

A Critique of Conventional Non-market Valuation: Attitudes and Action

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ABSTRACT

This paper revisits two conventional beliefs of environmental nonmarket valuation and examines their weaknesses and a new opportunity. The two beliefs are that willingness to pay (WTP) is an appropriate measure of non-market behaviour and that exogenous variables are relevant predictors of WTP whilst endogenous variables are not. The contemporary literature in psychology and economics is reviewed to demonstrate departures from these two beliefs.

KEY WORDS

Non-market valuation, willingness to pay, attitude-behaviour, new ecological paradigm, planned behaviour, discrete choice models

The author is a first-time presenter.

1. Introduction

The second half of the 20th century witnessed the conception and growth of nonmarket valuation. The number of applications using stated preference (SP) methods has increased dramatically (Adamowicz 2004). In particular, choice modelling (CM) has gained a strong recognition as an alternative to contingent valuation methods (CVM). Nonmarket valuation studies estimate the values of nonmarket goods that are usually public goods. SP methods measure the nonmarket values in the form of willingness to pay (WTP)¹ of a population. Researchers assume that WTP represents or approximates consumer behavior over nonmarket goods such as wetlands, rivers, and forests.

At the heart of SP nonmarket valuation are issues of heterogeneity (Boxall and Adamowicz 2002; Train 2003; Walker and Ben-Akiva 2002). The random utility model (RUM: $U_{iq} = V_{iq} + \varepsilon_{iq}$) includes a random component to reveal researchers' limited ability to observe everything that might have influenced individual utility (Louviere *et al.* 2000:40; Train 2003:19). Although, the RUM has made SP nonmarket valuation possible, the presence of the random component (ε_{iq}) has caused researchers to consider the accuracy and reliability of their estimates. Louviere *et al.* argue that preference heterogeneity is a part of the random component, and that if the feature of different error variances across choices is ignored, they will show up as parts of parameters and the intercept of the utility model. It has long been recognised that failure to incorporate 'behavioral heterogeneity (individual variations in tastes and preferences)' can lead researchers to 'inferior model specification, spurious test results and invalid conclusions' (Jones and Hensher 2004:1013-4; Louviere *et al.* 2000; Train 2003).

According to Boxall and Adamowicz (2002:421-2), the examination of heterogeneity is difficult in RUM applications. There have been two sets of approaches that dominated efforts to tackle heterogeneity. The first is to include individual-specific characteristics into the estimated indirect utility functions. These characteristics are mostly exogenous socioeconomic or demographic variables. The second employs generalized models such as random parameter logit or probit models to allow model parameters to vary across individuals. These models are limited because the sources of heterogeneity are not identified (Boxall and Adamowicz 2002:422). The question arises if endogenous variables such as environmental attitudes, beliefs, and motivations can be used to account for heterogeneity.

This paper revisits two conventional beliefs of environmental nonmarket valuation and examines their weaknesses and a new opportunity. The two beliefs are that WTP is an appropriate

¹ Willing to accept (WTA) is also used as an estimate of value. This paper concentrates on the use of WTP in SP applications.

measure of nonmarket behaviour and that exogenous variables are relevant predictor of WTP whilst endogenous variables are not. The contemporary literature in psychology and economics is reviewed to demonstrate departures from these two beliefs. The following two sections will briefly review the psychology of choice behaviour and the RUM. The two conventional beliefs are critically examined. The last section is the conclusion that will cover how nonmarket valuation studies have incorporated the psychological understanding of human behaviour and provide a couple of recommendations.

2. The Psychology of Choice Behaviour: WTP and Variables

To begin to develop a psychological understanding of human choice behaviour², we need to recognise that WTP measured in SP techniques is stated behavioural intention, not actual behaviour (Barro *et al.* 1996; Bateman *et al.* 2002:113; Heberlein and Bishop 1986; Mitchell and Carson 1989:186). The following sections briefly describe the causal factors of choice behaviour and critically review what WTP is about.

The Causal Factors for Choice Behaviour

Stern (2000) provides an overview of causal variables for environmental behaviour. They are attitudinal factors, external or contextual forces, personal capabilities, and habit or routines (Stern 2000:416-7). First, attitudinal factors include values, norms, beliefs, and attitudes (see Table 1 for the related definitions). These variables influence either general behavioural patterns of individuals or specific behaviours. There are several theories that explain behavioural variance. These include the norm-activation theory of Schwartz (1977), the cognitive dissonance theory of Festinger (1957), the theory of planned behaviour (TPB)³ of Ajzen (1991), and the new environmental paradigm (NEP) scale of Dunlap and Van Liere (1978).

Second, external or contextual forces are something exogenous to individuals. Some examples are regulations, legal/institutional structures, community expectations, financial constraints, and physical difficulties (for example, a constrained physical environment) (Stern 2000:417). The way these factors influence people's behaviour is dependent on their beliefs and attitudes (Stern 2000:417).

Third, personal capacities mean skills and knowledge necessary for specific behaviour. Although

² This term, 'choice behavior', means a general behaviour that involves a choice. Choice behaviour, in a sense, also encapsulates the behavior involved in SP nonmarket valuation studies.

