

# The Application of Cost-benefit Analysis to Metropolitan Projects with Environmental Impacts: The Case of Barcelona's Ring Roads

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## Introduction

In preparing for the celebration of the Olympic Games in summer 1992, Barcelona is developing many different projects, from those strictly necessary for the sports event to others which try to improve permanent aspects of the city. One of the major concerns has been to achieve an effective transportation system between the three Olympic sport areas in Barcelona and the Olympic Village –where accommodation for the athletes is located–, as well as with other Olympic areas outside Barcelona.

### *The project*

For this purpose –and for contributing to the reduction of severe day-to-day traffic problems–, a 1960s proposal of an urban ring road was revived. Barcelona already had two ring roads, an inner one (known as first ring) and an outer one (third ring). The new ring road, initiated in 1988 and to be completed in the first quarter of 1992, runs through built up areas for some 25 km. It consists of two parts, the so called second ring, near the mountain area, and the coastal ring.

The development of the ring road also involves some urban renewal in particular neighbourhoods and some improvements of the built environment in others. A neighbourhood called Nou Barris is a good example of the latter.

The project for the second ring in Nou Barris was first drawn up in 1968. It was a devisive urban motorway, literally splitting an established neighbourhood into two parts, leaving them with hardly any connection. Nou Barris is a populated area of nearly 100 thousand inhabitants, located in the northern part of Barcelona. It's population is basically composed of migrant working class families and the borough enjoys the lowest rent of Barcelona.

In early 1970s, still under Franco's regime, the project was started, but the neighbours physically stopped the works after massive oposition. The project was abandoned until 1988, when the democratically elected local authority drew up a second project with major modifications in its design. Most of the road was to be covered with the available surface devoted to open space and public facilities for the neighbourhood. The new project was improved in several aspects after wide consultation with neighbours, who showed disagreement with specific details.

A conventional cost-benefit analysis was undertaken to evaluate the new ring road (Riera, forthcoming). At the same time, a specific evaluation study for Nou Barris was set up.

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## The conventional evaluation approach

The conventional cost-benefit analysis undertaken for Barcelona's new ring road was similar to the well known British COBA. A traffic forecast was estimated over 30 years; from it, a matrix of time savings over the years, both for work trips and others, was found and translated to monetary terms. Time saving appeared to be the most relevant factor of the cost-benefit analysis, well above savings in accidents and other benefits.

On the costs side, construction was the main expenditure, followed by land values.

The internal rate of return of the ring road was found to be 74%. If discounted at 10%, the net present value would account for nearly £5 thousand million in 1990 values. The break-even year would be 1992. In other words, the project would be entirely profitable, in social terms, after its first year of completion (some sections having already been completed and in service between 1988 and 1992), when the benefits accumulated would be higher than the accumulated costs, always discounted at 10%.

## The contingent valuation approach

The conventional approach deals satisfactorily with social benefits such as time saving, reduction of accidents or running costs, but does not capture most of the design externalities, which in urban areas may be considerable. This is the case of the study undertaken for Barcelona's ring road, where the particular design of the Nou Barris section was not reflected in the benefits.

Thus, a specific study for the Nou Barris section was set up. The contingent valuation method appeared to be the most suitable approach. The vast majority of the neighbours were aware of the design of the project, which was a key issue, and this was a fundamental factor for the success of the technique applied.

### *The method*

Almost 30 years ago, contingent valuation method was first applied in the United States, in an academic context. Since then, the method has been used for all sorts of goods, in particular in transport projects. However, in Europe this approach has hardly been applied, as will be discussed later.

The contingent valuation approach basically consists in simulating a market for a non-market good through a questionnaire. The researcher represents the offer (seller) of a hypothetical good in that hypothetical market, and the respondent plays the demand role (buyer). Thus, a non-market good can be valued in such a hypothetical market.

To apply the method to Nou Barris, a questionnaire was prepared for a random sample of 400 neighbours older than 17 years. The interviews took place in June 1990.

### *Increasing familiarity*

The good which was valued was the set of modifications made in the 1988 project, in relation to the original 1968 project. In the questionnaire such modifications were detailed in four different aspects:

- (i) an extra access/exit to the ring road
- (ii) the covering of two thirds of the road
- (iii) public facilities and green open spaces
- (iv) provision of 1000 parking spaces.

Each aspect was stated in a different question, at the beginning of the questionnaire. Relevant pictures, both from models and the actual development, were shown to the respondents in order to clarify and reinforce the explanation.

As it will also be stressed later in a different context, although the valuation was over the set of modifications as a whole, it was important to spell them out because that tends to increase the degree of familiarity with the project and contributes to avoiding some biases in the scenario specification, notably:

- (i) part-whole bias
- (ii) symbolism bias

Part-whole bias occurs when the respondent values a larger or smaller entity than the researcher's intended good (Mitchell & Carson, 1989, p. 237). In a complex good such as the Nou Barris section of the ring road, respondents could easily take some of the modifications for the whole set. Thus, specifying the main components ought to help to value all the parts.

The other bias is symbolism, i.e. when the respondent values a symbolic entity instead of the rese-

archer's intended good. Again, a way of combating this bias is through familiarity. In Nou Barris, neighbours were obviously very familiar with the project, which was in progress by the time the survey was undertaken, but spelling out the parts of the project and reinforcing this by pictures, refreshed their perception of what the good actually was rather than what it was supposed to be.

