PERGAMON

Transportation Research Part F 4 (2002) 243–256

TRANSPORTATION RESEARCH PART F

www.elsevier.com/locate/trf

An international comparative study of self-reported driver behavior

Ioannis Golias *, Matthew G. Karlaftis

Department of Transportation Planning and Engineering, Faculty of Civil Engineering, National Technical University of Athens, 5 Iroon Polytechniou St, Athens 157 73, Greece

Received 1 March 2000; received in revised form 17 September 2001; accepted 13 October 2001

Abstract

Using a large data base of 20,725 questionnaires from 19 European countries, this article uses a combination of factor analysis and tree based regression to determine driver groups with homogeneous self-reported behavior and determine whether regional differences in driving behaviors exist. Self-reported behavior, including speeding, reckless driving, seat belt use, and drinking and driving are examined. The results suggest that speeding and general reckless (dangerous) behavior are related, perhaps capturing a driver's ''risk taking'' or ''pre-trip violations'' behavior. Similarly, seat belt use and driving under the influence of alcohol are also related and may represent a driver's ''law abiding'' tendency or ''during-trip violations'' behavior. Further, important regional differences and similarities between European drivers are uncovered. Northern European drivers report a significantly higher compliance with drinking and driving laws and seat belt use regulations than do Southern and Eastern European drivers. © 2002 Published by Elsevier Science Ltd.

Keywords: Self-reported behavior; Regression trees; European drivers

1. Introduction

Traffic safety, despite the tremendous attention it has received in both the scientific literature and practice, still poses some staggering problems. In the European Union, 1.25% of

* Corresponding author. Tel.: +30-1-772-1327; fax: +30-1-772-1285/2404.
E-mail addresses: igolias@central.ntua.gr (I. Golias), mgk@central.ntua.gr (M.G. Karlaftis).

1369-8478/02/$ - see front matter
PII: S1369-8478(01)00026-2

the population will die an average 40 years sooner than expected, and 33% will be hospitalized as a result of road accidents (SARTRE, 1998). Approximately 45,000 people are killed annually and 1.6 million are injured in the 15 European Union member States (SARTRE, 1998).

Based on many road safety analyses, risky road user behavior can be identified and targeted. The challenge is to convince road users that the target behavior is assented to personal safety. For this to happen, the correct groups of drivers have to be targeted with appropriate messages. As a first step it is necessary to identify homogeneous groups of drivers whose behavioral characteristics can be considered. The question is whether homogeneous groups of drivers can be identified and whether regional differences play an important role in determining behavior.

The literature on self-reported driver behavior is indeed impressive. Parker, Lajunen, and Stradling (1998) examined aggressive driving behavior using a self-report questionnaire, while Lajunen, Parker, and Stradling (1998) examined the dimensions of driver anger, aggressive and highway code violations and found that both highway code and aggressive violations were significantly related to the anger factor. Shinar, Schechtman, and Compton (1999) examined the trends in safe driving behaviors in the USA and reported that only a weak association was found among the individual driving behaviors (wearing seat belts, avoiding drinking and driving and observing the speed limit). Shinar (1995) and Schechtman, Shinar, and Compton (1999) examined drinking habits and safe driving behaviors and reported that the use of seat belts and the observation of the speed limit were not systematically related, though the use of seat belts was negatively related to the amount of drinking.

Much work has also been done toward identifying accident causal factors, socio-economic characteristics that affect driver behavior, and driver groups that share common behavior. Lourens, Visser, and Jessurun (1999) summarize much of the literature relating accident involvement with various causal factors, Yagil (1998) examined gender and age-related differences in attitudes toward traffic laws and violations, and Caetano and Clark (2000) examined the differences in driving under the influence of alcohol between Hispanics, blacks and whites. McKnight and McKnight (1999) examine work done in the field of age-related driver ability. Quimby, Maycock, Palmer, and Buttress (1999) examine factors influencing a driver's choice of speed and the related literature. Shin, Hong, and Waldron (1999) discuss much of the literature regarding seat belt use. Finally, Shinar, Schechtman, and Compton (2001) examine and summarize much of the previous work regarding the self-reports of driving behaviors in relation to external factors (such as sex, age, education and income). Their findings suggest that seat belt use, observing speed limits and abstaining from drinking and driving are independent of each other, with one consistent effect: women reported higher observance rates on all behaviors.

