

ECONOMIC ANALYSIS OF ENVIRONMENTAL IMPACTS AND BENEFITS IN SPAIN: TECHNIQUES, RESULTS, DEMAND, AND INSTITUTIONAL IMPACT

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1. Introduccion

Valuation and evaluation have been gaining popularity among the public administration of many countries. This has given more incentives to research in better tools to value and evaluate. Within the valuation of environmental goods, instruments like contingent valuation (with many variants), travel cost, and hedonic pricing, are achieving a good level of reliability. The same is true with evaluation techniques: cost-benefit analysis, macroeconomic impact, or even environmental impact assessment are used with a good standard, and can be used at a quite sophisticated state-of-the-art level.

Instruments and approaches to the environmental economic analysis and policy formulation basically come from two sources: academics, and the administration. This is probably true for most fields, from sciences, to technology and to social sciences, but in this paper's area it is clearly the case, as will be shown.

This paper presents the main valuation and evaluation instruments, examines the partnership between academics, administration, and industry in developing such instruments, focuses on applications in Spain, and suggests some future developments. For the Spanish applications, there are already very good reviews, as will be mentioned, of the published studies. Many more, however, are produced. Valuation and evaluation are typical areas of production of the so called gray literature: reports, unpublished papers, and alike. This makes it a bit more difficult to be complete in any revision. This is not the intention of this paper, though; rather, it attempts to illustrate the kind of work orientation in Spain, in relation to other countries.

2. Valuation

The middle years of the 20th Century witnessed the starting of the main valuation effort for environmental goods, and public goods in general. Within the environmental goods, protected natural areas and recreational activities were those that got more attention. The initial formulation of the travel cost method illustrates the social interest behind valuation methods at the beginning, and still a great deal applicable nowadays.

In 1947, the US National Park Service (Department of the Interior) commissioned a report to find out the social value of the natural wonders they managed. The rationale is most contemporary: if the value was known, and if it was high, then the National Park Service would have a strong argument to ask for more money to increase the too tiny budget they had to manage the parks. Also, if the value to people were known, the Service could design a sound strategy to collect part of the money from visitors that directly benefit from the environmental good.

The report contained a survey among ten specialists, asking for a way to calculate the value of the parks. Basically, nine of the specialists argued that this was not possible, while Harold Hotelling described, in a page and a half letter (Hotelling, 1949), a way that would later be known as the Travel Cost Method. The first applications, though, did not arrive till the end of the 1950s, with a first application to Yosemite National Park, in California (Clawson, 1959; Clawson and Knetch, 1966). It basically derives the value (consumer

surplus) from a estimated demand curve between cost involved in traveling to enjoy the environmental good, and the frequency of visits to the site.

By that time, the first attempts to apply the Contingent Valuation method took place. The first complete and influential application was also applied to an area of natural beauty: a forest in Northeast USA (Davis, 1963). But this time, it was an academic initiative –Davis’ Ph.D. dissertation. Along the 1960s, and specially 1970s, the method was refined, identifying the main potential biases and the most adequate solutions to avoid or mitigate them when applying the method. In contingent valuation, the market is simulated by a questionnaire, where the researcher offers a good at a given price, and the person interviewed represents the demand, saying yes or no to the offer. From that, the value of the good is estimated.

In the 1960s, a vivid academic debate took place on the influence of investments in public goods over land prices. This was, partly, the basis of an influential paper by Rosen (1974) detailing the theoretical grounds of the Hedonic Price Method of valuation. Although it is the least used method of the three, application are found consistently over the years till nowadays. It basically consists in estimating by regression analysis the attributes of a good that explain its market value (real estate prices, salaries, car sale prices...). From the estimated contribution of each attribute to the market price, the implicit value of each attribute (including environmental variables) is derived. For a simple explanation of the three methods in Spanish, see for instance Riera (1993b).

Most break-through contributions in the field of valuation came –and still come– either from academics or from the administration or industry needs; and often, from a combination of both. This is a trend even more easy to identify in evaluation methods, as will be shown later in this paper.

Out of the three main valuation methods, contingent valuation is the most used. As a matter of fact, applications vary by order of magnitudes. Hedonic pricing has been applied by tens, travel cost by hundreds of times, while contingent valuation ha a few thousands of applications all over the world.

