



Analysis

Comparing different attitude statements in latent class models of stated preferences for managing an invasive forest pathogen



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ABSTRACT

To better interpret preference data, environmental economists often measure two different types of attitudes: general environmental attitudes, and attitudes specific to an issue. Although methods such as joint latent class modeling can relate these measures to stated preference data, economics literature offers limited guidance on important details, including the relative merits of the two attitude types. This paper analyzes survey data about the management of the invasive, non-native fungus that causes the lethal disease white pine blister rust in high-elevation forests, a problem characterized by long time scales and potentially costly interventions of uncertain efficacy. The paper uses novel techniques for comparing across latent class model specifications to evaluate the relative contribution of general and specific attitude measures to the analysis of contingent valuation data. These demonstrate insights from investigating heterogeneity in respondents' perspectives and superior model performance with specific attitude statements versus with general attitude statements. In addition to the practical content, these results offer novel insight into ongoing debate on the meaning of stated preference valuation measures.

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1. Introduction

People value the environment in different ways and for different reasons. Accordingly, many environmental economists have long been interested in attitude measures and preference heterogeneity. Krutilla (1967 p.779) called for understanding nonmarket values because of the distinct preferences of a particular group he called the “spiritual descendants of John Muir.” The National Oceanic and Atmospheric Administration's (NOAA) “blue-ribbon panel” on contingent valuation (CV) (Arrow *et al.* 1993) recommended using measures of attitudes toward the environment not only to help interpret economic data but also to present disaggregated measures of willingness to pay (WTP). Similarly, Arrow *et al.* (1996) urged for cost-benefit analyses to supply information on heterogeneity and the distributional consequences of potential policies. Breffle *et al.* (2011) motivate the model estimated below by pointing to calls for integrating attitude data into economic models that range from McFadden (1986) to more recent papers focused primarily on preference heterogeneity (Ben-Akiva *et al.* 2002; Boxall and Adamowicz 2002; Morikawa *et al.* 2002).

Nonmarket valuation surveys typically elicit information on either one, or both, of two types of attitudes: *general attitudes*, which relate to broad evaluative beliefs or opinions, such as about the environment,

and *specific attitudes*, which relate to evaluative beliefs or opinions about the good or issue in question. It is not *a priori* clear whether one attitude type more appropriately complements preference data. The literature offers conflicting examples, and more generally, it offers little explicit discussion of the relative merits of different types of attitude data for improving and understanding economic models. Given the common practice of collecting such data, it is important to examine these relative merits empirically.

This paper addresses this gap by exploring the relationships among general attitude, specific attitude, and stated preference data from a CV survey about the management of the non-native pathogen that causes the disease white pine blister rust (WPBR) in high-elevation five-needled pine forests. It employs a joint latent class (JLC) model (Morey *et al.* 2006; Breffle *et al.* 2011) that links attitude and preference data without assuming any specific relationship between attitudes and preferences except that differences between classes would be similar for both. Because classes estimated by this model correspond to perspectives with commonalities across preference and attitude data, the interpretation of the estimated class segmentation will differ depending on the type of attitude statements used.

The paper demonstrates novel techniques for comparing the relative performance of different sets of attitude data in alternative JLC models. Its main contribution is to compare the relationship between different types of attitude measures and the stated preference data for the empirical application, thereby offering potential insight into the interpretation of the stated preference data and the usefulness of different types of attitude measures in applied environmental economics. Results

Abbreviations: CV, (contingent valuation); JLC, (joint latent class model); NEP, (new ecological paradigm); RUM, (random utility model); WPBR, (white pine blister rust); WTP, (willingness to pay).

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suggest that although both attitude types have empirical and explanatory merit here, the CV data in this study are substantially more similar to attitudes specifically about the particular issue than to general attitudes about the environment, in the sense that perspectives jointly defined by preferences and the former are more tightly estimated than those jointly defined by preferences and the latter. To the extent they are generalizable, these results offer empirical insight into ongoing debate about the interpretation of stated preference data, specifically, and into the relationships between attitudes and preferences more generally. In addition, the comparison techniques developed below can be generalized to inform the selection of appropriate covariates in other latent class models, another issue that has received little attention in the literature.

The next section provides background on the relationship between preferences and attitudes and the use of attitudes in nonmarket valuation. Section three introduces the empirical application and data source. Section four presents the conceptual background and general specification of the JLC model, as well as techniques for model comparison. After section five presents empirical results, section six discusses their interpretation and implications.

2. Background: Attitudes, Preferences, and Nonmarket Valuation

This paper focuses on groups of *perspectives*, in which a perspective refers to a general, unobservable worldview. Though many plausible stories could account for distinct perspectives (e.g., political ideology, socioeconomic status, or genetics), the critical feature is that individuals within a common perspective group share similar attitudes and preferences. Perspectives may or may not be evaluative, and the concept therefore is more general than either *attitudes* or *preferences*. Stated preferences describe the tradeoffs people are willing to make; an interest in perspectives as defined here includes analysis of these tradeoffs without precluding the potential merit of understanding other dimensions of people's perspectives, such as their attitudes.

