# Port expansion and negative externalities: estimating the costs borne by local residents

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**ABSTRACT**
Port expansion has been seen as the origin of negative externalities affecting local residents' wellbeing and contributing to the poor public image of ports. In this study the contingent valuation method is used to estimate the costs borne by local residents as a consequence of the negative externalities derived from the growth of the Port of Valencia (Spain) in the last thirty years. Although the current practice is to use the willingness to pay measure to value both gains and losses, in this case it was deemed more appropriate to use the willingness to accept (WTA) measure given the perceived property rights. The econometric analysis undertaken reveals that WTA is positively related to the bid offered and negatively related to family income, as expected. Among the different externalities derived from this growth, the only concern that affects individuals' WTA is the reclamation of land from the sea. Finally, the results obtained show that the present value of the costs potentially borne by local residents ranges from a minimum value of €64.4 million to a maximum value of €107.4 million depending of the aggregation criterion chosen.

**Key Words:** Contingent valuation, willingness to accept, port expansion, negative externalities, land reclamation.

**JEL code:** Q51.

## 1. Introduction

Throughout history seaports have played a vital role in promoting the economic development and prosperity of nations. They have been the main vehicle for trading with other countries and securing food, energy and supply of other commodities. In the European Union (EU), seaports handle 76% of extra-EU trade and 36% of intra-EU trade representing key elements of modal transfer (Eurostat, 2009). However, the globalization process, along with the technological changes experienced by the shipping industry in the last decades of the twentieth century, brought about the expansion of ports and the relocation of terminals to urban peripheral sites more suitable to meeting the current

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requirements of space and transport link with the hinterland (Saz-Salazar and García-Menéndez, 2003; Olivier and Slack, 2006; Huang et al., 2011). Thus, port expansion has been seen as the origin of negative externalities (land reclamation, noise, air pollution, visual impact, amenity loss, etc.) affecting local residents' wellbeing and contributing to the poor public image of ports. More often, the external costs of facilities are borne by local residents while the benefits are distributed globally throughout all the economy. This phenomenon is popularly known as "not in my backyard" (NIMBY) syndrome (Schively, 2007). Thus, it is understandable that people living in the surrounding neighbourhoods could look at the port facilities more as a threat than as a source of welfare. Managing port growth in times of increasing urbanization and heightened environmental awareness is perhaps one of the greatest challenge facing ports today (Hicks, 1991). Thus, environmental issues and regulations arise as factors shaping the current success of ports considering the lower social tolerance to environmental problems (Soriani, 2004).

The case study presented in this article aims to shed light on the issue of negative externalities in port areas using a contingent valuation survey. In particular, a willingness to accept (WTA) framework is used to estimate the costs borne by local residents as a consequence of the growth process experienced by the Valencia Port (VP) in the last thirty years. Although usually a willingness to pay (WTP) framework is the preferred question format in contingent valuation analysis, the choice between WTP and WTA is a question of property rights (Mitchell and Carson, 1989). In this case, the WTA framework seems more appropriate given the property rights of individuals that have been living for a long time in this area and have seen how the significant increase in port activity has dramatically affected their wellbeing. A WTP scenario would not have been believable and realistic since in the current circumstances this growth process, aimed at favoring the general interest, is unstoppable.

The higher difficulty inherent to a WTA scenario, along with the guidelines proposed by the Blue Ribbon Panel of experts (Arrow et al., 1993), that recommend the use of WTP questions as a more conservative choice, can explain the paucity of WTA studies in the existing contingent valuation literature in comparison with those adopting a WTP approach. To this respect, Carson et al. (2003) point out that Contingent valuation is a survey approach mainly used to determine what people would be WTP for specified changes in the quantity or quality of public goods or, more rarely, what they would be WTA in compensation for well-specified degradations in the provision of these goods.

Considering public awareness of the environment, the information gathered from this study is of obvious interest in decision-making processes, since the role played by seaports -in promoting the economic prosperity- should be tempered by the knowledge that a sizeable part of local residents could be affected negatively by the port's growth. Ignoring these external costs in a cost-benefit framework severely undermines the accuracy and relevance of the results obtained (Carson et al., 2001).

The outline of the paper is as follows. Section 2 describes the policy issue under economic valuation. Section 3 presents the theoretical model used for estimating the median WTA. Section 4 describes the survey process and the main elements of the hypothetical market constructed. Section 5 presents the results obtained while in section 6 the conclusions and policy implications are summarized.

## 2. Case study: Valencia Port

Valencia, with a population of 814,208 inhabitants, is the third most populated city in Spain. Its seaport, in terms of container traffic measured in twenty-foot equivalent units (TEU), ranked in 2010 as the largest port in the Mediterranean area and the fifth largest port in Europe (ESPO, 2011). Its hinterland covers a radius of 350 kilometers, which produces 55% of Spanish GDP with over half of the active population of the country. In

the last thirty years, the VP has growth dramatically and has achieved international status. In particular, container traffic has multiplied by thirty-five in the period considered, while the total traffic has increased eightfold (see table 1).

