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Linking Policies for Biodiversity Conservation with Advances in Behavioral Economics

by

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[2] School of Economics, The University of Queensland, Brisbane QLD 4072, Australia
Email: c.tisdell@economics.uq.edu.au

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For more information write to Professor Clem Tisdell, School of Economics, University of Queensland, Brisbane 4072, Australia. Email
c.tisdell@economics.uq.edu.au

LINKING POLICIES FOR BIODIVERSITY CONSERVATION WITH ADVANCES IN BEHAVIORAL ECONOMICS

Abstract

Global biodiversity loss and its consequences for human welfare and sustainable development have become major concerns. Economists have, therefore, given increasing attention to the policy issues involved in the management of genetic resources. To do so, they often apply empirical methods developed in behavioral and experimental economics to estimate economic values placed on genetic resources. This trend away from almost exclusive dependence on axiomatic methods is welcomed. However, major valuation methods used in behavioral economics raise new scientific challenges. Possibly the most important of these include deficiencies in the knowledge of the public (and researchers) about genetic resources, implications for the formation of values of supplying information to focal individuals, and limits to rationality.

These issues are explored for stated-preference techniques of valuation (e.g., contingent valuation) as well as revealed preference techniques, especially the travel cost method. They are illustrated by Australian and Asian examples. Taking into account behavioral and psychological models and empirical evidence, particular attention is given to how elicitation of preferences, and supply of information to individuals, influences their preferences about biodiversity. Policy consequences are outlined.

Keywords: Biodiversity, behavioral economics, contingent valuation, experimental economics, travel cost method.

LINKING POLICIES FOR BIODIVERSITY CONSERVATION WITH ADVANCES IN BEHAVIORAL ECONOMICS

1. Introduction

If one interprets the field of behavioral economics in a broad way, its development and application to environmental economics in the last 50 years or so has been remarkable, and the increasing interest of economists in the conservation of nature and biodiversity has also stimulated the development of behavioral economics. There are varied definitions of behavioral economics and Earl (1988, p. 1) states that exactly what it is is unclear. However, for the purposes of this essay, the following general definitions will suffice. Behavioral economics applies to 'scientific research on human and social cognitive biases [and processes] to better understand economic decisions, and is primarily concerned with rationality or lack thereof' (Wikipedia, 2005). A second conception of behavioral economics is that it 'uses facts, models and methods from neighboring sciences [such as psychology] to establish descriptively accurate findings about human cognitive ability and social interaction, and to explore the implications of these findings for economic behavior' (Fehr et al., 2004, p. 391).

Increasingly, behavioral economics has become more closely associated with experimental economics and empirical (observational) study of human decisions (cf. Sent, 2002, p. 287). Thus it contrasts with the strong emphasis of neoclassical methods on the use of deductive or axiomatic methods for predicting economic choice and behavior based on the concept of rational economic man. Furthermore, behavioral economics gives much more attention to the processes involved in economic decision-making than does neoclassical economic theory. Nevertheless, the neoclassical economic model can be regarded as a special or particular model in behavioral economics. This accords with the view, for example, of Camerer (1999, p. 10) that behavioral economics should include 'the rational principle as a mathematical special case'. Recent research in behavioral economics illustrates ways in which the neoclassical model is a special case, and/or at variance with actual human behaviors in several important respects. It is claimed, by many practitioners of behavioral economics, that these divergences are regular and are often of policy significance (e.g., Camerer, 1999).

If dependence on empirical observation of stated preferences and choices is regarded as a key feature of behavioral economics, experimental economics can be regarded as a subset of it. Environmental economics has displayed increasing emphasis on behavioral economics since the 1950s. Growing interest in nature conservation and in the demand for maintaining biodiversity has reinforced this trend.

This article is developed as follows. Some background information is provided on biodiversity loss and about the development generally of economic methods for assessing biodiversity loss and environmental change. New behavioral issues arising from the economic assessment of biodiversity loss are identified. The relevance of these for stated preference methods and for revealed preference methods is discussed and is illustrated by Australian and Asian examples. Policy implications of the analysis are canvassed before concluding.

