Modelling the economic impacts of road crashes in Greece

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Abstract
This research aims to quantify the Willingness-To-Pay (WTP) attitude of the Greek public towards mitigating road crash risk and thus crash involvement in the macroscopic scale. An online questionnaire survey was designed and distributed to participant drivers. Two scenarios of WTP in order to reduce crash involvement probability were included: 20% and 50% reductions in probability; 238 valid responses were collected and analyzed. Ordinal and multinomial logistic regression models were used to correlate driver preferences between the two scenarios and several independent variables, in contrast with the do-nothing (0%) reduction scenario. Results indicated that most drivers are very positively predisposed towards a road crash risk reduction. The choice between low and high reductions depends on trip duration and cost increases, family situation, driving experience and annual family income. The calibrated WTP models are used in a case study to calculate the human cost (value of statistical life) in Greece during 2016.

Objective
- Estimation of the human cost of road crashes based on the WTP method
- Identification of driver attitudes towards the probability of being involved in a road crash

Data Collection
An online questionnaire survey was utilized by 238 participants for the estimation of human cost, which consisted of four distinct sections:
- Driving experience
- Road crash perception and involvement
- Willingness to pay investigation
- Demographic questions

Figure 1. Gender distribution per age group of participant drivers

Methodology
Two modelling approaches were employed:
- Ordinal logistic regression for the occurrence probability of an event \( p \), based on the assumption that the logarithms of odds follow an arithmetic series, can be expressed as follows:
  \[ y_i = \logit(p) = \ln \left( \frac{p}{1-p} \right) = b_0 + \sum b_i x_i \]  
  (1)
- Multinomial logistic regression for \( N \) possible outcomes can be described as an array of \( N \)-1 independent binary regressions of the odds of an outcome compared to the previous one, as follows:
  \[ \hat{p} = \sum \frac{e^{b_i x_i}}{1 + \sum e^{b_i x_i}} \]  
  (2)

Crash Cost Calculation
The individual human cost, also known of Value of Statistical Life (VOSL), can be derived from a division:
  \[ HC = \frac{AVG inc \times WTP \times TF/fatalities}{\text{years}} \]  
  (3)

Conclusions
- The vast majority of Greek drivers choose to reduce the probability of getting involved in a road crash (slightly or considerably)
- Certain income categories are more willing to adapt to new measures which will deliver positive results in addressing road safety issues than others
- Other characteristics that influence people’s driving behaviour and their preferences towards road safety are driver age, driver gender, purpose of transport
- By quantifying the human cost of crashes, their economic impacts can be better understood