The present study attempts to extend previous work by re-addressing the question of self-reported driver behavior. Driving habits such as speeding, reckless driving, seat belt use, and drinking and driving are examined using a large International (European) data base in a two-step process with two goals: First, to examine whether different self-reported behaviors are related in European drivers and, second, to uncover whether regional differences and similarities, a topic which has not been covered in the available literature, in self-reported behaviors exist.

Table 1
Region separation[a]

Northern Europe	Southern Europe	Eastern Europe
UK	Greece	Slovakia
Austria	Portugal	Slovenia
Belgium	Spain	Czech Republic
Finland	Italy	Poland
France	Ireland	
Germany		
Hungary		
Netherlands		
Sweden		
Switzerland		

[a] Ad-hoc separation.

Table 2
Characteristics of the sample examined

Characteristic	Mean	Standard deviation
Countries	19	–
Questionnaires	20 725	–
Men	9953	–
Women	6430	–
Age	41.80	14.62
Years of driving experience	9.7	6.1
Kms. driven in the last 12 months	16.196	2.721

2. Method and data

2.1. Data

The present study is based on the data provided by the SARTRE (1998) survey. [1] The basic data set used contains 20,725 observations from 19 European countries (Table 1). Each country provided a sample of at least 1,000 respondents, representative of the general driving population in terms of rural/urban balance, employment, sex, age, and city size (some of the basic descriptive characteristics for the sample used are presented in Table 2). The SARTRE questionnaire comprised of 131 questions covering four main categories of driver behavior: speeding, seat belt use, drinking and driving, and general reckless driving (the questions from the SARTRE survey used in this paper are presented in Tables 3 and 4).

[1] The entire SARTRE questionnaire, with over 131 questions and an extensive subject matter, are not presented here. The questionnaires along with detailed descriptions of the survey and sampling methodologies and procedures can be found in SARTRE (1998), at www.inrets.fr or from the authors of this paper upon request.

Table 3
Independent variables used in the study

Variable name	Symbol	Description
Sex	Sex	Binary variable for male versus female
Age groups	Age	Age groups: <19, 25–39, 40–54, >55
Regions	Reg.	Region groups: Northern, Southern, Eastern Europe
Annual Kms. travelled	Kms.	('000s) kms. groups: <5, 5–10, 10–15, 15–20, 20–30, >30
Vehicle engine (in cc)	cc	Engine groups: <1000, 1000–1299, 1300–2000, >2000
Question 3a	Penalties	Penalties for driving offenses should be more severe *Strongly agree*, *agree*, *neither*, *disagree*, *strongly disagree*
Question 12	Check 1	On a typical journey, how likely is it that you will be checked for speed?
Question 26	Check 2	On a typical journey, how likely is it that you will be checked for alcohol? *For questions* 12, 26: *never*, *rarely*, *sometimes*, *often*, *very often*, *always*
Question 18	Fined 1	In the last 3 years have you been punished for not wearing a seat belt?
Question 25	Fined 2	In the last 3 years have you been punished for not wearing a seat belt? *For questions* 18, 25: *no*; *yes*, *only fined*; *yes*, *fined and/or other penalty*
Question 43	Area	Areas: rural/village, small town, suburban, urban
Question 44	Exper. 1	Driver groups: professional, during work, to and from work, none of these
Question 48	Exper. 2	How much driving experience have you had (in years)?
Question 51	Income	On a scale from 1–8 (actual values depend on country)

Table 4
Driver behavior variables used in the study

Variable name[a]	Symbol	Description
Possible responses for Questions 10, 14, 16: *never*, *rarely*, *sometimes*, *very often*, *always*		
Question 10a	Speed 1	How often do you drive faster than the speed limit on Motorways?
Question 10b	Speed 2	How often do you drive faster than the speed limit on Main Roads?
Question 10c	Speed 3	How often do you drive faster than the speed limit on Country Roads?
Question 10d	Speed 4	How often do you drive faster than the speed limit in residential areas?
Question 14a	General 1	How often do you follow the vehicle in front too closely?
Question 14b	General 2	How often do you give way to pedestrians at crossings?
Question 14c	General 3	How often do you drive through a traffic light on amber?
Question 14d	General 4	How often do you overtake when you think you can just make it?
Question 16a	Belts 1	How often do you wear a seat belt in making a trip in town?
Question 16b	Belts 2	How often do you wear a seat belt in making a trip between towns?
Question 16c	Belts 3	How often do you wear a seat belt in making a trip on motorways?
Possible responses for Questions 21, 22: *every day*, 5 *to* 6, 3 *to* 4, 1 *or* 2, <1		
Question 21	Alcohol 1	How many days per week do you drive after drinking even a small amount of alcohol?
Question 22	Alcohol 2	Last week, how many days did you drive, when you may have been over the legal limit for drinking and driving?

