The Role of Attitudes and Beliefs on Deterrence of Speeding among Young Drivers

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1. Introduction

Excessive speed has been found as a risk factor that increases both frequency and severity of road crashes. Despite tremendous progress in safer vehicles and road design in the last two decades, speed still tends to contribute to a major proportion of severe road crashes. Interventions adopted to enhance drivers' compliance with speed limits have been focused on drivers (e.g., knowledge campaigns), road design (e.g., self-explaining roads), and in-vehicle systems (e.g., intelligent speed adaptation). However, motives of drivers to commit speed violation are often strong, and speeding tends to be among the most prevalent driving violations, particularly among the younger drivers. For instance, analysis of traffic counter data from 2016 to 2018 showed that the average rate of speed violation on rural roads in Iran has been around 10.2 percent. Moreover, it has been estimated that on average, one percent reduction in the rate of speed violation would decrease frequency of road crashes by around 3.3 percent.

For all groups of drivers, stricter penalties have been shown to strengthen deterrence against traffic offences. With the aim of enhancing the deterrence effect, a range of different penalty systems (including monetary fines, temporary or permanent driving license suspension, confiscation of vehicle, demerit points, mandatory participation in a rehabilitation programs, prison sentence and community service) have been suggested and executed to impose stronger sanctions against violating drivers. Each system might impose positive effects on road safety, although the literature lacks comprehensive studies that examine effects for all mechanisms. For instance, a relatively recent meta-analysis found that increase in fixed penalties is associated with a small reduction in fatal accidents, although the effect varies between studies from less than 1% to 12%.

In Iran, non-compliance with the speed limit has the potential for non-monetary fines as well as monetary. The non-monetary mechanisms include demerit point and car impoundment. According to the law, the penalty for speed violation is 600,000IRR if the driver is detected to exceed the speed limits by up to 30 km/h above the speed limit. A higher penalty of 2,000,000IRR, however, is applied in the case the violation is more than 30km/h above the speed limit. In addition, driving 30 to 50 km/h above the speed limit would incur five points on the license. The driver will receive 10 points on the license in case of driving more than 50km/h over the limit. In case of reaching 30 points, the license will be suspended for three months. Moreover, if a driver is caught committing one of the most dangerous driving offenses defined by the law, while speeding 50 km/h or more over the speed limit,

the driver's car will be impounded for 72 hours.

Attitudes and beliefs as the interpretations of the world around us are formed based on previous experience, familiarity, knowledge, etc. Beliefs have been defined as convictions about phenomena or objects that are believed to be true regardless of actual truth. It is believed that beliefs are the building blocks of attitudes, which have been defined as relatively enduring organization of beliefs about an object or situation predisposing one to respond in some preferential manner. According to the theory of planned behavior (TPB) a behavior is formed by a person's beliefs about the probable consequences of the practiced behavior (behavioral beliefs), beliefs about the expectations of other people (normative beliefs) and person's beliefs in regard to the presence of factors that may enable or obstruct the behavior (control beliefs). Behavioral beliefs, normative beliefs and control beliefs have been shown to trigger attitudes, social norms, and perceived behavioral control.

The role of beliefs and attitudes in driving violations have been investigated but the literature lacks evidence that beliefs and attitudes impact deterrence effects of speeding penalties. On the other hand, policy makers tend to adopt new forms of penalties for which the deterrence effect is unknown. Therefore, this study aimed to investigate the role of beliefs and attitudes on deterrence effects of penalty systems in a sample of university students in Iran.

2. Questionnaire design

The questionnaire had four main parts. The first part was a stated preference survey to investigate the drivers' choice of speeding penalties. This part was included a set of predefined scenarios of speeding penalties and levels. For each question the choice set encompassed a combination of different speeding penalties and levels. Table 1 shows penalty mechanism (attribute) and levels used in questionnaire. Design of scenarios was carried out using the choice experiment method (CEM), with regards to balanced and orthogonal design considerations. Each respondent was given four scenarios, each of which encompassed three choices made up of combinations of different penalties and levels.