Unlike other ports that have been created around a natural bay, the VP is located along a straight shoreline; thus in order to continue growing successfully the only way to do so was by reclaiming land from the sea and from the outskirts of the city. As a result of this process, the VP area increased almost fourfold since 1980, when it had an area of 1.5 million square meters compared to its current 5.5 million square meters (see table 1).

Table 1. PV growth process: some relevant data

| | 1980 | 2010 |
|---|---|---|
| TEU traffic (TEUs) | 117,916 | 4,206,937 |
| Total traffic (Tons) | 8,004, 029 | 64,028,786 |
| Area ($m^2$) | 1,480,919 | 5,498,750 |

Source: Port of Valencia authority and Annual Reports 1981 and 2010.

The technical advice provided by the VP environmental unit, along with the meetings held with stakeholders (community groups and environmental groups) and several focus groups, allowed us to identify the main environmental issues related to its growth. The first environmental problem concerns the land reclaimed for the expansion of the port area to the south close to the Nazaret neighborhood and bordered by the river Túria estuary. This area of land was used for the construction of a logistics facility. While expanding to the south, the VP "gobbled up" the former beach of Nazaret to construct a new container terminal with an area of 683,232 square meters. The second environmental issue relates to the construction of new quays that protrude into the sea, thus altering the coastal hydrography, thereby changing marine currents and causing erosion of nearby beaches. The third environmental issue at stake concerns nuisances derived from the port activity affecting nearby residents. In particular those who live closest to the port have to bear sporadically noises, odors, and dust from open storage of dry bulks cargoes. Finally, the

last environmental issue relates to the possible negative landscape impact caused by the very existence of the port itself.

## 3. Theory and methods

### 3.1 Theoretical framework

The expansion process experienced by the VP has resulted in a decrease in the environmental quality enjoyed by the local residents from $z^0$ to $z^1$. Without this growth, the average household is assumed to enjoy a quality level $z^0$ while with the referred process the enjoyable quality level is only $z^1$. Following Johansson (1993), let us consider and individual that maximizes his utility subject to budget constraint. Then, the individual's indirect utility function can thus be written as:

$$V = U\left[x(p,y,z),z\right] = V(p,y,z) \qquad (1)$$

where $x$ is a $1 \cdot n$ vector of private goods and $z$ is a $1 \cdot m$ vector of public or environmental goods. The quantity demanded of private goods is a function of prices ($p$), income ($y$) and the provision or quality of environmental commodities ($z$). The indirect utility function is decreasing in prices, and increasing in income and the quality of the environment. Let us now introduce a change in the environmental quality. Then the change in utility is:

$$V = V(p,y,z^1) - V(p,y,z^0) \qquad (2)$$

where a superscript 0 (1) denotes initial (final) levels values for the environmental good. Since the utility function is not observable, we need a money measure to evaluate the change in utility. Then let us consider the compensating variation or CV in short. If environmental quality deteriorates, then CV is the minimum amount of money that must be given to the individual to compensate him for the loss of environmental quality leaving him just as well off as prior to the change. Thus CV measures the willingness to accept compensation for deterioration in environmental quality:

$$V(p, y + CV, z^1) = V(p, y, z^0) \qquad (3)$$

Now, following Hanemann (1984), if we assume that the utility function has some components which are unobservable to the researcher and are treated as stochastic, then the individual's utility function can be written as:

$$V(y, s, z) = U(y, s, z) + \varepsilon \qquad (4)$$

where $y$ is the individual's income, $s$ is a vector of his socio-economic characteristics, $z$ is the quality of the environment and $\varepsilon$ is a random disturbance term with an expected value of zero. When offered an amount of money $A$ as a compensation for a change in $z$ ($z_0 \rightarrow z_1$), the individual will accept the offer if:

$$U(y+A, s, z_1) + \varepsilon_1 \quad \geq \quad U(y, s, z_0) + \varepsilon_0 \qquad (5)$$

where $\varepsilon_0$ and $\varepsilon_1$ are identically and independently distributed (i.i.d.) random variables with zero means. For the researcher, the individual's response is a random variable that will have some cumulative distribution (c.d.f) $G_{WTP}(A)$. Therefore, the probability that an individual will accept the suggested compensation $A$ is given by the equation below:

$$\text{Prob } \{\text{“yes” to } A\} = \text{Prob } (A \geq WTA) = G_{WTA}(A) \qquad (7)$$