2. Background: Biodiversity Loss and Economic Evaluation

Biodiversity loss is a major environmental concern and there are several reasons for this. The magnitude of the loss is large and is occurring mainly for anthropogenic reasons connected with economic growth. While there is uncertainty about the exact rate of species loss, natural scientists agree that the net loss is well in excess of normal background rates of extinction (Ehrlich and Wilson, 1991; Smith et al., 1993; Hughes et al., 1997; Balmford et al., 2002) and the rate of extinctions globally appears to be increasing (Smith et al., 1993). While Dietz and Adger (2003) came to the conclusion that higher income countries expend more effort than lower income countries on biodiversity conservation, they find that this extra effort only partially decelerates biodiversity decline. Overall, the prospects of halting biodiversity decline in the foreseeable future seem to be bleak. The decline not only includes wild species but also varieties of many domesticated animals used for productive purposes, such as livestock (Tisdell, 2003), and varieties of plants used for production.

This loss results in a diminution in natural capital and threatens the long-term sustainability of economic production. Material production based on the use of biological resources is threatened. In addition, to the extent that biodiversity adds to human satisfaction via the enjoyment of variety, novelty and intangible values, biodiversity loss impoverishes humankind. Furthermore, apart from any anthropocentric advantages from biodiversity conservation, there are ethical concerns, such as the view

that humankind has an ethical duty to help sustain biodiversity (Leopold, 1966; Passmore, 1974; Sagoff, 1996). For some individuals, this is a Kantian categorical imperative (Kant, 1959).

Starting in the 1950s and early 1960s, economists began to develop techniques that eventually became their main instruments for evaluating potential losses in biodiversity. These included revealed preference methods, such as the travel cost method (Trice and Wood, 1958; Clawson, 1959; Knetsch, 1963; Clawson and Knetsch, 1966), and stated preference methods, such as the contingent valuation method (Davis, 1964). All were anthropocentric, assumed utility maximization and generally assumed the applicability of neoclassical economics. However, these methods also require the observation of actual human behavior and the examination of the actual statements of individuals about their preferences. Thus, their evolution contributed to the development of behavioral economics, especially since some limitations and anomalies in the neoclassical approach were soon revealed as a result of the application of these methods (e.g., Knetsch, 1989).

Stated preference and revealed preference valuations are widely used by environmental economists in social cost-benefit analysis (SCBA) to assess the desirability, or otherwise, of biodiversity change. However, these assessments have mostly been restricted to the margins of the problem of conserving biodiversity because they have usually been based on partial analysis. For example, SCBA has mostly been used to assess the desirability of conserving a particular species (or at most, a small group of species) or particular land areas, the preservation of which would contribute to the maintenance of biodiversity, other things equal. This restricted analysis is partly a consequence of the limitations of the available economic techniques. However, it may also implicitly recognize the limited capacities (bounded rationality) of individuals to evaluate possibilities. Furthermore, there are well-canvassed limitations to SCBA as a mechanism for social choice (Hanley, 1992). Moreover, the accurate elicitation or determination of values using stated and revealed preferences faces many well-known obstacles (Carson et al., 2001; Venkatachalam, 2004). Nevertheless, economic studies of biodiversity conservation have increased our knowledge of this subject and have added to our awareness of its economic importance.

3. Basic Behavioral Issues

Early approaches to evaluating the economic desirability of environmental change continued to rely heavily on the individualistic rationality assumptions of neoclassical economics, and vestiges of this path dependence continue. Such evolutionary path dependence is not surprising. However, neoclassical economics was primarily concerned with providing an abstract theory of how markets for private goods work. It adopted an atomistic reductionist approach (see Miller and Rees, 2000, p. 6-7) using the notion of ideal or representative types of consumers and producers and ignores biophysical conditions. Variations in human behavior and knowledge were ignored and economic preferences and decisions were assumed to be free of any complicating social influences. For private goods in a near-stationary world, this probably was a useful abstraction and undoubtedly neoclassical theory provided valuable insights into the way markets operate. However, in a world of significant change and one in which public goods and mixed goods are important, neoclassical economics is of reduced relevance. This is especially so because neoclassical economics pays no significant attention to the processes involved in preference formation and in decision-making. Because public goods, mixed goods, and uncertainty are so frequently encountered in the valuation of biodiversity changes, this limits the scope for applying the absolute rationality assumptions of neoclassical economics.

