The Willingness to Pay for Property Rights for the Giant Panda: Can a Charismatic Species Be an Instrument for Nature Conservation?

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ABSTRACT. *This paper presents the results from a contingent valuation (CV) that elicited willingness to pay (WTP) of OECD citizens, for the conservation of the Giant Panda. The study investigates the extent to which such a charismatic or flagship species can be used to promote wider biodiversity conservation. There exists an internally consistent WTP for the purchase of property rights of the habitat required for the conservation of the panda. This WTP is shown to consist largely of the value placed on the ''naturalness'' of the species, implying that the symbolic nature of the panda might be a potential instrument for greater biodiversity conservation.* (JEL Q22)

I. INTRODUCTION

Meta-analyses of the WTP for individual species have found that there exist preferences for a few charismatic species as compared to the vast number of less well known species (Metrick and Weitzman 1996; Loomis and White 1996; Loomis and Giraud 1997; Kontoleon 1996). These are species that are immediately recognizable and identifiable by name (e.g., elephant, lion, tiger, panda).[1] Also, they are commonly associated with a particular geographic location or habitat (e.g., African savannahs, Indian forests, Chinese bamboo forests). Because of this association between the species and their habitats, these charismatic species are also sometimes referred to as ''flagship species'' (Leader-Williams and Dublin 2000).

The representative status of the flagship species plays a key role in conservation. For example, most conservation NGOs focus their appeals for funding around the plight of a few charismatic species, as in ''adopt an elephant'' appeals. The World Wide Fund for Nature (WWF) previously has selected ten species worldwide on which to base its fund-raising campaign. This organization even uses the subject of our study—the Giant Panda—as the emblem of its general campaign for the conservation of natural habitats and systems. Similar practices are followed by governmental agencies that have been shown to allocate disproportionate amounts of conservation funds to a hand full of charismatic species.[2]

This fascination with a few individual species might be a great boon for general biodiversity conservation, or it might not. All of the above-listed species are endangered, and

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[1] There is some limited work from the behavioral biology (Lorenze 1978) and cognitive psychology literatures (Guilleman 1981; Kabayashi 1990) that tries to analyze the behavioral and psychological reasons why some species have a greater appeal than others. This work has mostly focused on the effects of external characteristics of species on human perception. An interesting area for further research is to examine the impact of species characteristics and attributes on individual preferences.

[2] Considerable empirical support for the predominance of the flagship species phenomenon can be found in Metrick and Weitzman (1996), Williams, Burgess, and Rahbek (2000a, 2000b), and Leader-Williams and Dublin (2000). Further empirical research on extent and impact of this phenomenon is warranted.

for most, the primary cause of their endangerment is the loss of their natural habitat. The focus on a handful of species might translate into funding for their natural habitat, and thus provide much broader conservation benefits, if society is willing to support the flagship species in this way. On the other hand, it might be the case that society is willing to support the preservation of the flagship species alone, in preference to other life forms or forms of nature.[3] Thus, there is an important policy question: Is the flagship species approach an important instrument for biodiversity conservation, or a mere distraction?

The case of the Giant Panda is a critical test for whether the flagship species approach works for general nature conservation.[4] The species is one of the most widely recognized and cherished flagship species in the world. It is also highly endangered, with fewer than 1,000 individuals remaining in the wild in Sichuan Province, China. The primary cause of this endangerment is habitat disruption.[5] It has been estimated that the rate of habitat disruption in the panda reserves has proceeded at a pace of 5% per annum, over the past two decades.[6] Despite being such a prominent flagship species, current conservation efforts for the panda are not focused on habitat conservation but increasingly rely on captive breeding programs in *ex situ* facilities.[7] Funding for the panda is increasingly allocated to panda preservation alone. Does this mean that society is unwilling to provide funding for the natural habitat of the panda, even despite its relatively unique status? If this is the case for the panda, it is difficult to imagine an instance in which the flagship approach might be turned to the purpose of general habitat conservation.

We employ a CV study that considers these issues in three steps. The first part of our study investigates the WTP for panda lands provided for the sole purpose of panda conservation. This is an important policy question considering that we observe increased reliance on *ex situ* panda conservation practices. We find that a significant and theoretically consistent WTP for such land exists.

The second part of our study examines the nature of this flagship-inspired demand for habitat. In the spirit of Loomis and White (1996), we view the demand for panda habitat as a possible form of derived demand for general biodiversity conservation.

> [The valuation of a well-known species] may often include implicit valuation for the components of the ecosystem that supports these high-profile species. For example, humans may value watching bald eagles yet be unaware or indifferent towards pocket gophers. Yet, if pocket gophers are a critical part of the raptors' food supply, then humans have a derived value for the pocket gophers and their habitat. (Loomis and White 1996, 198)

In order to assess the nature of this derived demand, we decompose the WTP for the conservation of the giant panda into two components: 1) its quantitative component

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[3] In fact, we increasingly observe the paradox that some of these flagship species that are being feted as the cause for conservation, are themselves being subjected to *ex situ* conservation efforts (e.g., artificial breeding centers) (Olney, MacE, and Feistner 1995). Some notable examples include the tiger (Meacham 1997), and the Giant Panda (Swanson and Kontoleon 2000).

[4] We thank an anonymous referee for pointing out that it is the emblematic or symbolic qualities of the panda and not the species itself that serve this function. This interpretation is assumed throughout the paper.