**3.2 Willingness to pay or willingness to accept?**

The dictates of the standard economic theory are quite clear when asserting that the discrepancies between WTP and WTA are negligible when income effects are small (Freeman, 1993). However, the empirical evidence on contingent valuation has often been found to be inconsistent with the valuation assertion of standard theory since these differences not only exist, but also are of great magnitude, e.g. Horowitz and McConnell (2002) find that WTA is about seven times higher than WTP. The extent to which people

demand more to accept a loss than they are willing to give up in order to obtain an otherwise commensurate gain is a subject of growing academic interest (Knetsch, 2010). Several explanations about these discrepancies have been raised. Hanemann (1991) shows that both an income effect and a substitution effect determine the sign and magnitude of this disparity. However, even if there is only a small income effect, there still can be a substantial disparity if the elasticity of substitution between the environmental good and the rest of goods is sufficiently low (Hanemann, 1999). A second explanation, offered by Kahneman and Tversky (1979), refers to an endowment effect or loss aversion. Usually, as people are attached to goods for several reasons, then losses are weighted substantially more than gains. Consequently, people ask for more compensation when losing a good than what they are willing to pay to keep it. And, a third explanation lies in the idea of asymmetrical assignment of moral responsibility suggested by Boyce et al. (1992). This explanation arises from the field of environmental economics stressing the idea that existence or intrinsic values may be very important for environmental commodities, thus individuals may want to preserve them for moral motives.

On grounds of convenience, the WTP framework is the preferred question format used to assess both gain and losses because it is often easier to measure and estimate. The argument against WTA is the lack of experience of respondents with compensation claims and the cognitive effort required to answer a WTA question, which may result in a high rate of protest responses and unreasonably high values obtained relative to WTP (Anderson et al., 2000). However, the bias in valuing losses introduced by the practice of near exclusive use of the WTP measure seems likely to distort public policy and regulatory choices, thus leading to undue encouragement of environmental harmful activities and discouragement of mitigating measures (Knetsch, 2010). In this research, it was deemed more convenient to measure WTA given the perceived property rights. In particular it

seems that most people would regard the existence of the previous area surrounding the port as the reference state and basis for their feelings of loss since they have been living there for a long time before the expansion process of the port took place. Therefore, the appropriate measure would be WTA instead of WTP since this latter contradicts the perceived or actual property rights. A second reason for choosing WTA relates to the hypothetical scenario constructed, which should be believable and realistic so that respondents take it seriously (Whittington, 2002). In this case, it would have been quite unrealistic to ask respondents their WTP for avoiding this expansion process -and its negative effects- since port growth favours the general interest of the entire population and therefore is unstoppable in the current circumstances.

## 4. Survey process and design of the study

The information gathered from several focus groups and two pilot studies, gave essential clues for the design of the questionnaire given the higher difficulty inherent to a WTA scenario. Initially, in the first pilot study the area of influence considered was the whole city of Valencia. However, after a meticulous analysis of the responses it was obvious that to spend more effort interviewing in this whole area was a waste of time and expense, since the responses obtained were not those expected by economic theory. Therefore, after the pre-test stages the final survey was fielded in July 2010 and restricted to the area of the city closer to the port area that is known as "Distritos Marítimos" covering six neighbourhoods. A total of 400 face-to-face interviews were conducted in these neighbourhoods (see Table 2). Mitchell and Carson (1995) argue strongly in favour of personal interviews because the greater control possible in the interview situation is a significant advantage over less controllable mail surveys. Maguire (2009) concludes that survey mode matters since it not only can affect the decision of participating in the hypothetical market but also the contribution decision. The survey was carried out by a

market research consultancy and the interviewers were instructed to stress the academic nature of the study. A stratified sample was elaborated by establishing quotas according to the demographic structure of the population, so the main sample parameters (income, age, education, gender, etc.) closely resemble those of the entire population of the city. The weight assigned to each neighbourhood in the final sample was calculated by considering both its population and the proximity to the port area. Therefore, the neighbourhoods closer to the port area –Nazaret and Pinedo- were assigned a higher weight than they would have been given, if only their population had been considered.

To facilitate the understanding of the valuation scenario, respondents were provided with a verbal and a visual description (see figure 1) of the negative effects derived from the VP expansion process and they were asked to value the importance of each one of these negative effects and the degree of effect upon them. In the same way, two different images showing the port area before and after its expansion process, allowed the respondents to understand the real magnitude of this process (see figures 2, and 3). Visual aids play a vital role in holding respondents' attention during the presentation of a relatively long scenario (Mitchell, 2002).