In evaluating attitudes to biodiversity loss and in using SCBA, the features listed below occur. These considerations are not allowed for in neoclassical economics but it is desirable to allow for them in evaluating preferences about biodiversity.

(i) Individuals often lack knowledge of or have limited knowledge of species, the payoffs from their conservation, and the effectiveness of strategies to conserve them. This knowledge varies widely between individuals and for species. For example, when a sample of 204 members of the Brisbane public were asked to rate their knowledge of ten Australian wild mammals (Tisdell and Wilson, 2004) on a scale of no knowledge, poor, good, and very good knowledge, the results shown in Table 1 emerged.

Table 1. Percentage of a sample of 204 members of the Brisbane public indicating no knowledge or poor knowledge of the Australian mammal species listed

Species (Common and scientific name)	Not known (2)	Known but knowledge is poor (3)	Not known or poor knowledge of species (2 + 3)
Koala *(Phascolarctos cinereus)*	1.5	18.6	20.1
Red kangaroo *(Macropus rufus)*	5.9	31.4	37.3
Dugong *(Dugong dugon)*	10.3	38.7	49
Northern hairy- nosed wombat *(Lasiorhinus krefftii)*	12.7	47.5	60.3
Tree kangaroo *(Dendrolagus lumholtzi)*	26	49	75
Northern quoll *(Dasyurus hallucatus)*	43.1	39.7	82.8
Mahogany glider *(Petaurus gracilis)*	48.5	37.3	85.8
Northern bettong *(Bettongia tropica)*	65.2	29.4	94.6
Eastern pebble-mound mouse *(Pseudomys patrius)*	88.7	5.9	94.6

Source: Author's primary data

(ii) For species, and for environments, such as natural areas, about which individuals have no knowledge or restricted knowledge, their preferences may not be defined, or may be poorly defined. These goods possess many of the qualities of experiential goods. This has led Spash (2002) to suggest that information provision may not be merely informative but preference forming.

(iii) Bounded rationality (Simon, 1957) may limit the ability and willingness of individuals to specify their preferences completely. This is consistent with the theories of Thaler (1999).

(iv) Attempts by researchers to elicit preferences can alter an individual's stated preferences due to the interaction effect and the limited attention span of the individuals being questioned or observed. This is similar to the Heisenberg effect in physics (Heisenberg, 1930). Tisdell (1968, p.5, note 6) mentions its possible relevance to the economics of decision-making.

(v) Increased knowledge and experience often systematically alter valuations of or preferences for commodities. The dynamics of preference variation resulting from such changes is behaviorally important.

(vi) Social influences on values can be important. This includes the type of moral dimensions mentioned by Etzioni (1988) and bandwagon effects. For example, 53 percent of individuals in a sample of 204 members of the Brisbane public said they

would increase their support for the conservation of tree kangaroos if others did likewise (Tisdell and Wilson, 2004, p. 2348).

(vii) The actual observed preferences of individuals and their behavior may be inconsistent with those predicted by neoclassical economics theory. This has, for example, been highlighted by the endowment effect (Knetsch, 1989; Tversky and Kahneman, 1991; Kahneman et al., 1991) and by prospect theory (Kahneman and Tversky, 1979).

(viii) Observed behavior is not necessarily informed behavior and, therefore, need not reflect an individual's 'true' preference for a commodity. This limits the usefulness of revealed preference techniques, such as the travel cost method, for economic valuation of biodiversity change.

(ix) In applying SCBA to decisions about nature conservation, researchers should be guided by the goal of optimally imperfect decision-making along the lines suggested by Baumol and Quandt (1964). SCBA should only be refined up to the point where the extra anticipated benefit from this equals its extra anticipated cost.

