to stop covering these matters. The author advocates that the quantity of coverage become more routine and consistent, to replace the current practice of bursts of coverage that are interpreted by the public as signs of danger. The author also feels that more attention should be given to the images conveyed by the headlines, graphics, and pictures, which may distort the substantive content of the communication.

Author(s)	Nelkin, D.
Date	1981
Reference	*Nuclear Power as a Feminist Issue*
	Environment, 23:15-39

KEY WORDS

Nuclear power. Attitudes.

ABSTRACT

Surveys have shown that far more women oppose nuclear power than men. Some women have published articles that voice their concerns, and some organizations have also become involved. The League of Women Voters has become active in the role of educating and providing information to the public. State and local chapters of the league have been active intervenors in siting hearings. They have also monitored accidents, mediated disputes, lobbied and testified in Congress, and reviewed environmental impact statements. The YWCA has adopted a resolution that opposes further construction of nuclear plants until adequate safety precautions are implemented and the nuclear-waste disposal problem is solved.

The feminist movement has been trying to develop the idea of a "women's culture." The adoption of nuclear power as a feminist issue reflects the importance of this cultural ideal. The feminist culture is based on the assumption that there is a fundamental bond between women and nature.

There has been increased political activism among feminist anti-nuclear groups. The first of these groups was formed as a result of the death of Karen Silkwood. After the Three Mile Island accident, the organized anti-nuclear activity among feminists increased. Groups such as Lesbians United in Nonnuclear Action (LUNA) and Women against Nuclear Development (WAND) came into existence. Eventually these groups developed a networking system that allowed them to meet and demonstrate in an organized manner.

The author concludes that although much of the nuclear debate focuses on health and safety issues, to the groups that are most active in the anti-nuclear movement, the issue of nuclear power is a moral crusade.

Author(s)	Nelson, J.P.
Date	1981
Reference	*Three Mile Island and Residential Property Values: Empirical Analysis and Policy Implications*
	Land Economics, 57(3):363-372, Aug.

KEY WORDS

Hedonic. Nuclear power. Property values.

ABSTRACT

This study seeks to determine if there was any change in home prices in the Three Mile Island (TMI) area as a result of the 1979 accident. It uses data from sales of 100 homes within 3-4 miles of the plant in a hedonic price analysis covering the period from January 1978 through December 1979. In this analysis, neither the absolute prices nor the appreciation rate is significantly different after the accident.

Taking another approach, the author also compares the mean prices and appreciation rates for homes within a 5-mile radius and a 20-mile radius of TMI and in a control area 100 miles away (Williamsport, Pennsylvania). The author concludes that while there was some decline in prices and the appreciation rate for homes within a 5-mile radius during the first quarter after the accident, the market recovered quickly.

KEY WORDS

Earthquake. Risk perception. Hedonic. Information.

ABSTRACT

This study takes a fairly broad look at how earthquake-risk information is transmitted to potential home buyers and the possible effects of that information on the housing market. Literature on the relationship of attitudes to behavior, on communication processes, and on the effects of information on attitudes is reviewed as background. Two reactions to information about earthquake risk are postulated: avoidance of the at-risk area or self-insurance against damages by paying a lower purchase price.

Several methods were used to perform the study. These included a review of the information disclosure process, and an unsuccessful effort to alter it experimentally. Recent purchasers of both in-zone and out-zone homes (zones identified as having high earthquake risk) were surveyed about their purchase decision. Real estate agents were also surveyed about the sales process. Survey questionnaires are provided in the report.

The two regions studied are Berkeley and central Contra Costa county. They were selected from the many California areas having a significant risk of earthquake as a means of minimizing the socioeconomic differences in the analysis. In the 1978 survey of in-zone and adjacent (within three miles) buyers, the percentage who considered earthquake risk as an important issue in their purchase decision was inversely related to length of residence in the Bay area. Buyers in adjacent areas evidenced more concern about earthquakes and projected a higher value for potential losses than did home buyers in the higher risk zones.