To increase their familiarity not only with the good, but with the process of valuing too, respondents were asked to give a score, from 0 to 10, to these four aspects of the project, as well as to the modifications as a whole.

### *Bidding game*

The core of the questionnaire was the price elicitation question. It certainly is not very easy to give a price on a non-market good. It is difficult both in the United States and Europe, but even more in Spain, where the market had been protected for decades. An open elicitation question would have increased the rate of nonresponses, which already was expected to be rather high. Consequently, the elicitation method chosen was the so called bidding game.

The bidding game method consists of offering a starting price and ask the respondent whether he/she would pay such amount, more or less. If the answer is «the same amount», this would be the value elicited from this respondent. If the person interviewed considers that his/her valuation is higher (lower) than the price, than a second question is asked, with a higher (lower) reference price. The process could continue several times, but it normally involves three rounds. At the last round, the question could state something like: «You said you would pay more than £x, but less than £y. Which is the maximum amount you would pay?»

The bidding game method, which is the most standard in contingent valuation applications, has the advantage of revealing to respondents a way of tackling a difficult question such as valuing a non-market good. This sort of help may cause a bias, but it seems very useful in countries with less tradition of awareness of the value of collective goods provided by the public sector.

The most obvious and common bias involved in the bidding game method is the starting point bias, i.e. where respondent's price is directly or indirectly influenced by the given price. When the influence is indirect, the respondent may, to some extent, lower or raise the price according to the one given by the researcher, which is seen as a more exact value. When the influence is direct, the respondent gives the same price, known as yea-saying, even though his/her actual valuation differs from it.

In order to mitigate these biases, two different starting prices were used, each one applied to half of the sample. The two starting prices were £225 and £450.

### *Willingness to pay*

The price elicitation question was formulated in terms of willingness to pay, rather than willingness to accept. In other words, persons interviewed were asked to reveal the maximum amount of money they would be prepared to pay to be able to enjoy the good.

### *Results*

The average value revealed by respondents was a bit over £200, in 1990 values. Taking into account that Nou Barris has a population of 83,000 aged 18 or more, the total benefit over the neighbourhood of the project modifications made in 1988 were easily calculated. A total benefit of £17 million, in round figures, was contrasted with the cost of the modifications, £14 million, to find a net benefit of some £3 million.

Thus, despite the low rent of Nou Barris, neighbours would be prepared to pay for more than the cost of the modifications. The cost-benefit analysis would be positive, comparing the modifications with the alternative of developing the original 1968 project.

In the scoring section, all four parts referred above, as well as the project as a whole, achieved marks between 7.5 and 9 points, out of 10. The most popular modification appeared to be the provision of new green open spaces with an average score of 9 points.

### *Nonresponses*

Some of the respondents were not able to specify the value of their willingness to pay for the modifications, or gave a protest answer such as £0. The level of nonresponses to the price elicitation question was 40%, which is considerably higher than the usual levels obtained in the United States for similar studies: 20 to 30%.

It seems reasonable to expect –and even desire– a percentage of nonresponses, since to value a non-market good is not an easy task and it is preferable not to have a response than to have one that is unconsidered. It is the role of the researcher to help the respondent without forcing a bias. The aids mentioned above –increasing familiarity, spelling out the different parts of the good, using graphical material, evaluating first in scoring terms, formulating the question in a bidding game form and others– may help. Nevertheless, there are some differences from country to country that call for other specific aids.

In Barcelona, the reason for non response was asked. The majority of the nonrespondents who specified a reason said that they should not pay for a good which the Administration is responsible for providing. The particular public economic culture of Spain –and some other Continental European countries– suggest the need for a complementary explanation in the questionnaire, when using contingent valuation analysis, in order to help the persons interviewed to understand the simulated market and be able to give a hypothetical price.

## Summary and conclusions

Barcelona is developing many projects in preparation for the Olympic games in summer 1992. One of the major concerns is mobility, particularly from the Olympic Village to the sports facilities. A complete new ring road is under construction in Barcelona, and this will provide the necessary access since both the Olympic Village and the various sports facilities are located near the road.

The road has obviously also been designed to provide continuing benefits after the Olympic games, alleviating Barcelona's downtown congestion. A conventional cost-benefit analysis was carried out to check whether such a large investment was profitable in social terms. It was found to be profitable, with an internal rate of return of 74%, a net present value of £5 thousand million (in 1990 values and discounted at 10%).

One section of the ring road which crosses a crowded and popular neighbourhood presents some interesting aspects. A previous older project was paralysed by a neighbourhood campaign, and a few demonstrations took place against several details of the current project. In this context, a contingency valuation analysis was undertaken. This technique, with a long tradition in the United States, has been applied, for the first time in Spain, in this project. A questionnaire survey of a representative sample of the population was undertaken in the neighbourhood, asking for their willingness to pay for the modifications introduced in 1988 for the whole project and some parts of it, both in monetary and scoring terms.

It was found that all the components were valued positively. On average, the willingness to pay for the modifications was of some £200 per person, with a total benefit over the neighbourhood of £17 million and a net benefit of £3million.

Contingent valuation analysis has not been used in Europe as widely as in the United States of America, where the method was first applied. One of the reasons could be the different public economic culture of both areas. Nevertheless, the method is not to be discarded in Europe. With all the different aids already known, and some others to be applied specifically to particular countries, it could become a more promising valuation tool both for cost-benefit analysis and the decision making process in general.

## References

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