[5] This is due to the continuing use of panda habitat for subsistence (non-commercial) activities such as hunting, gathering, and minor logging activities (Liu et al. 2001; MacKinnon and De Wulf 1994; Mackinnon et al. 1989).

[6] This decline in suitable panda habitat in the main panda reserve (Wolong) has lead to a decline in the panda population from 145 in 1974 to 72 animals in 1986. Based on wildlife-habitat relationships and the decreasing frequency of finding pandas in the wild, the current number of wild pandas in the Wolong Reserve is likely to be even smaller (Liu et al. 2001).

[7] Numerous *ex situ* panda conservation programs have been pursued in the China, the United States, Mexico, Germany, Japan, and Hong Kong. The latest and most ambitious panda conservation program pursued in China (Under ''China's Agenda 21''—White Paper on China's Population, Environment, and Development in the 21st Century) is titled the ''*Ex situ* conservation of the Giant panda in Sichuan province.'' None of these programs has had any impact on *in situ* conservation of the species since ''of the 400 pandas bred in captivity since 1936 none have ever been released into the wild'' (Chapman 2001).

(the WTP for preserving the stock levels of the species); and 2) its qualitative component (the WTP for the quality of environment in which the species resides). We determine the relative proportion of the value of panda habitat that is attributable to these quantitative and qualitative components. We further examine this qualitative component of the WTP for panda habitat. We investigate the extent to which there is a value flowing from the ''naturalness'' of the habitat, and the extent to which it is a logically distinct entity from the other values. We find that there is an important, substantial and distinct value attaching to the conservation of the panda within its natural habitat. This provides support for the view that the flagship approach to conservation may be able to provide funding for broader aspects of nature conservation other than the mere preservation of the flagship species itself.

Third we investigate the ability of respondents to recognize the existence of a value for panda habitat in the absence of the flagship species. That is, to what extent is the flagship species a necessary instrument for the conservation of its habitat? We find that there is some evidence to support the proposition that the WTP for the panda habitat would not exist, if the panda did not exist.

At the end of the article, we discuss our findings, and argue the following three points concerning charismatic species and nature conservation. First, the construct of individual ''flagship'' species is probably necessary to generate interest in the more abstract concept of nature or biodiversity conservation; the general public can support nature conservation but it requires concrete and specific figureheads on which to lodge this support. Second, there is the risk that the particularistic demand for these charismatic species can become a substitute rather than an instrument for nature conservation, if the policymakers respond with *ex situ* rather than in situ policies. In short, there is support for nature conservation that must be channelled through the mechanism of providing natural habitat for charismatic species, and if this is not done, it is support that is lost. Third, for these reasons, it is crucial that we select our flagship species carefully; all of the important habitats require representatives, and all of the chosen representatives should come from important habitats.

II. A CONTINGENT VALUATION STUDY ON THE CONSERVATION OF THE GIANT PANDA AND ITS HABITAT

A contingent valuation study was designed and implemented in 1998 that examined the relative magnitude of the types of values held by non-Chinese for conserving the Giant Panda and its habitat.[8] Three conservation policy scenarios were valued. The total WTP for each scenario was defined as the value for the simultaneous change in the quantity (stock) and the quality (living environment) of the species from the current reference to a new level. By survey design, each scenario entailed and/or restricted different types of values. Hence, the difference between scenarios provides an indication of the magnitudes of relative components of value.[9] Full details of the study can be found in Swanson et al (2001). Here we focus on presenting aspects of the survey design that are most relevant for this paper.

[8] The CV study was part of a larger research exercise funded by the CCICED that explored alternative sustainable management schemes for China's nature reserves. The aims of the research project were to examine the values of the non-Chinese population (and in particular OECD citizens) for reserve services. On the basis of this study, therefore, we can only make valid inferences over the population of OECD countries. Future work should be undertaken to examine how the implications from the present CV study are affected when Chinese preferences are examined and accounted for.

[9] This approach to decomposing values is also referred to as the scenario difference approach. It is to be preferred to other approaches where individuals are directly asked to partition their total values into component values. This is so since it avoids what Mitchell and Carson (1989, 288) have labelled the ''fallacy of motivational precision'': the error committed by CV practitioners when they assume that respondents are aware (to the degree of precision desired by the researcher) of what motivates their value judgements. The scenario difference approach avoids this problem since it only elicits aggregate values.

Defining Wildlife Values

Common welfare theoretic definitions of wildlife values that have been used to formulate CV scenarios are presented in Freeman (1993), Fredman (1995) and Loomis (1988). These authors have all modelled wildlife values as a function of their stock sizes. In this study, we employed an alternative definition of value that explored other facets of wildlife value. We focused on both the impact of a change in the quantity (or stock) of wildlife in valuation decisions, and on the impact of the quality (i.e., quality of lifestyle) of wildlife. That is, our definition takes into account that wildlife conservation policies have multidimensional impacts on the state, q, of a particular species, affecting both its quantitative aspects (mainly stock size), as well as its qualitative aspects (namely living environment). Hence, the definition of value used here treats $\boldsymbol{q}$ as a vector.[10]