³ The theory of planned behaviour (TPB) of Ajzen (1991), the expanded and upgraded versions of the theory of reasoned action (TRA) of Fishbein and Ajzen (1975), is known to be 'the most widely researched' model of the relationship between attitudes and behaviour (Armitage and Conner 2001:471).

sociodemographic variables have been found to be limited in explaining environmental behaviours (Bateman *et al.* 2002:330; Dietz *et al.* 1998; McFarlane and Boxall 2003), such variables as age, gender, income, ethnic background, and educational level could be 'indicators or proxies for personal capacities' (Stern 2000:417).

The final set of variables are related to habits or routines. Habits sometimes need to be changed and routines need to be modified to change behaviour (Stern 2000:417). However, these variables are not an important subject because we are interested in rational, conscious choice behaviour.

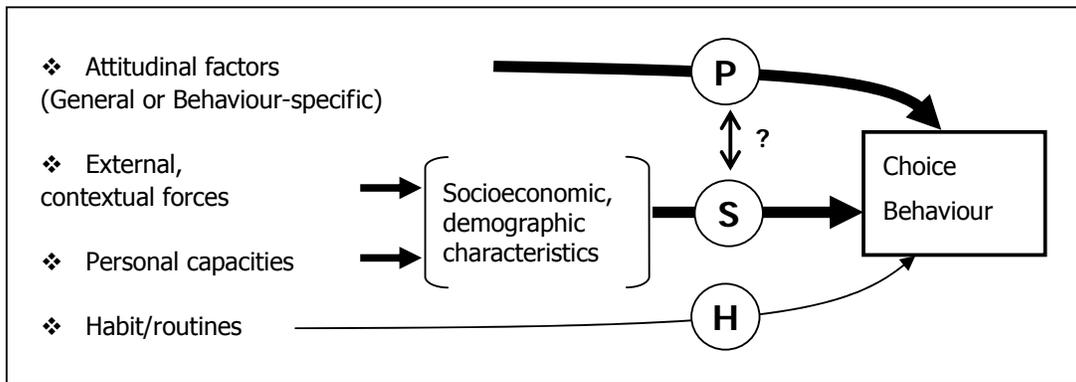
Table 1 **Some definitions of attitudinal factors**

| Concepts | Definitions |
|-------------------------------------|---|
| Value | 'An enduring belief that a specific mode of conduct is personally or socially preferable to an opposite or converse mode of conduct' (Rokeach 1973:5). Values as the most abstract form of social cognitions 'serve as prototypes from which attitudes and behaviour are manufactured' (Vaske and Donnelly 1999:524). |
| Attitude | 'A mental state' and must refer to some object, to which individuals respond favourably or unfavourably (Eagly and Chaiken 1993; Vaske and Donnelly 1999:526-7). |
| Salient beliefs | The prevailing determinants of a person's intentions and actions, which are antecedent to attitude toward the behaviour, subjective norm, and perceived behavioural control (Ajzen 1991:189). |
| Attitude toward the behaviour | The degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question (Ajzen 1991:188). |
| Subjective norm | The perceived social pressure to perform or not to perform the behaviour |
| Perceived behavioural control (PBC) | The perceived ease or difficulty of performing the behaviour, reflecting past experience as well as anticipated impediments and obstacles (Ajzen 1991:188). |
| Intention | 'The extent to which people are willing to try or exert effort, in order to perform a behaviour' (Ajzen 1991:188). It is assumed to be 'the immediate antecedent of behaviour' (Ajzen 2002:1). |

Accordingly, these causal factors of choice behaviour can be put into one simple diagram. Figure 1 depicts the relationship between the causal factors and choice behaviour. It seems that there are three separate paths (see also a path diagram by Boxall and Adamowicz 2002:427)). The first path (P) shows the behavioural influence of attitudinal factors such as values, beliefs, and

attitudes. They are either general or behavior-specific. The second path (S) represents the influence of socioeconomic, demographic forces such as income, age, gender, and education levels. P and S are negatively related in their way to determine the behaviour (Stern 2000). The predictive power of P is stronger when that of S is weaker. Also, S is influenced by attitudinal factors (Stern 2000). The final path is about the behavioural influence of habit or routines.

Figure 1 Causal relationships of choice behaviour



According to Stern (2000), these causal factors work differently for particular behaviours, and are not independent from each other. He concludes that environmental behaviours are dependent on 'a broad range of causal factors, both general and behaviour-specific'; 'each target behaviour should be theorized separately'; and attitudinal factors show the greatest predictive power when behaviours are not seriously constrained by context or personal capacities (Stern 2000:421-2). The final point is supported by Tyler *et al.* (1982), Ajzen (1991), Stern (1992:279), and Bamberg (2003:22). However, determining the nature of the relationships between the causal factors and behaviour is empirically complex because of the collinearity existing amongst the causal factors.

This general view of Stern is also supported by Bamberg (2003). Concerning the empirical disappointment that only about 10 per cent of variance in environmental behaviour is explained by the general attitude (Bamberg 2003:22), Bamberg (2003:30) concludes:

[T]he disappointment about the weak direct relationship between general environmental concern and specific environmental behaviour is due to an inadequate understanding of how general attitudes influence specific behaviours. As situation invariant 'orientation patterns' general attitude like environmental concern cannot influence specific behaviours directly. ... But via their impact on the 'definition of the situation' that is how to frame the decisional problem, the relevant behavioural alternatives and the personally salient consequences associated with these alternatives,