Chart 1 can help to understand the difference in the number of applications and summarize their main characteristics.

Chart 1
Main methods for valuing environmental goods

	DIRECT OBSERVATION	INDIRECT OBSERVATION
EXISTING MARKET	○ Market Prices	○ Travel Cost ○ Hedonic Prices
CONSTRUCTED MARKET	○ Contingent Valuation	○ Hypothetical Travel Cost ○ Hypothetical Hedonic Prices

The first box (market prices) corresponds to the valuation of those goods that do have a market. They are rather exceptional for environmental goods (since they tend to be non-market goods), although it is the usual indicator for private market-goods.

One of the main differences of the first row methods from the second one is the ex-ante or ex-post nature of the valuation exercise. The first row methods are most useful for ex-post valuation, since they are based on market observation, and such a market has to already exist in order to observe the value. Even so, they can be applied to value a similar good, and then transfer the value to the environmental good. The second row methods, on the other hand, is most useful for ex-ante valuation, although they are often used for ex-post situations as well.

The methods from the first column tend to require less assumptions and computational hypothesis than the second column ones. Even so, some variations of the contingent valuation method can be computationally very complex.

The second row methods have a further advantage which is more important to understand the popularity of the contingent valuation method and its numerous variations (contingent ranking, contingent choice, contingent rating, pairwise choice...). The advantage is that hypothetically constructed markets are very flexible and allow the researcher or practitioner

to exactly set up a market for the exact good to value. That also overcomes one of the main limitations of the first raw methods: too often, the accessible data –if available– are not the best indicator of the exact good one wants to value.

In Spain, the popularity of the contingent valuation method over travel cost, and of the latter over hedonic pricing, is also evident following the international situation. The reasons are the same in both geographical areas.

Most applications in Spain have been devoted to value parks and areas of natural interest. This is also the case elsewhere, although in a lower proportion. There are several good papers that review Spanish valuation exercises of recreational areas, protected spaces, forests, agricultural landscapes and alike (among others, León, 1994; Del Saz, 1996; González, 1997, Kriström and Riera, 1997), and will not be reviewed here individually.

Valuation has also been applied to other areas. The first application in Spain was in the transportation field (Riera, 1993a), valuing the environmental impact of a given design of an urban ring road. Transportation is the second field in number of applications in Spain, after natural spaces. Related to transportation, contingent valuation has been used to estimate the value of travel time (Riera, 1997), which has also been calculated by other techniques. Traffic noise is a related field with a few value estimations. In the energy field, applications have been undertaken to value the negative effects of polluting emissions to the air (Riera and Penín, 2000, and in Galicia, Day et al., 1999). Health related activities is another field with several applications (Pinto et al., 1998; Puig et al., forthcoming). It also has been applied to waste management (Gándara and Riera, 2000). Another field of application has been urban development (Riera, 1995, Del Saz, 1996). Even cultural heritage has been valued, like Gaudi's Sagrada Familia in Barcelona (Díaz et al., 2000).

Geographically, there are people devoted to valuation in most Spanish regions. That I am aware of, at least in Galicia, Catalonia, Madrid, Canary Islands, Balearic Islands, Aragon, Murcia, Valencia, Andalucia, and Navarra. In most of the regions the subject is or has been taught at the universities in more or less detail. This contributes to the impression that this is a fast growing area within economics in Spain.

A very noticeable difference among valuation applications in Spain and some other countries, especially the USA, is the typical budget for the exercise. They differ by an order of magnitude. A contingent valuation exercise in the US can easily exceed 300,000 Euros (50 million pesetas), whereas in Spain it must be around 20,000 Euros (3 million pesetas) or below. However, at least in Spain, the largest share does not go to the very time demanding process of design, or to computation, but to the interviewing activity. A specialized firm on surveys can charge around 20,000 Euros for 500 interviews face-to-face. Some times, particularly when the exercise is for academic purposes, students are used as interviewers, lowering the cost dramatically.

In Spain –much more so than in the US–, the practitioners of valuation applications tend to be academics, and very little is done from private consultancy firms. The low budget for the practitioner may be one of the reasons. Another reason is that in Spain the field is “younger” (just started in the early 1990s) and a great deal of the work is related to Ph.D. dissertations or to research of some kind. Finally, another reason is that local administration, rather than regional or central government, or private industry, tend to commission studies where valuation of environmental goods is required, which often implies low budget and strong relations with nearby universities.

