International Public Preferences and Provision of Public Goods: Assessment of Passive Use Values in Large Oil Spills

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With global media reporting major environmental disasters, environmental damages linked to large oil spills may go well beyond the territorial limits of affected countries, particularly in the case of passive use values. Given international maritime law and foreign registration of many oil tankers there may be some basis for collecting these international damages as well. This may be particularly true now days for member countries of the European Union. In this analysis, we compare environmental damages linked to the Prestige oil spill using an online survey in three different European countries: Spain, UK, and Austria. Both, Spain and UK have suffered various oil spills of different magnitudes over the last twenty years, whereas Austria is located inland. The surveys have been conducted in winter 2008 simultaneously in the three countries and 500 completed responses were collected per country. Comparability of sampling techniques in the three countries was assured by employing an international online marketing company with representative panels in the countries of study.

Research hypotheses are WTP values are sensitive to the distance to the spill and linked to citizen's perceptions and probability of future oil spill occurrence in their own countries. In terms of our hypotheses we find that WTP falls off with distance. Conclusions and implications of our results make us reflect upon the potential importance of passive use values in the compensation process of environmental damages caused by large international oil spills.

Keywords: passive use values, oil spills, Europe

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Introduction

With global media reporting major environmental disasters, environmental damages linked to large oil spills may go well beyond the territorial limits of affected countries, particularly in the case of passive use values. Given international maritime law and foreign registration of many oil tankers there may be some basis for collecting these international damages as well. This may be particularly true now days for member countries of the European Union. In this analysis, we compare environmental damages linked to the Prestige oil spill using an online survey in three different European countries: Spain, UK, and Austria.

Economic valuation of environmental losses due to accidents such as the Prestige oil spill is challenging. In addition to economic losses related to the use and direct enjoyment of the resource (such as commercial and recreation losses), there are also passive use values (not related to on site use). These are more difficult to measure, although past studies suggest that the majority of environmental values are these existence values due to their public good nature (Loomis, 1988).

This paper focuses on the economic valuation of the environmental damages caused by the Prestige oil spill to three European countries in terms of their passive use values lost. In the passive use valuation literature, there are several valuation studies conducted that have demonstrated the need for including these value components in order to capture the total economic value of environmental goods lost due to oil spills (Carson et al., 1992; Loureiro, Loomis and Vázuez, 2009; Van Biervliet, Le Roy, and Nunes, 2005). Notably, the CVM research conducted after the Exxon Valdez oil spill is

the most cited study in this area (Carson et al., 1992; 2003). Other relevant valuation studies conducted after oil spills are those by Grigalunas et al. (1986) and Van Biervliet, Le Roy and Nunes (2005).

As it is well-known, passive use values can be only measured employing direct methods, based on the construction of a hypothetical market or referendum. Given that many of the environmental assets do not have a market determined price, the value for these natural resources is obtained via stated preference surveys, eliciting individual values towards the environmental goods lost.

The method to be employed in this study is the contingent valuation methodology (CVM). Our analysis follows the main Blue Ribbon Panel recommendations from the NOAA panel (Arrow, 1993) to the extent practical, which have become a reference in contingent valuation. Following Arrow et al´s. (1993) recommendations, the survey has been designed to be administered with easy to understand economic questions (with voter referendum format), and reminding respondents that any response to the WTP question was acceptable. Several focus groups and pretests were performed to ensure adequate information was given to respondents so that they could value the damages of avoiding another spill like the Prestige size oil spill. Therefore, the main objectives of this research are:

1. To estimate in monetary terms the passive use values and non market use losses caused by the Prestige oil spill in three European countries: Spain, UK and Austria. This provides welfare estimates that can be used by the EU government for obtaining compensation for the oil spill damages and in the valuation of other future similar spills via benefit-transfer.

2. To test how a similar questionnaire to that developed earlier in the Exxon Valdez study may be used in the European context, after recent advances

in valuation methodology are included. The two major advances included are: a cheap talk script (following the approach earlier developed by Cumming and Taylor, 1999) that reminded participants about the existence of hypothetical bias in surveys; and a certainty scale from 1-10, following Champ et al. (1997). We test whether the cheap talk variable has a significant influence on the likelihood of voting in favour of the program, and how the certainty level may affect WTP estimates.