Table 2. Number of interviews per neighbourhood

| | Population | | Interviews | |
|---|---|---|---|---|
| Neighbour hood | Number | Weight (%) | Number | Weight (%) |
| El Grao | 9,578 | 15.3 | 65 | 16.2 |
| Cabanyal-Canyamelar | 20,879 | 33.3 | 80 | 20.0 |
| Malvarrosa | 14,171 | 22.6 | 85 | 21.2 |
| Beteró | 8,488 | 13.6 | 55 | 13.8 |
| Nazaret | 6,903 | 11.0 | 75 | 18.8 |
| Pinedo | 2,605 | 4.2 | 40 | 10.0 |
| Total | 62,624 | 100.0 | 400 | 100.0 |

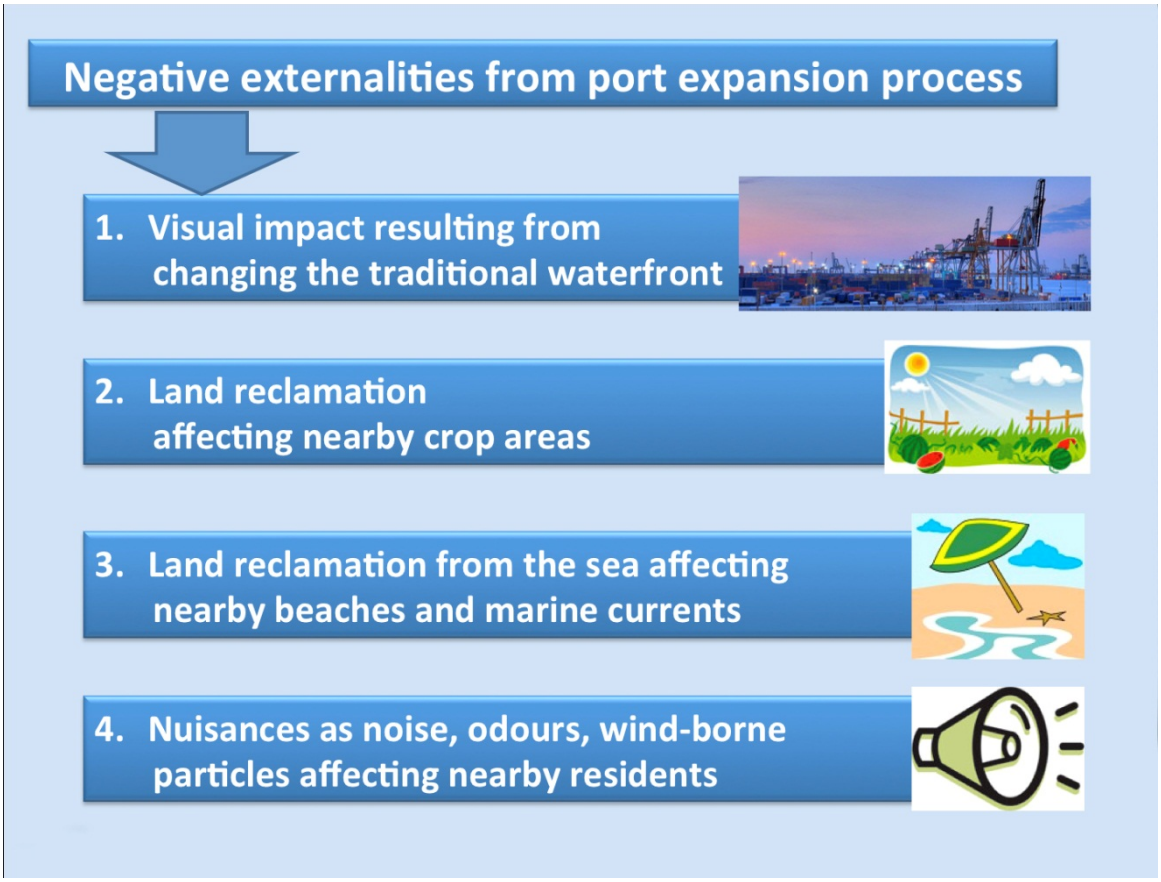


Figure 1. Negative externalities derived from port expansion

The payment vehicle chosen was an annual reduction in the local taxes currently paid by the respondents since it was a WTA scenario and not a WTP framework. This payment mechanism was regarded as the most appropriate since it is plausible, very familiar to the population surveyed and incentive compatible (provides incentives for truthful demand revelation).

The WTA question used was a dichotomous-choice referendum question. This elicitation format was chosen since it has some advantages over open-ended WTA questions that are more prone to strategic behaviour and at the same time it is easier for respondents to answer. Following Cooper (1993), five different bids were considered (€10, €30, €60, €120 and €270) based on the open-ended responses to a pre-test survey. In order to keep these cost figures within a credible range the maximum compensation offered to the respondents was approximately the average amount paid in 2009 by local residents in

real estate taxes. The purpose behind this upper limit was to be conservative and avoid offering unrealistic compensations to respondents. In the same way, once the payment was offered, respondents were asked if they were able to remember, and to state, the amount paid last year in real estate taxes. In this way, we were trying to ascertain if they were aware of the real magnitude of the compensation offered to them.

The survey concluded with a set of validation questions that can be used later to interpret WTA estimates. These involved socio-economic, attitudinal and behavioural indicators such as the membership in neighbourhood and environmental groups, views towards the environment and the social status of the respondents (personal and familiar income after tax, formal education completed, etc.).


Figure 2. Port of Valencia before its expansion process (year 1980) showing the former Nazaret beach that was "gobbled-up" by this process.