The above issues will now be considered in relation to stated preferences, revealed preferences, and implications for conservation policy will be examined. They will be illustrated by recent research results.

4. Stated Preferences, especially Contingent Valuation, and Biodiversity Conservation

In assessing stated preference approaches to eliciting preferences, I shall concentrate on the contingent valuation method (CVM), but some of the points raised also apply to other stated preference methods. It is not intended to recapitulate standard lists of limitations of CVM (Carson et al., 2001; Venkatachalam, 2004) but rather to concentrate on features that have received less emphasis.

In view of the limited capacity of individuals to consider a large set of possibilities simultaneously, the process of asking individuals to state their preference for a particular object may focus their concentration on the object being evaluated and reduce their concentration on alternative objects. Compared to the situation prior to elicitation, this is likely to alter the individuals' stated contingent valuation of the object to be valued, probably elevating it if the object is considered to be desirable and depressing it

if the object is believed to be undesirable. If this effect is present, it means that the individual's prior value is unobservable. Therefore, a Heisenberg effect is present. The size of this effect is likely to be unknown, and may not be discoverable.

The provision of information about an object, e.g., a species (cf. Samples et al., 1986), and experience with the object alters individuals' stated valuations of it. Particularly when the object is not well known, variations in these values can be substantial. For example, consider an experiment involving 204 members of the public in Brisbane, in which participants were asked to state how much as a one-off payment they would be prepared to pay to help conserve the mahogany glider, *Petauris gracilis* (Tisdell et al., 2005). They stated, prior to being given any information about the mahogany glider that they were prepared to pay AUD24.49, on average, to help conserve it. After they attended a lecture which dealt mainly with the mahogany glider and were able to read a booklet giving information about the mahogany glider and other focal species, their stated willingness to pay (WTP) rose, on average, to AUD35.67, that is by 43 per cent.

A WTP-path like that shown in Figure 1 might be present in cases like this assuming that stated preferences are elicited at t_1 and t_2 and that information provision about the species (object) to be valued is provided between t_1 and t_2. *AB* represents the assumed but unobserved WTP value given a stationary world prior to elicitation of WTP at t_1. *BC* is the assumed (but unobservable) Heisenberg-effect. The path between t_1 and t_2 is unknown but will depend on how and when information is distributed and absorbed. Elicitation of the WTP-value at t_2 may also result in a Heisenberg effect. It is hypothetically indicated by *DF*. Without any further stimulus and under relatively stationary conditions, the WTP-values may decay and follow a path like *FEG*. How long this will take and whether the WTP-value will eventually return to *0A* (or the observed value at *C*), or remain above it, would be a matter for empirical investigation. The theory, however, indicates that a unique WTP-value may not exist even under relatively stationary conditions.

