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A stated preference experiment for understanding drivers' risk perception

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Abstract

Because most traffic accidents are caused by the human factor, intervention programs should work to prevent and reduce these fatal incidents by focusing on drivers. The human factor relates to aspects of risk that are controlled by people, for example, whether or not people follow driving rules, their attitude and behavior while driving, and so on. Furthermore, road users´ perception of risk influences their driving behavior. As a result, this study investigates the key factors that affect drivers' risk perception. A survey involving a Stated Preference experiment was created to collect information about drivers' risk perception of five behavioral factors. The University of Granada (Spain) provided the researchers with student email addresses, which were used to complete a total of 788 online surveys. Additionally, a stratification of the sample was developed for calibrating different Ranking Ordered Logit models, which permit the identification of differences among the key factors influencing the risk perception of the surveyed drivers. The results obtained demonstrate that not following passing rules and distracted driving are the most influential factors on drivers' risk perception, while speed limits were found to produce a low impact on drivers' risk perception. Moreover, models´ results show some interesting differences in risk perceptions of drivers of differing gender and driving experience.

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Keywords: Risk perception; Stated Preference experiment; Ranking Ordered Logit model;driving rules; driver behaviour

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1. Introduction

According to the World Health Organization (WHO, 2009), traffic accidents are the second leading cause of death for people between the ages of 5 to 29, and the third leading cause of death for people between the ages of 30 and 44. Traffic accidents produce 1.27 million deaths and between 20 and 50 million traumatisms every year. Different factors related to the driver, the infrastructure, the vehicle and the weather conditions are involved in the cause of accidents. However, the majority of traffic accidents, 70% to 90% (Luna Blanco, 2013), are caused by the human factors such as drivers´ unsafe attitudes while driving.

Certainly, road users' perception of risk in the driving environment influences their driving behavior and task performance (Wang et al. 2002). The perceived risk generates the degree of caution that people apply to their behavior and causes variation in their actions regarding their personal health and safety. Luna Blanco (2013) differentiates between risk and danger by explaining that risk is related to the human factor by involving human responsibility, whereas danger is defined as an external factor to a person. This distinction allows us to develop intervention programs in order to prevent and reduce traffic accidents by focusing on risk rather than danger.

The particular subject of risk perception while driving has been studied and reported in the existing literature. For example, Noland (1995) demonstrated how risk perception changes with the mode of transportation. Additionally, Wang et al. (2002) studied the relationship between this type of risk perception and geometric characteristics of the road and traffic. Moreover, Iragüen & Ortúzar (2004) and Rizzi & Ortúzar (2006) studied drivers' willingness to pay for reductions in fatal accident risk in order to apply this monetary measure to transportation project evaluation.

Stated Preference (SP) experiments constitute an effective way to collect drivers' risk perceptions while driving by having them evaluate the risk of a hypothetical driving situation as a whole, while also having them consider different risk factors simultaneously. As a result, their response provides a more accurate measurement of the actual magnitude of the influence of each attitudinal factor on overall risk perception. In fact, several previous researchers in this area have demonstrated the effectiveness of this technique by using SP experiments for their analysis of risk perception (Wang et al., 2002; Iragüen & Ortúzar, 2004; Rizzi & Ortúzar, 2006; Eboli and Mazzulla, 2008).

Therefore, the main goal of this research is to investigate drivers' risk perception considering only the factors related to their attitude while driving by utilizing data collected with a SP experiment, which was designed in a previous work by Cardamone, Eboli and Mazzulla (2014). This survey was implemented by using new data collection methods, such as an online survey. This web-based sampling method has been successfully used to conduct SP experiments (Iragüen & Ortúzar, 2004; Rizzi & Ortúzar, 2006). Then, in order to understand drivers' behavior and determine the impact of different attitudes on their risk perception, a discrete choice model was used to calibrate the collected data. Moreover, due to the fact that different drivers can perceive different factors as key elements for influencing the risk of an accident, a specific analysis focusing on certain determined groups of drivers was completed. These groups included males versus females and also three groups of drivers stratified according to the number of years owning a drivers license (from 0 to 7 years, from 8 to 22 years and from 23 to 47 years).

After the introduction above, this paper is structured as follows: Section 2 describes the design and implementation of the survey and the approach used for determining the factors that most influence risk perception. In Section 3, the main characteristics of the collected sample are displayed. Additionally, in Section 4, the outcomes obtained from calibrating the discrete choice models are discussed, providing a comparison among the different models. Finally, the paper concludes with Section 5, presenting the main conclusions of the research.

2. Methodology

2.1. Survey design and implementation

The survey designed for this research consisted of four sections. The first section was targeted towards collecting data regarding the socio-economic characteristics of the respondents. Specifically, the people surveyed were asked for information concerning age, gender, employment (status, sector and occupational status), monthly net income of their household, and number of members of their household.

The second section of the questionnaire concerned the respondent's driving behavior, and it is composed of multiple-choice questions asking about drivers' tendency to be distracted while driving, to drive after drinking

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