For convenience, we assume that q consists of two dimensions, the quantity and the quality of a species' existence, $\boldsymbol{q} = (q_1 - q_2)$. The former is assumed to be measured by stock size, while the latter is measured by the quality of the environment afforded to a species. Most wildlife conservation policies would impact on both elements in $\boldsymbol{q}$. Individual WTP for a change in stock size, q_1, would be associated with the values obtained from preserving the genetic material of a species. In contrast, WTP for changes in species quality, q_2, is to reflect a form of altruistic value towards the species itself. More specifically, in economic (anthropocentric) terms preferences for species quality can be modelled using a paternalistic altruism utility framework. The individual (altruist) obtains utility when the beneficiary (species) receives or ''consumes'' certain resources (e.g., land).[11] Using a paternalistic altruism framework for the value for species quality is very useful since it avoids the conceptual difficulties of positing and discussing a utility function for the species itself.[12] Hence, the individual preference function is specified as $u = u(x(q_1, q_2))$ where x is the composite good. For a multidimensional policy change that results in the simultaneous change in two or more dimensions in q, the Hicksian compensating welfare measure is the amount of income paid or received that would leave the individual at the initial level of utility subsequent to the multiple impacts of policy. For the change from q^1 to q^2 a holistic measure of value is represented by:

$$WTP(q^0, q^1) = e(p, q_1^0, q_2^0, u^0) - e(p, q_1^1, q_2^1, u^0). \qquad [1]$$

Where $e(\cdot)$ is the standard individual expenditure function defined for market prices p and fixed utility u^0. Following Hoehn (1991), component values can be subsequently defined from [1] by using a simultaneous valuation path that begins at $q^0 = (q_1^0, q_2^0)$and ends at $q^1 = (q_1^1, q_2^1)$.The simultaneous valuation path values the effect of each element of q as the overall vector changes from q^0 to q^1. The disaggregated expression for [1] is then given by:

$$WTP(q^0, q^1) = \int_{q^0}^{q^1} \left[\frac{\partial e(p, q_1, q_2, u^0)}{\partial q_1}\right] dq_1 + \int_{q^0}^{q^1} \left[\frac{\partial e(p, q_1, q_2, u^0)}{\partial q_2}\right] dq_2, \qquad [2]$$

where each of the two components of [2] evaluates a derivative of the expenditure function $\partial e(p, q_1, q_2, u^0)/\partial q_i$, $i \in \{1, 2\}$ as the overall wildlife conservation policy shifts

[10] Several economists have cautioned $\boldsymbol{q}$ that need not be viewed as a single scalar measure but as a vector of attributes and that different elements of this vector may give rise to different values (Freeman 1993) For example Kopp (1992, 28) points out that ''what is certainly clear is that elements of the vector $\boldsymbol{q}$ that are appropriate for the motivation of use values . . . may not be well-suited to the motivation of non-use values.''

[11] These resources need not be restricted to land. For example, they may take the form of institutional or legal measures that secure that species are managed in a particular less intrusive and disruptive manner.

[12] Interpreting individual preferences for species quality in terms of paternalistic altruism directly follows from the conceptual work by McConnell (1997).

from its initial to its post-policy level (Hoehn 1991).

The merit of any formal definition lies in its ability to better explain human behavior, in its capacity to construct meaningful empirical hypotheses as well as in how well it conforms to the intuition underlying a particular concept. The definition of wildlife value presented above seems to better satisfy these requirements compared to the standard formal definition. First, the definition of value provided here allows for a simultaneous change in more than one attribute of $\boldsymbol{q}$ that captures the realities of conservation policies. Second, it captures the idea that different elements in $\boldsymbol{q}$ may be associated with different component values.

Description of Scenarios Valued

The conceptual framework presented above was used to construct the scenarios of the final version of the questionnaire. Three panda conservation scenarios were designed.[13] Each individual was asked to value all three scenarios irrespective of his/her answer to the other valuation questions. Due to budgetary constraints, a split-sample approach could not be used and hence the same respondents were asked to answer several WTP questions. The special design issues that emerge when multiple WTP bids are elicited from the same individual had to be addressed. First, the reference level of utility for each scenario had to be determined. It was decided to use the same reference level and obtain WTP for the changes q^0. This approach avoids the problems with substitution and income effects that would emerge if we had used a sequential design (Randall 1991) since respondents are asked to re-adjust their budget constraints as they go from one question to the other. Such a design has been labelled the ''exclusive-list'' format and is to be contrasted with the ''inclusive-list format'' where respondents provide incremental values to a sequence of WTP questions (Bateman et al. 2001a; Bateman et al. 2001b). Second, the sequence in which scenarios were to be presented had to be addressed. This refers to whether descriptions of scenarios were to be presented all in advance as opposed to presenting the scenarios sequentially. Bateman et al. (2001a, 2001b) have referred to the former approach as ''advanced disclosure,'' while the latter as the ''step-wise'' disclosure approach. Economic theory tells us that when operating under a (mutually) exclusive list format, then the order in which the WTP is ascertained for the options of the list should not matter (Randall 1991). Yet, empirical evidence presented in Bateman et al. (2001a, 2001b) suggests that ordering effects are present under a step-wise presentation format implying that there seems to be some other psychological processes at work that biases the results. The same body of research has found, however, that such ordering effects are significantly nullified under the advanced disclosure approach. Moreover, advance warning designs have shown to produce much more stable results in that respondents do not wish to adjust their stated bids. In contrast, empirical evidence from the same authors suggests that step-wise formats tend to induce respondents to want to change their initial bids as more goods are progressively added to the visible choice set. Finally, the results of Bateman et al. (2001a, 2001b) unequivocally show that the advance warning design produces more consistent results in terms of scope sensitivity of WTP values. Taken together, these findings justify the use of the advanced warning format in the current study. Finally, since the advanced warning format has been found not to lead to ordering effects it was immaterial whether the WTP questions were asked in a ''bottom-top'' or ''top-bottom'' manner. The current paper employed the former order of presentation.