Figure 3. Image of Valencia Port after its expansion process (year 2010), showing the land reclaimed from the sea, the Nazaret neighborhood and the Logistic Facility area.

## 5. Empirical results

### 5.1 Respondent's environmental perception

InTable 3 we briefly analyse the respondent's perception of the environmental problems derived from port expansion. We find that 40% of respondents state that they feel "quite" or "strongly" affected in their wellbeing by the environmental impact derived from the land reclaimed from the sea in order to construct new quays. From their opinions, it can be deduced that they are aware that the construction of these new port facilities, has changed marine currents causing erosion problems on nearby beaches, and thus threatening their recreational opportunities.

Regarding the rest of environmental problems considered, this same percentage is considerably lower. In particular, if we focus on "the nuisance caused to nearby residents",

we find that only 18% of respondents feel "quite" or "strongly" affected while in the other two remaining problems this percentage is 22%. The conclusion that can be drawn from this prior analysis is that the most important problem for the respondents is the "reclamation of land from the sea" while the rest of problems are of minor importance to them.

Table 3
Respondent's environmental perception

| Environmental problem | 1 Not at all affected | 2 Little affected | 3 Somewhat affected | 4 Quite affected | 5 Strongly affected |
|---|---|---|---|---|---|
| Visual impact | 193 (48.3%) | 63 (15.8%) | 57 (14.2%) | 48 (12.0%) | 39 (9.8%) |
| Land reclamation | 220 (55.0%) | 71 (17.8%) | 20 (5.0%) | 58 (14.5%) | 31 (7.8%) |
| Land reclaimed from the sea | 145 (36.3%) | 58 (14.5%) | 39 (9.8%) | 79 (19.8%) | 79 (19.8%) |
| Nuisances affecting nearby residents | 215 (53.8%) | 62 (15.8%) | 57 (14.2%) | 48 (12.0%) | 39 (9.8%) |

### 5.2 Breakdown of rejection responses

Using follow-up questions to the WTA referendum, allowed us to distinguish between true zero responses and protest responses. Of the full sample, 54% of respondents rejected the compensation offered to them giving a "no" response (see Table 4). Although this percentage seems fairly high, Johnson and Whitehead (2000) point out that for many policy issues CV questions generate a considerable number of zero responses. However, considering that in this particular case the hypothetical market constructed was a WTA scenario, which requires a higher cognitive effort than a WTP scenario, the number of zero responses received can be considered acceptable[2]. Furthermore, it is much lower than the 65% to 90 % reported by Ferreira and Gallaher (2010).

[2] If the 66 protest responses obtained are excluded, this figure drops to a reasonable 37.5%.

Table 4
Reasons for a "no" WTA response

| Reasons | N (%) |
|---|---|
| True zero responses | 150 (37.5) |
| Protest responses | |
| *Lack of information* | 13 (3.2) |
| *Compensation perceived as unethical* | 25 (6.3) |
| *Do not believe compensation will be paid* | 11 (2.8) |
| *Opposed to port development* | 5 (1.2) |
| *The valuation scenario makes no sense* | 12 (3.0) |
| Total protest responses | 66 (16.5) |
| Total rejection (true zero + protest responses) | 216 (54.0) |

Protest responses usually are rejections to some aspect of the hypothetical market created, to a lack of information concerning the compensation offered and to what might be considered unethical behaviour, i.e. some people consider it unethical to accept a compensation for a decrease in environmental quality. In some cases, protest responses are also the result of the belief that the compensation will not be paid, i.e. respondents distrust those public bodies responsible for the payment of compensation. In our study, the percentage of protest responses was 16.5%, quite similar to the 14% obtained by Groothuis et al. (1998). The main reason for protesting was to consider the compensation offered as unethical (6.3%) and a lack of information (3.2%).

**5.3 Determinants of WTA**

In order to identify the determinants of a "yes" or "no" response to the offered bid, the logit technique was used coding positive responses as 1 and negative responses as 0. However, respondents were in fact given three alternative answers instead of two: "yes", "no" and "don't know". This gives rise to the problem of how to code the "don't know" responses. In our case, two sets of models have been estimated. In the first, the "don't know" responses have not been considered and, in the second case, following Groothuis et al. (1998), "don't know" responses are treated as "yes" responses in order to provide a

more conservative estimate of WTA. So, the first dependent variable is identified as "Yes 1" and the second one as "Yes 2".

