



Non-Market Valuation Techniques

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Introduction

Economic value is one of many possible ways to define and measure value. Although other types of value are often important, economic values are useful to consider when making economic choices – choices that involve tradeoffs in allocating resources.

Measures of economic value are based on what people want – their preferences. Economists generally assume that individuals, not the government, are the best judges of what they want. Thus, the theory of economic valuation is based on individual preferences and choices. People express their preferences through the choices and tradeoffs that they make, given certain constraints, such as those on income or available time.

The economic value of a particular item, or good, for example a loaf of bread, is measured by the maximum amount of other things that a person is willing to give up to have that loaf of bread. If we simplify our example “economy” so that the person only has two goods to choose from, bread and pasta, the value of a loaf of bread would be measured by the most pasta that the person is willing to give up to have one more loaf of bread.

Thus, economic value is measured by the most someone is willing to give up in other goods and services in order to obtain a good, service, or state of the world. In a market economy, dollars (or some other currency) are a universally accepted measure of economic value, because the number of dollars that a person is willing to pay for something tells how much of all other goods and services they are willing to give up to get that item. This is often referred to as “willingness to pay.”

In general, when the price of a good increases, people will purchase less of that good. This is referred to as the law of demand—people demand less of something when it is more expensive (assuming prices of other goods and peoples’ incomes have not changed). By relating the quantity demanded and the price of a good, we can estimate the [demand function](#) for that good. From this, we can draw the demand curve, the graphical representation of the demand function.

It is often incorrectly assumed that a good’s market price measures its economic value. However, the market price only tells us the *minimum* amount that people who buy the good are willing to pay for it. When people purchase a marketed good, they compare the amount they would be willing to pay for that good with its market price. They will only purchase the good if their willingness to pay is equal to or greater than the price. Many people are actually willing to pay more than the market price for a good, and thus their values exceed the market price.



In order to make resource allocation decisions based on economic values, what we really want to measure is the net economic benefit from a good or service. For individuals, this is measured by the amount that people are willing to pay, *beyond* what they actually pay. Thus, two goods that sell for the same price may have different net benefits. For example, I may have a choice between wheat and multi-grain bread, which both sell for \$2.00 per loaf. Because I prefer multi-grain, I am willing to pay up to \$3.00 for a loaf. However, I would only pay \$2.50 at the most for the wheat bread. Therefore, the net economic benefit I receive for the multi-grain bread is \$1.00, and for the wheat bread is only \$.50.

In the absence of ownership and efficient pricing, we need special techniques to place consumer preferences for natural resources and environmental goods and services on common ground with the demands for more conventional commodities. Three types of procedures have been employed to measure these demands.

- **Travel cost and random utility models, which are based on expenditures and travel behavior for recreational opportunities**
- **Hedonic methods of decomposing prices of market goods to extract embedded values for related environmental attributes**
- **Experimental methods for eliciting preferences, either by using hypothetical settings, called contingent valuation, or by constructing a market where none existed**

Travel cost models, random utility models, and hedonic methods are indirect measures based on observable behavior. Experimental methods, or contingent valuation, are based on direct surveys of individuals.



Contingent Valuation Method

Overview

The contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystem and environmental services. It can be used to estimate both [use](#) and [non use values](#), and it is the most widely used method for estimating non-use values. It is also the most controversial of the non-market valuation methods.

The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services. In some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. It is called “contingent” valuation, because people are asked to state their willingness to pay, *contingent* on a specific hypothetical scenario and description of the environmental service.

The contingent valuation method is referred to as a “stated preference” method, because it asks people to directly state their values, rather than inferring values from actual choices, as the “revealed preference” methods do. The fact that CV is based on what people say they would do, as opposed to what people are observed to do, is the source of its greatest strengths and its greatest weaknesses.

Contingent valuation is one of the only ways to assign dollar values to non-use values of the environment—values that do not involve market purchases and may not involve direct participation. These values are sometimes referred to as “passive use” values. They include everything from the basic life support functions associated with ecosystem health or biodiversity, to the enjoyment of a scenic vista or a wilderness experience, to appreciating the option to fish or bird watch in the future, or the right to bequest those options to your grandchildren. It also includes the value people place on simply knowing that giant pandas or whales exist.

It is clear that people are willing to pay for non-use, or passive use, environmental benefits. However, these benefits are likely to be implicitly treated as zero unless their dollar value is somehow estimated. So, how much are they worth? Since people do not reveal their willingness to pay for them through their purchases or by their behavior, the only option for estimating a value is by asking them questions.

However, the fact that the contingent valuation method is based on asking people questions, as opposed to observing their actual behavior, is the source of enormous controversy. The conceptual, empirical, and practical problems associated with developing dollar estimates of economic value on the basis of how people respond to hypothetical questions about hypothetical market situations are debated constantly in the economics literature. CV researchers are attempting to address these problems, but they are far from finished. Meanwhile, many economists, as well as many psychologists and sociologists, for many different reasons, do not believe the dollar estimates that result from CV are valid. More importantly, many jurists and policy-makers will not accept the results of



CV. Because of its controversial nature, users must be extremely cautious about spending money on CV studies and about using the results of CV studies.

This section continues with some example applications of the contingent valuation method, followed by a more complete technical description of the method and its advantages and limitations.

Hypothetical Scenario:

A remote site on public land provides important habitat for several species of wildlife. The management agency in charge of the area must decide whether to issue a lease for mining at the site. Thus, they must weigh the value of the mining lease against the wildlife habitat benefits that may be lost if the site is developed. Because the area is remote, few people actually visit it, or view the animals that rely on it for habitat. Therefore, non-use values are the largest component of the value for preserving the site.

Why Use the Contingent Valuation Method?

The contingent valuation method was selected in this case because of the importance of non-use values, and their potentially significant levels.

Alternative Approaches:

Since non-use values are significant, and few people actually visit the site, other methods, such as the travel cost method, will underestimate the benefits of preserving the site. In this case, contingent choice methods might also be used, depending on the questions that must be answered, and whether contingent choice question formats are more effective than standard contingent valuation questions. This would be decided in the survey development stage of the application.

Application of the Contingent Valuation Method:

Step 1:

The first step is to define the valuation problem. This would include determining exactly what services are being valued, and who the relevant population is. In this case, the resource to be valued is a specific site and the services it provides – primarily wildlife habitat. Because it is federally owned public land, the relevant population would be all citizens of the U.S.

Step 2:

The second step is to make preliminary decisions about the survey itself, including whether it will be conducted by mail, phone or in person, how large the sample size will be, who will be surveyed, and other related questions. The answers will depend, among other things, on the importance of the valuation issue, the complexity of the question being asked, and the size of the budget.



In-person interviews are generally the most effective for complex questions, because it is often easier to explain the required background information to respondents in person, and people are more likely to complete a long survey when they are interviewed in person. In some cases, visual aids such as videos or color photographs may be presented to help respondents understand the conditions of the scenario that they are being asked to value.

In-person interviews are generally the most expensive type of survey. However, mail surveys that follow procedures that aim to obtain high response rates can also be quite expensive. Mail and telephone surveys must be kept fairly short, or response rates are likely to drop dramatically. Telephone surveys may be less expensive, but it is often difficult to ask contingent valuation questions over the telephone, because of the amount of background information required.

In this hypothetical case, the researchers have decided to conduct a mail survey, because they want to survey a large sample, over a large geographical area, and are asking questions about a specific site and its benefits, which should be relatively easy to describe in writing in a relatively short survey.

Step 3:

The next step is the actual survey design. This is the most important and difficult part of the process, and may take six months or more to complete. It is accomplished in several steps. The survey design process usually starts with initial interviews and/or focus groups with the types of people who will be receiving the final survey, in this case the general public. In the initial focus groups, the researchers would ask general questions, including questions about peoples' understanding of the issues related to the site, whether they are familiar with the site and its wildlife, whether and how they value this site and the habitat services it provides.