Social psychology defines an *attitude* as “any belief or opinion that has an evaluative component” (Gray 1999 p.507): attitudes must be about something and that “aboutness” must be evaluative. Attitudes are not directly observable but can be inferred from, for example, one's expressed level of agreement with statements that reflect an attitude, called attitude statements in this paper. Theory typically does not preclude the same attitude fulfilling more than one function, such as the utilitarian function of guiding behavior or the value-expressive function relating to “...relatively abstract attitudes that people claim as guiding principles behind their more specific attitudes and actions” (Gray 1999 p.507).

In turn, an attitude is more general than a *preference* (e.g., Kahneman et al. 1999), which in standard microeconomic theory (e.g., Mas-Colell et al. 1995; Varian 2003) is a complete, reflexive, and transitive relation between the elements of a choice set. To have a preference, an individual must have evaluative positions toward the options, which is to say the individual must have attitudes about the elements of a choice set. However, whereas microeconomics asserts that well-behaved preferences must be consistently ordered,¹ social psychology allows attitudes to be incomplete or inconsistent. Therefore, a preference consists of a set of attitudes that follow a particular structure; an attitude is necessary but not sufficient for a preference. That is, preferences and attitudes must be similar in content, in the sense that both are evaluative positions over choices, but are different in kind, in the sense that they differ in strictness about their requisite structure. The attitudes statements investigated below are on similar topics to the CV question. Thus, both can be expected to pertain to coherent perspectives as a more general construct. However, because the attitudes statements do not address the tradeoffs that are fundamental to the concept of a preference, the two are different.

¹ More flexible concepts of preferences, such as that of bounded rationality, still maintain that preferences are structured and consistent, conditional on circumstances.

Nonmarket valuation surveys often collect data on general attitudes, specific attitudes, or both (Meyerhoff 2006), but economics does not offer a general theory of attitudes, despite many economists acknowledging their relevance. Most empirical studies provide little, if any, justification of why a particular type of attitude is measured, and literature offers conflicting examples and advice. On the one hand, the NOAA panel (Arrow et al. 1993) and others (Spash 1997) recommend incorporating general environmental attitudes in economic evaluation. For example, the New Ecological Paradigm (NEP) (Dunlap and Van Liere 1978; Dunlap et al. 2000) measures general environmental attitudes with attitude statements such as “The earth has plenty of natural resources if we just learn how to develop them.” Kotchen and Reiling (2000) introduced the NEP to the economics literature as a measure of general environmental attitudes, which they and Aldrich et al. (2007) use to identify different groups of respondents with clustering and latent class methods. Similarly, Choi and Fielding (2013) link WTP to protect endangered species to NEP responses in a choice modeling framework, and Videras et al. (2012) use latent class modeling to link respondents' general environmental attitudes, and those of their neighbors, with some pro-environmental behaviors but not others.

On the other hand, some authors (Bamberg et al. 1999; Meyerhoff 2006) suggest that while general attitudes may affect framing of choice, they should have no direct effect on preferences. Supporting this view, Cooper et al. (2004) found no significant relationship between NEP responses and WTP in a CV study about lake water quality improvements. Instead, many environmental economics studies focus on attitudes that are specifically directed toward the management question under investigation (e.g., Langford et al. 2001; Jorgensen et al. 2001; Tapsuwan et al. 2010; Nguyen et al. 2013), whereas a smaller number use both types of attitudes similarly (e.g., Martín-López et al. 2007; García-Llorente et al. 2011). Carson et al. (2001) assert that specific attitudes tend to be “generally better predictors of WTP than self-identification as an environmentalist” (p. 194) and Kealy et al. (1990) argue that the specific intentions about specific behaviors measured by CV would be expected to correlate with more specific attitudes. Well-cited studies on the role of “warm glow” in motivating CV responses (Nunes and Schokkaert 2003) and on assessing the scope test for CV (Heberlein et al. 2005) measure specific rather than general attitudes. Finally, two environmental economics latent class studies (Boxall and Adamowicz 2002; Morey et al. 2006) both rely on measure of attitudes specific to the issues investigated. The implicit assumption seems to be that specific attitudes provide relevant information about preferences because the two are similar, though not identical. However, few if any studies directly compare specific versus general attitudes in economic modeling.

3. Application and Data

For empirical insight, this paper investigates attitude and contingent valuation data from a survey on the public benefits of managing the invasive, non-native pathogen that causes the lethal disease white pine blister rust (WPBR) in high-elevation, five needled-pine forests. These forests cover approximately two million acres of public land in western North America, including several “flagship” National Parks, and are associated with many ecosystem services, including wildlife habitat, watershed regulation, and recreational opportunities (Mattson et al. 1992; Tomback and Kendall 2001; Samman et al. 2003; Petit 2007; Robbins 2010; U.S. Fish and Wildlife Service 2011). They consist of the foxtail pine, Rocky Mountain bristlecone pine, Great Basin bristlecone pine, limber pine, and whitebark pine: species known as containing some of the oldest living organisms on Earth. The non-native fungus *Cronartium ribicola*, which causes WPBR, was introduced in the early 20th century and has slowly spread across much of these forests' range, leading to mortality at all stages of the trees' lifecycles. This degradation of forest health, which is defined as all four stages of the trees' regeneration cycles occurring simultaneously, thereby threatens the

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