The survey was administered in group interviews where respondents were provided with a common presentation of the scenarios to be valued. Respondents were not allowed

[13] The number of three programs appeared to be the most that individuals could handle in a valuation exercise. Moreover, the chosen scenarios were the ones that were of most policy relevance in that they corresponded to the actual scenarios that are currently being contemplated by Chinese authorities.

to interact with one another.[14] Respondents were first informed about the plight of the Giant Panda. It was then explained that the highest concentration of pandas was found in the Wolong Reserve, amounting to about 200 animals. The population of pandas in Wolong consisted of both caged animals in the local breeding center, as well as wild pandas in the reserve. It was further stated that conservation efforts would focus on just this reserve since this offers the only realistic chance of saving the species. Moreover, respondents were told that the species can only be saved if its population increases and thereafter maintained to 500 animals which is considered by scientists as the minimum viable population (MVP) (MacKinnon and De Wulf 1994).[15]

Further, it was explained that the Chinese authorities were contemplating three alternative conservation programs for the Giant Panda. It was made clear that only one (if any) of the three scenarios would be implemented. Moreover, it was stated that whichever of the conservation programs was adopted the species would be saved with equal certainty, but that the scenarios differed in the means by which this would be achieved.[16] The means of conservation were explained as having to do with the quality of the living environment that would be allowed to the conserved panda population. Further, it was stressed that without international financial support this goal would unlikely to be achieved and the panda would become extinct in the near future. Moreover, it was stated that the program would be managed by the Chinese authorities, while it would be financed via a compulsory airport tax surcharge levied on all foreign tourists leaving China. Finally, the payment ladder approach was used to elicit WTP values.[17]

In line with the definition of wildlife value presented above, each of the three conservation scenarios was described as having a two dimensional impact on the state of the Giant Panda (compared to the current status quo). First, the stock of the species would be increased and maintained at the MVP level (the quantitative component of change). Individuals were informed that each panda conservation program being considered would increase (and thereafter maintain) the size of the panda population from the current level of 200 animals to a viable population level of 500 animals.

Second, a different type of living environment would be allowed to the affected panda population (the qualitative component of the program). There were three distinct qualitative scenarios. A subset of the visual aids used to explain these three scenarios is shown in Figures 1–3. In the first scenario, a breeding program would be developed that would conserve pandas in captivity in standard zoo-type cages; this is the status quo that currently exists within the in situ breeding facility within Wolong Reserve. In this environment, each panda would be allowed 100 square meters of living space. In aggregate, 5 hectares of land would be required under this program to maintain 500 pandas. (See Figure 1.)

The second qualitative scenario described would conserve and maintain the same number of pandas (500) but would do so in pens

[14] To enhance the quality of the sample a partnership was achieved with the China International Travel Service (CITS) which offered access to tourist groups as well as information that would allow for some basic stratification (nationality, estimated income and age of group). This strategy aimed at assuring that a sufficiently large and representative sample was collected, ensured that respondent attentiveness was enhanced and that response rates were maximized. Interviews were conducted in English, German, and French. Also, currency conversion sheets were used to assist people in stating their WTP bids.

[15] The MVP is defined as the minimum number of stock that provides the necessary genetic diversity for the preservation of a species. CV respondents were more simply informed that 500 animals would ''be sufficient for the conservation of the species.''

[16] Most likely the results would have been altered if the likelihood of survival of the species were not kept constant across scenarios. The effects from this added policy dimension (i.e., the likelihood of success) could have been more readily examined using a choice experiment framework.

[17] It was also made clear that panda conservation entailed no recreational benefits since ecotourism is not possible in the treacherous mountains of Sichuan.

FIGURE 1
FIRST CONSERVATION SCENARIO: PANDAS IN CAGES (100 SQ. M.) (PHOTOGRAPH BY THE AUTHORS.)

rather than cages. A pen would allocate each panda 5,000 square meters (or half a hectare), an area that is roughly the size of a football field. In total, 250 hectares of land for the entire program would be required to maintain 500 pandas (an increase by a factor of 50 in living space allocation). (See Figure 2.)

Finally, the third qualitative scenario afforded *in situ* conservation of the 500 pandas within their natural habitat. (See Figure 3.) Under this scenario, each panda would be allocated 400 hectares of natural habitat (i.e., of the nature that exists within the undisturbed areas of Wolong Reserve). In aggregate, this program requires 200,000 hectares of undisturbed habitat, roughly the same size as the Wolong Reserve.[18,19]

These scenarios were devised to generate variation in both the quantitative and the qualitative dimensions of conservation program for this panda population. The three scenarios each provided for the same quantitative change from the status quo (i.e., from 200 to 500 pandas) but the three varied between one another in terms of the qualitative change afforded this minimum viable population. Hence, the survey design enabled the analysis of one level of quantitative change, and three levels of qualitative change. These will now be discussed and analysed in the following sections.

[18] An anonymous referee rightfully points out that a potentially improved design would have used a split-sample approach where one sample was only asked to reveal their WTP for the ''reserve'' scenario and the other were asked to value all three scenarios as described in the text above. Since the WTP estimates for the reserve scenario from both treatments would be derived through an exclusive list format the bids would be justifiably comparable. Such comparative studies allow for an improved means for examining the internal consistency of WTP bids and constitute an important area for further research.

[19] The use of visual aids and ample presentation time (approx. 30 minutes) resulted in a high degree of respondent comprehension of the scenarios. Follow-up questions suggested that about 60% of the sample found the survey interesting while only 5% found it ''difficult to understand.''