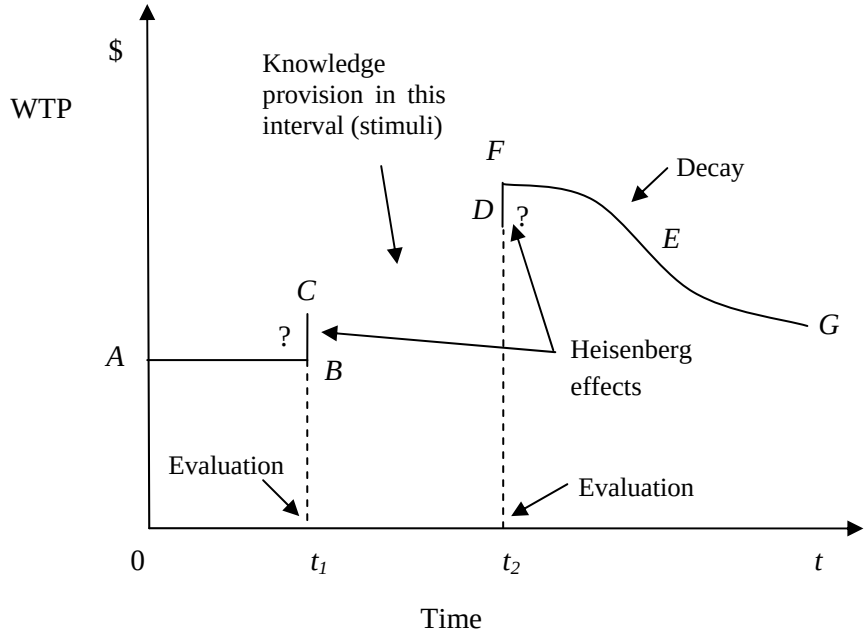

Fig. 1. Illustration of the Heisenberg-effect and dynamic influences on WTP for conservation of a species.

In the case illustrated by Figure 1, information provision about the species is shown as elevating WTP for its conservation. However, if the species has negative attributes, information provision could result in depression of WTP. The diagram can be redrawn to cover this case.

The presence of this dynamic valuation phenomenon raises the question of what is the appropriate WTP value to use in SCBA in deciding on the desirability of action to conserve a species. This will be discussed in the policy section.

Note that stated WTP for schemes to conserve a species does not represent the economic value of a species (Bandara and Tisdell, 2005). This is because this WTP depends on several factors such as the likeability of the species, its degree of endangerment (see Samples et al. (1986) and Tkac (1998)), and therefore whether and to what extent specific actions are required to conserve it, and moral considerations (Kotchen and Reiling, 2000). The consumptive usefulness of a species to humans may also have some influence on WTP (Serpell, 2004). Thus, for a species that is highly liked, such as the red kangaroo in Australia, but which is also abundant and not threatened, the willingness of individuals to contribute to schemes for its conservation is low but is likely to become high if the red kangaroo were to become endangered (Tisdell and Wilson, 2004).

Bandara and Tisdell (2005) found that the willingness of a sample of Sri Lankans to contribute funds to a project to conserve the Asian elephant was influenced by its apparent degree of endangerment. The willingness of the sample of Sri Lankans to donate funds had the form indicated by *ABCDF* in Figure 2, where *x* represents the assumed population level of the Asian elephant, and x_1 corresponds to the current elephant population. The branch *ABC* of the relationship is strictly convex and steeper than the branch *CDF* which is strictly concave.

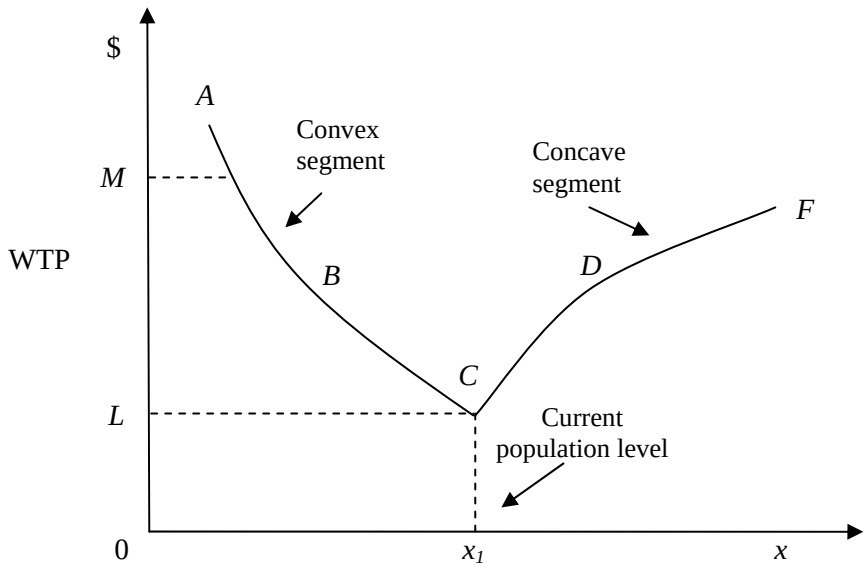

Fig. 2. Willingness to contribute funds for conservation of the Asian elephant based on amounts stated by a sample of Sri Lankans.

