



Analysis

How Sensitive Are Environmental Valuations To Economic Downturns? ☆

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ABSTRACT

This paper assesses the temporal stability of willingness to pay estimates (WTP) under changing economic conditions. Specifically, two questions are addressed: a) is WTP stable over time? And b) if it is not, are the changes just driven by socio-economic effects, or something else? In order to investigate these questions, we used data from the Contingent Valuation Method (CVM) study conducted after the Prestige oil spill in Spain in 2006, and a second wave of the same survey repeated in 2009, after Spain entered a serious recession. Median WTP estimates dropped from €60.36 in 2006 to €26.92 in 2009 per household, a statistically significant reduction. To investigate the amount of the drop in WTP due to observables versus changes in preferences between 2006 and 2009, we use the 2006 logit WTP coefficient estimates with 2009 levels of the independent variables and we obtain a WTP of €46.37. This estimate is statistically different from the 2009 estimate (€26.92). In the same fashion, by using 2009 logit WTP coefficients with 2006 data, we obtain an estimate of €50.29, also different from the 2006 estimate. Implications of these findings for temporal stability of welfare measures and benefit transfer exercises are also discussed.

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1. Introduction

The question of whether individual preferences or valuations are stable over time is an important one due to its implications for benefit-cost and policy analyses of long lived projects or regulations. Many economists have challenged the traditional assumption that preferences are stable, arguing that these may be contingent upon the context in which they are expressed (Levitt and List, 2007a, 2007b). The economic literature on preference stability is booming (see for example Mannering et al., 1994; De Oliveira et al., 2008), but we have been able to find only one (unpublished) paper that looks at how preferences for environmental protection change with a macroeconomic downturn such as a recession (Kahn and Kotchen, 2010). However, their paper does not directly address how economic values for environmental protection change with the changing macroeconomic conditions. In the present work, we attempt to fill in this gap in the literature, using the economic crisis in Spain as a natural experiment to assess how the public's value for environmental protection changes during the recession.¹

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¹ We present results contained in the court case of the Prestige oil spill. Such findings could not be published nor submitted for publication until the case had been reviewed by the Spanish Supreme Court. (Date of review: Sept 30th, 2015).

Nearly all willingness to pay (WTP) studies for environmental goods and services use data from a survey done in one particular year. These single year values often get extrapolated out several years into the future when benefit-cost analyses or natural resource damage assessments are performed. This was certainly the case in quantifying damages from the British Petroleum (BP) oil spill in the Gulf of Mexico. WTP surveys conducted by Federal and State governments during the recession in the U.S. were used to assess economic damages of this spill, and then these damages will be extrapolated over the future recovery period. Thus, an important policy and empirical question is whether the state of the economy in the year of the survey has a dramatic effect on the WTP estimates (or use and passive use values) obtained at any particular point in the business cycle.

Contingent Valuation Method (CVM) estimates of WTP for passive use values are often subject to great scrutiny. In part this is due to their hypothetical basis (see for example Vossler et al., 2003; Aadland and Caplan, 2006). The sensitivity of CVM derived estimates of WTP have been tested regarding WTP question format (see for example, Reaves et al., 1999; Jordan and Elnagheeb, 1994), question ordering (e.g., Bateman and Langford, 1997), survey mode, and framing effects (e.g., Flachaire and Hollard, 2008). Another area of testing has been to investigate the test-retest reliability of CVM estimates of WTP. In this case, ceteris paribus, sensitivity of estimates over time is seen in most cases as a sign of unreliability of results. In order to mitigate the possible time sensitivity of estimates, the Blue Ribbon Panel recommended that "Time dependent measurement noise should be reduced by averaging across independently drawn samples taken at different points of time.

A clear and substantial time trend in responses would cast doubt on the “reliability” of the findings.” (Arrow et al., 1993, p. 4609).

Of particular relevance for this present work is the analysis conducted by Carson et al. (1997) assessing the temporal reliability of WTP estimates obtained from the Exxon oil spill contingent valuation (CV) survey, conducted two years apart. They show that the distribution of responses “for” or “against” the program valued were stable over time. Other studies also evaluating the temporal reliability of WTP estimates are those by Brouwer and Bateman (2005), McConnel et al. (1998); Stevens et al. (1994); Whitehead and Hoban (1999); and Loomis (1989, 1990). Most of these studies use the same individual respondents in both time periods (i.e., a panel) but a few others do not (Reiling et al., 1990; and Carson et al., 1997). However, the premise underlying all these studies is that consistency of WTP estimates indicates a reliable estimator. But this premise is based on the assumption of ceteris paribus. Specifically, that the determinants of WTP have not changed over the time interval. However, reliability also requires that when the underlying determinants of WTP or valuation context have changed, a reliable method would yield a different WTP estimate. Nevertheless, little is known about how values for public goods vary when macroeconomic conditions and personal income changes, as well as the psychological toll that a recession takes on consumer confidence, and hence willingness to spend their own money on public goods.