There are also some important differences between this study and the pioneer CVM Exxon Valdez study. First, the survey was conducted online. As such, several changes were required in order to adapt the survey protocol to the European setting. Some of these changes were directly reflected into the valuation scenario. In particular, the valuation question was a dichotomous choice (DC) question instead of a double-bounded question. In this paper, we describe the stages of the survey implementation as well as its main parts and most relevant results. Last, conclusions and implications of our results make us reflect upon the potential importance of passive use values in the compensation process of environmental damages caused by large oil spills.

2. Description of the Prestige Oil Spill and Associated Environmental Damages

On November 13, 2002, the single-hull 26 year-old oil tanker, Prestige, suffered a serious accident just 46 kilometers off the Finisterra Cape, in the Northwest of Galicia (Spain). The Prestige possessed was a substandard vessel. It was owned by a Liberian company, registered in the Bahamas, and was operated by a Greek captain with a Filipino and Greek crew. It carried about 77,000 metric tons (MT) of heavy low-quality oil. Six days after the accident, and after traveling without a clear direction outside the

Atlantic coast of Galicia, the Prestige sank 222 Kilometers away from the Cies Islands on November 19, 2002, after splitting in two during a storm.

On its way to the bottom of the sea, the tanker spilled more than 60,000 MT of oil, polluting more than 1,300 kilometers of coastline. The Prestige oil spill was a very serious environmental catastrophe. It began in November 2002 and lasted for about 4 months, affecting the coasts of Northern Portugal, Northern Spain and Southern France. Nevertheless, most of the oil impacted the continental shelf and coastal zones of Galicia (region in NW Spain). Thus, this spill had international dimensions which previous studies, such as Loureiro, Loomis and Vázquez (2009) have ignored. Although Galicia is well-known for its dangerous waters, in which several oil spills have occurred previously before, the Prestige oil spill was the most serious environmental accident ever suffered in Spanish waters (Loureiro et al., 2006). The Galician coast, which was the most heavily affected by the Prestige oil spill, supports a large number of human settlements that are economically and culturally linked to the sea. At present, there are over 80 communities whose economies depend directly on catching fish and extracting shellfish resources.

The oil spill from the Prestige arrived at the Spanish coast in three large “black waves,” which extended the adverse effects of the spill on biological resources for several months. The first large wave arrived at the Galician coast on November 16, 2002, and at the time the regional authorities of Galicia issued a prohibition for inshore fishing as well as shellfish extraction (fishing and shellfish ban) in the affected area. The lack of cleanup equipment and qualified personnel made difficult a quick and effective response across such a large affected area.

Until February 1, 2003, the Prestige continued to leak oil from its tanks while on the seabed, creating multiple smaller spills that arrived at the seashores. The cleanup operation continued for many months, although by summer time 2003 most of the affected beaches were cleaned. In December 2004, after all cleaning operations were completed on the coast, a total of 97,000 MT of waste coming from the Prestige had been collected along the coast of Galicia. In addition, after a complex extraction operation took place during the summer months of 2004, the Spanish oil company "Repsol" extracted the remaining oil inside the tanker, collecting about 11,000 MT more.

It is believed that the total economic losses caused by the Prestige oil spill are quite large. In order to get compensation for such losses the Spanish government started two litigation processes, one in Spain against the Prestige´s owner, and a second one in the city of New Jersey (USA) against the Prestige certifier's. At the moment of writing this journal article, no final legal action has been taken against the Prestige's owner or against the certification company. The damages to passive use values estimated in this study may be useful in order to claim compensation for the affected parties.

3.The Survey

The questionnaire follows the basic structure from previous questionnaires employed by Carson et al. (2003), Carson et al. (2004) and Loureiro, Loomis and Vázquez (2009), although adapted to the European socio-economic context, and to the specific case of the Prestige oil spill. In the introductory part, the questionnaire begins with warm-up questions, where respondents indicate their level of concern with respect to several social issues, such as taxes, unemployment, and pollution, among others.