Note that the economic value of conserving the Asian elephant for this set of persons must exceed *OL*. For example, it must at least be equal to *OM*.

The question arises of whether and to what extent these results are consistent with the endowment effect and with prospect theory (Kahneman et al., 1991; Kahneman and Tversky, 1979). WTP seems to be 'anchored' at the current population of elephants, that is the status quo. However, the Asian elephant is classified as endangered at current population levels (Asian Elephant Group, 1996). Further reduction in its populations will significantly raise the probability of its extinction. Avoidance of the extinction possibility could determine the left-hand branch of the function illustrated in Figure 2 rather than the endowment or prospect relationship, although both influences could be present.

If only the endowment or prospect relationship applied, then the left hand branch of the curve in Figure 2 would be much steeper than its right hand branch (as here), but it would be strictly concave not strictly convex.

Nevertheless, if the population of a species is secure, the endowment or prospect effect, but not the endangerment effect, may occur for a range of a focal species' population. For example, suppose that the population level of a focal species is at a secure level x_1 but will be endangered if it falls x_0 or less. Then the relationship illustrated in Figure 3 may occur. This supposes that the prospect or endowment relationship applies for a decline in the species population until the species population level falls to x_0, and then for further falls, action to avoid extinction of the species dominates. Therefore, between x_0 and x_1, the curve of the willingness to contribute funds for conservation of the species is concave but below x_0 it is convex.

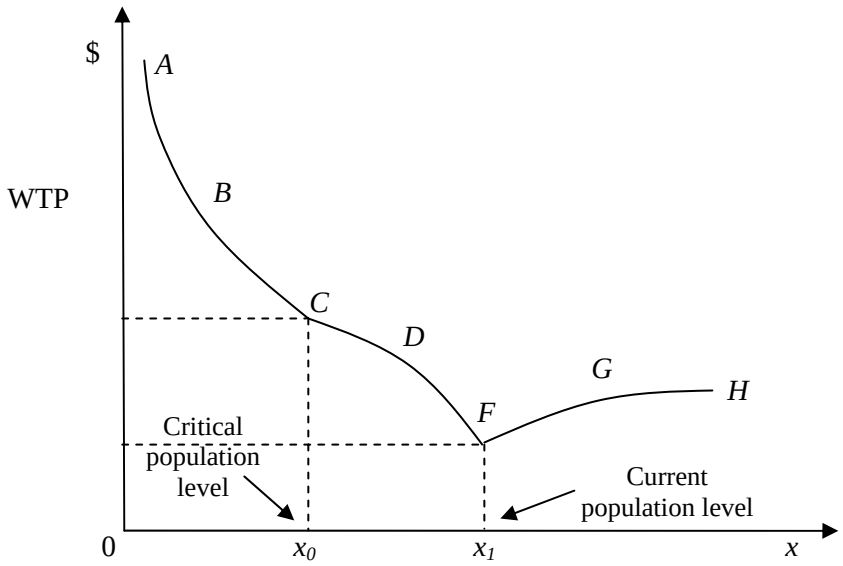

Fig. 3. Hypothetical willingness to contribute funds to a conservation scheme to prevent a reduction in the current population of a focal species or to secure an increase in this level allowing for the endowment effect and prospect theory.

The WTP function shown in Figures 2 and 3 may turn downwards for declining populations of a species when its population reaches very low levels, and also could do this for increasing populations when its population reaches very high levels. In the first case, this would reflect the low likelihood of saving the species when its population is at precariously low levels. In addition, increasing lack of familiarity with such a rare

species could reduce public support for it (Tisdell and Wilson, 2002) when its population level is very low. On the other hand, the public's support for a conserving a species in high numbers may fall with its increasing population because it becomes a 'pest'.

Nevertheless, several interesting phenomena have been observed in relation to the above situation. DeKay and McClelland (1996) have found experimentally that many individuals are willing to contribute funds for conserving a species when there is little or no prospect of its survival. This indicates the presence of a morally inspired act because the action is not effective (or is highly unlikely to be effective) in saving the species. Such actions are not uncommon. For example, individuals are known to try to save others from disaster knowing that both they and persons in peril will perish, or almost certainly will do so.