FIGURE 2
SECOND CONSERVATION SCENARIO: PANDAS IN PENS (0.5 HA. PER PANDA) (PHOTOGRAPH REPRINTED FROM CHINESE GIANT PANDA, PUBLISHED FOR THE CHENGDU ASSOCIATION FOR EXTERNAL CULTURAL EXCHANGES BY CHENGDU PRESS.)

III. WTP FOR PANDA CONSERVATION AND PANDA HABITAT

Table 1 provides sample summary statistics of the three stated WTP distributions. The sample means and median values are increasing in the direction in which scenarios are nested (bottom-top) with mean (median) values of US$3.9 (US$1), US$8.4 (US$5), and US$14.8 (US$10), respectively. All values are significantly different from zero (at 1% and 5% respectfully).[20] Moreover, all three WTP distributions exhibit the commonly observed shape, with a large mass at low figures and a long tail. Further, we see that the percentage of zero responses substantially decreases (from 37% to 7%) as we move ''upwards'' along the qualitative dimension (i.e., from the ''cage'' to the ''reserve'' scenario). Since all design aspects (such as the payment vehicle) remained constant across scenarios, it can be inferred that the decline in the proportion of zero responses is due to increases in the WTP for the qualitative change in the program (i.e., the amount of land provided to the species).

The results thus far show that there exist some sort of preferences for the conservation of this panda population, and that these dem-

[20] Also, all participants responded to all three WTP questions in the predicted direction (i.e., they provided a non-decreasing bid sequence).

FIGURE 3
THIRD CONSERVATION SCENARIO: PANDAS IN THEIR NATURAL HABITAT (400 HA). NOTE: THESE FIGURES ARE A SUBSET OF THE VISUAL AIDS USED IN THE FINAL SURVEY. (PHOTOGRAPH REPRINTED FROM CHINESE GIANT PANDA, PUBLISHED FOR THE CHENGDU ASSOCIATION FOR EXTERNAL CULTURAL EXCHANGES BY CHENGDU PRESS.)

TABLE 1
SAMPLE SUMMARY STATISTICS OF WTP RESPONSES FOR ALTERNATIVE PANDA CONSERVATION SCENARIOS

	WTP for Cage Scenario (US$)	WTP for Pen Scenario (US$)	WTP for Reserve Scenario (US$)	WTP for Panda Conservation When Probability of Success Is Low (US$)
Mean	3.90	8.43	14.86	0.10
Median	1.00	5.00	10.00	0
Standard deviation	5.34	10.13	15.69	0.43
Minimum	0.00	0.00	0.00	0
Maximum	30.00	75.00	100.00	3
% of zero responses	37.05	24.59	7.54	95
Sample size	305	305	305	305

onstrate an increasing WTP relative to the amount of land afforded to the panda population. Further, a Man-Whitney test confirms that the differences between the elicited values for the different panda conservation scenarios are different from zero, which implies that values are scope sensitive with respect to changes in the amount of land provided to each panda.[21] Moreover, it can also be seen that not only are values exhibiting statistically significant increases in the desired direction, but they are also exhibiting diminishing returns with respect to the land provided to each panda. Using sample means of total values, we see that marginal WTP for the first 5 hectares associated with the ''cage'' scenarios is $0.72/hectare.[22] The marginal WTP for the additional 200 hectares required for the ''pen'' scenario is $0.002/hectare, while the marginal WTP for the additional hectares (199,750) required for the ''reserve'' scenario is $0.000054/hectare.

The functional relationship between the WTP for panda conservation and additional levels of land was further examined by estimating a stacked regression model. This models the WTP for panda conservation as a function of different amounts of land, as well other individual-specific variables. The model (through simulations) also allows for the estimation of marginal WTP values for a larger span of land values. This functional relationship can be used by policymakers to assess the net benefits from conserving a marginal hectare of land.[23] Also, the sign and significance level of the estimated parameters on individual characteristics provide further indication of the degree to which the measured values are expression of consistent (economic) preferences and are not simply random responses or expressions of general attitudes and beliefs. That is parametric estimation of WTP offers additional internal (construct) validation of CV results (Mitchell and Carson 1989, 206; Arrow et al. 1993).

A random effects Tobit is the appropriate specification since this accounted for: (a) potential censoring at zero (Donaldson et al. 1998);[24] and (b) possible correlation across the three WTP responses (since they come from the same individual) (Greene 1990; Madalla 1987).[25] The results of this model are presented in Table 2. Only the best fit and most parsimonious model is presented. The variable on ''land'' enters the set of regressors in logarithmic form since economic theory suggests diminishing marginal values with respect to habitat (Mäler 1974; Hoehn 1991). Apart from land, the specification includes covariates of personal disposable income, as well as two attitudinal variables. The first, ''animal welfare index,'' captures latent sentiments of sympathy towards animals. The second, ''program index,'' represents a subjective assessment of the credibility of the panda conservation programs. The results of Table 2 show that all coefficients have the expected sign. The parameter on land is positive and highly significant. Figure 4 presents simulated marginal WTP values for various levels of land (while keeping other covariates fixed at sample mean levels). The graph clearly shows the pattern of increasing but diminishing values. Moreover, the coefficient on animal welfare is positive and significant which is consistent with the notion that higher WTP for enhanced levels

[21] The Anderson-Darling tests rejected that the WTP distributions are normally distributed and hence non-parametric tests of significance ware employed. The Man-Whitney test rejects the null that WTP responses were equal at the 1% significance level in all cases.