[a] The original questionnaire numbering is retained for comparative purposes.

2.2. Methodology

The methodology used in this paper follows a two-step approach: First, factor analysis is used to identify relationships (correlations) between different self-reported driver behaviors; then, tree based regression analysis is used in an attempt to identify which external factors (regional and socio-economic characteristics) affect the related aspects of self-reported behavior indicated by factor analysis.

Hierarchical tree-based regression (HTBR) is a tree-structured nonparametric data analysis methodology that was first used in the 1960s in the medical and the social sciences (Morgan & Sonquist, 1963). An extensive review of the methods used to estimate the regression trees and their applications can be found in Breiman, Friedman, Olshen, and Stone (1984). HTBR is technically binary, because parent nodes are always split into exactly two child nodes, and is recursive because the process can be repeated by treating each child node as a parent. In essence, the HTBR algorithm proceeds by iteratively asking the following two questions: (i) which of the independent variables available should be selected for the model to obtain the maximum reduction in the variability of the response (dependent variable); and (ii) which value of the selected independent variable (discrete or continuous) results in the maximum reduction in the variability of the response? These two steps are repeated using a numerical search procedure until a desirable end condition is met.

The HTBR methodology has several attractive technical properties: it is nonparametric and does not require specification of a functional form; it does not require variables to be selected in advance since it uses a stepwise method to determine optimal splitting rules; its results are invariant with respect to monotone transformations of the independent variables; it can handle data sets with complex (nonhomogeneous) structure; it is extremely robust to the effects of outliers; it can use any combination of categorical and qualitative (discrete) variables; and, it is not affected by multicollinearity between the independent variables.

3. Results

In the first part, the results of the factor analysis are presented examining the relationships (correlations) between the four self-reported driver behaviors: speeding, dangerous driving, drinking and driving, and seat-belt use. The second part describes the findings of the relation between regional and socioeconomic characteristics and self-reported driver behaviors, using the HTBR methodology.

3.1. Related driver behaviors

The first step in the factor analysis was to extract an initial meaningful number of factors to be used in the subsequent analysis. Using the scree plot test (Cattell, 1966), the number of initial factors to be retained was two. The same result was obtained by using the ''proportion of variance'' criterion, which retains a factor if it accounts for a certain proportion of the variance in the

data set. Kim and Mueller (1978) suggest that a factor be retained if it accounts for at least 10% of the common variance.

After identifying the two potential factors, all questions were initially loaded on those factors. Subsequently, indicators with low communalities were excluded from further analysis. A multi-step iterative procedure was employed to obtain the final model. First, all questions with meaningful loadings on at least one factor were retained for further analysis (generally, loadings are meaningful if their value exceeds 0.50). Second, since it is desirable to include indicators in a factor analysis model that load highly on only one factor (Loehlin, 1987), different combinations of indicators were used until a robust solution was reached, in which indicators loaded highly (i.e., $>.60$) on only one factor. Third, the process was repeated until the analysis resulted in a small number of similar models (the same number of factors and similar indicators loading on the factors). And last, the final model was selected using Akaike's Information Criterion (AIC). This criterion suggests that the model with the smallest AIC value should be chosen as the best model (Bollen, 1989).

For this analysis, maximum likelihood factor analysis with promax rotation was used to estimate the factor loadings (promax is an oblique rotation, indicating that the factors are correlated). Table 5 reports the estimation results where it can be seen that seven questions load on the first factor and five questions on the second factor. All the loadings and communalities are high. The two common factors account for approximately 91% of the common variance.