My joint studies have found that some members of the public are prepared to donate conservation funds for a secure and abundant species such as the red kangaroo (Tisdell and Wilson, 2004), and even for disliked (but secure) species such as the taipan snake (Tisdell, Wilson and Swarna Nantha, 2004). This may appear to be irrational. However, such actions are often a form of moral signaling. For example, many individuals, when asked to state their reasons for their allocations to the various species considered for conservation funding, mentioned that all species have a right to exist – a moral position. However, some also mentioned that all species have an ecological role, for example the taipan snake, and this could be interpreted as the signaling of a utilitarian position. Of course, a mixture of these motives could be present.

5. Revealed Preference and Biodiversity Conservation

There seems to be a widespread view that, since revealed preferences are based on observed behavior, they are likely to be more accurate indicators of individuals' actual preferences than stated preferences. However, the scope for using revealed preference methods is restricted because markets are often absent or incomplete, as in the case of pure public goods and mixed goods, and suitable surrogate markets do not always exist. In such cases, stated preference methods remain an essential means for gathering information about demand for these types of goods, such as the demand for nature conservation and biodiversity, although revealed preference methods can play a supplementary role in their economic evaluation. However, revealed preference

methods are based on assumptions about human behavior. These are essential to interpret the behavior observed, and often they are the same behavioral assumptions as those that underpin neoclassical economic analysis.

Take the travel cost method, for example. It assumes that individuals are well informed about the economic choices available to them and are utility maximizers. This also implies that they are well informed about sites that they may visit. While this may be reasonable for sites previously visited by recreationists, many sites, such as national parks in remote areas, are poorly known to many visitors and can be regarded as experiential goods. In some cases, the majority of visitors will only visit these places once in their lifetime.

In my study of a sample of 451 visitors to the Jourama Falls section of Paluma National Park in Northern Queensland between Townsville and Cairns, 69% of the sample reported that they had not previously visited it. Considering that about 32% of these visitors were from overseas, this is not surprising.

The sampled visitors were asked how they would rate their knowledge of this site (Jourama Falls) before leaving on their visit to Jourama Falls. They could answer on a scale – excellent, very good, good, poor and non-existent. More than half (52.1%) said that their knowledge was poor (25.7%) or non-existent (28.4%). Approximately 27.4% of respondents said that they visited the site almost by chance or that chance was an important element in their decision to visit it. In addition, 27.3% of respondents reported that they spend little or no time in gathering information about tourist places and attractions to visit when they are on holidays in a region, 52.3% reported spending a moderate amount of time on this, and 7.8% reported spending a lot of time. Therefore, visitors to sites, such as Jourama Falls, appear to vary considerably in how well they are informed prior to their visits. In the case of Jourama Falls, the assumption of the travel cost method that visitors are well informed is violated because more than half the visitors were uninformed or little informed about the site prior their visit. This may be common for protected and similar areas that most individuals visit only once in their lifetime, or rarely and only at different stages of their lifetime.

6. Policy Discussion

Attempts to elicit willingness to pay for the conservation of species or natural areas using stated preference methods encounter difficulties due to the Heisenberg

observational effect, and the dynamic influences of information provision (and experience). This can result in significantly different WTP values when measured at different points in time, even when general conditions are stationary. It can therefore be difficult to decide on the appropriate WTP value to use for policy purposes. In Figure 2, for example, is the value corresponding to *C*, *F*, *E*, *G* or another value appropriate?

Fortunately, optimal social policy choice does always require perfection in evaluation. In fact, perfection is sometimes irrational. For example, the net social benefit of conserving some species may be positive for the lowest of their relevant observed WTP values, or even for lower ones. This may also occur for an over-estimate of actual costs; that is an upper bound estimate of costs. This was found to be so, for example, in assessing the social desirability of setting aside a sufficient area of habitat to conserve the mahogany glider, *Petauris gracilis* (Tisdell et al., 2005). Even if there was some limited elevation in stated values due to the Heisenberg effect, optimal social policy in this case using SCBA would still be to set aside sufficient habitat to conserve the mahogany glider. The exact limits to the variation in values consistent with the optimality of a particular choice can be checked mathematically.