A hedonic price analysis was used to try to identify the effect of risk information on the housing market. In this portion of the study, data from southern Alameda county were added. Real estate data for 1972 (before required risk disclosure) and 1977 were analyzed. In 1972, the zone location had no relationship to home prices in Contra Costa county. However, by 1977, the in-zone location had a significant negative value of about $4,000, and out-zone homes showed a significant positive value. Results for Alameda county were positive for the out-zone location, but there was no price relationship for

the in-zone location. Berkeley showed a largely unexplained reversal of the price relationship, with a positive value for the in-zone location and negative value for the out-zone location. Unfortunately, neither the sample size nor the hedonic equation coefficients are reported.

KEY WORDS

Floods. Risk. Property values. Floodplain management.

ABSTRACT

There are reasons to believe that overdevelopment, from an economic efficiency standpoint, has occurred on the nation's floodplains. It is hypothesized that floodplain development has proceeded beyond the point where the acceptance of the flood risk can be justified by the local benefits to be gained, and that expected flood damages for the latter units of the floodplain capital investment are greater than the expected benefits from such an investment.

This paper tests the overdevelopment hypothesis by measuring the effect of the National Flood Insurance Program (NFIP) on residential property values. It investigates the role of inexpensive information in the formation of flooding-potential perceptions, and it indicates the implications of these results on floodplain-management policies. These hypotheses were tested by using multiple regression analysis techniques.

The basic conclusion is that before the introduction of the NFIP, residential property values in the floodplain were less than fully discounted for the existing flood potential. This shows that overdevelopment had occurred, most likely because of overoptimistic flooding-potential perceptions and the expectation of liberal federal disaster relief if a major flood occurred.

The authors feel that significant benefits could be gained from a more economically efficient allocation of capital resources to the nation's floodplains. This is, at least, the necessary condition for considering the implementation of a floodplain management policy to provide better information and eliminate the incentives created by the expectation of liberal disaster relief. The sufficient condition for implementing a particular policy is that its expected benefits, above public costs of administration, are greater than those of all other alternatives.

Author(s)	Payne, B.A., S.J. Olshansky, and T.E. Segel
Date	1987
Reference	*The Effects on Property Values of Proximity to a Site Contaminated with Radioactive Waste*
	Natural Resources J., 27:579-590, summer

KEY WORDS

Radioactive waste. Property values.

ABSTRACT

In reviewing the literature, the authors cite numerous studies on the impacts of environmental disamenities, many of which use hedonic methods. This study is concerned with the effect on prices for residential houses resulting from their proximity to the Kerr-McGee Chemical Corp. site in West Chicago, Illinois. Thorium contamination of the site, which had existed for more than 50 years, was not revealed to the public until July 1976.

Data on the year of sale, selling and listing prices, and age of the residence were collected for 1973-1982 for properties within one mile of the site. These properties were divided into an inner ring, within a two-block radius of the plant boundary (N = 168), and an outer ring, within a two-block to a one-mile radius of the plant boundary (N = 1,084). Using a two-by-two factorial analysis of variance (ANOVA) procedure, the authors found no significant difference between the inner- and outer-ring prices up to 1976. For older homes, there was a significant difference from 1977 to the date of this paper.

KEY WORDS

Hazardous waste. Siting. Compensation. Safety.

ABSTRACT

Economic compensation has been recognized as a way to offset perceived risks and gain acceptance for hazardous-waste facilities. The Massachusetts Hazardous Waste Facility Siting Act, passed in 1980, incorporated provisions for both siting negotiation and compensation arrangements. In spite of numerous siting attempts, however, no new facilities had been sited by 1984. Given this apparent failure of a siting strategy based on compensation, the author explores how various economic and safety options affect opposition to facility siting.

A random survey was conducted in five communities (N ≈ 300 in each town). Of these respondents, 56% favored siting a waste-treatment plant somewhere in Massachusetts, but 62% opposed locating it in their community. The people who favored a facility but opposed it locally were queried about what measures might change their opposition to local siting. Nine economic measures and two safety-related options were evaluated. Most of the economic measures positively influenced about 40% of this group, while the safety features influenced more than 60%. Combining the proposals produced only a slight additional decrease in the opposition.

Author(s)	Randall, A., J.P. Hoehn, and D.S. Brookshire
Date	1983
Reference	*Contingent Valuation Surveys for Evaluating Environmental Assets* Natural Resources J., 23(3):635-648, July

KEY WORDS

Contingent valuation. Methodology. Bias.

