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Analysis of speeding characteristics in Greece

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Abstract
The objective of this research was the **analysis of speeding characteristics** in Greece. Field measurement data on speed, vehicle type, road type, weather conditions and time period were used. **Three binary logistic regression models** were developed. The first one includes as dependent variable the exceeding of the speed limits with zero tolerance, even by 1 km/h (yes/no). In the next two models, the exceeding of the limits by 10 km/h or more and by 20 km/h or more respectively is considered. The results indicate that **motorcyclists** are more likely to exceed the speed limits compared to drivers of passenger cars, while the opposite is the case for other types of vehicles. In the **urban road network**, drivers are more likely to exceed the limits compared to motorways. In addition, the probability of exceeding the speed limits is lower in adverse weather conditions. Regarding weekends, the probability of exceeding the speed limits is lower compared to weekdays.

1. Introduction
Speeding, alcohol consumption, distraction and not wearing a helmet and seat belt are major causes of road crashes and injuries (Clarke et al., 2009; Thomas et al., 2013). Excessive speed is the **main cause in one third of all crashes** and collisions (OECD, 2006). Reducing the average speed by 1 km/h on the European road network could save 2.100 lives per year (ETSC, 2019). The objective of this paper is the analysis of speeding characteristics in Greece.

2. Data Collection
Field measurement data on speed, vehicle type, road type, weather conditions and time period were collected during the period November-December 2021 in Athens, Thessaloniki and Larissa. In total, the speed of **12.115 vehicles** in different weather conditions was recorded. The following summary tables present basic descriptive statistics of the collected data on speeding by road type and vehicle type. It emerges that 33% of the vehicles examined exceeded the speed limits by at least 1 km/h. The percentage of vehicles exceeding the speed limit by 10 km/h or more is 14%. The corresponding percentage for exceeding 20 km/h or more is 5%.

	Exceeding the speed limit			Exceeding the speed limit by 10km/h or more			Exceeding the speed limit by 20km/h or more		
Road Type	**Yes**	**No**	**Total**	**Yes**	**No**	**Total**	**Yes**	**No**	**Total**
Urban	2.902	3.731	6.633	1.301	5.332	6.633	451	6.182	6.633
Rural	686	2.557	3.243	322	2.921	3.243	107	3.136	3.243
Motorway	409	1.830	2.239	127	2.112	2.239	45	2.194	2.239
Total	**3.997**	**8.118**	**12.115**	**1.750**	**10.365**	**12.115**	**603**	**11.512**	**12.115**

	Exceeding the speed limit			Exceeding the speed limit by 10km/h or more			Exceeding the speed limit by 20km/h or more		
Vehicle Type	**Yes**	**No**	**Total**	**Yes**	**No**	**Total**	**Yes**	**No**	**Total**
Passenger Car	2.915	5.560	8.475	1.297	7.178	8.475	431	8.044	8.475
Motorcycle	495	657	1.152	232	920	1.152	105	1.047	1.152
Van	359	734	1.093	182	911	1.093	61	1.032	1.093
Truck	205	933	1.138	32	1.106	1.138	6	1.132	1.138
Other	23	234	257	7	250	257	0	257	257
Total	**3.997**	**8.118**	**12.115**	**1.750**	**10.365**	**12.115**	**603**	**11.512**	**12.115**

3. Statistical Methodology
Binary Logistic Regression was used due to the binary nature of the dependent variable (**speeding: yes/no**).

$$y_i = logit(Pi) = \frac{\ln Pi}{1 - Pi} = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \cdots + \beta_n x_{ni}$$

where:
n: number of independent variables,
$\beta_1, \dots, \beta_n$: regression coefficients of the independent variables $x_1, \dots, x_n$,
β_0 : constant term of the equation,
(Pi) : predicted probability (0-1).

Statistical tests: z-test, Accuracy, AIC, AUC, McFadden PseudoR^2

Elasticities of the independent variables have been calculated.

4. Results

Independent variables	Coefficients βi			Relative influence e*			Elasticity e		
	Speeding	Speeding 10+	Speeding 20+	Speeding	Speeding 10+	Speeding 20+	Speeding	Speeding 10+	Speeding 20+
Reference category: Passenger Cars									
Motorcycles	0,29	0,40	0,82	1,76	1,00	1,77	0,17	0,36	1,07
Van	-	-	-	-	-	-	-	-	-
Truck	-0,44	-1,45	-2,30	-2,39	-2,03	-1,52	-0,23	-0,73	-0,92
Other	-2,03	-1,79	-	-8,03	-2,25	-	-0,78	-0,81	-
Reference category: Athens									
Larissa	1,86	1,62	1,67	15,50	6,42	5,79	1,50	2,29	3,50
Thessaloniki	1,11	1,26	1,28	7,58	3,86	3,24	0,73	1,38	1,96
Reference category: Motorways									
Rural Road	-	-	-	-	-	-	-	-	-
Urban Road	1,83	1,53	0,94	21,18	6,77	2,35	2,04	2,42	1,42
Reference category: Good weather conditions									
Adverse weather	-0,49	-0,72	-0,94	-2,67	-1,28	-1,00	-0,26	-0,46	-0,60
Reference category: Weekday									
Weekend	-0,18	-0,72	-1,02	-1,00	-1,25	-1,04	-0,10	-0,45	-0,63

5. Discussion
Motorcyclists tend to exceed speed limits more than car drivers, especially when delinquent behaviour escalates, possibly due to a quest for excitement and adrenaline. Truck drivers are less prone to speeding compared to car drivers, and as delinquency increases, their tendency to speed decreases, possibly due to lower speed thresholds for trucks and heightened awareness among professional drivers.

On **urban roads**, it was observed that drivers are more likely to exceed speed limits than on motorways. One possible reason for this is that on average the speed limits on motorways are much higher than those on urban roads and drivers are more restrained from going too fast.

In the case of **exceeding speed limits by 10 km/h** or more, the influence of urban roads on speeding is greater. This may be due to the fact that drivers, knowing that they have exceeded the posted limits, but considering that they are within the legal-acceptable excesses, tend to exhaust the room for speed development.

Whereas, in the case of **exceeding speed limits by 20 km/h** or more, the influence of urban roads on speeding is reduced compared to the previous scenario. This may be due to the fact that the drivers are in an urban environment that does not allow speed limits to be exceeded to a very large extent due to heavy traffic congestion, the presence of traffic lights, pedestrian crossings, etc.

Moreover, drivers are less likely to exceed speed limits in **adverse weather conditions**. On weekends, drivers are less inclined to speed compared to weekdays, and as delinquency rises, the tendency to speed diminishes, likely because weekend trips are often for leisure, possibly on motorways, where the likelihood of exceeding the speed limit is lower.

6. References
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