Next, specific questions about respondent's familiarity with oil spills were presented, together with rankings of perceived damages. At the beginning, participants were not given information about the objectives of the present survey, which allowed for more spontaneous responses to the questions presented. Next, the questionnaire continued by describing the damages caused by the Prestige oil spill, focusing on the environmental losses. We should note that in order to mitigate protest responses, in the introductory section we included a broad range of damages, when presenting the effects of the spill, including also those damages caused in the commercial fisheries sector and to the volunteers' health. However, in our valuation section, we focus only on environmental damages, stating clearly that other studies are evaluating the rest of the damages not contained in our valuation scenario. Our focus groups recommended the inclusion of this information to reduce the protest responses to the survey. Given the economic magnitude of the spill, participants considered that excluding mention of these other damages was not acceptable.

In the next section of the survey, environmental damages in the affected area were described in terms of affected habitats and fauna. For a better understanding of the dimensions of the spill, maps and photographs of the affected areas were presented, highlighting the number of kilometres of damaged coast and the number of closed beaches. With respect to the damages to marine birds and mammals, information about the number of dead birds and mammals was presented. Given that many bird colonies are migratory, it is not always possible to reflect the relative losses compared to the total stock. To solve this problem, we chose to reflect not only the quantitative losses but also the qualitative ones. As an example, in some bird colonies the effect of the spill has been as severe as causing the species to be endangered. This issue has been shown explicitly in the case of the common murre (*Uria aalge*) Galician populations. This part

of the questionnaire was complemented with photographs of the species in their habitats on a healthy state, and with interactive questions asking whether respondents had ever seen these bird species outdoors. As Carson et al. (2003) did, we also avoided the inclusion of pictures of oiled species to avoid extreme psychological reactions, following a conservative valuation approach.

Like the Exxon Valdez study, we valued the damages from the Prestige spill by estimating WTP to avoid another similar sized spill. Therefore, the next survey section introduced the possibility of a future oil spill episode like the one caused by the Prestige, if no preventive measures were to be put in place. Once this was stated, a show card with a proposed program to avoid future spills was presented to participants. The program was specially designed for its initial application in the Atlantic and Cantabrian Spanish coasts. This program was depicted as part of a broader strategy conducted by the EU to avoid marine pollution. The program description identified several action lines, which were in accordance to the focus groups discussions. Such action lines were: a) proper training of personal for surveillance and emergency tasks; b) inspection and surveillance of maritime traffic in all Cantabric and Atlantic coasts of Spain using escort ships that would travel along the coast. This would be done by escort ships that would be also able to sanction the tankers that cause accidental oil spill or those which do not follow properly the established procedures; c) a rapid and qualified response in emergency situations, using professionals and tools to prevent the oil spill from spreading. The escort ship will throw special booms that would immediately encircle any ship that was leaking oil. These booms are about two meters high above the sea level and other two meters below the sea level. Given that the oil floats on water, in the days after the accident, the booms can keep the oil from spreading. The oil kept inside the boom can be suctioned up into tankers that are part of the escort ships. We indicated

that similar systems have been employed successfully in the North Sea and in Alaska during the Exxon Valdez oil spill.

After this description of the proposed program, respondents were asked about their expectations regarding the program efficacy, and also if they had any further question about the program, except those related to the economic costs of this action, which would be explained later. Next, based on scientific predictions of damages, individuals were shown the difference between the expected environmental damages in the next seven years with and without the proposed program. This time frame was chosen because it reflects, on average, the frequency of important oil spills in the Northern Spanish coast. Therefore, the difference between the expected damages with and without the described program will allow us to understand the effectiveness of the proposed measures in terms of reducing the environmental damages. The difference on the damages related to each of the scenarios was presented in the following way:

4. Valuation Scenario: Description of Expected Damages with and without Program

If the program does not get implemented, there is scientific evidence that in the next seven years there will be:

- About 1,500 kilometers of coastline will be oiled
- The number of oiled birds will be about 28,320
- The number of oiled mammals will be about 80
- And the average number of soiled beaches will be 1,030

However, if the program gets applied, then on average in the next seven years researchers expect the following damages to occur:

- About 300 kilometers will be oiled
- 11,590 birds will be oiled
- The number of oiled mammals will be reduced to 25
- And the average number of soiled beaches will be 370

These effects were explained with the help of graphic information displayed in a show card. Note that the difference between the expected damages without program and with program is equal to the damages caused by the Prestige oil spill. Once the proposed program was presented together with the expected results, interviewees were given the chance to decide over its application, as in a real referendum. Their decision was about whether they would vote in favour or against the program, bearing in mind the costs to their household. In this sense, they were once more reminded about the nature of the program, which will be developed at an EU-level and where each member State should pay its equivalent contribution, if the respective country supports the program's application. The text presented was the following:

Your option to decide about this program

As you may understand, the application of this program carries associated costs. An option to pay for these costs is that the European Union starts a fund to prevent oil spills. Each country member with sea in the European Union would have to contribute to this new fund.