ABSTRACT

This examines the pros and cons of using contingent market surveys to value nontraded goods. To conduct such a survey, several elements must be clearly and explicitly defined:

1. The nature of the environmental good,

2. The status quo level of the good,

3. The change in the level or quality of the good to be evaluated,

4. The institutional structure in which the change will take place, and

5. The method of payment (or compensation) for the change.

Contingent valuation has several advantages over methods based on historical market data. It allows the valuation of alternatives that are outside the range of historical experience (so long as the alternatives can be understood by the respondents). Thus, it allows an *ex ante* analysis. Unlike hedonic methods, it does not require simplifying assumptions like identical preferences among households.

In empirical applications, contingent market surveys have generally produced results in which the bids for changes were significantly related to demographic and economic variables and were made in directions consistent with theory. Studies comparing methods have generated consistent results for contingent valuation and hedonic prices, for contingent valuation and travel costs, and for contingent valuation and cash transactions in an experimental market.

In spite of the strengths of this method, there are still concerns regarding its use. Like all surveys, contingent valuation is subject to sampling and enumerator bias. Strategic bias and the possibility that people will deliberately overstate or understate values have

been major concerns, but there is little actual evidence that they affect estimates. There is evidence of information bias and of a sensitivity to the framing of questions. The authors suggest that further research is needed to investigate the more basic concern that the willingness-to-pay (WTP) and willingness-to-accept (WTA) estimates generated by contingent valuation methods diverge more than the amount predicted by theory.

Author(s)	Real Estate Counseling Group of Connecticut, Inc., and Financial Consulting Group of Ohio
Date	1987
Reference	*Patterns of Real Estate Market Behavior around the Feed Materials Production Center, Fernald, Ohio*

KEY WORDS

Property values. Hedonic. Radioactivity.

ABSTRACT

On December 10, 1984, information was released on the recent discharge of a quantity of uranium trioxide from the Feed Materials Production Center to the surrounding environment. This focused media attention on the plant and aroused concerns about safety. Class-action suits were filed, claiming damages to nearby property owners in the form of lost value.

To identify any impacts on property values, the authors compared data for a study area conducted within six miles of the plant boundary with data for a control area in Dalton, Ohio. The data were primarily for single-family residences and covered the period two years prior to and two years after the announcement.

In a hedonic price analysis, a statistically significant increase in sales prices within the study area was found after the announcement. There was a reversal of the previous trend of declining prices in the area. Price changes in the study and control areas do not differ significantly.

The sign on the distance variable in the regression model was negative (with the price increasing as the distance to the plant decreased) but insignificant. Tests on data for various directional vectors around the plant were inconclusive, as were tests on subsets of the data. A regression of property characteristics on "days on market" indicated that homes sold faster after the announcement than they had before it.

Author(s)	Roback, J.
Date	1982
Reference	*Wages, Rents, and the Quality of Life*
	J. of Political Economy, 90(6):1257–1278, Dec.

KEY WORDS

Hedonic. Wages. Property values. Amenities. Disamenities.

ABSTRACT

The author brings together hedonic price analyses that analyze the effect of amenities on local labor and land markets. She notes that the conditions for the simultaneous clearing of land and labor markets are not well understood, and she does not attempt to identify all of the factors that affect the implicit price gradients of wages and land rents. However, she proceeds to develop a general equilibrium model to illustrate the implicit price effects of amenities and disamenities on these markets. This model requires the assumption that capital and labor are completely mobile among cities, and that all workers have identical tastes and skills.

Two major sources of data are employed in this analysis. Weekly earnings and labor force characteristics for 1973 are taken from a U.S. Bureau of the Census study, *Current Population Survey*. These data cover the 98 largest cities in the United States. Average site prices per square foot for 83 cities are taken from a 1973 HUD study, *FHA Homes*. There is no intracity location information in this data base, and it also has the drawback of overrepresenting low-income families.

Variables such as crime rate, population, heating-degree days, number of clear days, and annual snowfall were among the amenities and disamenities analyzed. The author found that the wage-rate differential among cities was largely explained by amenity levels. In general, land rents increased with the amenity level, and wage rates decreased. A major conclusion of this work is that the implicit value of amenities is not fully reflected in housing prices. An adjustment for wage differences is also needed.