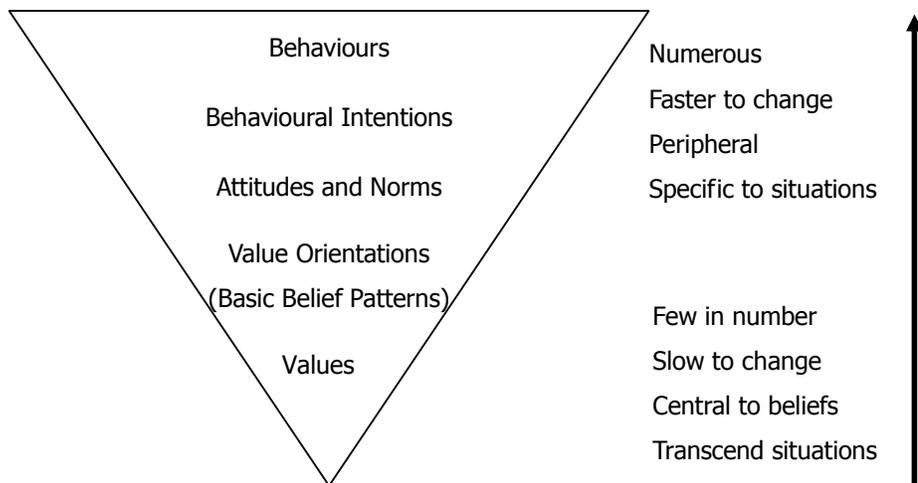
general attitudes are important indirect determinants of specific behaviours.

Then, it is worth stipulating how attitudinal factors work as causal factors influencing choice behaviour and why the predictive power of attitudinal factors varies. The following two sections will cover these, respectively.

The Invisible Hand of Choice Behaviour: Attitudinal Factors

Fulton *et al.* (1996) provide a simple snapshot of psychological construct of choice behaviour. As seen in Figure 2, the inverse pyramid shape represents characteristics of the components and a hierarchical relationship among them. Starting from the bottom, values are limited in number, take time to change, are fundamental to beliefs, and are not directly related to specific situations. Moving upward in the inverse pyramid, attitudes and norms are numerous, evolving fast, not that significant to beliefs (lower components), and behaviour-specific. Behavioural intentions are known as the immediate precedence to actual behaviours (Ajzen 1991), or 'the most direct predictor' of them (Vaske and Donnelly 1999:527).

Figure 2 **The cognitive hierarchy model of human behaviour**

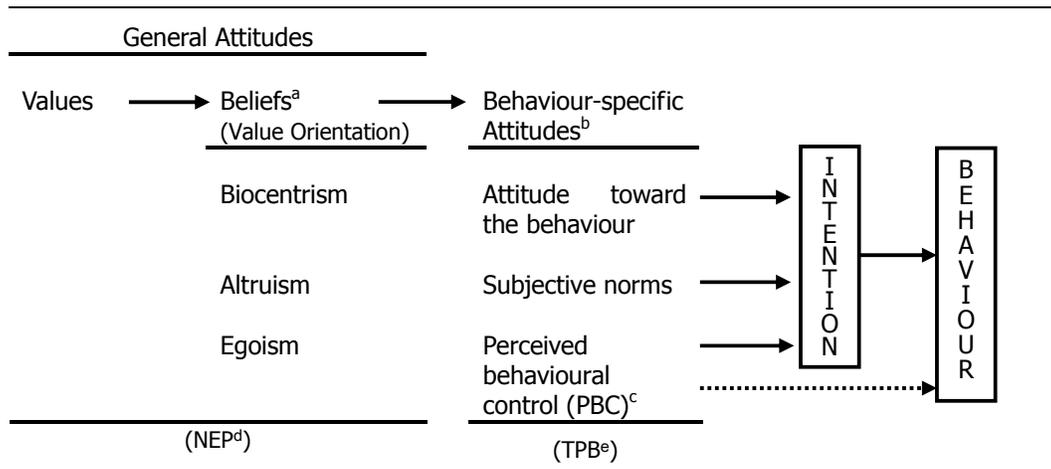


Source: Fulton, D.C., Manfredro, M.J. and Lipscomb, J., 1996. 'Wildlife value orientations: A conceptual and measurement approach', *Human Dimensions of Wildlife*, 1(2):24-47.

The hierarchical model of Fulton et al. is common in more detailed psychological constructs of choice behaviour. Some examples are an attitude-behaviour model developed by Eagly and Chaiken (1993), a psychological construct developed for the value-belief-norm (VBN) theory of Stern (2000), the NEP, and the TPB. For reasons of clarity and simplicity, the psychological constructs can be generalised into a simpler diagram (Figure 3). Starting from the left, general

attitudes (values and beliefs) are determinants of behaviour specific attitudes. Intention as the immediate precedent to actual behaviour is determined by behaviour specific attitudes. The lowest row in Figure 3 indicates representative methods to measure either general attitudes (the NEP) or behaviour-specific attitudes (the TPB).

Figure 3 A generalised psychological construct of choice behaviour



Note: ^a: The contents of value orientations are from Stern (1992).

^b: The contents of behaviour-specific attitudes are from Ajzen (1991).

^c: PBC affects both intentions and actual behaviours.

^d: The new environmental paradigm (NEP) scale of Dunlap and Van Liere (1978).

^e: The theory of planned behaviour (TPB) of Ajzen (1991).