In later focus groups, the questions would get more detailed and specific, to help develop specific questions for the survey, as well as decide what kind of background information is needed and how to present it. For example, people might need information on the location and characteristics of the site, the uniqueness of species that have important habitat there, and whether there are any substitute sites that provide similar habitat. The researchers would also want to learn about peoples' knowledge of mining and its impacts, and whether mining is a controversial use of the site. If people are opposed to mining, they may answer the valuation questions with this in mind, rather than expressing their value for the services of the site. At this stage, test different approaches to the valuation question and different payment mechanisms would be tested. Questions that can identify any "protest" bids or other answers that do not reveal peoples' values for the services of interest would also be developed and tested at this stage.

After a number of focus groups have been conducted, and the researchers have reached a point where they have an idea of how to provide background information, describe the hypothetical scenario, and ask the valuation question, they will start pre-testing the survey. Because the survey will be conducted by mail, it should be



pretested with as little interaction with the researchers as possible. People would be asked to assume that they've received the survey in the mail and to fill it out. Then the researchers would ask respondents about how they filled it out, and let them ask questions about anything they found confusing. Eventually, a mail pretest might be conducted. The researchers continue this process until they've developed a survey that people seem to understand and answer in a way that makes sense and reveals their values for the services of the site.

Step 4:

The next step is the actual survey implementation. The first task is to select the survey sample. Ideally, the sample should be a randomly selected sample of the relevant population, using standard statistical sampling methods. In the case of a mail survey, the researchers must obtain a mailing list of randomly sampled U.S. citizens. They would then use a standard repeat-mailing and reminder method, in order to get the greatest possible response rate for the survey. Telephone surveys are carried out in a similar way, with a certain number of calls to try to reach the selected respondents. In-person surveys may be conducted with random samples of respondents, or may use "convenience" samples – asking people in public places to fill out the survey.

Step 5:

The final step is to compile, analyze and report the results. The data must be entered and analyzed using statistical techniques appropriate for the type of question. In the data analysis, the researchers also attempt to identify any responses that may not express the respondent's value for the services of the site. In addition, they can deal with possible non-response bias in a number of ways. The most conservative way is to assume that those who did not respond have zero value.

How Do We Use the Results?

From the analysis, the researchers can estimate the average value for an individual or household in the sample, and extrapolate this to the relevant population in order to calculate the total benefits from the site. For example, if they find that the mean willingness to pay is \$.10 per capita, the total benefits to all citizens would be \$26 million.

Case Study Examples of the Contingent Valuation Method:

Case # 1—Mono Lake

The Situation

The State of California Water Resources Control Board was faced with a decision about how much water to allocate to Los Angeles from sources flowing into Mono Lake. The reduced water flows to the lake were affecting food supplies for nesting



and migratory birds. One of the first contingent valuation studies to measure the use and non-use values that citizens have for public trust resources was a survey of California households regarding willingness to pay for increased water flows into Mono Lake.

Initial Work

The initial academic study asked California households, in a mail survey, whether they would pay more on their water bill for higher cost replacement water supplies, so that natural flows could once again go into Mono Lake. They were told that, according to biologists, the higher flows to the lake were needed to maintain food supplies for nesting and migratory birds.

The average willingness to pay per household was estimated to be \$13 per month, or \$156 per year. When multiplied by the number of households in California, the total benefits exceeded the \$26 million cost of replacing the water supply by a factor of 50. One impact of the survey results was to change the nature of the debate over Mono Lake from "fish or people" to one that recognized that people care about fish and birds, as well as about inexpensive water supplies for Los Angeles.

Follow-up Work

The State of California determined that information about the general public's willingness to pay for increased water in Mono Lake could be an important part of the economic analysis of the water allocation decision. As part of an Environmental Impact Report, the State hired a consulting firm to perform a more detailed contingent valuation survey. This new survey involved the use of photo-simulations showing what the lake would look like at alternative water levels. It also gave detailed information about effects of changing lake levels on different bird species. The survey was conducted over the telephone, with people who had been mailed information booklets with maps and photo-simulations. Survey respondents were asked how they would vote in a hypothetical referendum regarding Mono Lake.

This study also showed that the benefits of a moderately high (but not the highest) lake level were greater than the costs. While one cannot claim the economic analysis was a deciding factor, the California Water Resources Control Board did reduce Los Angeles' water rights by half, from 100,000 acre feet to about 50,000 acre feet, to allow more flows into Mono Lake.

Case # 2 – Water Over the Falls

The Situation

The Federal Energy Regulatory Commission faced a licensing decision where one important issue was how much water the utility company should allow to flow over the falls at a recreation area. Increasing the flow over the falls would result in less hydropower generated, but more water for recreation. The previous license required



only a minimum instream flow of 50 cubic feet per second, which reduced the flow over the falls to a trickle.

The Application

A contingent valuation survey was developed to determine how much visitors to the falls would be willing to pay for increased overflow levels. The survey instrument included pictures of the falls at four different flow levels and a series of valuation questions. It was mailed to a sample of previous visitors to the site. The key survey questions asked how much individuals would pay to visit the falls with each of the four flow levels depicted in the photos, and how many times they would visit each year at the four different flow levels.

Results

Since both visitation and value per day were sensitive to flow, a statistical analysis of the survey results was used to estimate a total recreation benefit function. Using this function, the economic value of additional flows in each month was calculated, and compared to the economic value of the foregone hydropower required to allow the additional flows. The resulting optimum flow level during the summer months, when visitation was high, was calculated as 500 cubic feet per second, which was ten times larger than the existing minimum instream flow.

Case # 3 – Glen Canyon Dam

The Situation

One of the highest profile uses of the contingent valuation method in water resources management involved the re-regulation of Glen Canyon dam. In the early 1980's it became clear that continued operation of the dam to provide peak-load power was adversely affecting the downstream ecosystem in the Grand Canyon, and significantly reducing the quality of recreational rafting. The valuation question of concern was how much recreational rafting was worth, compared to the market value of the peak-load power supply.

Application

The Bureau of Reclamation and National Park Service worked with a consulting firm to develop a contingent valuation survey to estimate how the value of rafting changed with different flows in the Grand Canyon. The study attempted to quantify how the value of rafting in the Grand Canyon would change with more even base flows, as compared to reduced flows during peak-power periods. The study found substantial economic values for rafting with increased water flows – \$2 million per year.

As in the Mono Lake study, the impact of the contingent valuation analysis helped change perspectives about how economic tradeoffs should be discussed. Rather than



recreation versus hydropower, the challenge was now to find a release pattern that increased the economic value of all uses of the river water.

Results

For a variety of reasons, more even flows were put into place while the final environmental impact studies were being prepared, and Congress formalized these flows when it passed the Grand Canyon Protection Act of 1992. Whatever the effects of the contingent valuation study on that decision, the study did represent one of the first federally-funded projects to estimate non-use values. It was also one of the first contingent valuation studies included as part of a federally funded economic analysis.

Additional Research

As it became clear that more than recreation was at stake in re-regulation of the dam, it became more obvious that citizens throughout the U.S., not just rafters, cared about how dam operations affected the natural resources of the Grand Canyon. In particular, people were concerned about threatened and endangered fish, native vegetation, and birds, which were all being adversely affected by "unnatural" water flows and a lack of high spring water flows. As a result, the Bureau of Reclamation funded a major contingent valuation study of households throughout the U.S. to estimate their willingness to pay for flow regimes that would protect the natural resources in the Grand Canyon.

The results showed strong support for a more natural flow regime. While it would be difficult to point to any one study as definitively affecting the management of the Glen Canyon dam, the public support illustrated through the contingent valuation study, and in other ways, resulted in substantial changes in the management of the dam. This included large spills during the spring of 1995 to emulate the natural high spring flows.

Case Study # 4 – Economic Value of Noncommercial Fish Situation

Rivers in the Four Corners Region provide 2,465 river miles of critical habitat for nine species of fish that are listed as threatened or endangered. Continued protection of these areas required habitat improvements, such as fish passageways, as well as bypass releases of water from dams to imitate natural water flows needed by fish. A contingent valuation survey was used to estimate the economic value for preserving the critical habitat.

Application

Survey respondents were provided detailed maps that highlighted the areas designated as critical habitat units for the fish. They were told that some State and Federal officials thought the combined costs of the habitat improvements and the restrictions on hydropower were too costly and had put forward a proposal to eliminate the critical habitat unit designation. They were asked if they would contribute to the Four Corners Region Threatened and Endangered Fish Trust Fund.



