Can psychological variables help predict the use of priced managed lanes?

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ABSTRACT

This research examined the relationship between several psychological variables (conscientiousness, general locus of control, personal need for structure, financial risk tolerance, driving risk perceptions, risky driving style, and careful driving style), travel attribute preferences, carpooling attitudes, and preferences for priced managed lanes. Using data based on 664 respondents from three cities (Denver, Miami, and San Diego), mixed logit models indicated that several variables, particularly travel time, toll, sex, and income, were better predictors of managed lane use than the psychological variables. Of the psychological variables, significant results were obtained for only conscientiousness and risky driving style. Specifically, respondents with a higher risky driving style score reported a lower preference for carpooling on general purpose lanes. High conscientious individuals reported a lower preference for carpooling on managed lanes. Although the results for the psychological variables were generally not as strong as had been expected, aspects of the study design may have resulted in an underestimate of their effects. These aspects are acknowledged and their implications are discussed in the context of future research.

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1. Introduction

As of January 2013 there are 12 cities in the United States that have priced managed lanes (https://ceprofs.tamu.edu/mburris/pricing.htm) and many more cities are contemplating their use. These managed lanes (also sometimes referred to as "express lanes", and "high occupancy/toll lanes") generate revenues and manage traffic demand by offering a priced premium service. The managed lanes are usually situated in the middle of congested general purpose lanes and separated by striping or, in a few cases, concrete barriers. To ensure that the managed lanes offer a premium service and do not become congested, travelers typically must pay a toll or meet certain criteria (such as three or more occupants in a vehicle) to use them. The toll generally varies by time of day or by congestion level, increasing as demand for the lanes increases. Thus, travelers have to make a decision, often on the spur of the moment, between a tolled, free-flow trip or an untolled congested trip. The present study investigated the relationship between a number of psychological variables and the decision to use managed lanes in an effort to further the understanding of travel behavior and the ability to predict the potential usage of future priced managed lanes.

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Researchers often estimate the likelihood a traveler will use a toll road using stated preference surveys. However, a review of the limited research on this topic, suggests that stated preference surveys for managed lanes and high occupancy/toll lanes appear to underestimate the willingness to pay. For instance, recent analysis of Katy Freeway/Managed Lane travelers (see Devarasetty, Burris, & Shaw, 2012a,b) and I-394 Freeway/High Occupancy Toll lane traveler data (see Burris, Nelson, Kelly, Gupta, & Cho, 2012) has shown that many travelers pay to use these managed lanes when adjacent toll-free lanes are operating at nearly the same speed. Assuming that drivers are indeed cognizant of the fact that high occupancy tolled and managed lanes are traveling at nearly the same speed, it would seem that some travelers are paying for the use of these lanes for reasons other than travel time savings. Therefore, current models do not capture the full story. Consequently, this research examined whether pertinent individual difference variables (i.e., differences in personality, attitudes, and preferences) can contribute to an explanation and understanding of travelers' decisions to use managed lanes.

It has long been empirically established that individual differences play an important role in driving-related behavior and choices. However, the usual outcome variables of interest have been errors and violations as anomalous behaviors, typically operationalized as crashes and moving violations (i.e., tickets; Arthur & Day, 2009). Recent research has also began to pay some attention to driving anger expression as a potentially relevant driving outcome (e.g., Dahlen, Edwards, Tubré, Zyphur, & Warren, 2012). Regardless of the specific outcome, there are three general classes of variables considered as predictors of driving behaviors—demographic and exposure factors, cognitive and information processing variables, and personality traits (Arthur & Day, 2009). Conceptually, the viability of these variables as predictors of driving outcomes is concordant with the well-established relationship between knowledge, general mental ability, and personality traits and performance in the workplace (Barrick & Mount, 1991; Hunter, 1986). Although general mental ability and declarative knowledge of driving principles have not performed well as predictors of driving outcomes (e.g., see Arthur, Barrett, & Alexander, 1991; Arthur & Doverspike, 2001), personality traits have been shown to be successful predictors (Clarke & Robertson, 2005). Consequently, an investigation of the role personality variables play in the choices that travelers make to pay to use managed lanes is an important extension of this body of research. A review of the extant literature identified a cluster of variables as being theoretically germane to the domain of traveler choices. These are conscientiousness, locus of control, personal need for structure, risk tolerance, driving risk perceptions, and driving styles. The variables included in the present study have been shown to relate to other driving outcomes (e.g., crashes and tickets) which include the proclivity to engage in certain driving behaviors. Thus, the theoretical and conceptual basis for the role of the variables in the present study is based on a generalization from previous findings (e.g., Clarke & Robertson, 2005) to managed lane preferences as a novel, focal outcome variable. Therefore, the goal of the present study was to investigate the relationship between the specified psychological variables and travelers' preference for using managed lanes.

2. Literature review

2.1. Potential variables influencing managed lane usage

Numerous factors may influence a traveler's decision to use managed lanes. In the context of the present study, these can be broadly categorized in terms of (1) the characteristics of the driver, and (2) the characteristics of the trip. Although the primary focus of the present study is driver characteristics, we briefly review the relevant literature on both categories because we sought to investigate the ability of driver characteristics to predict managed lane choice over and beyond trip characteristics.

2.1.1. Characteristics of the driver
2.1.1.1. Socio-economic characteristics. Many socio-economic characteristics of travelers have been shown to influence their use of managed lanes, with the most important being income, whereby higher income travelers are more likely to use managed lanes more often (Sullivan et al., 2000). Additionally, females tend to use the lanes more often than males (for example see Devarasetty et al., 2012a).

2.1.1.2. Psychological variables. As previously noted, Arthur and Day (2009) distinguished between three categories of predictors of driving outcomes, specifically demographic and exposure variables, cognitive and information processing variables, and personality traits. In this section, we briefly review the research on predictor variables from the personality and non-cognitive literature, and provide the rationale for considering these variables in the present study. Along the same lines, a number of conceptually pertinent attitudinal variables are also introduced and described.

Some personality traits commonly used in personnel and organizational psychology research have been successfully used in the prediction of crash involvement and moving violations. For instance, Clarke and Robertson's (2005) meta-analysis revealed that extraversion, conscientiousness, and agreeableness are all valid predictors of crash involvement (corrected mean validities of .24, .26, and .21, respectively).

The documented role individual differences play in driving outcomes served as the impetus for considering and exploring the role they could play in travel choices. Consequently, on the basis of a detailed review of the extant literature, a number of psychological characteristics that seemed theoretically germane to driving choices were identified. These individual difference variables along with their posited relationship with managed lane use are briefly described in the following paragraphs.