[22] The marginal WTP values stated above simply provide an indication of the internal validity of the elicited values (in that they exhibit diminishing returns). They were calculated as the difference in value between programs divided by the difference in hectares implied by the programs (see Rollins and Lyke 1998).

[23] A continuous specification was used despite the fact that the land variable takes on only three values since this provided the most parsimonious specification. A similar functional relationship between WTP and habitat for the preservation of the spotted owl has been estimated by Loomis and Caban (1998).

[24] Respondents could not provide negative values for scenarios that they disliked. Also, we observe a relatively large percentage of zero WTP responses for the first two scenarios (see Table 1). Both of these facts necessitate the use of a censored regression model.

[25] The random effects model includes a random disturbance that is common to, and constant over a given individual' s responses and assumed to be uncorrelated with the other regressors (Madalla 1987), as well as a transitory error due to random response shocks across individuals (Alberini, Kanninen, and Carson 1994). Similar models have been used by Larson and Loomis (1994), Loomis and Caban (1998) and Payne et al. (2000).

TABLE 2
RANDOM EFFECTS TOBIT MODEL OF WTP FOR ALTERNATIVE PANDA CONSERVATION SCENARIOS

	WTP Pandas			
Variable	Coef.	Std. Err.	*t*-value	P-value
Animal welfare index[a]	3.690	0.728	5.070	0.000
Program index[b]	2.129	0.811	2.626	0.009
Income (logs)[c]	7.845	1.095	7.162	0.000
Land (in logs)[d]	1.314	0.071	18.538	0.000
Constant	−68.554	7.917	−8.659	0.000
LnL	−2808.4134			
Wald chi2(4)	497.91			
Prob > chi2	0.0000			
N	915			

[a] Attitudinal index capturing latent sentiments of sympathy towards animals. Constructed on the basis of factor analysis of responses to attitudinal questions on animal welfare sentiments. Questions that factored together were: Willingness to wear fur; Willingness to use cosmetic tested on animals; Willingness to support ban on leg hold traps; Willingness to support animal welfare society. See Kontoleon (2003) for details of factor analysis.
[b] Index of subjective assessment of the credibility of the panda conservation programs. Calculated by taking the average score of five-point Likert scale answers to the questions: What kind of support do you think the Wolong Panda Conservation Program would receive from foreigners visiting China? Do you think that the airport tax increase described above is a fair method of financing the expenses connected with the implementation of the Wolong Panda Conservation Program?
[c] Personal disposable annual income in logs (in 1998 US Dollars).
[d] Log of land where land takes on the values of land specified in the three scenarios.

of species quality (living environment) would be associated with higher animal welfare sentiments. In addition, the significant and positive coefficient on the ‘‘program index’’ highlights the importance of designing credible, reliable, and believable wildlife conservation programs. Finally, the coefficients of income exhibits the desired direction supporting the theoretical consistency of the WTP responses. In sum, these results demonstrate that there is a significant and logically consistent WTP for lands provided for the sole use of the panda population.

IV. DECOMPOSING VALUES INTO QUANTITATIVE AND QUALITATIVE COMPONENTS

Since the quantitative component of value is assumed to remain constant across all three scenarios (given that the panda population is constant at 500 in all three), the difference between scenarios is then assumed to provide an estimate of WTP for changes in the qualitative component of the programs.[26] Taking the difference between the three WTP distributions will produce inferred measures of these WTP:

$$WTP_{pen—cage} = WTP_{pen} - WTP_{cage} \quad [3]$$

$$WTP_{reserve—cage} = WTP_{resere} - WTP_{cage} \quad [4]$$

$$WTP_{reserve—pen} = WTP_{reserve} - WTP_{pen}. \quad [5]$$

The first qualitative change involves allotting each panda an enlarged living space. [3] provides the additional WTP for removing pandas from small cages within the breeding center to one where animals are kept in football field-sized pens. This value is US$4.53 and represents the value individuals would be willing to pay to purchase 200 additional hectares of land for the benefit of the species itself. This extra land would neither make ad-

[26] The quantitative component of the programs received an average WTP of $3.90.