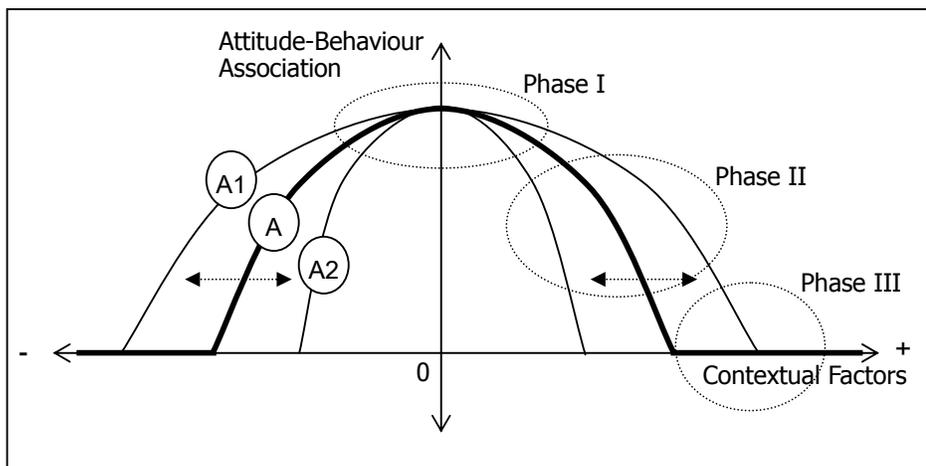
The influence of values on attitudes and behaviour works indirectly through value orientations, which are patterns of basic beliefs (Fulton *et al.* 1996). These value orientations are equivalent to the concepts defined by Stern (1992). Stern (1992:279) identifies four concepts as environmental concern. First, environmental concern is about 'a new way of thinking', away from human centricism (anthropocentrism) and exceptionalism (Stern 1992:280). This ecological or ecocentric concern has been measured by the new environmental paradigm (NEP) scale developed by Dunlap and Van Liere (1978). Second, environmental concern is about 'anthropocentric altruism' (Stern 1992:280). We care about nature because of improved human well-being, not because of the intrinsic values of nature. Studies using the norm-activation theory of Schwartz (1977) are related to this concept (Stern 1992:280). Third, environmental concern is about 'egoism'. People protect the environment because doing so is beneficial for them or their close friends/relatives. This concept is tied to individual cost and benefit studies, such as utility, value, or preference studies (Stern 1992:280). Finally, environmental concern is about 'deeper causes' such as 'religious beliefs' or 'postmaterialist cultural values' (Stern 1992:280).

Some studies advocate a unidimensional continuum of value orientations that ranges from anthropocentrism to biocentrism (Fulton *et al.* 1996; Shindler *et al.* 1993; Steel *et al.* 1994; Thompson and Barton 1994; Vaske and Donnelly 1999). In this sense, Stern's first concept—ecocentrism—can be understood as biocentrism (or intrinsic values) and his second and third concepts—altruism and egoism—as anthropocentrism (or instrumental values).

A Dilemma in Predicting Choice Behaviour: the ABC Theory

The relationship between the attitude-behaviour (AB) association and contextual factors (C) has been observed as the inverse U shape—the ABC theory (Guagnano *et al.* 1995; Stern 2000:415). The association (AB) is the strongest when C is neutral, and becomes neutral when C is strongly negative or positive. Ajzen (1991), Bamberg (2003), Stern (1992), Stern (2000), Tyler *et al.* (1982) agree that attitudinal factors (A) are determinants of intentions and are the best predictor of actual behaviours (B) only when the behaviours are not seriously constrained by contextual forces or personal capacities (C). Also, the way these constraints influence behaviours depends on attitudinal factors. Consequently, as shown in Figure 1, the relationship between the psychological variables and the sociodemographic variables (the proxy for the constraints) can be further speculated by using the ABC theory.

Figure 4 **The relationship between the attitudinal-behaviour association and contextual factors: the ABC theory**



Note: The two axes have a special representation. They represent the relative strengths of attitudes and contextual factors, as determinants of behaviours. In this sense, the absolute interpersonal differences in their strengths do not matter. For example, everybody can be placed at the same position in the attitude-behaviour association.

The inverse U shape relationship between the attitude-behaviour association and contextual

factors are empirically tested by many studies such as Black *et al.* (1985), Guagnano *et al.* (1995), and Stern (1999). For example, Black *et al.* (1985) found that easy behaviours such as controlling indoor temperature have about 60% of the variance explained by attitudinal variables. However, the explanatory power of attitudinal variables declines when the behaviour involves more effort, more investment, and more time. Behaviours such as having additional insulation or storm windows installed have only about 25% explained by attitudes.

The ABC theory can be graphically illustrated in Figure 4. Following curve A, there are three phases of the relationship. Behaviour is strongly associated with attitudes around the vertical axis, where the influence from contextual factors on behaviour is negligible (Phase I). As we move away from the vertical axis and consequently the influence from contextual factors on behaviour gets stronger, the attitude-behaviour association gets weaker (Phase II). Finally, attitudes have no influence on behaviour from the point where curve A touches the horizontal axis (Phase III). When contextual factors are strongly negative or positive, the association is neutral. The three Phases can also be found in the left hand side of the vertical axis. Three curves—A, A1, and A2—imply population heterogeneity. The slopes or shapes of the curves are different pursuant to the individual sensitivity to the marginal change of the variables.