The construction of an equation that predicts WTA for the good with a reasonable explanatory power and coefficients with the expected signs provides evidence of the proposition that the survey has measured the intended construct (Carson, 2000). So for each one of the two dependent variables created (the first one "Yes 1" excludes the "don't know" responses and the second one "Yes 2" treats these responses as "yes" responses) two logistic model specifications have been considered:

$$P(Yes) = 1/(1+\exp[\beta_0 + \beta_1 \ln(A) + \beta_2 income]) \qquad (5)$$

$$\begin{aligned} P(Yes) = 1/(1+\exp[&\beta_0 + \beta_1 \ln(A) + \beta_2 income + \beta_3 neighborhood + \beta_4 reduce + \\ &\beta_5 familysize + \beta_6 information + \beta_7 cabanyal + \beta_8 seaimportance + \\ &\beta_9 seaaffected + \beta_{10} localtaxes]) \end{aligned} \qquad (6)$$

where *P(Yes)* is the probability of a "yes" response and *A* is the bid offered. The first specification includes only as explanatory variables the bid offered and the income, while the second specification also includes demographic and attitudinal variables. In Table 5 all the explanatory variables are described with their mean values and standard errors. The preferred models estimated with their variables and coefficients are shown in Table 6. The maximum likelihood coefficients estimated indicate how the probability of accepting a certain bid amount offered is affected by the set of explanatory variables considered. Our analysis is confined to non-protest responses as is usual in contingent valuation analysis (Morrison et al., 2000). As expected, in both specifications as the log of the compensation offered (*A*) increases respondents are more likely to accept it, i.e. the higher the bid offered the higher the probability of acceptance. The positive coefficient of the INCOME variable is negative as expected, indicating that the probability of a "yes" response decreases with increases in income. Groothuis et al. (1998) suggest that this result is consistent with

diminishing marginal utility of income, so respondents with higher incomes are less influenced by the compensation for the negative externalities borne. Another variable that also shows a negative sign is CABANYAL. This is a dummy variable that takes value one if the interview was conducted in this neighbourhood and zero value in the rest of cases. Therefore, its negative sign indicates that people living in this neighbourhood are less willing to accept the compensation with regard to the rest of neighbourhoods considered. The reason behind this result is that the vast majority of the port workers actually live in this neighbourhood, so if they earn their living from the port activity it seems quite logical that they are not opposed to the VP expansion since this latter implies more job opportunities.

Table 5. Description of the explanatory variables

| Variable | Description | Mean | Standard Error |
|---|---|---|---|
| Log (A) | Log of the offered bid | 4.074 | 0.125 |
| INCOME | Respondent's household monthly income after taxes in eleven intervals ranging from €0 to > €3,000 | 4.964 | 0.065 |
| NEIGHBOURHOOD | A dummy variable representing the membership to a neighborhood association (membership=1; other cases=0) | 0.147 | 0.391 |
| REDUCE | A dummy variable representing the environmental concern ("agree" or "strongly agree" with reducing current standard of living to protect the environment=1; other cases=0) | 0.561 | 0.283 |
| FAMILYSIZE | Number of members of the respondent's family | 2.043 | 0.104 |
| INFORMATION | Respondent's opinion regarding the information provided ("very little" or "little"=1; rest of cases=0) | 0.079 | 0.504 |
| CABANYAL | A dummy variable representing the neighborhood were the interview was carried out (Cabanyal=1; other cases=0) | 0.140 | 0.529 |
| SEAIMPORTANCE | A dummy variable representing the importance given by the respondent to the problem "land reclaimed to the sea" ("quite important" and "strongly important"=1; rest of cases=0) | 0.266 | 0.303 |
| SEAAFFECTED | A dummy variable representing how respondents perceive that their wellbeing is affected by the environmental problem "land reclaimed to the sea" ("quite affected" and "strongly affected"=1; rest of cases=0) | 0.187 | 0.344 |
| LOCALTAXES | A dummy variable representing the respondent's awareness of the local property taxes paid last year (if remembered=1; rest of cases=0) | 0.532 | 0.277 |

NEIBORGHOOD is a dummy variable that shows the membership of a neighbourhood association. Therefore, respondents that are members of these groups are more willing to accept the compensation offered.

In order to measure respondents' environmental concern, we followed Diekmann and Preisendörfer (2003) who used a set of "nine statements for environmental concern" that can be answered on a five-digit scale (from strongly disagree to strongly agree). In our study, the only statement that was significant -as shown by the positive sign of the variable REDUCE- is that "to protect the environment, we all should be willing to reduce our current standard of living". So it seems that respondents who are more concerned with environmental problems are more willing to accept the compensation offered to them.

FAMILYSIZE is another variable related positively to the probability of accepting the compensation offered; so the higher the family size, the higher the respondent's WTA. Larger families have more children; so this result could be explained by the fact that respondents, when answering, are not only considering their own wellbeing, but also the wellbeing of other family members that potentially are also negatively affected. In order to test whether respondents were satisfied with the INFORMATION level provided, they were asked about their views towards it. So considering how this dummy variable was defined, the result obtained is unexpected since usually a lack of information is the cause behind protest responses.

The variables SEAIMPORTANCE and SEAFFECTED show also a positive coefficient. So those respondents that, on the one hand, rated as "quite" and "strongly important" the environmental problem related to the reclamation of land from the sea as a consequence of the port's growth and, on the other hand, stated that they were "quite" and "strongly affected" by this problem, are more willing to accept the compensation offered.