Table 1. Attributes, units and levels used in the scenarios

Attribute	Unit	Level
Monetary fine	IRR×10^4	50, 140, 230, 300
Demerit point	Number	5, 10, 20, 25
Car impoundment	Day	3, 6, 9, 12
Social deprivation	Month	1, 3, 5, 7

The second part of the questionnaire was designed to collect social and economic data about the respondents (including age, gender, and year of getting the driver license, car ownership status and number of weekly hours driving). In the third part, drivers' attitudes towards road crashes (e.g., respecting the speed limits in the built-up

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area enabled us to stop faster in case of an emergency) and attitudes towards speeding (e.g., speeding is one of the most important problems in our society) were measured using instruments developed and validated by De Pelsmacker and Janssens in 2007. Responses were collected on a Likert scale from 1 as strongly disagree to 5 as strongly agree. The fourth part of the questionnaire included three questions measuring the drivers' beliefs about the penalties (e.g., traffic fines is just a business for the government to make money). The instrument was developed by the authors and the responses were collected on a Likert scale from 1 ad strongly disagree to 5 as strongly agree.

3. Data collection

Convenient sampling method was used to collect data from university students with a driving license who were active drivers (drove at least one hour a week). Sampling was conducted at campuses of Kharazmi University in Karaj, College of Engineering at the University of Tehran, and the East Tehran Branch of Islamic Azad University. A total of 550 questionnaires were collected. The respondents were assured that the information they provided would remain confidential and that the data would be used for the purpose of this study. Out of the returned questionnaires 501 were qualified for use (return rate 91.1 percent). 70.3 percent of the respondents were make and 29.7 percent were female. 61.8 percent of the respondents drove less than 10 hours a week. For around 60 percent of respondents less than 5 years passed from the issuance of driving license.

4. Data analysis

We conducted a Multinomial Logit (MNL) regression to correlate the drivers' selection of the speeding penalties to attitudes towards excessive speed and road crashes, as well as their beliefs about speed penalties. Likelihood of selecting alternatives was hypothesized to be affected by the respondents' characteristics (e.g., age and gender), as well as the alternative characteristics (attribute levels). The underlying assumption in estimating the multinomial

logit model is that the random components of the utilities of the different alternatives are independent and identically distributed (IID) with a Type I extreme-value (or Gumbel) distribution. The maximum likelihood estimation was used to estimate the model parameters. The overall significance of the model was tested using a likelihood ratio (LR) Chi-squared test, which compares the log-likelihood value from the model including all variables to the log-likelihood value from the model containing only an intercept term.

5. Results

Table 2 shows the results of the model estimation. The results indicate an overall significance of the model estimated, and that the addition of variables significantly improved the fit of the model compared to the model containing only an intercept term.

6. Conclusion

Findings showed that each of the four penalty mechanisms is able to create a general deterrence effect for speeding which may lead to a crash reduction. The general deterrence effect, however, is the best for social deprivation followed by car impoundment, demerit points, and monetary fines. According to the results, for drivers who had a positive attitude towards accidents, social deprivation was more deterrent than demerit points and monetary fines. Analysis of interaction effects between social deprivation and drivers' beliefs showed that for drivers who did not have positive beliefs towards the penalties, social deprivation was less deterrent compared to other drivers. This evidence implies that education and information campaigns should be undertaken to take in the beliefs that the traffic fines are used to improve road safety by modifying drivers' behavior. Results also showed that, compared to other drivers, for those having supportive attitudes towards speeding, demerit points are less deterrent. This suggests a change in drivers' attitudes towards speeding in educational programs.

Table 2. Results of model estimation

Variable	Estimated parameter
PEN	-0.00505***
MIN	-0.03130**
STOP	-0.06814***
DEP	-0.15267***
DEP×BI	0.05410**
MIN×MAST	-0.02873**
PEN×MACT1	0.00277*
MIN×MACT2	0.01515**
STOP×MACT3	-0.03586*
DEP×MACT4	-0.04655**

No. of observations: 2004, LL(β): -1875.7492, LL(C): -2181.6985, 2*(LL(β) − LL(C)): 611.89
* $p<0.1$, ** $p<0.05$, *** $p<0.001$
PEN: Amount of monetary fine / 10,000 IRR
MIN: Number of demerit points
STOP: Days of car impoundment
DEP: Months of social deprivation
BI: 1 for the drivers whose beliefs scores < 2 and BI: 0, otherwise
MAST: 1 for the drivers whose attitudes scores towards speeding > 2 and MAST: 0, otherwise
MACT1: 1 for the drivers whose attitudes scores towards crashes <= 3 and MACT1: 0, otherwise
MACT2: 1 for the drivers whose attitudes scores towards crashes <= 2 and MACT2: 0, otherwise
MACT3: 1 for the drivers whose attitudes scores towards crashes > 2 and MACT3: 0, otherwise
MACT4: 1 for the drivers whose attitudes scores towards crashes < 2 and MACT2: 0, otherwise