There are three practical scenarios we can stipulate from the ABC theory. First, if researchers only consider contextual factors—exogenous variables—as determinants of choice behaviour, Phases I and II are ignored as random. However, it might be risky to do so when the population is highly heterogeneous. As a second scenario, if researchers only consider attitudinal variables—endogenous variables—as determinants of choice behaviour, Phases I and II will be ignored as random. Population heterogeneity is also the root cause of the problem. Third, in Phase II, both exogenous variables and endogenous variables determine choice behaviour in individually sensitive ways. The determining patterns of these variables will be different according to individual characteristics: population heterogeneity.

Although it is hard to tell which of these first two scenarios involves the more serious mistake, it is still useful to learn from both. For the first scenario (most nonmarket valuation studies), it is very difficult, if not impossible, to assess any anomaly between the estimates and the actual behaviour. Researchers simply assume that what they measure—WTP—is the proxy market value. In contrast, the second scenario (most psychological studies) provides an opportunity to examine correlations between intentions and actual behaviours.

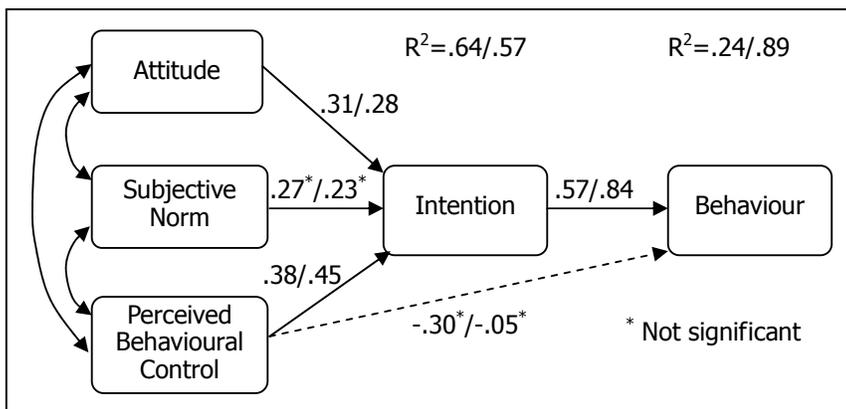
WTPs and a Mirage

The conventional nonmarket valuation uses WTP to represent the nonmarket behaviours of

consumers. However, the relationship between intentions (WTP) and actual behaviours is in dispute in attitude-behaviour studies. This section provides some empirical evidences for the anomaly between estimated intentions and actual behaviours. The evidences involve donation scenarios. It is noteworthy that real donations in each case might not be the accurate representation for the actual preferences of respondents because of their strategic behaviour. With payment being required, people may underestimate their true WTP in their bids in the hope that others will pay enough to have the good supplied without their paying the full WTP. However, the purpose of using these cases is to show the varying degrees of the anomalies between stated WTP and real choice behaviour, *ceteris paribus*, and some examples for the ABC theory. In other words, strategic behaviours occur in varying degrees. Why?

Ajzen *et al.* (2004:1108-9) claim that 'it is a common observation that people often fail to act in accordance with their stated intentions', and this discrepancy is known as hypothetical bias in nonmarket valuation. The overestimation of WTPs in hypothetical or contingent situations has been recognised by many studies, such as Brown *et al.* (1996), Cummings *et al.* (1995), Brown *et al.* (2003), Ajzen *et al.* (2004), and Harrison and Rutström (2005). A couple of examples are provided here. First, Brown *et al.* (2003) observed college students who voted in referendums, hypothetical and real, to donate \$1, \$3, \$5, or \$8 (for a scholarship fund). For \$1, the percentage of real yes votes exceeded that of hypothetical votes by 10%. For others, the percentages of hypothetical votes for \$3 and \$8 exceeded those of real votes by 30% and 48%, respectively.

Figure 5 Prediction of voting in real referendum: path analysis for the theory of planned behaviour without corrective entreaty (values before slash) and with corrective entreaties (values after slash)



Source: Ajzen, I., Brown, T.C. and Carvajal, F., 2004. 'Explaining the discrepancy between intentions and actions: the case of hypothetical bias in contingent valuation', *Personality and Social Psychology Bulletin*, 30(9):1108-21.

As the second example, Ajzen *et al.* (2004) examined the impact of including a corrective entreaty—reminding problems of a hypothetical referendum—in a CVM experiment for a scholarship fund. 160 college students participated in the experiment, comprised of a questionnaire survey and a referendum. Ajzen *et al.* used the theory of planned behaviour (TPB) and measured its components. Participants expressed their WTP (hypothetical) or/and joined a real donation condition (\$8). It was found that respondents vote according to their intentions in a hypothetical situation (99% accuracy), but they act differently in a real vote—80% respondents voted the same way in both hypothetical and real referenda. Hypothetical votes are strongly correlated with intentions (Brown *et al.* 2003:1114). Ajzen *et al.* (2004:1117) argue that the hypothetical bias happens not because people's beliefs and attitudes are weak, but because intentions are significantly different between hypothetical and real payment situations (mainly due to subjective norm in this case).

Figure 5 shows the overall results. The model explains 24% of the variance in the real behaviour without a corrective entreaty. However, the inclusion of the entreaty increased the explanatory power of the model, explaining 89% of the variance. The theory explains intention well regardless of the inclusion of the entreaty (R^2 values are not significantly different). Ajzen *et al.* (2004:1112) also found that demographic characteristics—gender, age, ethnicity, socio-economic status, political affiliation, and religious affiliation—have no significant influence in their observations.

