Analyzing Acceptance of Reduced Speed Limits on Greek Motorways: A Survey

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Introduction

In recent decades, several studies have focused on the effects of speed and speed limit on road safety, showing that speed of travel is highly correlated with road accident frequency and severity. In particular, driving on the high-speed motorway network can cause negative impacts such as air pollution, high fuel consumption and serious road accidents. To reduce the negative impacts of speed on road safety and promote safe and sustainable mobility for all, there is a global trend to implement lower speed limits. In addition to road safety, reducing driving speed can contribute to greener and more economical driving.

Reducing the speed limit on the Greek interurban road network, apart from its contribution to reducing road accidents and consequently injuries and mortality, constitutes a measure that is estimated to bring significant economic benefits to the state. More specifically, road accidents cost Greek society around €2.7 billion per year, while the actual cost could potentially exceed €8 billion per year if the actual number of casualties and accidents with property damage alone are taken into account. In this context, the main objective of the present study is to investigate the acceptance of the reduction of the speed limit on Greek motorways from 130 km/h to 120 and 110 km/h.

Data Collection

To achieve the study objective, a specially designed questionnaire was constructed. The questionnaire is divided into four sections covering a total of 43 questions. The questionnaires were collected in the form of an online survey via Google Forms. A total of 408 questionnaires were collected. The first section of the questionnaire consists of questions regarding driving experience, main mode of transport, frequency of driving and possible involvement in road accidents. The second section examines the respondents' views on road accidents in Greece. In the third section, 10 different scenarios are introduced for a hypothetical three (3) hour out-of-town (long-distance) journey. Specifically, a choice between three alternatives is requested based on three parameters: travel time, fuel consumption, and the probability of being in-volved in a road accident with injury.

- Alternative 1: reduce the speed from 130 km/h to 110 km/h.
- Alternative 2: speed reduction from 130 km/h to 120 km/h.
- No change.

The following table shows a sample of one random scenario out of 10 in which respondents were asked to choose between the alternatives.

Table 1. Scenario example

Attributes	Alternative 1	Alternative 2	No change
Increase in Travel Time (minutes)	21	7	0
Reduction in Fuel Consumption (€)	9€	3€	0€
Reduction in the probability of road accidents with injury (%)	30%	10%	0%

Finally, the fourth section of the questionnaire collects respondents' demographic characteristics, such as gender, age, education level, annual income, etc.

Statistical Analysis

Logistic regression models are used when the dependent variable is distinct (such as the three alternatives of the survey scenarios regarding reduced speed limits). Logistic regression is used to create models for predicting the influence of the presence or absence of certain characteristics in the selection of a particular alternative. In that context, utility function is used as a function of the attributes and other factors that affect the choice of the respondent.

More specifically, the utility function is defined as a mathematical model that describes the probability of the choice of each individual among alternatives based on the attributes. Based on the utility maximization context, as described by McFadden (1974) and Ben-Akiva and Lerman (1985), the utility of an alternative i (Ui) consists of a systematic part Vi and an error term ϵ, where the systematic part consists of (a) a vector of attributes α with attribute values Xiα for a given alternative i, and (b) their marginal effect on utility βiα and an Alternative Specific Constant ASC that captures systematic but non-explained variability in the data:

$$U_i = V_i + \varepsilon \quad (1)$$

Where Vi is given by:

$$V_i = \beta' X_i + ASC_i \quad (2)$$

Binary Logistic Model

The binary logistic regression analysis presented in Table 2 illustrates how different variables influence the acceptance of speed limit reduction on Greek motorways.

Table 2. Binary logistic regression model

Parameters	βi	p-value	Odds Ratio
(Intercept)	1.815	<0.001	0,593
property_crash	-0.883	<0.001	0.414
violatations	-0.506	<0.001	0.603
speed_role	0.928	<0.001	2.529
if_traffic	-0.852	<0.001	0.427
gender	-1.119	<0.001	0.327
income2	-0.541	<0.001	0.582
income3	-0.080	0.507	0.923
AIC	2960.5	-	-
X-squared	4.6897	0.196	-

Analyzing driving behaviors reveals a nuanced picture of how risk perception and traffic violations influence attitudes towards speed limits. An increase in accident likelihood does not straightforwardly lead to support for lower speed limits, suggesting a complex psychology at play where risk awareness doesn't always equate to safer driving decisions. Similarly, an uptick in fines for violations curiously deters the acceptance of speed limit reductions, possibly reflecting a misplaced confidence in personal speed management. This indicates a critical need for strategies that address the psychological aspects of driving to improve road safety.