Respondents were also told that efforts to raise funds would involve contributions from all U.S. taxpayers. If a majority of households voted in favor of the fund, the fish species would be protected from extinction. This would be accomplished through water releases from Federal dams timed to benefit fish, and through the purchase of water rights to maintain instream flows. Also, within the next 15 years, three fish species would increase in population to the point that they would no longer be listed as threatened species.

On the other hand, if a majority of households in the U.S. voted not to approve the fund, the critical habitats shown on the map would be eliminated. This would mean that water diversion activity and maximum power production would reduce the amount of habitat for these nine fish species. Respondents were told that if this occurred, biologists expected that four of the nine fish species would likely become extinct in 15 years.

The exact wording on the questionnaire was:

*Suppose a proposal to establish a Four Corners Region Threatened and Endangered Fish Trust Fund was on the ballot in the next nationwide election. How would you vote on this proposal? Remember, by law, the funds could only be used to improve habitat for fish. If the Four Corners Region Threatened and Endangered Fish Trust Fund was the only issue on the next ballot and it would cost your household \$_____ every year, would you vote in favor of it?
(Please circle one.) YES / NO*

The dollar amount, blank in the above illustration, was filled in with one of 14 amounts ranging from \$1-\$3 to \$350, which were randomly assigned to survey respondents.

Results

The questionnaire was sent to a random sample of 800 households in the Four Corners states of Arizona, Colorado, New Mexico, and Utah (with the proportions based on the states' relative populations). An additional 800 households were sampled from the rest of the U.S. The average willingness to pay was estimated to be \$195 per household. When extrapolated to the general population, the value of preserving the habitat areas was determined to be far in excess of the costs.

Case Study # 5 – Salmon Restoration Situation

As more and more anadromous fish species have been added to the Endangered Species list, the removal of dams blocking salmon migration routes has been proposed. The first dams to receive a formal environmental impact analysis for removal are the Elwha and Glines dams on the Elwha River on the Olympic Peninsula in Washington. These 200-foot dams are very old and have no fish ladders. They block migration of fish to 70 miles of pristine spawning grounds in Olympic National



Park, and it was estimated that their removal would more than triple salmon populations on the Elwha River. However, the cost to remove the dams and the 50 years of sediment build-up behind them was estimated to be in the neighborhood of \$100-\$125 million.

Application

A contingent valuation survey was developed to estimate the economic values associated with the removal of the dams. Households in Washington and elsewhere were asked if they would vote in favor of removing the dams and restoring the river, in order to triple salmon populations at an annual cost that varied across households.

Results

The estimated economic values per household ranged from \$73 for Washington households to \$68 for the rest of the U.S. households. Using these results, the economic value to Washington residents alone would nearly be enough to justify removing the dams and restoring the river. If one applied the average willingness to pay per household to the remaining 86 million households in the rest of the U.S., national willingness to pay was in excess of \$1 billion. Researchers concluded that despite any upward bias in the estimates of willingness to pay, the national benefits of removing the dams, in all likelihood, far exceeded the costs.

These results were included in the draft and final Environmental Impact Statements on dam removal which were prepared by the National Park Service. The recommendation in both the draft and final Environmental Impact Statement was to remove both dams and restore the Elwha River. In its budget request to Congress, the Clinton Administration included a request for money to purchase the dams from the private owners, with the intent of requesting funds for dam removal and restoration in subsequent years.

Summary of the Contingent Valuation Method:

The contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystem and environmental services. The method has great flexibility, allowing valuation of a wider variety of non-market goods and services than is possible with any other non-market valuation technique. It can be used to estimate both use and non-use values, and it is the most widely used method for estimating non-use values. It is also the most controversial of the non-market valuation methods.

The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services. In some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. It is called “contingent” valuation, because people are asked to state their willingness to pay, contingent on a specific hypothetical scenario and description of the environmental service.



The contingent valuation method is referred to as a “stated preference” method, because it asks people to directly state their values, rather than inferring values from actual choices, as the “revealed preference” methods do. It circumvents the absence of markets for environmental goods by presenting consumers with hypothetical markets in which they have the opportunity to pay for the good in question. The hypothetical market may be modeled after either a private goods market or a political market.

The fact that contingent valuation is based on what people say they would do, as opposed to what people are observed to do, is the source of its greatest strengths and its greatest weaknesses. Contingent valuation is one of the only ways to assign dollar values to non-use values of the environment—values that do not involve market purchases and may not involve direct participation. These values are sometimes referred to as “passive use” values. They include everything from the basic life support functions associated with ecosystem health or biodiversity, to the enjoyment of a scenic vista or a wilderness experience, to appreciating the option to fish or bird watch in the future, or the right to bequest those options to your grandchildren. It also includes the value people place on simply knowing that giant pandas or whales exist.

It is clear that people value non-use, or passive use, environmental benefits. However, these benefits are likely to be implicitly treated as zero unless their dollar value is somehow estimated. So, how much are they worth? Since people do not reveal their willingness to pay for them through their purchases or by their behavior, the only option for estimating a value is by asking them questions.

However, the fact that the contingent valuation method is based on asking people questions, as opposed to observing their actual behavior, is the source of enormous controversy. The conceptual, empirical, and practical problems associated with developing dollar estimates of economic value on the basis of how people respond to hypothetical questions about hypothetical market situations are debated constantly in the economics literature. CV researchers are attempting to address these problems, but they are far from finished. Meanwhile, many economists, psychologists and sociologists, for many different reasons, do not believe the dollar estimates that result from CV are valid. More importantly, many jurists and policy-makers will not accept the results of CV. Because of its controversial nature, users must be extremely cautious about spending money on CV studies and about using the results of CV studies.

Applying the Contingent Valuation Method:

Applying the contingent valuation method is generally a complicated, lengthy, and expensive process. In order to collect useful data and provide meaningful results, the contingent valuation survey must be properly designed, pre-tested, and implemented. Contingent valuation survey questions must focus on specific environmental service(s) and a specific context that is clearly defined and understood by survey respondents. In other words, a CV survey to assess the dollar value of the results of an environmental improvement cannot be based on the environmental improvement itself, but on increases in specific environmental services that the improvement is expected to provide.



The results of contingent valuation surveys are often highly sensitive to what people believe they are being asked to value, as well as the context that is described in the survey. Thus, it is essential for CV researchers to clearly define the services and the context, and to demonstrate that respondents are actually stating their values for these services when they answer the valuation questions.

A good CV study will consider the following in its application:

- Before designing the survey, learn as much as possible about how people think about the good or service in question. Consider people's familiarity with the good or service, as well as the importance of such factors as quality, quantity, accessibility, the availability of substitutes, and the reversibility of the change.
- Determine the extent of the affected populations or markets for the good or service in question, and choose the survey sample based on the appropriate population.
- The choice scenario must provide an accurate and clear description of the change in environmental services associated with the event, program, investment, or policy choice under consideration. If possible, convey this information using photographs, videos, or other multi-media techniques, as well as written and verbal descriptions.
- Unlike ordinary survey questions, which sometimes ask respondents whether they are willing to pay x dollars to improve "air quality," the nature of the good and the changes to be valued must be specified in detail in a CV survey. It is also important to make sure that respondents do not inadvertently assume that one or more related improvements are included. For example, if people are asked to value only air visibility, it would be important to make sure that they do not include their value for health-related improvements in their stated willingness to pay amount. Similarly, if people have a tendency to think of environmental improvements in general, even when asked about water quality alone, it would be necessary to point out specifically that environmental quality, other than water quality, would remain the same.
- Questions can be asked in a variety of ways, using both open-ended and closed-ended formats. In the open-ended format, respondents are asked to state their maximum willingness to pay for the environmental improvement. With the closed-ended format, also referred to as discrete choice, respondents are asked whether or not they would be willing to pay a particular amount for the environmental improvement, or whether they would vote yes or no for a specific policy at a given cost. The discrete choice format is generally accepted as the preferred method.
- In addition to the hypothetical question that asks for willingness to pay, the survey must specify the mechanism by which the payment will be made, for example through increased taxes. In order for the question to be effective, the respondent must believe that if the money was paid, whoever was collecting it could effect the specified environmental change.
- Respondents should be reminded to consider their budget constraints.