Therefore, in order for Spain to contribute to this new required fund, it will be required to increase the income taxes, so that enough operational budget is generated. The oil companies operating in Spain will have to contribute to this fund paying a portion of the costs of the program. In addition, Spanish tax payers will have to also pay their corresponding part of the bill. Spanish citizens who are not paying income taxes will be offered an alternative one time tax similar to a property tax.

- Remember that the described program will not be implemented unless the majority of Spanish taxpayers accept to contribute to this fund.
- By law, the money of this fund will be exclusively employed in oil spill prevention.
- We want to know your honest opinion about this program, Please, remember that there are no wrong answers. Remember this money is part of your budget, so you will have less income for doing your shopping and other things that you will desire.

Respondents were told that if the program was approved all segments of society and industry would be contributing to the payment of the program, specifically including oil companies, which should pay a proportion of the program implementation associated costs relative to their profits.

Next, the willingness to pay question (WTP) was presented. This was in the form of a voter referendum, offering the program implementation if they would vote to pay a specific one time increase in taxes. Moreover, all respondents voting yes or no, were asked about the degree of certainty in their response. The WTP question was the following:

It is expected that this program is in full operation in 2010. If the application of the escort ship program described above would cost your household xx€-, would you vote in favor to pay this amount just <u>one single time (say in the next tax declaration)</u> to reduce the damages described from the oil spill to the nature and fauna by oil spills?

YES …..1 NO …..2 DON´T KNOW….. 9

As and advancement over the previous Exxon Valdez study, after this DC question, participants were presented with the following certainty scale:

We do know there are many factors beyond your control that may affect the level of probability that you may vote as you stated above. Please circle the level of certainty you have regarding your previous response, meaning how sure you are about casting your vote in this way in a future referendum, given that 1=not certain at all, and 10=absolutely certain.

1	2	3	4	5	6	7	8	9	10

Next, we proceeded with additional open-ended questions asking about the reasons respondents had for their answers (both positive and negative) to the WTP question. The questionnaire concluded with questions about the socio-demographic profile of the respondents. Finally, interviewers were asked to complete some questions regarding their observations of the respondent's attention to the survey, and whether the respondent gave serious consideration to their answers.

5. Results

The previously described survey was implemented in Spain, UK and Austria. Spain was the most affected country by the Prestige oil spill, and UK and Austria had been chosen because in the first case, the UK has also a large coastline and probability of oil spills occurring, whereas Austria is a EU country without coastline. The panel of participants was provided by GMI, an international company conducting online research studies in the three mentioned countries.

In the following analysis all responses are included, even those that may be considered protest. This seems appropriate since in a real election their vote will count.

With respect to the characteristics of the sample, in Spain about 50% of respondents are men, whereas in the UK and Austria this goes up to 54.8 and 55.6, respectively. The average age of the respective samples goes from 42.39 in Austria, 43.40 years in Spain, and up to 45.08 years in the UK. Most respondents are of medium and high income (56.5% in Spain, 52.1% in the United Kingdom and 44.8 in Austria), and the baste majority were aware of the Prestige oil spill. In particular, about 99% and

75% of the respondents were aware in Spain and Austria, respectively. Finally, with respect to the certainty variable, about 34% of the Spanish participants are totally certain about their response, while this happens for the 30% of UK respondents and 25.6% of Austrian respondents.

6. WTP estimation: A Parametric Logit Model

In the following empirical application, WTP responses in the category of "do not know" or "no answer" have been recoded as negative responses. This procedure has been employed by Carson et al. (2003), and is one element making our WTP estimates conservative.

In addition to this non-parametric estimation, and given that our WTP responses come from a DC question, we employ a logit model to estimate the mean WTP for the prevention program with respect to methodological variables and traditionally socio-economic variables, such as income, age, gender and familiarity with the Prestige oil spill.