3. Evaluation

Most of the times, valuation has been applied in Spain just to estimate the value of the public good. However, it can also be used as part of an evaluation method. And we will see several examples of this practice.

The preferred evaluation method by economists is probably the so called cost-benefit analysis. It can measure the social attractiveness of a project, investment, or policy, with a very simple numeric indicator: the internal rate of return, or the net present value, or the benefit-cost ratio. Further, it can also rank several projects, distinguishing those that would pass the evaluation test from those that would not.

A Cost-benefit Analysis is a method that takes into account environmental externalities, and non-market goods in general, if they are

relevant for the social welfare impact of the project to evaluate. It accounts for all relevant costs and relevant benefits –does not matter whether they are private or external, market observable or not–, expressing them in monetary terms year by year. Therefore, to apply a cost-benefit analysis of a project with externalities requires some kind of previous valuation. And this is the way valuation enters into an evaluation method like cost-benefit analysis: translating into monetary units a cost or a benefit which value is not directly observable in a existing market, and therefore contributing to the estimation of the net flow of benefits minus costs.

The history of cost-benefit analyses goes back to the mid 20th Century, when it started to be applied extensively, especially in the USA. After the Second World War, the USA invested a great deal in infrastructure, particularly in roads. Such investments fostered the economic recovery and labor employment (following the dominant Keynesian macroeconomic thinking) and as well was supposed to help to move personnel and material more quickly in case of war. In any case, the Federal government required a standard cost-benefit analysis for most investments in infrastructure. This demand influenced the number of people who, from universities and research centers, devoted attention to this methodology. Most improvements still used nowadays took place in the 1950s and 1960s. It basically was a Government lead phenomenon, in the US. This is understandable, since social cost-benefit analysis (as it is also called) has this external dimension, beyond the private party promoting the investment. Therefore, it cares for the whole public interest. Therefore, it is a method appealing to public sector decision makers. Or to international organizations like the World Bank or similar regional banks, who developed the instrument further during the 1960s and 1970s. In Europe, only in the 1990s some EU investments started to require a formal cost-benefit analysis before sponsoring the project, although very few incorporate environmental impacts into it. The reason for that, and it's possible solution will be discussed later, under the topic of benefit transfer.

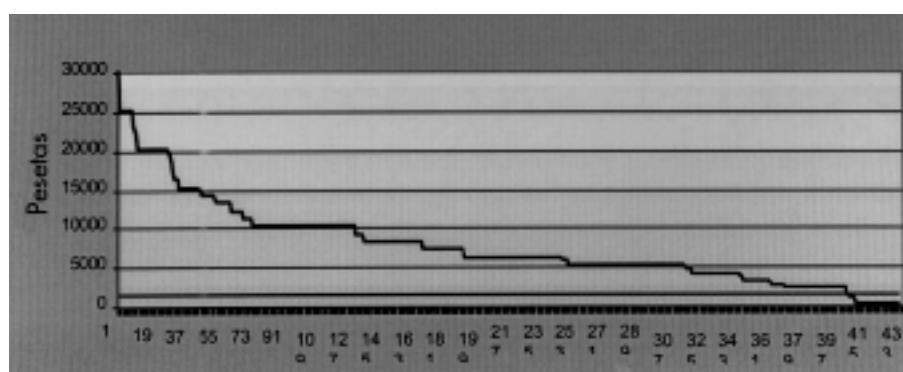
Spain, as most first world countries, has a considerable number of cost-benefit applications. Already Albi (1988) published an early and abundant list of early works. Since then, the list has been growing. However, the number of applications with an environmental dimension is not large at all. Even the Spanish government, while advertising a guide to apply cost-

benefit analysis to roads, does not include environmental impacts in it. Two of the recent Spanish cost-benefit papers with an environmental impact dimension are Riera and Macian (1998), and Riera and Penín (2000).

Some times, the non-market valuation accounts for all the benefits (or all the costs), while the costs (benefits) are more easily estimated by standard market prices. The whole exercise of comparing both costs and benefits of a project or a policy becomes much simpler when the values are already discounted to the initial period of time. Then, a typical contingent valuation exercise can be most useful to decision makers.