- Specify whether comparable services are available from other sources, when the good is going to be provided, and whether the losses or gains are temporary or permanent.
- Respondents should understand the frequency of payments required, for example monthly or annually, and whether or not the payments will be required over a long period of time in order to maintain the quantity or quality change. They should also understand who would have access to the good and who else will pay for it, if it is provided.
- In the case of collectively held goods, respondents should understand that they are currently paying for a given level of supply. The scenario should clearly indicate whether the levels being valued are improvements over the status quo, or potential declines in the absence of sufficient payments.
- If the household is the unit of analysis, the reference income should be the household's, rather than the respondent's, income.
- Thoroughly pre-test the valuation questionnaire for potential biases. Pre-testing includes testing different ways of asking the same question, testing whether the question is sensitive to changes in the description of the good or resource being valued, and conducting post-survey interviews to determine whether respondents are stating their values as expected.
- Include validation questions in the survey, to verify comprehension and acceptance of the scenario, and to elicit socioeconomic and attitudinal characteristics of respondents, in order to better interpret variation in responses across respondents.
- CVM can be conducted as in-person interviews, telephone interviews or mail surveys. The in-person interview is the most expensive survey administration format, but is generally considered to be the best approach, especially if visual materials are to be presented.
- Interview a large, clearly defined, representative sample of the affected population.
- Achieve a high response rate and a mix of respondents that represents the population.
- Whatever survey instruments and survey designs are used, and whatever response rate is achieved, make sure that survey results are analyzed and interpreted by professionals before making any claims about the resulting dollar values.

Advantages of the Contingent Valuation Method:

- Contingent valuation is enormously flexible in that it can be used to estimate the economic value of virtually anything. However, it is best able to estimate values for goods and services that are easily identified and understood by users and that are consumed in discrete units (e.g., user days of recreation), even if there is no observable behavior available to deduce values through other means.
- CV is the most widely accepted method for estimating [total economic value](#) , including all types of [non-use, or "passive use," values](#). CV can estimate [use values](#) , as well as [existence values](#) , [option values](#) , and [bequest values](#) .



- Though the technique requires competent survey analysts to achieve defensible estimates, the nature of CV studies and the results of CV studies are not difficult to analyze and describe. Dollar values can be presented in terms of a mean or median value per capita or per household, or as an aggregate value for the affected population.
- CV has been widely used, and a great deal of research is being conducted to improve the methodology, make results more valid and reliable, and better understand its strengths and limitations.

Issues and Limitations of the Contingent Valuation Method:

- Although the contingent valuation method has been widely used for the past two decades, there is considerable controversy over whether it adequately measures people's willingness to pay for environmental quality.
- People have practice making choices with market goods, so their purchasing decisions in markets are likely to reflect their true willingness to pay. CV assumes that people understand the good in question and will reveal their preferences in the contingent market just as they would in a real market. However, most people are unfamiliar with placing dollar values on environmental goods and services. Therefore, they may not have an adequate basis for stating their true value.
- The expressed answers to a willingness to pay question in a contingent valuation format may be biased because the respondent is actually answering a different question than the surveyor had intended. Rather than expressing value for the good, the respondent might actually be expressing their feelings about the scenario or the valuation exercise itself. For example, respondents may express a positive willingness to pay because they feel good about the act of giving for a social good (referred to as the “warm glow” effect), although they believe that the good itself is unimportant. Respondents may state a positive willingness to pay in order to signal that they place importance on improved environmental quality in general. Alternatively, some respondents may value the good, but state that they are not willing to pay for it, because they are protesting some aspect of the scenario, such as increased taxes or the means of providing the good.
- Respondents may make associations among environmental goods that the researcher had not intended. For example, if asked for willingness to pay for improved visibility (through reduced pollution), the respondent may actually answer based on the health risks that he or she associates with dirty air.
- Some researchers argue that there is a fundamental difference in the way that people make hypothetical decisions relative to the way they make actual decisions. For example, respondents may fail to take questions seriously because they will not actually be required to pay the stated amount. Responses may be unrealistically high if respondents believe they will not have to pay for the good or service and that their answer may influence the resulting supply of the good. Conversely, responses may be unrealistically low if respondents believe they will have to pay.



- The payment question can either be phrased as the conventional ‘What are you willing to pay (WTP) to receive this environmental asset?’, or in the less usual form, ‘What are you willing to accept (WTA) in compensation for giving up this environmental asset?’ In theory, the results should be very close. However, when the two formats have been compared, WTA very significantly exceeds WTP. Critics have claimed that this result invalidates the CVM approach, showing responses to be expressions of what individuals would like to have happen rather than true valuations.
- If people are first asked for their willingness to pay for one part of an environmental asset (e.g. one lake in an entire system of lakes) and then asked to value the whole asset (e.g. the whole lake system), the amounts stated may be similar. This is referred to as the “embedding effect.”
- In some cases, people’s expressed willingness to pay for something has been found to depend on where it is placed on a list of things being valued. This is referred to as the "ordering problem."
- Respondents may give different willingness to pay amounts, depending on the specific payment vehicle chosen. For example, some payment vehicles, such as taxes, may lead to protest responses from people who do not want increased taxes. Others, such as a contribution or donation, may lead people to answer in terms of how much they think their “fair share” contribution is, rather than expressing their actual value for the good.
- Many early studies attempted to prompt respondents by suggesting a starting bid and then increasing or decreasing this bid based upon whether the respondent agreed or refused to pay a such sum. However, it has been shown that the choice of starting bid affects respondents’ final willingness to pay response.
- Strategic bias arises when the respondent provides a biased answer in order to influence a particular outcome. If a decision to preserve a stretch of river for fishing, for example, depends on whether or not the survey produces a sufficiently large value for fishing, the respondents who enjoy fishing may be tempted to provide an answer that ensures a high value, rather than a lower value that reflects their true valuation.
- Information bias may arise whenever respondents are forced to value attributes with which they have little or no experience. In such cases, the amount and type of information presented to respondents may affect their answers
- Non-response bias is a concern when sampling respondents, since individuals who do not respond are likely to have, on average, different values than individuals who do respond.
- Estimates of nonuse values are difficult to validate externally.
- When conducted to the exacting standards of the profession, contingent valuation methods can be very expensive and time-consuming, because of the extensive pre-testing and survey work.

Many people, including jurists policy-makers, economists, and others, do not believe the results of CV.



The Contingent Choice Method

Overview

The contingent choice method is similar to contingent valuation, in that it can be used to estimate economic values for virtually any ecosystem or environmental service, and can be used to estimate non-use as well as use values. Like contingent valuation, it is a hypothetical method – it asks people to make choices based on a hypothetical scenario. However, it differs from contingent valuation because it does not directly ask people to state their values in dollars. Instead, values are inferred from the hypothetical choices or tradeoffs that people make.

The contingent choice method asks the respondent to state a preference between one group of environmental services or characteristics, at a given price or cost to the individual, and another group of environmental characteristics at a different price or cost. Because it focuses on tradeoffs among scenarios with different characteristics, contingent choice is especially suited to policy decisions where a set of possible actions might result in different impacts on natural resources or environmental services. For example, improved water quality in a lake will improve the quality of several services provided by the lake, such as drinking water supply, fishing, swimming, and biodiversity. In addition, while contingent choice can be used to estimate dollar values, the results may also be used to simply rank options, without focusing on dollar values.

This section continues with some example applications of the contingent choice method, followed by a more complete technical description of the method and its advantages and limitations.

Hypothetical Scenario:

In the contingent valuation section, we used the case of a remote site on public land that provides important habitat for several species of wildlife. The management agency in charge of the area must decide whether to issue a lease for mining at the site. Suppose that there are several possible options for preserving and/or using the site. These include allowing no mining and preserving the site as a wilderness habitat area, and various levels and locations for the mining operation, each of which would have different impacts on the site. Thus, several options must be weighed in terms of costs and benefits to the public. Again, because the area is remote, few people actually visit it, or view the animals that rely on it for habitat. Therefore, non-use values are the largest component of the value for preserving the site.

Why Use the Contingent Choice Method?

The contingent choice method was selected in this case because we want to value the outcomes of several policy options, and because non-use values are important.