Responses to the WTP questions have been analyzed with a logit model, where, the empirical specification takes the following functional form:

$$(2)\ \ln(Y_i/1-Y_i) = \beta_0 + \beta_1 Bid_i + \beta_2 Age_i + \beta_3 Gender_i + \beta_4 MidIncome_i + \beta_5 HighIncome_i + \beta_6 Know\Pr estige_i + \varepsilon_i$$

where the right hand side is the log of odds ratio of an affirmative response over a negative response to the WTP question. Tables 1-3 contain the variable description and summary statistics of the explanatory variables, presenting their means and standard deviations. Table 4-6 present estimated coefficients that will be employed to calculate the mean WTP estimates displayed in Table 7.

As reflected in Tables 4-6, results for the logit model indicate the bid or amount respondents were asked to pay has a negative effect on the probability of paying for the program. Additionally, individuals who stated being absolutely certain about their WTP response in Spain and in the UK are less likely to pay for the program, although this variable is only significant at the 10% level. Additionally, if the respondent is a male, the likelihood of paying for the program decreases.

The estimation of the mean and median WTP in a linear in bid logit model is computed employing the formula (Hanemann, 1984):

(3) $$WTP = \frac{-\tilde{\alpha}}{\tilde{\beta}},$$

Where $\tilde{\alpha}$ represents the term known as the *grand constant*, being the sum of the products of the means of the explanatory variables times their associated coefficients, and $\tilde{\beta}$ being the coefficient associated with the bid amount. The magnitude of WTP and the 95% confidence interval are presented in Table 7. Confidence intervals were estimated using bootstrapping. WTP per household ranges from €130.10 calculated from the Spanish sample to €90.19 from the UK sample. To conclude all three samples have positive WTPs for the oil spill prevention program applied in Spain. Thus, those who have been most affected by the spill are those who are willing to pay the most to avoid a future similar incident; thus WTP decreases with distance to the event, but it is statistically significant across several European countries.

7. Conclusions

In the present work the estimation of the passive use and non market use values lost due to the Prestige oil spill has been calculated. Passive use values include the loss

of goods that do not have a real market. This is the specific case of many environmental goods affected by the Prestige oil spill.

The contingent valuation analysis presented here follows previous studies conducted by Carson et al. (2003) and Carson et al. (2004). In this sense, the present study constitutes the first European reference to damage valuation of large oil spills.

Our parametric mean estimate of per household WTP is 40€, but is five times higher for residents living in the geographic area of the oil spill as compared to households in the rest of Spain. This estimation can be considered conservative due to several reasons. First, we compute WTP instead of WTA. This results into a lower estimate of the losses that what would otherwise be obtained. Secondly, responses coming from those individuals answering don't know to the WTP questions are recoded as negative responses. Third, we included protest responses in our WTP analysis. Therefore, any modification in these conservative assumptions would produce higher estimates than the ones presented here.

In spite of the conservative approach used in this valuation exercise, it is worth it noticing the importance of passive losses caused by a large catastrophic oil spill, such as the Prestige. The amount of these non-market values is comparable with the short term direct economic losses to commercial fisheries and tourism arising from the Prestige oil spill (Loureiro et al. (2006)). The similar magnitude of the direct use losses and the passive use losses is likely due the fact the area affected by the spill was a major commercial fishery, which was shut down for nearly an entire year, and the area provided also significant tourism. Nonetheless, our CVM study suggests it is feasible to include passive use values in the valuation damages from large oil spills in the European context. Our particular empirical results should be quite useful to the Spanish government in settling of damages with the ship's owner. Other EU countries may find

our empirical results useful to provide an initial starting point for benefit transfer of monetary damages from similar large oil spills, until site specific studies can be completed.