The two examples support the ABC theory. The first example shows that the anomaly—hypothetical bias—became larger as the strength of the contextual factor (money) increased. When the amount of donation was not significant, \$1, people showed a relatively consistent behaviour between hypothetical and real situations: small anomaly. However, as the amount rose to \$8, people behaved inconsistently between hypothetical and real situations: large anomaly. Accordingly, as the strength of the contextual factor (C) became larger, attitudinal factor (A) showed a weaker association with actual behaviour, or vice versa. The second example provides the opportunity for researchers to see how endogenous variables explain the variance of real behaviour. The relationship between intention and actual behaviour varied according to how the choices were framed (with or without the corrective entreaty), but the relationship between the endogenous variables and intention—the immediate antecedent of behaviour—remained intact. These are expected results in the ABC theory because Ajzen *et al.* (2004) fixed the strength of the contextual factor in individual decisions, by using the same amount of donation (\$8).

As argued by Ajzen *et al.*, there exist two significantly different intentions between real and hypothetical situations. It is expected that the difference (anomaly) between these intentions will be smaller with a smaller amount of donation, and be larger with a larger amount of money

than \$8. When the anomaly becomes larger, what researchers measure could be an illusive image: a mirage⁴.

The ABC theory signifies the possibility that WTP (intention) might not be reliable measure of actual behaviour, especially when the strength of contextual factors varies. And population heterogeneity makes the situation more complex so that researchers face a very difficult task to address anomalies between intention and actual behaviour. As a preliminary conclusion, unless a relatively stable predictor of actual behaviour—attitudinal factors—is considered, stated nonmarket values (WTP) might not be the reliable estimate of real nonmarket values.

3. Random Utility Model and Heterogeneity

Random Utility Models

Discrete choice models estimate utility through observing choices or responses of a population, based on the assumption of utility maximising behaviour of human beings. Thurstone (1927) first developed the concept of 'psychological stimuli', and Marschak (1960) translated 'stimuli' as 'utility', and models using this kind of approaches are random utility (maximisation) models (RUMs) (McFadden 2001:353; Train 2003:19).

The main feature of RUMs is that the utility of consumers cannot be directly observed by researchers (Louviere 2001:15). Although a portion of our choice behaviour (results from the choice process) can be explained, some fraction always remains 'unexplained' (Louviere 2001:15; Morrison *et al.* 1996:3; Rolfe 1998:33). Latent utility of the i th alternative for individual q (U_{iq}) then can be described with two components: an observable systematic (explainable) component (V_{iq}) and an unobservable random (unexplainable) component (ε_{iq}). This relationship is expressed in equation 1:

$$U_{iq} = V_{iq} + \varepsilon_{iq} \quad (1)$$

V_{iq} is often called as observed, 'representative utility' (Louviere *et al.* 2000:38) or 'deterministic utility' (Morrison *et al.* 1996:3), and ε_{iq} reflects 'unobserved individual idiosyncrasies of

⁴ According to Merriam-Webster Online Dictionary (2006), mirage means 'an optical effect that is sometimes seen at sea, in the desert, or over a hot pavement, that may have the appearance of a pool of water or a mirror in which distant objects are seen inverted, and that is caused by the bending or reflection of rays of light by a layer of heated air of varying density'.

tastes'(Boxall and Adamowicz 2002:424; Louviere *et al.* 2000:38). The random component (ε_{iq}) hinders our effort to 'understand perfectly and predict preferences; hence, the problem is inherently stochastic from the researcher's view, which naturally leads to formulating expressions for the probability of choice' (Louviere 2001:15). The probability for randomly selected individual q to choose i over j from the alternative set A is:

$$P_{iq} = \frac{1}{\sum_{j=1}^J \exp-(V_{iq} - V_{ij})} = \frac{\exp V_{iq}}{\sum_{j=1}^J \exp V_{jq}} \quad (2)$$

Equation 2 is the multinomial logit (MNL) model (Louviere *et al.* 2000:47; McFadden 1974:113; Train 2003:41). It is also called a conditional logit model because the equation becomes the logistic model in the case of binomial choices (McFadden 2001:354).

We observe choice behaviour (or its possibility) of consumers to estimate their utility level, which can be expressed as implicit prices (WTP) or preferences for environmental goods. However, there is also a portion of utility left over that is caused by heterogeneous characteristics of a population that are unobservable or unobserved. If they are unobservable by any means, there is no way for researchers to measure them. On the other hand, if some characteristics are previously unobserved but observable, we still have a chance to measure them. What this measurement does is to shift some utility from the random component to the deterministic component.