Alternative Approaches:

Since non-use values are significant, and few people actually visit the site, other methods, such as the travel cost method, will underestimate the benefits of preserving the site. In this case, contingent valuation methods might also be used. However, because we need to value several levels of services, based on different scenarios, the survey questions might become quite complicated.

Application of the Contingent Choice Method:

Because both contingent choice and contingent valuation are hypothetical survey-based methods, their application is very similar. The main differences are in the design of the valuation question(s), and the data analysis.

Step 1:

The first step is to define the valuation problem. This would include determining exactly what services are being valued, and who the relevant population is. In this case, the resource to be valued is a specific site and the services it provides – primarily wildlife habitat. Because it is federally owned public land, the relevant population would be all citizens of the U.S.

Step 2:

The second step is to make preliminary decisions about the survey itself, including whether it will be conducted by mail, phone or in person, how large the sample size will be, who will be surveyed, and other related questions. The answers will depend, among other things, on the importance of the valuation issue, the complexity of the question(s) being asked, and the size of the budget.

In-person interviews are generally the most effective for complex questions, because it is often easier to explain the required background information to respondents in person, and people are more likely to complete a long survey when they are interviewed in person. In some cases, visual aids such as videos or color photographs may be presented to help respondents understand the conditions of the scenario(s) that they are being asked to value.

In-person interviews are generally the most expensive type of survey. However, mail surveys that follow procedures that aim to obtain high response rates can also be quite expensive. Mail and telephone surveys must be kept fairly short, or response rates are likely to drop dramatically. Telephone surveys are generally not appropriate for contingent choice surveys, because of the difficulty of conveying the tradeoff questions to people over the telephone.

In this hypothetical case, the researchers have decided to conduct a mail survey, because they want to survey a large sample, over a large geographical area, and are asking questions about a specific site and its benefits, which should be relatively easy to describe in writing in a relatively short survey.



Step 3:

The next step is the actual survey design. This is the most important and difficult part of the process, and may take six months or more to complete. It is accomplished in several steps. The survey design process usually starts with initial interviews and/or focus groups with the types of people who will be receiving the final survey, in this case the general public. In the initial focus groups, the researchers would ask general questions, including questions about peoples' understanding of the issues related to the site, whether they are familiar with the site and its wildlife, whether and how they value this site and the habitat services it provides.

In later focus groups, the questions would get more detailed and specific, to help develop specific questions for the survey, as well as decide what kind of background information is needed and how to present it. For example, people might need information on the location and characteristics of the site, the uniqueness of species that have important habitat there, and whether there are any substitute sites that provide similar habitat.

At this stage, the researchers would test different approaches to the choice question. Usually, a contingent choice survey will ask each respondent a series of choice questions, each presenting different combinations and levels of the relevant services, as well as the cost to the respondent of the action or policy. In this example, each choice might be described in terms of the site's ability to support each of the important wildlife species. Thus, people will be making tradeoffs among the different species that might be affected in different ways by each possible choice of scenario.

After a number of focus groups have been conducted, and the researchers have reached a point where they have an idea of how to provide background information, describe the hypothetical scenario, and ask the choice question, they will start pre-testing the survey. Because the survey will be conducted by mail, it should be pretested with as little interaction with the researchers as possible. People would be asked to assume that they've received the survey in the mail and to fill it out. Then the researchers would ask respondents about how they filled it out, and let them ask questions about anything they found confusing. Eventually, a mail pretest might be conducted. The researchers continue this process until they've developed a survey that people seem to understand and answer in a way that makes sense and reveals their values for the services of the site.

Step 4:

The next step is the actual survey implementation. The first task is to select the survey sample. Ideally, the sample should be a randomly selected sample of the relevant population, using standard statistical sampling methods. In the case of a mail survey, the researchers must obtain a mailing list of randomly sampled U.S. citizens. They would then use a standard repeat-mailing and reminder method, in order to get the greatest possible response rate for the survey. Telephone surveys are carried out in a similar way, with a certain number of calls to try to reach the selected



respondents. In-person surveys may be conducted with random samples of respondents, or may use “convenience” samples – asking people in public places to fill out the survey.

Step 5:

The final step is to compile, analyze and report the results. The statistical analysis for contingent choice is often more complicated than that for contingent valuation, requiring the use of discrete choice analysis methods to infer willingness to pay from the tradeoffs made by respondents.

From the analysis, the researchers can estimate the average value for each of the services of the site, for an individual or household in our sample. This can be extrapolated to the relevant population in order to calculate the total benefits from the site under different policy scenarios. The average value for a specific action and its outcomes can also be estimated, or the different policy options can simply be ranked in terms of peoples’ preferences.

How Do We Use the Results?

The results of the survey might show that the economic benefits of preserving the site by not allowing mining are greater than the benefits received from allowing mining. If this were the case, the mining lease might not be issued, unless other factors override these results. Alternatively, the results might indicate that some mining scenarios are acceptable, in terms of economic costs and benefits. The results could then be used to rank different options, and to help select the most preferred option.

Case Study Examples of the Contingent Choice Method:

Case # 1—Landfill Siting in Rhode Island

The Situation

With its primary landfill nearing capacity, the State of Rhode Island was faced with the need to choose locations for new landfills, a highly controversial process.

The Challenge

Besides technical considerations, the State wanted to address the social and economic tradeoffs and values related to the location of a landfill. In this way, State officials hoped to avoid some of the controversy associated with landfill siting.

The Analysis

Researchers at the University of Rhode Island conducted a contingent choice, paired comparison, survey. The survey asked Rhode Island residents to choose between



pairs of hypothetical sites and locations for a new landfill, described in terms of their characteristics. The site comparisons described the natural resources that would be lost on a hypothetical 500 acre landfill site. The location comparisons described the area surrounding the landfill. Each comparison also gave the cost per household for locating a landfill at each hypothetical site or location.

The Results

The results of the survey were used by the State to predict how residents would vote in a referendum on different possible landfill locations. First, 59 possible sites were selected, based on geological and public health criteria. These sites were ranked using the contingent choice survey results, in order to come up with a short list of potential sites, which was further evaluated and narrowed down. The final decision, based on geological, public health, public preferences, and political considerations, was to expand the existing landfill site.

Case # 2—Management of the Peconic Estuary System

The Situation

The environmental and natural resources of the Peconic Estuary System—the bay waters, beaches, wetlands, ecosystems, habitats, and parks and watershed lands—provide many services to the public. The Peconic Estuary Program was established under the National Estuary Program, to create a conservation and management plan for the environment and natural resources of the Estuary.

The Challenge

In order to develop a management plan that best serves the public, information was needed about the value that the public holds for the ecosystem services of the Estuary.

The Analysis

Several studies were conducted to estimate the uses and economic values associated with the Estuary, including a contingent choice survey to estimate the relative preferences and economic values that residents and second homeowners have for preserving and restoring key natural and environmental resources: open space, farmland, unpolluted shellfish grounds, eelgrass beds, and intertidal salt marsh.

The Results

Early discussions revealed that the public has a strong attachment to environmental and amenity resources of the Peconic Estuary, even if they do not use these resources directly. Most respondents to the survey (97 percent) supported at least one hypothetical action to protect resources, and indicated they would financially support such actions. The relative priorities of respondents for protecting natural resources, in



order, were for farmland, eelgrass, wetlands, shellfish, and undeveloped land. The estimated per acre dollar values were about \$13 thousand for undeveloped land, \$30 thousand for unpolluted shellfish grounds, \$54 thousand for saltmarsh, \$66 thousand for eelgrass and \$70 thousand for farmland. The survey results indicated that the resource priorities, or relative values of resources, are more reliable than are the dollar estimates of values, and thus the researchers recommended that relative values, rather than dollar values, be used in the process of selecting management actions.

Summary of the Contingent Choice Method

The contingent choice method is similar to contingent valuation, in that it can be used to estimate economic values for virtually any ecosystem or environmental service, and can be used to estimate non-use as well as use values. Like contingent valuation, it is a hypothetical method – it asks people to make choices based on a hypothetical scenario. However, it differs from contingent valuation because it does not directly ask people to state their values. Instead, values are inferred from the hypothetical choices or tradeoffs that people make.