So it seems that from the four environmental problems derived from this growth process, the only one that clearly affects respondents' WTA is precisely the reclamation of land from the sea.

Table 6. Logit model: WTA determinants

| | Don't know responses excluded (Yes 1) | | Don't know responses as "yes" (Yes 2) | |
|---|---|---|---|---|
| Variable | Model 1 | Model 2 | Model 3 | Model 4 |
| Intercept | -0.766024 | -2.482896*** | -0.569204 | -2.019629*** |
| | (-1.408) | (-3.468) | (-1.072) | (-3.008) |
| Log (A) | 0.269536** | 0.367937*** | 0.262822** | 0.340085*** |
| | (2.372) | (2.942) | (2.352) | (2.830) |
| Income | -0.131122** | -0,129411** | -0.148281*** | -0.153102*** |
| | (-2.278) | (-1.991) | (-2.620) | (-2.441) |
| Neighbourhood | | 0,700516* | | 0.753970** |
| | | (1.790) | | (1.968) |
| Reduce | | 0.621853** | | 0.459215* |
| | | (2.193) | | (1.715) |
| Familysize | | 0.191936* | | 0.163234* |
| | | (1.840) | | (1.663) |
| Information | | 1.034060** | | 0.951455* |
| | | (2.048) | | (1.895) |
| Cabanyal | | -1.584076*** | | -0.777226* |
| | | (-2.991) | | (-1.943) |
| Seaimportance | | 0.533087* | | 0.495865* |
| | | (1.756) | | (1.682) |
| Seaaffected | | 0.689325** | | 0.611448* |
| | | (2.002) | | (1.810) |
| Localtaxes | | 0.478240* | | 0.465411* |
| | | (1.724) | | (1.765) |
| Log Likelihood | -184.1271 | -159.4466 | -192.4690 | -174.0518 |
| Pseudo $R^2$ | 0.06463 | 0.30825 | 0.07090 | 0.25131 |
| Correct prediction | 62.59% | 71.22% | 61.94% | 69.20% |
| N | 278 | 278 | 289 | 289 |
| Median WTA (€) | 191.88 | 172.87 | 139.74 | 121.66 |
| (95% confidence interval) | (176.97-206.79) | (162.42-183.33) | (130.42-149.08) | (115.30-128,03) |

Note: *t*-values are shown in parenthesis. * Statistically significant at 90% level; ** Statistically significant at 95%level; *** Statistically significant at 99% level.

Finally, the variable LOCALTAXES is also positively related with the probability of accepting the compensation offered. So those individuals that remembered and stated the amount paid last year to the local administration for this concept are more willing to accept the proposed bid. To this respect, we think that these individuals were more aware of the

real magnitude of the compensation offered to them since they had in mind a reference figure.

Another method of examining the theoretical validity of the results obtained is by considering the number and percentage of "yes" responses at each bid amount. In this case, the percentage of "yes" responses should be monotonically increasing since the higher the bid offered to the respondent, the higher the probability of accepting it. As can be seen in Table 7, it is, although not perfectly, a well behaved distribution since the percentage of "yes" responses increases as the bid increases for both dependent variables considered. This result suggests that respondents are behaving rationally in the hypothetical referendum.

Table 7. Percentage of "yes" responses at each bid amount offered

| | Yes responses | | No responses | | % Yes | |
|---|---|---|---|---|---|---|
| Offer | Yes 1 | Yes 2 | Yes 1 | Yes 2 | Yes 1 | Yes 2 |
| €10 | 17 | 19 | 44 | 44 | 27.86 | 30.16 |
| €30 | 28 | 30 | 40 | 40 | 41.17 | 42.86 |
| €60 | 25 | 30 | 35 | 35 | 41.66 | 46.15 |
| €120 | 30 | 32 | 37 | 37 | 44.77 | 46.38 |
| €270 | 30 | 32 | 35 | 35 | 46.15 | 47.76 |

In order to obtain a welfare measure of the change in respondents' utility resulting from this change in the environmental quality, the Cameron (1988; 1991) technique was used for calculating the median WTA:

$$WTA = \exp\left(\frac{\beta_0 + \beta_2 income + \beta_3 neighborhood + ... + \beta_{10} localtaxes}{\beta_1}\right) \qquad (7)$$

where the numerator is the sum of the coefficient of the estimated constant ($\beta_0$) plus the product of the other independent variables' coefficients times their respective means, and the denominator ($\beta_1$) is the coefficient estimate of the bid amount. Median WTA ranges

from a minimum value of €122 (model 4) to a maximum value of €192 (model 1). In any case, when "don't know responses are coded as "yes" responses, the median WTA values obtained are more conservative. In the same way, when the model includes as explanatory variables demographic and attitudinal variables (models 2 and 4) the welfare measures obtained are also more conservative than when only the bid and income variables are considered. Now, in order to know the magnitude of the welfare measures obtained, it is necessary to compare these values with a reference figure as it is the average amount paid in real estate taxes by a house owner in Valencia in 2009. So considering that this latter figure was € 272, then the median WTA values obtained would mean an hypothetical reduction in this tax of between 45% and 71% for those families negatively affected by the port expansion process.

