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Investigation of road accident severity per vehicle type

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Introduction

The effective treatment of road accidents and thus the enhancement of road safety is a major concern to societies due to the losses in human lives and the economic and social costs. Tremendous efforts have been dedicated by transportation researchers and practitioners to improve road safety. Although various research studies examining road accident severity have been found in international literature, only a few were carried out in Greece (Yannis et al., 2005; Theofilatos et al., 2012). Moreover, previous studies have shown the difference in severities between different types of vehicles. Consequently, the present study aims to contribute to existing knowledge by investigating road accident severity in Greece with particular focus on vehicle type, in order to identify the critical risk factors.

Objectives

The aim of the present study is the investigation of road accident severity per vehicle type. Three expressions of accident severity were examined: i) the number of fatalities divided by the total number of involved vehicles, ii) the number of severe injuries divided by the total number of involved vehicles and iii) the number of slight injuries divided by the total number of involved vehicles. Furthermore, separate accident severity models were developed for each type of vehicle.

Data and Methods

Accident data were collected from the Hellenic Statistical Authority's database, which includes disaggregate road accident data based on police accident records in Greece. More specifically, a 5-year period was considered for this study, namely from 2004 to 2008. Totally, 59,316 road accidents were recorded and 105,074 injured persons were involved.

Vehicle type	Car	Truck	Bus	Moped (<50cc)	Motorcycle (>50cc)
Fatalities	8.4%	12.7%	3.6%	6.3%	5.3%
Severe injuries	9.0%	9.9%	5.4%	12.3%	9.8%
Slight injuries	82.6%	77.4%	91.0%	81.4%	84.9%

The applied method of analysis is the lognormal linear regression.

$$Logy_i = \beta_0 + \beta_1 \chi_{1i} + \beta_2 \chi_{2i} + ... \beta_v \chi_{vi} + \varepsilon_i$$

where y is the dependent variable, β_0 is the beta coefficient of the constant term, β_1,..., β_v are the beta coefficients of the independent variables $x_{1i}, x_{2i}, \ldots, x_{vi}$ and ε_i is the error term. The subscript i corresponds to the individual or observation, where i=1,2,...k. It is noted that since a logarithmic transformation of the dependent variable y took place, the relationship of independent variables and y is not linear.

$$y = 10^{\beta_0 + \beta_1 \chi_{1i} + \beta_2 \chi_{2i} + ... \beta_v \chi_{vi}}$$

Three injury types are investigated (fatalities, severe injuries and slight injuries). Moreover, accident severity is explored for each type of vehicle separately. For example, when cars are examined, only accidents with at least 1 car involved are considered.

Results

The models for the number of fatalities divided by the total number of involved vehicles are illustrated. The models for the number of severe and slight injuries have a similar approach.

	Fatalities			
Independent variables	Moped (<50cc)		Motorcycle (>50cc)	
	beta coefficient	t-statistic	beta coefficient	t-statistic
Constant term	-1.314	-	-1.276	-35.34
Area type	n.s	-	n.s	-
Time	-0.019	-1.83	n.s	-
Rain	n.s	-	0.063	3.69
Other weather	n.s	-	n.s	-
Head-on crash	0.304	19.412	0.304	26.29
Rear-end crash	0.32	21.656	0.322	25.99
Collision with pedestrian	n.s	-	n.s	-
Side crash	0.302	35.745	0.270	30.41
Sideswipe crash	0.339	17.403	0.328	25.04
Collision with fixed	n.s	-	0.018	1.78
Run-off road	n.s	-	n.s	-
Other crash type	0.039	2.401	n.s	-
Median barrier	n.s	-	n.s	-
R^2	0.822		0.509	

	Fatalities					
Independent variables	Car		Truck		Bus	
	beta coefficient	t-statistic	beta coefficient	t-statistic	beta coefficient	t-statistic
Constant term	0.451	15.944	-1.372	-22.971	-1.160	-10.746
Area type	n.s	-	n.s	-	n.s	-
Time	n.s	-	n.s	-	n.s	-
Rain	0.044	6.516	0.030	2.039	n.s	-
Other weather	n.s	-	n.s	-	n.s	-
Head-on crash	n.s	-	0.317	21.699	0.348	4.784
Rear-end crash	0.077	6.446	0.335	14.436	0.382	6.932
Collision with pedestrian	-0.335	-41.928	n.s	-	n.s	-
Side crash	n.s	-	0.340	26.396	0.558	8.304
Sideswipe crash	0.074	4.654	0.257	5.751	n.s	-
Collision with fixed	-0.272	-39.713	0.084	6.159	n.s	-
Run-off road	-0.291	-42.337	n.s	-	n.s	-
Other crash type	n.s	-	n.s	-	n.s	-
Median barrier	n.s	-	n.s	-	n.s	-
R^2	0.506		0.651		0.734	

Conclusions

The effect of various parameters, such as crash type and weather conditions on accident severity was identified for each type of vehicle (car, moped, motorcycle, bus and truck). The results of the study can be proved useful for enhancing road safety in Greece. Further research could focus on examining additional parameters such as road geometrical characteristics, traffic parameters such as flows, speeds and so on. Furthermore, different areas and regions in Greece could be explored. In this case, other statistical methods could be explored as well, for example multilevel models.

References

1) Theofilatos, A., Graham, D.J., Yannis, G. (2012). Factors affecting accident severity inside and outside urban areas in Greece. Traffic Injury Prevention 13(5), 458-467.

2) Yannis G., Golias J., Papadimitriou E. (2005). Driver age and vehicle engine size effects on fault and severity in young motorcyclists accidents. Accident Analysis and Prevention, 37(2), 327-333.