Contingent choice, also referred to as conjoint analysis, was developed in the fields of marketing and psychology to measure preferences for different characteristics or attributes of a multi-attribute choice. For example, a marketing study might ask potential consumers to state which of two hypothetical cars they prefer, with each car described in terms of its characteristics, such as price, roominess, reliability, safety, fuel economy, power and so on. Statistical techniques are then used to establish a relation between the characteristics and the individual's preferences. As long as one of the characteristics of the good is price, it is possible to derive the willingness to pay for changes in the levels of the good's other characteristics.

The contingent choice method asks the respondent to state a preference between one group of environmental services or characteristics, at a given price or cost to the individual, and another group of environmental characteristics at a different price or cost. Because it focuses on tradeoffs among scenarios with different characteristics, contingent choice is especially suited to policy decisions where a set of possible actions might result in different impacts on natural resources or environmental services. Thus, it is particularly useful in valuation of improvements to ecosystems, given that several service flows are often simultaneously affected. For example, improved water quality in a lake will improve the quality of several services provided by the lake, such as drinking water supply, fishing, swimming, and biodiversity. In addition, while contingent choice can be used to estimate dollar values, the results may also be used to simply rank options, without focusing on dollar values.

Applying the Contingent Choice Method

There are a variety of formats for applying contingent choice methods, including:

- **Contingent Ranking**—Contingent ranking surveys ask individuals to compare and rank alternate program outcomes with various characteristics, including costs. For instance, people might be asked to compare and rank



several mutually exclusive environmental improvement programs under consideration for a watershed, each of which has different outcomes and different costs. Respondents are asked to rank the alternatives in order of preference.

- **Discrete Choice**—In the discrete choice approach, respondents are simultaneously shown two or more different alternatives and their characteristics, and asked to identify the most preferred alternative in the choice.
- **Paired Rating**—This is a variation on the discrete choice format, where respondents are asked to compare two alternate situations and are asked to rate them in terms of strength of preference. For instance, people might be asked to compare two environmental improvement programs and their outcomes, and state which is preferred, and whether it is strongly, moderately, or slightly preferred to the other program.

Whatever format is selected, the choices that respondents make are statistically analyzed using discrete choice statistical techniques, to determine the relative values for the different characteristics or attributes. If one of the characteristics is a monetary price, then it is possible to compute the respondent's willingness to pay for the other characteristics.

As with contingent valuation, in order to collect useful data and provide meaningful results, the contingent choice survey must be properly designed, pre-tested, and implemented. However, because responses are focused on tradeoffs, rather than direct expressions of dollar values, contingent choice may minimize some of the problems associated with contingent valuation. Often, relative values are easier and more natural for people to express than absolute values.

As with contingent valuation, a good contingent choice study will consider the following in its application:

- Before designing the survey, learn as much as possible about how people think about the good or service in question. Consider people's familiarity with the good or service, as well as the importance of such factors as quality, quantity, accessibility, the availability of substitutes, and the reversibility of the change.
- Determine the extent of the affected populations or markets for the good or service in question, and choose the survey sample based on the appropriate population.
- The choice scenario must provide an accurate and clear description of the change in environmental services associated with the event, program, investment, or policy choice under consideration. If possible, convey this information using photographs, videos, or other multi-media techniques, as well as written and verbal descriptions.
- The nature of the good and the changes to be valued must be specified in detail, and it is important to make sure that respondents do not inadvertently assume that one or more related improvements are included.



- The respondent must believe that if the money was paid, whoever was collecting it could effect the specified environmental change.
- Respondents should be reminded to consider their budget constraints.
- Specify whether comparable services are available from other sources, when the good is going to be provided, and whether the losses or gains are temporary or permanent.
- Respondents should understand the frequency of payments required, for example monthly or annually, and whether or not the payments will be required over a long period of time in order to maintain the quantity or quality change. They should also understand who would have access to the good and who else will pay for it, if it is provided.
- In the case of collectively held goods, respondents should understand that they are currently paying for a given level of supply. The scenario should clearly indicate whether the levels being valued are improvements over the status quo, or potential declines in the absence of sufficient payments.
- If the household is the unit of analysis, the reference income should be the household's, rather than the respondent's, income.
- Thoroughly pre-test the questionnaire for potential biases. Pre-testing includes testing different ways of asking the same question, testing whether the question is sensitive to changes in the description of the good or resource being valued, and conducting post-survey interviews to determine whether respondents are stating their values as expected.
- Include validation questions in the survey, to verify comprehension and acceptance of the scenario, and to elicit socioeconomic and attitudinal characteristics of respondents, in order to better interpret variation in responses across respondents.
- Surveys can be conducted as in-person interviews, telephone interviews or mail surveys. The in-person interview is the most expensive survey administration format, but is generally considered to be the best approach, especially if visual materials are to be presented. Telephone surveys are generally not effective for presenting contingent choice questions.
- Interview a large, clearly defined, representative sample of the affected population.
- Achieve a high response rate and a mix of respondents that represents the population.
- Whatever survey instruments and survey designs are used, and whatever response rate is achieved, make sure that survey results are analyzed and interpreted by professionals before making any claims about the resulting dollar values.

Advantages of the Contingent Choice Method

- The contingent choice method can be used to value the outcomes of an action as a whole, as well as the various attributes or effects of the action.
- The method allows respondents to think in terms of tradeoffs, which may be easier than directly expressing dollar values. The tradeoff process may encourage respondent introspection and make it easier to check for consistency of responses. In addition, respondents may be able to give more



meaningful answers to questions about their behavior (i.e. they prefer one alternative over another), than to questions that ask them directly about the dollar value of a good or service or the value of changes in environmental quality. Thus, an advantage of this method over the contingent valuation method is that it does not ask the respondent to make a tradeoff *directly* between environmental quality and money.

- Respondents are generally more comfortable providing qualitative rankings or ratings of attribute bundles that include prices, rather than dollar valuation of the same bundles without prices, by de-emphasizing price as simply another attribute.
- Survey methods may be better at estimating relative values than absolute values. Thus, even if the absolute dollar values estimated are not precise, the relative values or priorities elicited by a contingent choice survey are likely to be valid and useful for policy decisions.
- The method minimizes many of the biases that can arise in open-ended contingent valuation studies where respondents are presented with the unfamiliar and often unrealistic task of putting prices on non-market amenities.
- The method has the potential to reduce problems such as expressions of symbolic values, protest bids, and some of the other sources of potential bias associated with contingent valuation.

Issues and Limitations of the Contingent Choice Method

- Respondents may find some tradeoffs difficult to evaluate, because they are unfamiliar.
- The respondents' behavior underlying the results of a contingent choice study is not well understood. Respondents may resort to simplified decision rules if the choices are too complicated, which can bias the results of the statistical analysis.
- If the number of attributes or levels of attributes is increased, the sample size and/or number of comparisons each respondent makes must be increased.
- When presented with a large number of tradeoff questions, respondents may lose interest or become frustrated.
- Contingent choice may extract preferences in the form of attitudes instead of behavior intentions.
- By only providing a limited number of options, it may force respondents to make choices that they would not voluntarily make.
- Contingent ranking requires more sophisticated statistical techniques to estimate willingness to pay.
- Translating the answers into dollar values, may lead to greater uncertainty in the actual value that is placed on the good or service of interest.
- Although contingent choice has been widely used in the field of market research, its validity and reliability for valuing non-market commodities is largely untested.



Hedonic Pricing Method

Overview

The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes. It can be used to estimate economic benefits or costs associated with:

- environmental quality, including air pollution, water pollution, or noise
- environmental amenities, such as aesthetic views or proximity to recreational sites

The basic premise of the hedonic pricing method is that the price of a marketed good is related to its characteristics, or the services it provides. For example, the price of a car reflects the characteristics of that car—transportation, comfort, style, luxury, fuel economy, etc. Therefore, we can value the individual characteristics of a car or other good by looking at how the price people are willing to pay for it changes when the characteristics change. The hedonic pricing method is most often used to value environmental amenities that affect the price of residential properties.

This section continues with an example application of the hedonic pricing method, followed by a more complete technical description of the method and its advantages and limitations.

Hypothetical Situation:

Agency staff want to measure the benefits of an open space preservation program in a region where open land is rapidly being developed.