## 6. Aggregation

Aggregation is always a controversial issue in welfare economics since the use of simple approaches, as adding up individual WTA values, can severely bias the aggregate estimates, particularly when the survey analyst does not have prior knowledge of the correct area over which to aggregate (Bateman et al., 2006). Therefore, in this study with the intention of being conservative and trying not to overestimate the social costs borne by local residents, the extent of the market considered has been precisely those living in the close vicinity of the port area, although we are aware that some individuals living in other areas may hold economic values regarding this environmental issue. As the payment vehicle used was a reduction in the current real estate tax paid by local residents, the aggregation criterion chosen has been double: the number of families settled in the referred neighborhoods, which amounts to 25,049 families, and the number of houses (30,748) located in this same area (both data have been provided by the City Council Statistics Office).

Now, considering the goodness of fit of the different models estimated, and trying

again to be conservative, the median WTA estimate chosen is €121.66 (model 4). Finally, it is necessary to consider both a horizon time and a discount rate. Again this process is troublesome since the present value of the costs borne by local residents depends directly on the specific value that these two variables could take. So, considering that the average age of the respondents is 46 and that life expectancy in the province of Valencia is 80 years, a horizon time of 34 years has been considered. Regarding the discount rate, two constant rates of 1% and 3% have been chosen since our analysis is not focusing on the long term.

So if the number of families is now multiplied by the median WTA, then the costs borne by local residents are equivalent to € 3,047,461 per year, while if the aggregate criterion is the number of houses, then this same figure would be € 3,740,801. With regard to the 34 year horizon time, the present value of these costs (see Table 8) ranges from a minimum value of € 64.4 million (when the aggregation criterion is based on the number of families and a discount rate of 3%), and a maximum value of € 107.4 million (when the aggregation criterion is based on the number of houses and a discount rate of 1%). In any case, these figures should be considered with caution since they are the result of different assumptions taken during the analysis both when the different models have been estimated as when the different aggregation criteria have been chosen as is shown in Bengochea et al. (2005).

Table 8. Estimation of the costs borne by local residents (€)

| Aggregation criterion | Number of families (25,049) | | Number of houses (30,748) | |
|---|---|---|---|---|
| Discount rate | 3% | 1% | 3% | 1% |
| Present Value assuming a 34 year horizon time and a median WTA= €122.66 | 64,398,448 | 87,470,254 | 79,049,995 | 107,370,961 |

## 7. Conclusions

There is no doubt about the crucial role that seaports play in promoting the economic prosperity and development of nations. However, in order to meet the current requirements

of space and transport links with their hinterlands, the expansion of seaports in recent decades has led to important environmental problems, as is the case analysed in this study. Ignoring a sizeable part of local residents, in particular those living closest to ports, adversely affected by these external costs, can distort public policy leading to undue encouragement of environmentally harmful activities. Therefore, in order to assist in decision-making processes, this research aims to estimate the costs borne by local residents applying the contingent valuation method. Despite the overwhelming use of WTP approaches for measuring both gain and loses, in this case it was deemed more convenient to use a WTA approach given the perceived property rights of individuals that have been living for a long time in this area and have witnessed the negative impact of port expansion on their well being. The results suggest that there is no evidence of substantial protest responses with regard to the WTA question used, indicating that in this particular context the implicit property rights are more consistent with a WTA scenario than with a WTP scenario.

Assuming a 34 year horizon time, the results obtained show that the present value of the costs potentially borne by local residents ranges from a minimum value of €64.4million (if the discount rate chosen is 3% and the aggregation criterion is the number of families), to a maximum value of €107.4 million (when the discount rate is 1% and the aggregation criterion is the number of houses). These figures would be meaningless if they were not underpinned by a minimal test of theoretical validity. Therefore, when estimating the determinants of WTA, it has been shown that the main variables (bid offered and income) were significant and showed the expected sign. Our results also show that among the different externalities stemming from the VP expansion, the only one that affects individuals' WTA is the reclamation of land from the sea, so it seems that this problem is the main source of concern to local residents.

Finally, we are aware that the methodology applied, and the research conducted, has its own limitations (Diamond, 1996; Flachaire and Hollard, 2007) and hence, it alone can never provide the definitive answer to such an important issue as the negative externalities derived from port expansion. However, considering the paucity of WTA studies, we humbly believe that our contribution is relevant since, to our knowledge, no previous study has attempted to apply a WTA scenario to this particular area of research. Therefore, it would be very satisfying indeed for us to know that our research could help pave the way for conducting other studies in this promising field of research since it provides minimum, although valuable, guidance.

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