An example of it can be seen in Figure 1, which contains a contingent valuation estimate of the social value of a new municipal waste management policy for the Barcelona metropolitan area. The figure compares the cost per capita of the project with the willingness to pay of each of the people surveyed.

Figure 1
Evaluation of 1998 Barcelona's Metropolitan Program of
Municipal Waste



Individuals ordered according to willingness to pay responses

Source: Riera and Gándara (1999).

The horizontal line represents the cost and the decreasing line the individual willingness to pay, in pesetas of 1998.

The conclusion in this case is twofold. First, that the mean benefits are larger than the mean costs. Second, that there is a large majority of people who would be in favor of the new policy (involving more recycling and less

dumping), while the people expected to be against it represents a minority. Furthermore, it indicates that people in pro the new policy are strongly in favor of it, with a willingness to pay several times larger than the actual cost.

Many times, the evaluation exercise is substituted –or complemented– by an “economic impact” exercise. It has the curious characteristic that it converts in “benefits” what in the cost-benefit analysis is perceived as a cost. An example could explain it better. Imagine there are two options, A and B, for a road tunnel under a mountain. The benefits from users are identical, and the only difference is the cost, since A is cheaper and B more expensive (probably because of the soil composition). In a cost-benefit analysis, A would be preferred to B. But from an economic impact point of view, B would be pointed out as more desirable than A, since it would generate more employment and a greater increase of the Gross Domestic Product.

To avoid (partly) the spectacularity of the figures, and to approximate further the economic impact approach to a sensible evaluation method, the economic impact of the particular investment can be compared with the economic impact of an investment of the same amount, spread across the whole economy. In other words, to find whether investing in a particular project would generate more or less economic impact than leaving this money in the economy for investors and consumers to borrow.

This is hardly ever done. But if estimated, it produces some surprises. For instance, investing in roads generates a positive differential impact both in employment and product terms. However, investing in telecommunications, generates a positive effect on productivity, but a negative differential impact in employment. Economic impact has been extensively applied, also in Spain. For a relatively recent work in Galicia, see the very fine work of Argimón (1997).

The economic impact approach, although much used, does not take explicit account of the environment. This could be done, and is a challenge for future work.

The evaluation approach that most explicitly takes the environment into consideration is the environmental impact assessment. Its origin probably constitutes the best example of cooperation between academics and outside academics worlds.

It was designed in the second half of the 1960s in the USA, and took legal form the 31st of December of 1969 in the National Environmental Policy Act (NEPA). NEPA did create the obligation of central Government agencies to ask for an environmental impact statement on major projects. And it created a new agency, later evolved to the current EPA (Environmental Protection Urgency), to guide the whole NEPA implementation process.

At that time, society was increasingly concerned about the damage infringed to the environment by public investments in infrastructure and others. The welfare of current and future generations was already in the agenda. Academics had the general knowledge of methods and techniques to discriminate among those environmental impacts that could be considered severe from those of less importance. The administration played the role of investing in public goods. The idea was to put those elements together.

NEPA makes it compulsory for the administration to guarantee that the environment has been taken into consideration, through an environmental impact study. For that, academics had the knowledge of how to deal with such evaluations. Both in cooperation for better meeting society's demands is what is in the basis of the approach. The final saying, obviously, remained at the administration, who could go ahead with an investment with major impacts. The difference was that, now, those impacts would explicitly be assessed in the decision making process.

Rapidly, academics gave way to practitioners from private consultancy firms, but still cooperated with EPA and other agencies on establishing procedures, and putting forward suitable techniques. This is a general trend in the relation between administration, academics and other professionals, that could be traced in Spain too, to a lesser extend.

Other countries started to follow the US initiative in the 1970s, and the European Union adopted it in the mid 1986, coinciding with the entrance of Spain into the Union. Since it was adopted through a directive that affected all State members, Spain too legislated on the subject, becoming law in 1988.

Since then, the practice of environmental impact assessment in Spain is almost routinely. However, the scientific level of the vast majority of

applications is far from sophisticated or state-of-the-art. Several reasons could explain that. One, environmental impact studies are commissioned by the investor. The investor tends to spend little money on the study, therefore making it difficult to apply more expensive and time-consuming techniques. Also, too often, the investor tends to choose practitioners who could do the job with few problems and demands. Finally, the amount of environmental impact statements undertaken in Spain is quite large, and more state-of-the-art procedures would require a stronger effort on professional preparation.