Additionally, socio-economic and demographic factors play a significant role in shaping speed limit preferences. Women tend to support lower speed limits more than men, likely due to a stronger emphasis on safety. Meanwhile, individuals with moderate incomes, particularly those who frequently use highways, show a preference for reducing speed limits, highlighting the impact of driving environment on safety perceptions. These insights suggest that effective road safety measures must consider the diverse motivations and experiences of drivers, tailoring interventions to meet the complex landscape of driver behavior and preferences.

Multinomial Logistic Model

This section presents the findings of the statistical analysis on participants' choice of speed reduction alternative, based on the data collected in the third section of questionnaire survey. As explained above, participants were asked to choose among the three aforementioned alternatives regarding speed limit reduction.

Table 3. Multinomial Logistic Model

Parameters	βi	p-value	Odds Ratio
(Intercept):1	0.233	0.388	-
(Intercept):2	-0.477	0.023	-
Time	-0.026	0.005	0.450
Fuel	0.005	0.792	0.192
Accident	0.010	0.004	0.829
exp:1	-0.413	0.001	1.997
exp:2	-0.440	0.001	0.521
property_crash:1	0.485	0.000	0.652
property_crash:2	0.757	0.000	1.534
stat_deaths:1	0.826	0.000	0.690
stat_deaths:2	1.023	0.000	-
speed_role:1	-0.821	0.000	0.520
speed_role:2	-0.402	0.036	-
moto_risk:1	-1.119	0.000	1.398
moto_risk:2	-0.785	0.000	0.456
gender:1	0.843	0.000	2.323
gender:2	0.508	0.000	1.662
income:1	0.096	0.467	-
income:2	0.551	0.000	1.734
Log-Likelihood	-2338.5	-	-
Likelihood ratio test chisq	337.01	-	-

The model describes how respondents' choices are connected to the various variables of the model and provides a comprehensive picture of how it influences people's decisions to adopt one of the three options. The model's results can be used to understand how the necessary policy interventions for speed reduction and road safety improvement are affected.

Travel time is a significant factor for participants who show a clear preference for faster journeys as travel time increases, expressing their desire for no reduction in the speed limit. On the other hand, safety is also a primary goal for participants, with an increase in the rate of accidents or the likelihood of causing accidents making it more likely for them to desire a reduction in the speed limit. Information and awareness about road accident fatalities in Greece seem to significantly influence their decision, as does the perception of the dangers faced by motorcyclists on highways.

Furthermore, economic status and personal experience with accidents also play a role in preferences for speed limits. Individuals with an income between 10,000 and 25,000 euros and those who have personally been involved in accidents are more likely to wish for a reduction in the speed limit. Concerns about accidents and awareness regarding the cost of travel due to rising fuel prices indicate the complex dynamics that affect drivers' decisions. The summary of injuries and motorcyclist driving highlights the need for a more comprehensive approach to road safety, considering the variety of factors that influence decisions regarding speed limits.

Overall, individuals' perception of road accidents, fuel consumption, and the riskiness of motorcyclists plays a significant role in their decision regarding the speed limit on highways. It is important to consider these factors when formulating policies for road safety.

Conclusion

The research paper primarily aimed to explore the acceptance of reduced speed limits on Greek motorways, from 130 km/h to 120 km/h and 110 km/h. This exploration was grounded on existing literature emphasizing the adverse impacts of high speeds on road safety, air pollution, fuel consumption, and subsequent economic implications for the state.

Through the analysis, the binary logistic regression model pinpointed key variables, such as involvement in property crashes, traffic code violations, gender, and income, as significant determinants in accepting reduced speed limits. For instance, those involved in property damage accidents or having traffic code violations in the past three years were less inclined towards reduced speed limits. Conversely, respondents acknowledging the pivotal role of speed in accidents showed a higher acceptance rate for speed reductions. The multinomial logistic model further detailed how travel time, accident likelihood, driving experience, and the number of road crash deaths, among others, shaped the preferences of respondents. Factors like longer travel time, in-creased experience, and higher statistics of road deaths influenced resistance to speed limit reductions. These findings are instrumental for policy-makers and stakeholders in crafting effective and well-accepted interventions to promote road safety and sustainability in Greece.

Based on the above conclusions and observations, a series of areas for further research are proposed, including exploring the psychological factors affecting drivers' decisions to drive at high speeds despite the risks involved, examining technological solutions for safer driving, investigating the impact of economic factors on speed decisions, understanding the role of social and cultural values, exploring the effects of environmental factors on driving, investigating policy innovations to encourage safer driving, and evaluating the effectiveness of various speed restriction measures. These proposals aim to approach the issue of road safety in a more comprehensive and multidimensional way, seeking to provide the authorities with the tools for a more effective response to the challenge.

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