Table 1. Summary Statistics of Main Explanatory Variables for Spain

Variable	Description	Mean	St. Dev
Vote	=1 if answer is affirmative; 0 otherwise	0.4744	0.4999
Bid	Amount requested	151.8597	118.6383
Certainty	=1 if certainty score =10; 0 otherwise	0.3452	0.4760
Age	Respondent's Age	43.4076	11.6370
Gender	=1 if gender is male; 0 otherwise	0.5056	0.5005
Medium Income	=1 if income is between €20000-€50000; 0 otherwise	0.3653	0.4820
High Income	=1 if income is over €50001; 0 otherwise	0.2004	0.4008
Know	=1 if know the Prestige oil spill; 0 otherwise	0.9933	0.0819

Table 2. Summary Statistics of Main Explanatory Variables for United Kingdom

Variable	Description	Mean	St. Dev
Vote	=1 if answer is affirmative; 0 otherwise	0.4283	0.4954
Bid	Amount requested	152.0978	123.3797
Certainty	=1 if certainty score =10; 0 otherwise	0.3043	0.4606
Age	Respondent's Age	45.0848	13.5083
Gender	=1 if gender is male; 0 otherwise	0.5478	0.4982
Medium Income	=1 if income is between £20000-£50000; 0 otherwise	0.3326	0.4717
High Income	=1 if income is over £50001; 0 otherwise	0.1891	0.3920
Know	=1 if know the Prestige oil spill; 0 otherwise	0.3440	0.4756

Table 3. Summary Statistics of Main Explanatory Variables for Austria

Variable	Description	Mean	St. Dev
Vote	=1 if answer is affirmative; 0 otherwise	0.4594	0.4989
Bid	Amount requested	141.0363	121.3422
Certainty	=1 if certainty score =10; 0 otherwise	0.2564	0.4371
Age	Respondent's Age	42.3953	11.8548
Gender	=1 if gender is male; 0 otherwise	0.5598	0.4969
Medium Income	=1 if income is between €20000-€50000; 0 otherwise	0.3483	0.4769
High Income	=1 if income is over €50001; 0 otherwise	0.1026	0.3037
Know	=1 if know the Prestige oil spill; 0 otherwise	0.7552	0.4305

Table 4 . Logit Model Regression Results for Spain

Variable	Coef.	Std. Err.	Z	P>|Z|
Bid	-0.0073	0.0010	-7.1700	0.0000
Certainty	-0.7072	0.2238	-3.1600	0.0020
Age	0.0293	0.0093	3.1500	0.0020
Gender	0.1938	0.2101	0.9200	0.3560
Medium Income	-0.0906	0.2357	-0.3800	0.7010
High Income	0.0481	0.2849	0.1700	0.8660
Know	0.3048	1.3306	0.2300	0.8190
Constant	-0.4610	1.3670	-0.3400	0.7360
Log likelihood	-268.6122			
LR χ^2_{11}	78.4900			
LR P-value	0.0000			

Table 5. Logit Model Regression Results for United Kingdom

Variable	Coef.	Std. Err.	Z	P>|Z|
Bid	-0.0058	0.0010	-5.9900	0.0000
Certainty	-0.5947	0.2310	-2.5700	0.0100
Age	0.0095	0.0078	1.2100	0.2250
Gender	0.0534	0.2114	0.2500	0.8010
Medium Income	0.2234	0.2351	0.9500	0.3420
High Income	0.7375	0.2850	2.5900	0.0100
Know	0.5261	0.2186	2.4100	0.0160
Constant	-0.1531	0.4360	-0.3500	0.7250
Log likelihood	-266.1958			
LR χ^2_{11}	62.6000			
LR P-value	0.0000			

Table 6. Logit Model Regression Results for Austria

Variable	Coef.	Std. Err.	Z	P>|Z|
Bid	-0.0054	0.0009	-5.7300	0.0000
Certainty	0.1480	0.2369	0.6200	0.5320
Age	-0.0034	0.0089	-0.3800	0.7020
Gender	-0.8910	0.2155	-4.1400	0.0000
Medium Income	0.3240	0.2329	1.3900	0.1640
High Income	0.4401	0.3484	1.2600	0.2070
Know	0.5737	0.2462	2.3300	0.0200
Constant	0.5777	0.4408	1.3100	0.1900
Log likelihood	-269.3262			
LR χ^2_{11}	58.7800			
LR P-value	0.0000			

Table 7. Mean WTP Estimates

Country	Mean (€)	95% Confidence Interval*
Spain	130.10	124.01-136.20
United Kingdom	90.19	82.38-97.99
Austria	103.86	94.73-112.99

*Obtained by bootstrapping

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