Nevertheless, there are some exceptions, which tend to be located in those very large investment projects. Just a recent example is the environmental impact statement of the expansion of Barcelona airport. The call for proposals by the investor (AENA) set the budget limit in 100 million pesetas + VAT (around 700,000 Euros). This is exceptional. And there was another interesting exception. The new runway is going to invade a wetland protected area. The call for proposals stated that the study would have to value in monetary units such an environmental impact.

This shows a way of easily improving the environmental impact assessment procedure, both in Spain and elsewhere. This will be commented in the next section.

4. The Way Ahead

As must be clear by now, I strongly believe in the potential of cooperation between academics and the administration, industry and private practitioners. It has proved very useful in the past, and could be equally effective in the future. Professionals at private firms and public administration are very innovative, and so tend to be people at universities and other research institutions. The partnership of them both is an attractive way to proceed.

I also firmly believe that academics should not be looking for competing with private practitioners in studies involving the topics above. Indeed, they can work at lower price. But in my opinion, academics ought to play this innovation role more clearly when getting involved in consultancy activities.

One of the main obstacles for the expansion of the use of environmental valuation in evaluation methods is clearly the cost of the estimation and the time required. A good contingent valuation study is seldomly completed in less than six months. Normally it requires closer to three quarters of a year. This is too much time (and cost) for applications to the usual environmental impact study, the standard cost-benefit analysis, or even an economic impact study.

However, there is a way to streamline the process. In the environmental valuation literature it is called benefit transfer. In cost-benefit analysis of transportation infrastructure this is done for almost all of the benefits. Time savings are not usually valued for the users of the projected infrastructure, but extracted from other studies or from an average available to practitioners. In Spain, the values are published by the central government although they are not updated very often. Exactly the same happens with the value of accidents, injuries and even premature deaths.

But this is not the case with the environment. Probably for several reasons. One is that the practice of transferring values of time or accidents has a much longer tradition (it started earlier) than with environmental values. Second, the variety of environmental impacts is far larger than time and other goods alike, making it more difficult to standardize.

Whatever the reason, it seems reasonable to think that in the future environmental valuation will normalize its practice of benefit transfer. This will require several standard values, for those impacts that are studied more often. In Spain, there is already enough knowledge in protected open spaces and recreational activities to attempt a meta-analysis and be able to infer and transfer values for its use in cost-benefit analysis and environmental impact assessment.

There are many areas of research that could contribute to further improvements of valuation and evaluation of environmental aspects. Just to single out one of them, improvements could be made on the topic of equity. If decision making is not to take only account of efficiency, but also of income distributional issues, valuation methods can clearly help.

Contingent valuation, for instance, since is based on surveys, can elicit good information on people's income, and relate it to willingness to pay. In

this way, we already know that environmental goods has an income elasticity below the unity (Kriström and Riera, 1996). In other words, people are prepared to pay more if they earn a higher income, but as income grows, the willingness to pay for environmental goods grows slower. It means that, in proportion, lower income people are ready to pay a higher share of their income than higher income people.

The information could then feed the evaluation method. One of the criticisms to cost-benefit analysis, is that it cares about efficiency, but not equity. The solution introduced in the late 1960s was to use weights to favor lower income population. However, the way it has been applied has been disappointing to most analysts. If both approaches could be coupled in a better way, the usefulness of cost-benefit analysis would clearly increase.

5. Conclusions

In summary, economics have learned to deal quite well with valuation and evaluation of environmental goods and impacts. Its early development has been linked to the cooperation between the public administration and universities and research institutions, and to lesser extend to the industry. If Spain is to follow more closely the most developed countries, cooperation will increase in the future.

The possibilities of economic valuation and evaluation are in almost every field. The most popular field for application is related to natural areas and recreational activities. But applications range from air pollution, to water issues, soil damages, health related problems, urban development, and many more.

Research of interest to the administration can be done in new areas of common interest with academics. Refined evaluation methods, design of taxes, evaluation of new investments, analysis of the value of environmental goods, understanding of equity issues, are just some of the areas for fruitful cooperation.

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