Author(s)	Schmalensee, R., R. Ramanathan, W. Ramm, and D. Smallwood
Date	1975
Reference	*Measuring External Effects of Solid Waste Management*
	Environmental Protection Agency Report EPA-600/5-75-010, prepared for the Office of Research and Development, March

KEY WORDS

Hedonic. Municipal waste disposal. Property values.

ABSTRACT

Most of this report reviews the theory and previous empirical studies pertaining to the valuation of externalities. The section most relevant to an impact assessment for a radioactive-waste disposal site, however, provides the details of a study of four landfill sites in California. The four neighborhoods analyzed were chosen because of their immediate proximity to the landfills.

The study used data on the real estate market and tax assessments to examine how much an area's proximity to a landfill affects residential property values. A multitude of variables that describe housing characteristics, condition, and location (such as view of the dump, degree downwind, and location on the truck route) were used. Characteristics of the residents, such as income, were not included in the analysis. Data for each site were analyzed separately, using both log/log and linear models.

The results of the analysis of the Palos Verdes landfill site appear to be strongly influenced by the fact that the dump was slated to be filled within 10 years and then converted to a golf course. Increasing proximity to the site was associated with increasing home prices and a direct view of the site. However, price was negatively related to the proximity of the garbage truck route.

For the other three sites, price and proximity to the landfill were not strongly related. At the Tujunga site, proximity to the adjacent freeway and gravel pit affected prices more negatively than did proximity to the dump. Proximity to a freeway was associated with decreasing prices at the Sheldon-Arleta site too. Neither market price nor assessed value appeared to be affected by the distance from the landfill. Data for the Calabaras site also failed to show any relationship between price and distance.

KEY WORDS

Nuclear power. Public opinion polls.

ABSTRACT

For the last 10 years, public opinion polls have shown that the people have more and more doubts about nuclear power. The public has not reached the point where it wants to abandon nuclear power as an energy source, but it now demands "safety first."

In the 1970s, most Americans described themselves as supporters of nuclear power; only 25% called themselves opponents. By the 1980s, an American Broadcasting Co. (ABC) poll revealed that only 29% described themselves as supporters, 27% felt they were opponents, and 40% were undecided. The author feels the Three Mile Island accident turned many supporters into "undecideds." After the Chernobyl accident, the percentage of supporters dropped to 27%, while the percentage of opponents grew to 36%.

The Roper Organization asked people to compare four energy sources. Gas was rated as best for the environment. Although nuclear power was considered the most plentiful energy source, it was rated the least acceptable for widespread use and was rated as being the most potentially dangerous energy source. The issue that bothers most people about nuclear power is waste; they do not feel that radioactive waste can be safely disposed of.

The author feels that the way to deal with these problems is to provide more government action. Polls have shown that people are willing to pay for a greater governmental effort to clean up toxic wastes.

Author(s)	Seller, C., J.R. Stoll, and J.P. Chavas
Date	1985
Reference	*Validation of Empirical Measures of Welfare Change: A Comparison of Nonmarket Techniques*
	Land Economics, 61(2):156-175, May

KEY WORDS

Contingent valuation. Travel costs. Recreation.

ABSTRACT

Seller and her colleagues use the valuation of recreational boating at four lakes in eastern Texas to assess the comparative validity of travel-cost and contingent market methods. The travel-cost survey (N = 731) covered variable costs, including launch and user fees, but excluded the value of travel time. The contingent market survey (N = 623) addressed only the cost of boating in the form of an annual boat-ramp permit. It was divided into two subgroups to test the effects of open-ended versus closed-ended questions in soliciting bids.

The travel-cost survey and closed-ended contingent market survey produced recreation values that were similar for two of the four lakes. For a third lake, the travel-cost estimate was the higher of the two and appeared to be more consistent with both actual use and quality ratings. The estimates for the remaining lake were judged to be invalid. Recreation value estimates developed from the open-ended contingent market survey were lower than the boaters' actual expenditures. The authors suggest that this result may have been caused by strategic bias or the people's inability to bid without a market benchmark.

KEY WORDS

Nuclear power. Costs. Risk perception.

ABSTRACT

The cost of nuclear power has risen sharply in recent years, clouding the optimistic projections of planners and contributing to a serious slowdown in the industry. This article looks at the factors underlying nuclear cost increases, and it specifies a nonlinear regression technique that identifies the costs that are caused by public and professional uncertainty about future technological performance as opposed to the costs that are caused by objective design-related and construction-related factors.