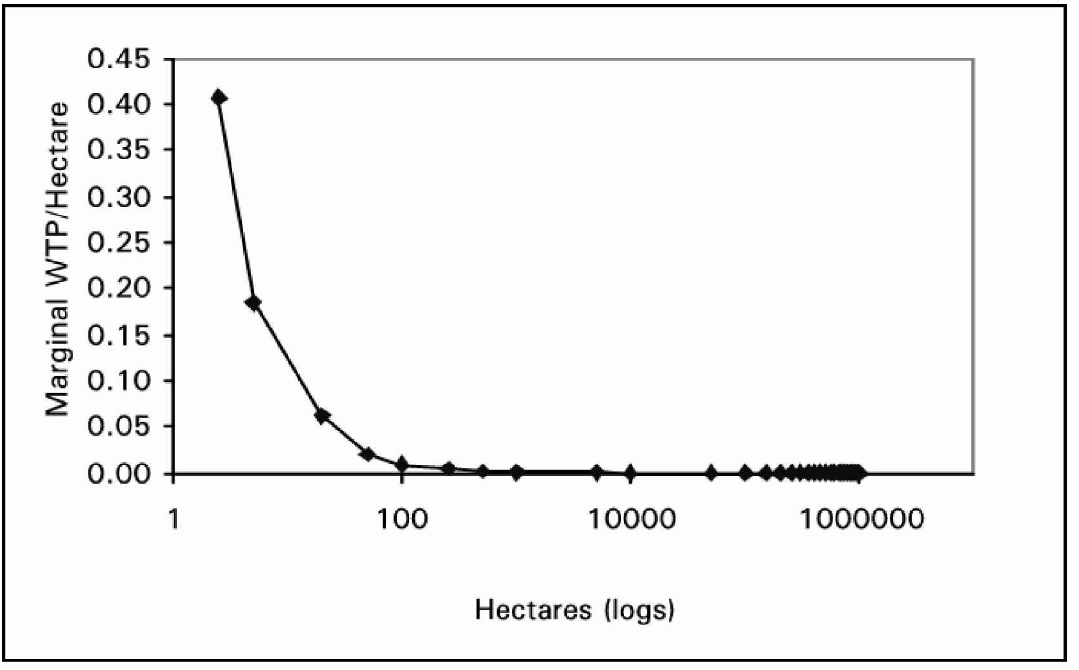

FIGURE 4
PREDICTED DIMINISHING MARGINAL WTP/HECTARES FROM RANDOM EFFECTS TOBIT

ditional contribution to the survival of the species, nor to overall biodiversity preservation. Its ''acquisition'' would simply provide utility to the ''valuer'' from knowing that the species is allotted additional land/space resources to those required for its mere biological preservation. This qualitative component of WTP constitutes more than half (54%) of the total bid for the ''pen'' scenario (US$4.53 versus US$3.90 for the quantitative component).

Further, [4] provides the additional WTP for removing pandas from the cage-based breeding center and purchasing the land required for an in situ conservation program. The survey promised a program which would allow the panda population to live undisturbed within its natural environment. The difference between the reserve-based program and the cage-based one [5] is US$10.96 (73% of the total WTP of US$14.86). There is therefore three times the WTP for the natural habitat for the population than there is for the mere conservation of the population itself.

It is possible that some part of the bid in the reserve scenario accords with the value of the additional space afforded to the panda population, while another part of it flows from the ''naturalness'' of the habitat. We assume that the maximum WTP for ''natural'' habitat accords with the difference between the reserve scenario and the pen scenario (since both the attribute of space allocation and the attribute of ''naturalness'' is varying between these scenarios). This maximum value is US$6.43 and is the value associated with buying 199,995 extra hectares of land for the panda population. This value has been interpreted as a form of implicit valuation of ''natural habitat'' and it constitutes 43% of the total bid of US$14.88 (for the reserve scenario).[27]

Our decomposition of the WTP for the giant panda demonstrates that the panda's

[27] Further research is required to externally validate and test the disaggregation presented above. Yet, these figures can serve as an illustrative example of such a value disaggregation.

flagship status translates into substantial WTP for natural habitat. The charismatic species generates a WTP for both its quantitative preservation (maintained stocks) and also for some minimum space for its individual use, but this represents only about half of the total WTP available for the conservation of the panda population. There is an increase in the WTP for the species from USD 8.43 to USD 14.86, generated only by the provision of a ''natural'' quality of life. This is value derived from the panda that is available to nature conservation for *in situ* conservation, but is unavailable when *ex situ* is elected. Clearly, the giant panda might be used as an important instrument for general nature conservation purposes.

V. WTP FOR *IN SITU* PANDA CONSERVATION WHEN LONG TERM SURVIVAL IS NOT CERTAIN

The final issue of interest is the extent to which the Giant Panda is a necessary instrument for the conservation of nature. That is, if the pandas were not used as an instrument for the conservation of this habitat, then would an independent WTP exist to provide for the conservation of these lands? This is important for the purpose of determining the extent to which the construct of charismatic species has become a necessary instrument for nature conservation (and not just a potential instrument).

We examined these questions in the context of a final part of the panda survey be presenting as auxiliary scenario after the values of the three main conservation programs had been elicited. The scenario tried to obtain an indication of whether individuals valued the Wolong Reserve independently from its function as panda habitat. The last column of Table 1 presents the summary statistics from this WTP question. As can be seen, the sample overwhelmingly stated a zero WTP for a conservation program that (although securing the preservation of the Wolong Reserve), did not guarantee the conservation of the panda.[28]

Thus, the WTP for the Giant Panda is not only a potential instrument for nature conservation, it is potentially a necessary instrument for nature conservation. Once having created the construct of charismatic species, it is the continuing existence of such constructs that drives the WTP of the public for nature in general.

VI. DISCUSSION

We would now like to address the issue raised in the title of the paper. First, our study finds that there is a clear WTP for the property rights required for the in situ conservation for the panda. The nature of this demand is logically coherent: the WTP for wildlife conservation is an increasing function of land (at a diminishing rate) while it is also consistent with other independently measured individual characteristics such as ones ability to pay (income) as well as ones attitudes toward animals (animal welfare index).

In order to put the WTP for panda lands into perspective, consider first that the current annual budget for Wolong Reserve is about US$250,000, or $1.25 per hectare. Furthermore, under the current benefit-sharing regime, the local peoples living in and near (and using) the reserve are receiving 4% of the annual budget, or approximately $0.05 per hectare. Given this low level of returns from panda conservation (i.e., the restrictions on the use of the reserve), it is readily apparent why it would be the case that local peoples would be hostile to both the reserve and to the pandas that live within it (see Swanson et al. 2001).