Why Use the Hedonic Pricing Method?

The hedonic pricing method was selected in this case because:

1. Housing prices in the area appear to be related to proximity to open space.
2. Data on real estate transactions and open space parcels are readily available, thus making this the least expensive and least complicated approach.

Alternative Approaches:

If the open space of concern is used mainly for recreation, the travel cost method might be used. Alternatively, survey-based methods, like contingent valuation or contingent choice, might be used. However, these methods would generally be more difficult and expensive to apply.



Application of the Hedonic Pricing Method:

Step 1:

The first step is to collect data on residential property sales in the region for a specific time period (usually one year). The required data include:

- selling prices and locations of residential properties
- property characteristics that affect selling prices, such as lot size, number and size of rooms, and number of bathrooms
- neighborhood characteristics that affect selling prices, such as property taxes, crime rates, and quality of schools
- accessibility characteristics that affect prices, such as distances to work and shopping centers, and availability of public transportation
- environmental characteristics that affect prices

In this case, the environmental characteristic of concern is the proximity to open space. The researcher might collect data on the amount and type of open space within a given radius of each property, and might also note whether a property is directly adjacent to open space. Often, this type of data may be obtained from computer-based [GIS](#) (geographical information systems) maps. Data on housing prices and characteristics are available from municipal offices, multiple listing services, and other sources.

Step 2:

Once the data are collected and compiled, the next step is to statistically estimate a function that relates property values to the property characteristics, including the distance to open space. The resulting function measures the portion of the property price that is attributable to each characteristic. Thus, the researcher can estimate the value of preserving open space by looking at how the value of the average home changes when the amount of open space nearby changes.

How Do We Use the Results?

The results can be used to evaluate agency investments in open space preservation. For example, specific parcels may be under consideration for protection. The hedonic value function can be used to determine the benefits of preserving each parcel, which can then be compared to the cost.

Case Study Example of the Hedonic Pricing Method—Values of Environmental Amenities in Southold, Long Island

The Situation

The town of Southold, Long Island, New York has coastlines on both the Peconic Bay and Long Island Sound. Compared to the rest of Long Island, it is a relatively rural area, with a large amount of farmland. However, population and housing density are



rapidly increasing in the town, resulting in development pressures on farmland and other types of open space.

The Challenge

The Peconic Estuary Program is considering various management actions for the Estuary and surrounding land areas. In order to assess some of the values that may result from these management actions, a [hedonic valuation study](#) was conducted, using 1996 housing transactions.

The Analysis

The study found that the following variables that are relevant for local environmental management were had significant effects on property values in Southold:

- Open Space: Properties adjacent to open space had, on average, 12.8% higher per-acre value than similar properties located elsewhere.
- Farmland: Properties located adjacent to farmland had, on average, 13.3% lower per-acre value. Property values increased very slightly with greater distance from farmland.
- Major Roads: Properties located within 20 meters of a major road had, on average, 16.2% lower per-acre value.
- Zoning: Properties located within an area with two- or three-acre zoning had, on average, 16.7% higher per-acre value.
- Wetlands: For every percentage point increase in the percent of a parcel classified as a wetland, the average per-acre value increased by .3%.

The Results

Based on the results of this study, managers could, for example, calculate the value of preserving a parcel of open space, by calculating the effects on property values adjacent to the parcel. For a hypothetical simple case, the value of preserving a 10 acre parcel of open space, surrounded by 15 “average” properties, was calculated as \$410,907.

Summary of the Hedonic Pricing Method:

The hedonic pricing method is used to estimate the value of environmental amenities that affect prices of marketed goods. Most applications use residential housing prices to estimate the value of environmental amenities. The method is based on the assumption that people value the characteristics of a good, or the services it provides, rather than the good itself. Thus, prices will reflect the value of a set of characteristics, including environmental characteristics, that people consider important when purchasing the good.

The hedonic pricing method may be used to estimate economic benefits or costs associated with:



- environmental quality, including air pollution, water pollution, or noise
- environmental amenities, such as aesthetic views or proximity to recreational sites

The hedonic pricing method is relatively straightforward and uncontroversial to apply, because it is based on actual market prices and fairly easily measured data. If data are readily available, it can be relatively inexpensive to apply. If data must be gathered and compiled, the cost of an application can increase substantially.

Applying the Hedonic Pricing Method Using Housing Prices:

In general, the price of a house is related to the characteristics of the house and property itself, the characteristics of the neighborhood and community, and environmental characteristics. Thus, if non-environmental factors are controlled for, then any remaining differences in price can be attributed to differences in environmental quality. For example, if all characteristics of houses and neighborhoods throughout an area were the same, except for the level of air pollution, then houses with better air quality would cost more. This higher price reflects the value of cleaner air to people who purchase houses in the area.

To apply the hedonic pricing method, the following information must be collected:

- A measure or index of the environmental amenity of interest.
- Cross-section and/or time-series data on property values and property and household characteristics for a well-defined market area that includes homes with different levels of environmental quality, or different distances to an environmental amenity, such as open space or the coastline.

The data are analyzed using [regression analysis](#), which relates the price of the property to its characteristics and the environmental characteristic(s) of interest. Thus, the effects of different characteristics on price can be estimated. The regression results indicate how much property values will change for a small change in each characteristic, holding all other characteristics constant.

The analysis may be complicated by a number of factors. For example, the relationship between price and characteristics of the property may not be linear – prices may increase at an increasing or decreasing rate when characteristics change. In addition, many of the variables are likely to be correlated, so that their values change in similar ways. This can lead to understating the significance of some variables in the analysis. Thus, different functional forms and model specifications for the analysis must be considered.

Advantages of the Hedonic Pricing Method:

- The method's main strength is that it can be used to estimate values based on actual choices.
- Property markets are relatively efficient in responding to information, so can be good indications of value.



- Property records are typically very reliable.
- Data on property sales and characteristics are readily available through many sources, and can be related to other secondary data sources to obtain descriptive variables for the analysis.
- The method is versatile, and can be adapted to consider several possible interactions between market goods and environmental quality.

Issues and Limitations:

- The scope of environmental benefits that can be measured is limited to things that are related to housing prices.
- The method will only capture people's willingness to pay for perceived differences in environmental attributes, and their direct consequences. Thus, if people aren't aware of the linkages between the environmental attribute and benefits to them or their property, the value will not be reflected in home prices.
- The method assumes that people have the opportunity to select the combination of features they prefer, given their income. However, the housing market may be affected by outside influences, like taxes, interest rates, or other factors.
- The method is relatively complex to implement and interpret, requiring a high degree of statistical expertise.
- The results depend heavily on model specification.
- Large amounts of data must be gathered and manipulated.

The time and expense to carry out an application depends on the availability and accessibility of data.



Benefit Transfer Method

Estimates economic values by transferring existing benefit estimates from studies already completed for another location or issue.

Overview

The benefit transfer method is used to estimate economic values for ecosystem services by transferring available information from studies already completed in another location and/or context. For example, values for recreational fishing in a particular state may be estimated by applying measures of recreational fishing values from a study conducted in another state.

Thus, the basic goal of benefit transfer is to estimate benefits for one context by adapting an estimate of benefits from some other context. Benefit transfer is often used when it is too expensive and/or there is too little time available to conduct an original valuation study, yet some measure of benefits is needed. It is important to note that benefit transfers can only be as accurate as the initial study.

This section continues with some example applications of the benefit transfer method, followed by a more complete technical description of the method and its advantages and limitations.

Hypothetical Situation

A park is being upgraded to provide additional recreational opportunities. One proposal is to add a swimming beach to the lake. Agency staff want to know the benefits of the new beach, but do not want to spend a great deal of money on a valuation study.

Why Use the Benefit Transfer Method?

The benefit transfer method was selected in this case for two main reasons. First, the agency does not have a large budget for site-specific benefits studies. Second, values for recreational uses are relatively easy to transfer.

Application of the Benefit Transfer Method

Step 1:

The first step is to identify existing studies or values that can be used for the transfer. In this case, the researcher would look for studies that value beach use, specifically for lake beaches if possible. For the purposes of this example, assume that the researcher has found two travel cost studies that estimated values for swimming at lake beaches.