A multivariate analysis of variance found a positive relationship between the costs related to uncertainty and those related to specific plant factors (such as size, age, and year of initial operation). Uncertainty and the costs associated with it are greater for larger plants but decrease as the plants accumulate operating experience. This result suggests that the tendency toward rapid deployment of large plants with innovative technologies has had a negative effect on power generation costs.

KEY WORDS

Hedonic. Disamenity. Property values. Attenuation.

ABSTRACT

Hedonic methods are used in this study to isolate how distance from a closed landfill in a subsequently constructed residential development affects prices. Because the landfill was closed before any homes were built, there was no opposition to its existence by home buyers, and its impacts were fully capitalized into housing prices.

Sales prices for 214 homes sold during 1985 and 1986 within a one-mile radius of the landfill were regressed on property characteristics. Both linear and quadratic functional forms were tested using the data for impact zones within a radius of 400-2,400 ft to determine the extent of the area over which impacts were measureable. About 67% of the price variance was explained by both the linear and the quadratic models. The best linear model fit an impact zone of 1,000 ft, and the best quadratic model fit a zone of 1,400 ft. Beyond this distance, price impacts were not significantly different from zero.

KEY WORDS

Psychometric approach. Risk.

ABSTRACT

This article uses the psychometric approach, in which respondents are asked to compare and characterize the relative riskiness of risk sources. This approach enables one to identify theoretically significant dimensions or factors underlying the various perceptions of risk held by individuals. Specifically, the respondents (League of Women Voters, college students, active club members, and experts) were asked to rank the perceived risk of 30 activities and technologies.

Two major factors, dread risk and unknown risk, were identified by factor analysis as being the dimensions that underlie the perceptions of risk. The dread-risk dimension concerns the degree to which a hazard is characterized as being uncontrollable, inspiring dread, and of high risk to future generations. Nuclear weapons (war) are the hazard with the highest level of dread risk; caffeine has the lowest level. Unknown risk concerns the extent to which a risk is observable, old, and known to either those who have been exposed to it or to science. Laetrile and DNA technology are the hazards with the highest levels of unknown risk, and dynamite has the lowest level.

The two dimensions are statistically independent. This means that the hazards can be similar on one dimension yet very different on the other. Usually one cannot predict the position of a risk source in relation to one dimension by its relation to the other dimension. For example, radioactive waste and oral contraceptives share similar positions in relation to the unknown risk dimension, but they differ in their relation to the dread dimension. The author concludes that hazards that are low in the dread and unknown risk dimensions are generally more acceptable to individuals than those that are high in both dimensions.

Author(s)	Smith, V.K., and W.H. Desvousges
Date	1986a
Reference	*Asymmetries in the Valuation of Risk and the Siting of Hazardous Waste Disposal Facilities*
	Proc. American Economic Review, pp. 291-294, May

KEY WORDS

Contingent valuation. Risk perception. Hazardous waste.

ABSTRACT

This paper further explores the results of a contingent valuation survey conducted in suburban Boston. The 609 respondents were asked to value risk changes associated with the siting of a hazardous waste facility in the vicinity.

Previous studies had led to the expectation that willingness to pay (WTP) and willingness to accept (WTA) for risk changes would have about the same magnitude. Instead, the authors found a large difference between WTP and WTA, with bids to lower risk being significantly higher than bids to avoid an increase in a risk of equal magnitude.

The authors seek to explain the seemingly anomalous results by estimating three semilog models: a model for increasing risk, a model for decreasing risk, and a pooled model with a dummy to indicate the direction of risk change. In these models, the dependent variable is the value of risk change scaled by the magnitude of the risk change, i.e., the marginal value of risk. The independent variables are the baseline risk level and socioeconomic characteristics.

Of the models, the pooled form most clearly shows the asymmetrical response to gains versus losses. The authors suggest that this result may imply that people feel that they have an implicit right to a low level of risk and that they should not have to pay to avoid a risk increase.

Author(s)	Smith, V.K., and W.H. Desvousges
Date	1986b
Reference	*The Value of Avoiding a LULU: Hazardous Waste Disposal Sites*
	The Review of Economics and Statistics, LXVIII(2), May

KEY WORDS

Hedonic. Hazardous waste. Property values.