To investigate this important policy issue, this paper tests the temporal sensitivity of non-use value estimates linked to the environmental damages caused by the Prestige oil spill to the Spanish society as a whole. Our hypotheses depart from those previous analyses in that temporal reliability becomes an issue to be investigated when macroeconomic conditions are altered due to exogenous shocks (such as the economic and financial crisis of 2009). These economic changes may have some direct impact on some of the participants’ income and hence their values toward environmental protection relative to other goods. In the case of a deep recession, stability of WTP may not be expected over time, just as it is not expected that market prices for many consumer durable goods such as houses would remain unchanged. However, it is important to determine whether such changes in socioeconomic characteristics (such as income) may have a significant role on WTP stability. Therefore, in our view, the affirmation that “A clear and substantial time trend in responses would cast doubt on the “reliability” of the findings (Arrow et al., 1993)” is only valid when valuation conditions are not altered. Thus, the main objective of this analysis is to assess to what extent WTP estimates change, when macroeconomic conditions such as respondent’s changes in income, and also changes in psychological aspects such as unobservable consumer preferences, priorities or change in confidence about their own future circumstances change.

2. Model and Empirical Hypotheses

Hicksian compensated welfare measures are derived from a utility difference model estimated via dichotomous choice CVM. The observed discrete choice response of each respondent is assumed to reflect a utility maximization process. The indirect utility function for each respondent is represented as

$$U = V(j, Inc; Q) + \varepsilon_j, \quad (1)$$

The systematic part of the utility ($V(\cdot)$) depends on income (Inc) and other individual characteristics (later added in the empirical model) and quality measures (Q) of the resource. Let $j = 0$ represent the low-quality stage whereas $j = 1$ represents the improved-quality stage for which the respondent must pay the random Bid amount. Additional random elements that affect individuals’ utility are presented by ε .

The indirect utility function for each respondent is represented as:

$$V(1, Inc - Bid; Q_1) + \varepsilon_1 \geq V(0, Inc; Q_0) + \varepsilon_0 \quad (2)$$

The random terms ε_1 and ε_0 are independent and identically distributed random variables with zero means. The yes or no response depends on the difference in the indirect utility functions or:

$$\Delta V = V(1, Inc - Bid; Q_1) - V(0, Inc; Q_0) \quad (3)$$

The utility difference model yields the logit specification when the probability of a “yes” WTP response is specified as the cumulative distribution function (c.d.f) of a standard logistic variate, where:

$$Prob(WTP = 1) = \frac{\exp(\Delta V)}{1 + \exp(\Delta V)} = \frac{\exp(\beta x)}{1 + \exp(\beta x)} \quad (4)$$

The same empirical valuation exercise is repeated in two different periods: 2006 (normal economic times) and 2009 (economic recession). There are three hypotheses to be tested in this analysis. The first one refers to the effects of the explanatory variables on the probability of responding positively to a given bid amount in the dichotomous choice CVM WTP question for each of the specific years. In particular, we test whether there is equality of coefficients in the logit WTP regression between the two time periods. Our first null hypothesis is

$$H_0 : \beta_{06} = \beta_{09} \quad (5)$$

where β_{06} is the vector of coefficients in 2006 and β_{09} 2009, respectively. The null hypothesis will be tested using a likelihood ratio test for coefficient equality.

The second hypothesis test is related to the magnitude of WTP, with the null hypothesis postulating that they are equal across years:

$$H_0 : WTP_{06} = WTP_{09} \quad (6)$$

For the third hypothesis test we want to isolate the role of economic determinants such as changes in income from changes in preferences. This test assesses the validity of a temporal benefit transfer type estimate using the 2006 logit coefficients with the 2009 levels of the explanatory variables yielding what we will denote as WTP_{06-09} . In a same fashion, we test the validity of 2009 WTP estimates versus an estimate using 2009 logit coefficients with 2006 levels of the explanatory variables, called imputed 2006 WTP, and denoted as WTP_{09-06} . These two tests are in the same spirit as a temporal benefit transfer exercise conducted over time, and over varying economic conditions, so that we test:

$$H_0 : WTP_{06} = WTP_{06-09} \quad (7)$$

$$H_0 : WTP_{09} = WTP_{09-06} \quad (8)$$

If we reject H_0 in (Eqs. (7)–(8)), we might infer that it is not income changes or other observable socio-economic changes from the recession that are driving these results. Rather it may be changes in unobservable preference trade-offs between the environmental public goods and other (possibly private) goods. These three last hypotheses will be tested by a non-parametric signed-rank Wilcoxon test (Wilcoxon, 1945). As suggested by Eiswerth and Shaw (2007) inter-temporal welfare values are adjusted by inflation rates.

3. Survey: Stages and Application

In order to investigate temporal sensitivity of WTP estimates to macroeconomic conditions, a CV study was first conducted in 2006 during normal economic times, and later repeated in 2009 during the recession. Valid CV estimates require careful survey design and testing. Our

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