Step 2:

The second step is to decide whether the existing values are transferable. The existing values or studies would be evaluated based on several criteria, including:

1. Is the service being valued comparable to the service valued in the existing studie(s)? Some factors that determine comparability are similar types of sites (e.g., lake beaches in a park), similar quality of sites (e.g., water quality and facilities), and similar availability of substitutes (e.g., the number of other lake beaches nearby).
2. Are characteristics of the relevant population comparable? For example, are demographics similar between the area where the existing study was conducted and the area being valued? If not, are data available to make adjustments?

In the example, the first study is for a similar lake beach. The beach is also in a park, has comparable water quality and facilities, and a similar number of substitute sites in the area. However, it is located in an urban area, while the beach being valued is in a rural area. Thus, the characteristics of visitors can be expected to be different for the two sites. The second study is in a rural area with similar types of visitors, but the lake has many more available substitutes.

Step 3:

The next step is to evaluate the quality of studies to be transferred. The better the quality of the initial study, the more accurate and useful the transferred value will be. This requires the professional judgment of the researcher. In this example, the researcher has decided that both studies are acceptable in terms of quality.

Step 4:

The final step is to adjust the existing values to better reflect the values for the site under consideration, using whatever information is available and relevant. The researcher may need to collect some supplemental data in order to do this well. For example, in this case, the sites valued in each of the existing studies differ from the site of interest. The researcher might adjust the values from the first study by applying demographic data to adjust for the differences in users. If the second study has a benefit function that includes the number of substitute sites, the function could be adjusted to reflect the different number of substitutes available at the site of interest.

In addition, because the beach will be new, the researcher will need to estimate how many people will use the beach. This might be accomplished by a survey of park visitors, asking whether they would use a beach on the lake, and how many times they would use it. The researcher would then multiply these visitation estimates by the value per day for beach use (adjusted for differences in population and site characteristics), to get an estimate of the economic benefits for the new beach.



Case Study Examples of the Benefit Transfer Method:

Case # 1— [Wetlands Restoration in Saginaw Bay, Michigan](#)

The Situation

The State of Michigan is considering plans to protect and restore coastal wetlands along the southern shore of Saginaw Bay.

The Challenge

The State must estimate the potential benefits from protecting and restoring the wetlands. A survey asked people about their support for restoring wetlands, but did not include a valuation question. Therefore, the researchers used benefit transfer methods to estimate the value of protecting and restoring wetlands around the Bay.

The Application

A valuation study for proposed wetlands protection and restoration of Ohio's Lake Erie coastal wetlands was used for the benefit transfer. Researchers assumed that the values estimated for Ohio were similar enough to be transferable to Michigan. The study valued similar programs and quantities of wetlands to those proposed in Michigan. However, coastal residents were not surveyed. Thus, the transfer of values from the Ohio study to coastal residents in Michigan requires the assumption that coastal residents have values similar to those of residents of other areas of the drainage basin.

Results

Estimates of wetland values for Michigan, based on the Ohio study, ranged from \$500 per acre to \$9,000 per acre for residents of the drainage basin, and from \$7,200 per acre to \$61,000 per acre for residents of the State of Michigan. These values can be used to evaluate decisions concerning purchase and restoration of wetlands around the Saginaw Bay.

Case # 2— [Benefits of Water Pollution Controls on Pulp and Paper Mills](#)

The Situation

The Clean Water Act provides standards for water quality that affect the pulp and paper industry, which must implement technological improvements to bring water quality up to standards.



The Challenge

Researchers attempted to assess the benefits of water quality improvements in a particular set of stream segments where pulp and paper mills discharge effluent. Clean Water Act policies mandate specific controls for effluent. This determines downstream water quality, which in turn affects benefits to recreational users of the streams, as well as non-use benefits from improved water quality.

The Application

Researchers used benefit transfer to estimate the economic benefits of improved water quality. They selected streams affected by 68 mills for the study. The researchers began by collecting data on existing water quality and pollution control costs for the streams, and assigning feasible uses for each stream, based on existing water quality.

The benefits transfer was based on three studies of other rivers, the Charles River in Boston, and the Monongahela River in western Pennsylvania that valued changes in water quality. Two were contingent valuation studies, and one was a travel cost study. Both recreational and non-use benefits were considered.

Results

The researchers found that, even using the upper bound estimate of benefits—\$66 million— total benefits for the 68 mills were only two-thirds of the costs to these mills—\$95.5 million. The total costs to the entire pulp and paper industry were estimated at \$310 million. If the 68 mills selected are assumed to be representative of the total of 306 mills, the upper bound estimate of the economic benefits of pollution control would be about 50% of the costs.

Summary of the Benefit Transfer Method

The benefit transfer method is used to estimate economic values for ecosystem services by transferring available information from studies already completed in another location and/or context. For example, values for recreational fishing in a particular state may be estimated by applying measures of recreational fishing values from a study conducted in another state.

Thus, the basic goal of benefit transfer is to estimate benefits for one context by adapting an estimate of benefits from some other context. Benefit transfer is often used when it is too expensive and/or there is too little time available to conduct an original valuation study, yet some measure of benefits is needed. It is important to note that benefit transfers can only be as accurate as the initial study.

The simplest type of benefit transfer is the unit day approach, where existing values for activity days are used to value the same activity at other sites. These estimates are based on expert judgment in combining and averaging benefit estimates from a number of existing studies. These “unit day values” may be adjusted for characteristics of the study site when they are applied.



A more rigorous approach involves transferring a benefit function from another study. The benefit function statistically relates peoples' willingness to pay to characteristics of the ecosystem and the people whose values were elicited. When a benefit function is transferred, adjustments can be made for differences in these characteristics, thus allowing for more precision in transferring benefit estimates between contexts.

Different standards for benefit transfer may be applied in different contexts. For example, a higher standard of accuracy may be required when the costs of making a poor decision are higher. A lower standard of accuracy may be acceptable when costs are lower, such as when the information from the benefit transfer is only one of a number of sources of information, or when it is used as a screening tool for the early stages of a policy analysis.

The benefit transfer method is most reliable when the original site and the study site are very similar in terms of factors such as quality, location, and population characteristics; when the environmental change is very similar for the two sites; and when the original valuation study was carefully conducted and used sound valuation techniques.

Applying the Benefit Transfer Method

Application of the benefit transfer method involves several steps. First, identify existing studies or values that can be used for the transfer. There are a number of valuation databases that can be useful (see the Links section for more information). Second, evaluate the existing values to determine whether they are appropriately transferable. Consider whether:

- the service being valued is comparable to the service valued in the existing studie(s). This includes determining whether the features and qualities of sites or ecosystems are similar, including the availability of substitutes.
- the characteristics of the relevant population are comparable. This includes determining whether the demographics, and peoples' preferences, are similar between the area where the existing study was conducted and the area being valued.

Third, evaluate the quality of studies to be transferred. The better the quality of the initial study, the more accurate and useful the transferred value will be. This step requires professional judgment of the researcher. Fourth, adjust the existing values to better reflect the values for the site under consideration, using whatever information is available and relevant. The researcher may need to collect supplemental data in order to do this well. For example, the researcher might survey key informants, talk to the investigators of the original studies, get the original data sets, or collect some primary data at the study site to use to make adjustments. Finally, estimate the total value by multiplying the transferred values by the number of affected people.



Advantages of the Benefit Transfer Method

- Benefit transfer is typically less costly than conducting an original valuation study.
- Economic benefits can be estimated more quickly than when undertaking an original valuation study.
- The method can be used as a screening technique to determine if a more detailed, original valuation study should be conducted.
- The method can easily and quickly be applied for making gross estimates of recreational values. The more similar the sites and the recreational experiences, the fewer biases will result.

Issues and Limitations

- Benefit transfer may not be accurate, except for making gross estimates of recreational values, unless the sites share all of the site, location, and user specific characteristics.
- Good studies for the policy or issue in question may not be available.
- It may be difficult to track down appropriate studies, since many are not published.
- Reporting of existing studies may be inadequate to make the needed adjustments.
- Adequacy of existing studies may be difficult to assess.
- Extrapolation beyond the range of characteristics of the initial study is not recommended.
- Benefit transfers can only be as accurate as the initial value estimate.
- Unit value estimates can quickly become dated.