ABSTRACT

The authors of this study found nuclear power plants and hazardous-waste disposal sites to be the most unpopular locally undesirable land use (LULU). They used a hedonic price function to construct a partial-equilibrium model for the demand for distance from such a site.

The data were collected in 1984 in a detailed survey administered in the Boston area (N = 268). Of those surveyed, 51% indicated a willingness to live within 22 miles of a nuclear plant, and the same percentage were willing to live within 10 miles of a hazardous-waste site. The authors suggest that the willingness to live at such close distances (relative to other surveys) may reflect an adjustment to the actual situation in Boston.

The survey questionnaire avoids the nonlinearity problems that are characteristic of hedonic estimation by holding the marginal price of the distance from a LULU constant. It also holds other housing characteristics constant. The authors examined the effects of various model forms and specifications on the results. A comparison of the semilog and log/log models indicated that the semilog model was superior on the basis of its close approximation to a Box-Cox transformation. The marginal price estimates were stable across both the forms and specifications of the model. In converting the changes in property price with respect to distance to an annualized form, the authors found a consumer's surplus in the range of $330-$495 per mile each year.

KEY WORDS

Hazardous waste. Risk perception. Compensation.

ABSTRACT

The authors start from the premise that community opposition to the siting of hazardous-waste facilities stems from a perception that these facilities introduce a risk to the community without an offsetting benefit. They test the hypothesis that the opposition can be reduced by either increasing the benefits or reducing the perceived risks associated with a facility.

A survey was conducted in a rural community, near major transportation routes, with no previous history of being considered as a waste facility site. It was considered to be typical of the type of location generally selected as a site. Members of several community leadership groups were surveyed (N = 115), but scientific sampling was not employed.

The survey tested the effect of four options on an acceptable residential distance from a hazardous-waste facility. Two of the options involved different forms and levels of facility-related benefits. The first was direct compensation, in the form of property tax abatement, with existing, 25%-, 50%- and 75%-reduction levels. The second option was indirect compensation, in the form of a user fee paid to the community. Annual payment levels were $0, $50,000, $200,000, and $500,000. On the risk-reduction side, the options involved various possible monitoring agencies: the site owner, the state EPA, a private consultant, and trained local citizens. The monitoring frequency was also varied as an option, with intervals being quarterly, monthly, weekly, and daily.

The survey data showed that without a user fee, 62% of the respondents wanted to live more than 50 miles away from a hazardous waste site. That percentage declined to 35% with a user fee of $500,000 per year. With the more direct compensation of property tax reduction at the 75% level, only 25% found that living 50 miles away was the minimum acceptable distance. Increasing the monitoring period from quarterly to daily decreased the percentage of those wanting the 50-mile distance from 44% to 32%.

The results were similar when the monitoring agencies were varied, but there was some inconsistency in the rankings. Changes in the percentage of the respondents finding various intervals between 1/4 mile and 50 miles away being acceptable were similar. There was no attempt in this survey to test the effect of combining risk reduction with benefit measures.

KEY WORDS

Decision problems. Preferences. Probabilities.

ABSTRACT

This article describes decision problems in which people systematically violate the requirements of consistency and coherence. It presents a series of problems in which seemingly minor changes in the formulation of choice problems caused significant shifts of preference. Psychological principles that govern the perception of decision problems, and the evaluation of their probabilities and outcomes, produce predictable shifts of preference when the same problem is framed in different ways.

Preference reversals are manifested in choices regarding monetary outcomes, both hypothetical and real, and in questions regarding the loss of human life.

The authors conclude by stating that individuals who face a decision problem and have a definite preference:

1. Might have a different preference when given a different framing of the same problem,

2. May be unaware of alternative frames and their potential effects on the relative attractiveness of options,

3. May wish their preferences to be independent of the frame, and

4. Are often uncertain about how to resolve the detected inconsistencies.

Author(s)	Uysal, M., and J.L. Crompton
Date	1985
Reference	*An Overview of Approaches Used to Forecast Tourism Demand*
	J. of Travel Research, 23(4):7-15, spring

ABSTRACT

Tourism is an enormous industry capable of generating millions of dollars and providing many jobs for a given city or state. Three essential questions can be answered by tourism forecasts. They are:

1. How many tourists will arrive at a destination, and when will they arrive?

2. Which areas represent the best marketing opportunities as a tourist spot?

3. Which factors influence the decision-making process for a future trip to a destination?

The main emphasis of this paper is to explain six alternative approaches to forecasting tourism demand; three are qualitative and three are quantitative. *Qualitative* approaches may be used when past data are insufficient; when new tourist sites, such as resorts, open and have no historical data; or when the site is located in a region or country that is involved in social or political discord, causing past data bases to be irrelevant. *Quantitative* approaches require the use of past data and are regarded as causal models that attempt to quantify the relationship between causal variables.