Population Heterogeneity

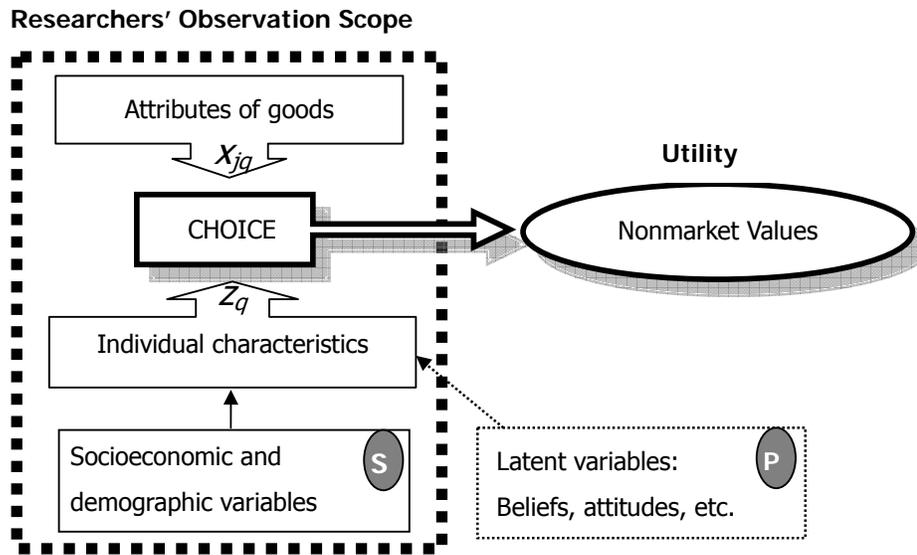
According to Merriam-Webster Online Dictionary (2005), 'heterogeneous' means 'consisting of dissimilar or diverse ingredients or constituents'. In the context of nonmarket valuation, it is helpful to distinguish two separate definitions of heterogeneity. First, people's preferences, tastes, or WTPs for nonmarket goods are different—taste heterogeneity. Second, people are different themselves, from the point which the first definition of heterogeneity can be inferred—population heterogeneity.

These two definitions of heterogeneity are directly related to the conventional way of modelling human choice behaviour. The first definition (H1) is about people's choices. Researchers are unable to observe decision makers' utility, but instead observe their choice probabilities across alternatives directly (Louviere *et al.* 2000:40; Train 2003:19). Different decisions made by respondents in CM represent different tastes. The second definition (H2) is about how people's different characteristics influence their choices. What researchers observe in CM are some

attributes for alternative j (x_{jq}) and some characteristics of decision maker q (z_q) (Train 2003:19). These attributes and characteristics are related to the utility of a sample: $V_{iq} = V(x_{jq}, z_q)$.

Figure 6 illustrates the two definitions of heterogeneity. The components—choice and utility—represent heterogeneous tastes (H1). People’s choices are diverse so that their nonmarket values are also diverse. The components enclosed by the thick dotted line are what researchers can observe. The lower part expresses heterogeneous populations (H2). Characteristics of a population (z_q) are comprised of two components: socioeconomic and demographic variables (S) and latent variables (P). The first component is observable and has been observed by researchers. The second component, in contrast, is not easily observable and has not been usually included in the utility function. Consequently, researchers usually treat S and P differently: S is a part of V_{iq} whereas P is a part of ϵ_{iq} .

Figure 6 The causal relationship between observations and nonmarket values



The following account of Boxall and Adamowicz (2002:421) stipulates the significant role of tackling population heterogeneity (H2) in nonmarket valuation.

Consumer preferences for goods and services are characterized by heterogeneity. Accounting for this heterogeneity in economic analysis will be useful in estimating unbiased models and for forecasting demand by including individual characteristics. Incorporating and understanding heterogeneity will provide information on the distributional effects of resource use decisions or policy impacts.

The Missing Piece

In the literature, it is argued that there are two sets of the population differences. The first set of characteristics are commonly available and observed sociodemographic variables such as income, gender, age, and education (Barton 2002; Boxall and Adamowicz 2002). The second set of characteristics are unobserved latent variables such as environmental attitudes, beliefs, perceptions, experience, motivations, and institutional trust (Barton 2002; Berenguer *et al.* 2005; Boxall and Adamowicz 2002; McFadden 2001:355; Ready *et al.* 2004).

However, the mainstream environmental valuation studies have largely ignored the presence of the latent variables (Boxall and Adamowicz 2002; Kotchen and Reiling 2000). Although many researchers use random parameter logit or probit models to allow model parameters to vary across individuals, these models are limited so that the sources of heterogeneity are not known (Boxall and Adamowicz 2002:422). How should researchers handle the latent heterogeneity?

There are two approaches to incorporating heterogeneity: as criteria for population segmentation and as parts of discrete choice models (Boxall and Adamowicz 2002:422). The first approach uses heterogeneous individual characteristics to cluster sample population to be relatively homogeneous segments. For an example of using sociodemographic characteristics for segmentation, see Salomon and Ben-Akiva (1983). The second approach is to parameterise heterogeneity in choice models. It is suspected that heterogeneity influences scale parameters and/or tastes parameters (β) (Boxall and Adamowicz 2002:422). See Cameron and Englin (1997) for an example of using demographic variables for this purpose.

For whichever approach researchers take, limited observations of possible factors or determinants of choice behaviour will result in unreliable or invalid estimates. Considering the ABC theory, it might be valuable for researchers to test the potential benefits of including endogenous psychological variables, together with exogenous sociodemographic variables. By the same token, potential multicollinear relationships between endogenous and exogenous variables must be taken into account. These relationships might be different case by case so that it will be difficult to have a generalized representative trend. If researchers can generalize the relationships, transferring values from one study into another site—benefit transfer—will also be advantaged.