Generally speaking, the optimal formulation of public policy from a rationality viewpoint requires economy in the collection of information. If information collection involves use of resources, no more information should be collected than the minimum required to solve the problem at hand. The Baumol-Quandt principle should be applied to policy determination, including the formulation of policies for biodiversity conservation (Baumol and Quandt, 1964). This may also influence the choice of techniques used for determining stated preferences. For example, the single bid method of contingent valuation is one of the least costly techniques to apply even though it is claimed to be less accurate than some multiple-bid methods. But the alternatives cost more to use. The single bid method is also claimed to give more conservative estimates of values than its alternatives (Bishop and Heberlein, 1990). Therefore, if a species is found to be worthwhile conserving using single bid values, it will also be so for more accurate but costly value estimates.

In economics, we need to give more attention to detailing and using optimally imperfect methods for policy formulation. At the same time, we should be clear in valuation analysis about what is being evaluated.

For example, the economic value of keeping a species in existence is usually not indicated by the willingness of individuals to donate funds for schemes to conserve it.

Normally, such values will underestimate the economic value of keeping the species in existence (other things constant), and the underestimation will tend to be greater the more secure (abundant) is the species' population. Nevertheless, the results are policy-relevant because they measure the level of public support for the conservation policy being proposed.

Apart from the above relationship, in which WTP reflects the urgency of conservation action as well as likeability of a focal species, stated values may reflect moral signaling (Kotchen and Reiling, 2000). That raises the question of how governments should deal with the moral signaling element. For example, if there is widespread support for trying to save a doomed species, should the government nevertheless spend money on its conservation? To do so would be politically popular but ineffective in saving the species.

Again, when using revealed preference approaches to determine the lower bounds of the economic value of natural areas, care is required to ensure that the fundamental assumptions underlying these approaches are satisfied, or at least approximately satisfied. In particular, greater care should be taken in using the travel cost method to evaluate such areas. Use of the method can be reasonable when a high proportion of visitors to a site are repeat visitors but seems doubtful when the majority of visitors to a site are first-time visitors. In the latter case, many of the visitors are likely to be poorly informed or uninformed about the attraction. Consequently, the method may work well for outdoor sites in an urban periphery with many repeat visitors but could be of limited value for economic assessment of natural areas in remote regions where the majority of visitors are one-time visitors from distant places.

7. Concluding Comments

Advances in behavioral economics (based on experiments and purposive observation) have shown that human decision-making is much more complex than envisaged in the neoclassical paradigm of economic man. This is mainly because neoclassical economics does not give much attention to human cognition and the bounded rationality of humankind. While the neoclassical approach has been able to provide valuable insights into the way that markets work if conditions change slowly, and into the economic valuations of private goods, it appears to be less useful for valuing public goods and mixed goods, such as those associated with biodiversity conservation. However, as

demonstrated in this paper, behavioral economics is providing challenging new insights into economic valuation and policy formulation. Its emphasis on the study of human cognition and bounded rationality has helped to advance knowledge. Moreover, behavioral economists do not rule out the possibility that some regularly observed human behavior is not rational at all, that the degree of conscious or rational choice varies between individuals, and that the degree of rationality exhibited by the same individual changes depending on circumstances and the object being considered. All of these factors can be policy-relevant.

Nevertheless, behavioral economics has not yet fully dealt with these issues even though it has identified types of economic behaviors ('anomalies') not predicted by neoclassical economic theory. It might be fruitful for it to give more attention to the dynamics of cognitive processes (e.g., of the type illustrated by Figure 1) than in the past. These processes have significant effects on the public's valuation of public and mixed goods, such as those involving the conservation of biodiversity, nature, and heritage commodities.

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