Qualitative Approaches

Traditional Approaches: These approaches are broken down into two categories: analyses of regional or national vacation surveys or survey inquiries of potential visitors to tourist areas. Inquiries offer insights about the attitudes or images of the potential tourists toward their destinations. These can be very valuable when they are used in conjunction with surveys conducted by tour operators, travel agencies, and the airlines,

but they can also be very costly and time consuming. Surveys are also useful in determining individuals' judgments and changes in the direction of causal factors.

Delphi Model: This is a special survey used to forecast long- and short-term events and estimate the probability of certain conditions prevailing in the future. By administering questionnaires, collating judgments, and providing results to expert participants, the Delphi technique taps expert judgments and creates ideas for solving problems. By eliminating face-to-face conversation among the participants, the technique results in ideas that are "pure" -- uninfluenced by other opinions.

Judgment-Aided Model: This approach assembles a panel of experts who attempt to achieve a consensus or agreed-upon forecast through debate and the exchange of ideas. These forecasts can be applied to certain scenarios to determine what can happen, given the trends and facts.

Quantitative Approaches

Time Series Approaches: In these approaches, data are collected over successive time periods. Exponential smoothing, univariate analysis (i.e., movement through time), and the Box-Jenkins transfer model are the three types of time-series approaches mentioned as being useful in forecasting tourism, although Uysal and Crompton suggest using a combination of these approaches.

Gravity and Trip Generation Models: A forecast can be made that estimates the number of trips taken by a given population on the basis of total population and distance from the proposed destination. Trip-generation models use equations that are refined forms of demand equations or derived from gravity models.

Multivariate Regression Models: These are the most-used quantitative techniques because this type of analysis reveals the amount of influence that several variables have upon tourism demand. Multivariate regression, using ordinary least squares and time-series data, is the most common method of forecasting the time-series demand, although other methods can be used as alternatives.

Conclusion

This paper offers a number of useful examples and documents actual applications of the different forecasting approaches to explain how certain methods fit certain situations. The authors stress that these forecasts are only approximations and should be expressed as ranges and not as exact predictions of future occurrences. They recommend incorporating quantitative methods with qualitative methods to best forecast tourism demand.

KEY WORDS

Decision Analysis. Probabilities. Subjective probability.

ABSTRACT

This paper reviews the existing research on encoding a person's subjective probability, especially in terms of the reliability and validity of the encoding process. One class of studies reviewed involved experiments using nonexperts, while the other class used experts as subjects. Four considerations that must be addressed in any measurement process are representation, uniqueness, meaningfulness, and scaling. This article is primarily concerned with scaling, which is frequently described as the technical aspect of measurement. It is suggested that the usual encoding techniques can be regarded as instances of the general methods used to scale psychological variables.

The clearest difference between the experts and nonexperts is in the terms of calibration studies. When subjective probabilities about events with which the experts are familiar are encoded, they can be well calibrated. Nonexperts show a rapid but limited improvement in calibration with training and feedback. Also, codes are less well calibrated when experts are required to assess events that are defined differently from what they are used to.

When asking whether an encoding method is reliable, the authors feel that reliability measures have been reported in few studies, and that they have usually been reported in terms of correlations obtained in laboratory experiments involving nonexperts. A high reliability coefficient was obtained in these situations. The high reliability for this group implies that high reliability exists among experts as well.

When looking at validity, the authors distinguished four categories: internal consistency, calibration, external validity, and construct and interresponse validity. Calibration, external validity, and interresponse correlations are different forms of the same question: Do two or more measures converge? Internal consistency is concerned with the scale properties of responses rather than their relationship to other measures. Current literature suggests that the various probability encoding techniques are relatively valid. No single encoding technique violated the rules of probability theory.