The remainder of the budget is spent on enforcement measures (battling local peoples with objectives different from the reserve) and a captive breeding program (keeping pandas in captivity rather than the reserve). The ''cage scenario'' used in the survey is based on the cages actually in use for panda *ex situ* conservation within Wolong Reserve. As panda populations in the reserve continue to decline, there is an ever-increasing share of Wolong pandas living in captivity rather

[28] Admittedly, the scenario suffers from credibility issues. For example, it is possible that individuals are rejecting a scenario inconsistent with those provided earlier in the survey.

than in their natural habitat. We believe that the case of the panda is exemplar of that occurring for many endangered species in many parts of the world.

Now consider the potential impact of the WTP for panda lands on the panda's plight. A conservative estimate (using the median WTP and assuming 5 million foreign western tourists to China for 1997) provides a figure of US$50 million per annum for the Wolong Reserve which amounts to US$250/hectare. If the local people continued to receive a royalty of 4%, this would amount to a return of US$10 per hectare for them (under the existing benefit-sharing regime). This would increase the returns from reserve status by a factor of twenty. If these payments were made contingent on the presence of pandas in the reserve, it would likewise greatly enhance the likelihood that the objectives of the local people and the panda conservationists would become congruent.[29] This would then reduce the likelihood of intrusions into the reserve, and reduce the amount of the reserve budget that need be spent on monitoring and enforcement. In the sense that this WTP might be able to translate into a secure tenure by a stable population of pandas, it is apparent that this particular species clearly does have the capacity to purchase its own property rights.

There is thus a clear capacity for using this charismatic species (panda) to acquire its own lands, but is it possible to make use of it as an instrument for nature conservation? The insistence on behalf of management agencies on saving particular species rests partly on the belief that this approach will be able to secure funding for the preservation of its habitat and by consequence of the (potential) biodiversity located wherein. It is widely believed to be the case that charismatic species are the flagships for general nature conservation.

Our study finds that this belief is well-founded. The total WTP for *in situ* panda conservation can be decomposed into three subcategories: quantitative or stock values (27%), quality of life values (30%), and derived demand for nature values (43%). The qualitative values constitute 73% of the entire bid for *in situ* panda conservation. Thus, a substantial proportion of the value of the Giant Panda would be lost if *ex situ* conservation were to be pursued exclusively. Almost half of the value given to the species would not be expressed in the context of mere quantitative preservation (as opposed to *in situ* conservation). Therefore, it makes sense to use such charismatic species as nature conservation ''flagships'': there is a lot of added value for conservation that would be wasted if the habitat were not tied to the charismatic species.

But would the habitat be conserved irrespective of the charismatic species? In our study, the WTP for *in situ* conservation drops to zero when the probability of survival of the flagship species is low. Hence, biodiversity values in this case are dependent on the preservation of the flagship species. The Giant Panda is not only a potential instrument for conservation, it is potentially a necessary instrument.

VII. CONCLUSION

The debate over the most appropriate means for conserving biodiversity is often polarised between advocates of the so-called ''species'' and ''ecosystems'' approach to conservation. The former focuses on the protection, both (in situ and *ex situ*) of endangered, often high profile, species. The latter seeks to conserve entire ecosystems (irrespective of whether they host any high profile species) with the sole aim of preserving as much diversity as possible (Van Kooten and Bulte 2000). Irrespective of which approach is preferable at a normative level, brief consideration of the results of this study and the prevailing conservation policies indicates that the construct of the charismatic species is now a ''fact of life.'' For example, Metrick and Wietzman (1996) show that 54% of all wildlife funding in the United

[29] A rough estimate of the value of the uses of the reserve by local people (comprising mainly of small-scale subsistence activities), range between 20 to 120 dollars in aggregate per year, per household (Swanson et al. 2001). Hence, it is likely that the appropriation of the values for *in situ* conservation estimated in this study would more than cover the current opportunity costs.

States is devoted to the conservation of just 1.8% of all listed endangered animals. Moreover, they show that the amount of funding spent on the conservation of a particular species does not depend on ecological criteria (such rarity and degree of endangerment), but rather on the public appeal and ''charisma'' of the species.

Therefore, the fate of nature conservation is now inextricably interlinked with the fate of particular charismatic species. The construct of the important endangered species has been created and sold, and policymakers now are going to have to live with the phenomenon. The final issue to consider here concerns the costs that this construct imposes on the campaign for general nature conservation.

That is, to what extent is the flagship approach limited in its capacity to contribute to wider biodiversity conservation? Van Kooten and Bulte (2000) identify two conditions for the flagship approach to be generally conducive to nature conservation: habitats that are species rich in one taxon must also be species rich for others; and rare and endangered species should occur in species-rich areas. Yet, more often than not, neither of these conditions are met in the instance of charismatic species. Studies by Prendergast et al (1993), and Williams, Burgess, and Rahbek (2000a, 2000b) show that the flagship approach has little positive effect on biodiversity conservation (for widely accepted ecological definition of biodiversity). This is so because biodiversity hot spots do not usually host flagship species.

Given that the flagship approach is not capable of delivering higher levels of biodiversity conservation, policymakers may be faced with trade-offs between conserving diversity per se and conserving certain rare (and perhaps high profile) species (Van Kooten and Bulte 2000). Alternatively, the policymaker might attempt to educate the population to discard the ''charismatic species'' approach (at the risk of destroying some WTP for nature conservation). A third alternative might be to attempt to create some new charismatic species that are more closely associated with the various biodiversity hotspots. Perhaps it is time to replace the panda (as the symbol of international nature conservation) with a beetle?

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