4. A New Opportunity for Nonmarket Valuation: Conclusion

There have been some efforts to introduce or include psychological understanding of human

behaviour into the standard model of nonmarket valuation. For example, Bateman *et al.* (2002:113-5) and McFadden (2001:362-8) deal with the roles of such psychological characteristics as attitudes, perceptions, subjective norms, or intention in determining or predicting choice behaviour of population. Bateman *et al.* introduce an attitude-behaviour model, a theory of reasoned action (TRA) developed by Fishbein and Ajzen (1975). They argue that the theory has 'obvious design implications' for SP techniques (2002:114). They continue to recognise the following four functions of attitudinal questions for SP methods (Bateman *et al.* 2002:148):

1. They 'warm-up' respondents and get them involved in the questionnaire.
2. They help respondents to think about all aspects of the change being valued and encourage them to investigate their preferences about it.
3. They provide valuable qualitative and quantitative information that may help to validate the monetary valuations.
4. Often, these variables also turn out to be good predictors of WTP.

McFadden (2001:362-3) provides an overview of how preferences are understood in psychology and the future direction of discrete choice:

Many psychologists argue that behaviour is far too sensitive to context and affect to be usefully related to stable preferences. ... The existence of underlying preferences is a vital scientific question for economists. ... [E]conomists must look through the smoke screen of rules to discern the deeper preferences that are needed to value economic policies. ... [M]any behavioural deviations from the economists' standard model are explained by perceptual illusions and information processing errors, ... I suspect that the standard model, enhanced to account for the most systematic perceptual illusions, will prove to be the best platform for evaluating most economic policies.

However, these efforts to discern 'the deeper preferences' have been limited to recommending some aspects of questionnaire design (Bateman *et al.* 2002) or to explaining cognitive illusional effects—for example, anchoring, context, and framing effects—in choice making behaviour (McFadden 2001). Neither of them applies psychological interpretation of choice behaviour to improving our ability to understand and predict choice behaviour in a systematic manner.

There are several studies that connect psychological characteristics to WTP or preferences measured by CVM. Kotchen and Reiling (2000) provide a critical overview of these studies. Stern *et al.* (1993), Kahneman *et al.* (1993), Stern *et al.* (1995), and Widegren (1998) worked on the relationship between environmental concern or attitudes and WTP measures, and presented mixed results of significant or not significant relationships. However, Kotchen and

Reiling (2000:96) deny the comparability of the differently measured attitudes and the validity of these CVM studies based on their poor designs. Some other studies such as Hanley and Craig (1991), Brown *et al.* (1996), Barton , and Boxall and Adamowicz (2002) use questions about environmental membership, trust in institutions, attitudes, or motivations. However, they are also subject to 'a poor reflection of environmental attitudes' without a systematic measurement (Kotchen and Reiling 2000:96).

It does not necessarily mean that every nonmarket valuation study that tried to measure psychological characteristics of population is badly formulated. Others use well-established psychological theories or instruments such as the TPB of Ajzen (1991) and the NEP scale of Dunlap *et al.* (2000). These are the expanded and upgraded versions of the theory of reasoned action of Fishbein and Ajzen (1975) and the new environmental paradigm scales of Dunlap and Van Liere (1978), respectively. Ajzen and Driver (1992), Kerr and Cullen (1995), Barro *et al.* (1996), Pouta and Rekola (2001), and Ajzen *et al.* (2004) are some examples of these studies, which used either the TPB or the TRA to explain, predict, or test (hypothetical bias of) WTP estimates measured by CVM. Kotchen and Reiling (2000), Connelly *et al.* , and Cooper *et al.* (2004) employ NEP to check the influence of environmental attitudes and motives on WTP, and/or the relationship between the attitudes and nonuse motivations. CM applications have been not found in the literature.

There are general implications from the previous studies. First, 'analysing environmental attitudes [measured by NEP] in the context of CV studies is useful for explaining nonuse valuation responses' (Kotchen and Reiling 2000:104). This is in line with the NOAA Panel recommendation of using environmental attitudes to explain CVM responses (Arrow *et al.* 1993:4609). Second, the TPB is 'a useful conceptual framework for trying to predict and understand' hypothetical and real behaviours (Ajzen *et al.* 2004:1119). Third, none of these studies articulate the attitude-behaviour relationship in the CM context. Fourth, previous studies use the information on psychological characteristics of population in a limited manner: they provide explanations of WTP or hypothetical bias tests, using path analysis or regression analysis. The literature does not provide rigorous tests of psychometrics for the benefit of general discrete choice models.

Recommendations

As a final section, a couple of recommendations can be made from the examination of the contemporary literature. First, researchers of nonmarket valuation may recognise the varying degrees of the discrepancies (or anomalies) between WTP and the actual behaviour in concern. What we have measured using stated preference techniques might have been illusive images. Various factors can influence people's choice behaviour, and each factor works differently on

different individuals. It is recommended to vigorously address population heterogeneity.

Second, researchers of nonmarket valuation may use both exogenous sociodemographic variables and endogenous psychological variables to capture population heterogeneity. If we continue to use only one type of these variables, in certain cases, a significant portion of the systematic component may be lost as a part of the random component. The consequence might not be tolerable in terms of validity and reliability of the nonmarket valuation studies. In doing so, multicollinear relationships between the various independent variables may arise. In addition because the psychological variables may be so close to the choice variables, the prospect of estimating a spurious relationship may arise. In such a case, the choice between alternatives in a stated preference application would be highly correlated with an 'independent' psychological variable because they are essentially measuring the same phenomenon. These relationships need to be investigated and tested so that the gain from this incorporation is larger than any loss due to observing both sets of variables. Furthermore, these investigations would be only meaningful when there are many rigorous studies that consider and compare the influences of and relationships between endogenous and exogenous variables, and between the dependent and 'independent' variables.

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