KEY WORDS

Utility. Risk. Expected utility.

ABSTRACT

This article attempts to resolve the disputes over the interpretation of consequences in the rule to maximize expected utility (MEU). MEU defines the expected utility of an option and requires that preferences be chosen among the options. The author's argument is that MEU with consequences taken broadly (MB) does not neglect attitudes toward risk, while MEU with consequences taken narrowly (MN) does neglect them.

The author believes that MN involves a restriction on the results of an option that counts as consequences. The restriction disqualifies the risk involved in an option as a consequence of the option. MB is obtained by adopting different interpretations of the key terms used in the definition of expected utility. MB takes probability as a rational degree of belief, and utility as a rational degree of desire, and the consequences as results. MB differs from MN in that it encompasses all results, including risk.

The author uses Allais and Ellesberg's paradoxes (which suggest that MEU ignores risk attitudes) and the above assumptions about MN and MB to defend his position. He states that MB takes risk attitudes into account by counting the risk involved in an option among the consequences of the option. It follows that the utility for an option-state pair is the utility of all the results of that option, given the state. The author defended MB against some objections -- in particular, the objection that it is inapplicable.

Author(s)	Willard, D.E., and M.M. Swenson
Date	1984
Reference	*Why Not in Your Backyard? Scientific Data and Nonrational Decisions about Risk*
	Environmental Management. 8(2):93-100

KEY WORDS

Risk assessment. Policy. Decision making.

ABSTRACT

The siting of hazardous waste facilities creates a special case of many "no win" environmental decisions that are faced today. Siting problems share many common features:

1. Something must be decided.

2. The decision affects some people more than others.

3. Scientists are not 100% confident of research results.

4. Decisions combine both scientific and political elements.

This paper attempts to illustrate and analyze several examples that combine these elements.

The authors use several examples, such as the public's fear of death from nuclear power, snake bites, and smoking to integrate the public's perception of risk into a decision-making model. The authors conclude that people resist locally unwanted land-use sitings because they fear disease and death. They also fear having their homes made ugly and less valuable. Only the public decides what, and how much, to fear. Another conclusion is that policymakers must accept peoples' fears as a valid part of the policy-making process. Scientists must separate their policy-making and scientific roles yet respond to policy alternatives with the information that fits the alternatives. They must still interact fully while maintaining their discrete roles.

Author(s)	Yezer, A.M., and C.B. Rubin
Date	1987
Reference	*The Local Economic Effects of Natural Disasters*
	Institute of Behavioral Science, Working Paper No. 61, University of Colorado, Boulder, Colo.

KEY WORDS

Disasters. Risk perception. Hedonic. Property values.

ABSTRACT

This study develops a strong theoretical base for measuring the indirect effects of disasters on regional, urban economies. Both inter- and intra-city effects are examined, on the basis of the assumption that there is a national equilibrium in capital and labor markets. These markets are responsive to the expected value of local natural resources, and disasters are treated as negatively valued natural resources. Disasters affect the economy through reduced output and personal and property damage, which result in welfare loss. This loss is capitalized in land values in both the commercial and residential sectors.

The hypothesis that is tested is that because land prices in a given region reflect the expectations about the occurrence (or nonoccurrence) of a disaster in that locality, only changes in the expected disaster rate (perceived risk) will affect prices. This hypothesis is tested for both a one-year and a four-year period, using data for 39 SMSAs (standard metropolitan statistical areas) from the 1979, 1980, and 1983 annual housing surveys. A hedonic price model that includes housing characteristics and the owner's market-value estimate is estimated. The data represent repeated measures on the same property, so that changes in the structure are accounted for in analyzing changes in the owner's price expectations.

The expected disaster rate for a locality is approximated by the actual rate of presidentially declared disasters over the 15-year period from 1965-1979. The difference in the rate for 1979-1983 from the prior rate is taken as the change in the expected rate. This rate is incorporated in the hedonic price model, which is specified in terms of the rate of change in housing prices or the appreciation rate. The results clearly indicate that changes in the expected disaster rate are inversely related to the rate of price appreciation. An increase in the disaster rate over what experience has led people to expect leads to a decrease in the housing-price appreciation rate. These changes are the estimated net of government mitigation efforts.