The resulting factor structure suggests that speeding and general reckless (dangerous) behaviors are related, perhaps capturing a driver's "risk taking" tendency; it could also indicate a drivers' tendency toward "during trip" violations. Similarly, seat belt use and driving under the influence of alcohol are also related and may represent a driver's "law abiding" or "pre-trip" violations

Table 5
Factor loadings for safety questions

Question[a]	Rotated factor loadings		Communalities (h_j^2)
	Factor 1 (λ_{1j})	Factor 2 (λ_{2j})	
Speed 1	**0.87**	0.39	0.91
Speed 2	**0.83**	0.29	0.77
Speed 3	**0.89**	0.37	0.93
Speed 4	**0.81**	0.22	0.70
General 1	**0.77**	0.23	0.65
General 2	0.37	0.31	0.23
General 3	**0.84**	0.31	0.80
General 4	**0.76**	0.39	0.73
Belts 1	0.29	**0.81**	0.74
Belts 2	0.28	**0.89**	0.87
Belts 3	0.25	**0.85**	0.79
Alcohol 1	0.43	**0.79**	0.81
Alcohol 2	0.33	**0.73**	0.64
Proportion of total variance	0.59	0.32	
Cumulative proportion	0.59	0.91	

[a] Description of the questions appears in Table 4.

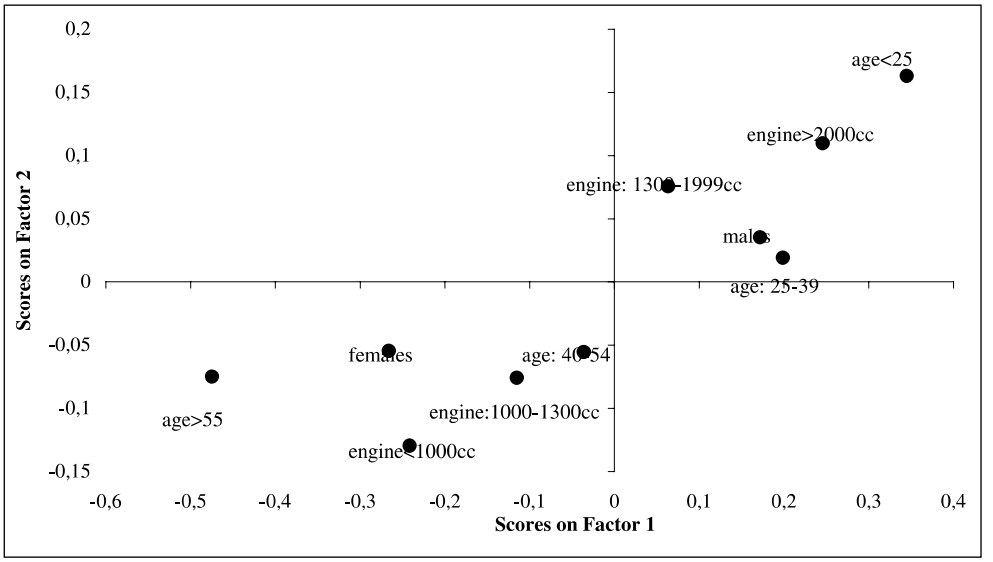

Fig. 1. Plot of Factor 1 against Factor 2 scores.

tendency. The results, in short, indicate that drivers who speed also tend to drive more dangerously (and vice versa), while drivers who report driving under the influence of alcohol also report that they do not use seat belts, but speeding and general dangerous driving are not highly related to seat belt use and driving under the influence of alcohol.

Fig. 1 depicts the factor scores for a variety of driver groups. This figure illustrates that drivers over 55 score low on both factors, while drivers under 25 score high on both factors (low scoring on Factor 1 means that drivers report that they do not speed and do not drive dangerously, and low scoring on Factor 2 implies that drivers report the use of seat belts and do not drive under the influence). Interestingly, drivers in the 25–39 age group score relatively high on Factor 1 (speeding and general dangerous driving) and quite low on Factor 2 (seat belt use and driving under the influence). Similarly, women, on average, report a much "safer" driving behavior (scoring low on both factors), while men score considerably higher on both factors; however, the main gender differences seem to be related more to risky driving than to law abiding. Finally, engine size seems to be an indicator of driver behavior as higher engine size is associated with higher scores on both factors.

3.2. The effect of exogenous factors on driver behavior

HTBR partitions the data into relatively homogeneous (low standard deviation) terminal nodes, and it takes the mean value observed in each node as its predicted value. In general, HTBR models can be fairly complex and detailed, and therefore difficult to illustrate mathematically. Nevertheless, the methodology lends itself to graphical "tree" representations.

The models shown in Figs. 2 and 3 are the results of the HTBR methodology applied to the factor scores obtained for Factors 1 and 2. It should be noted that *all* independent variables listed

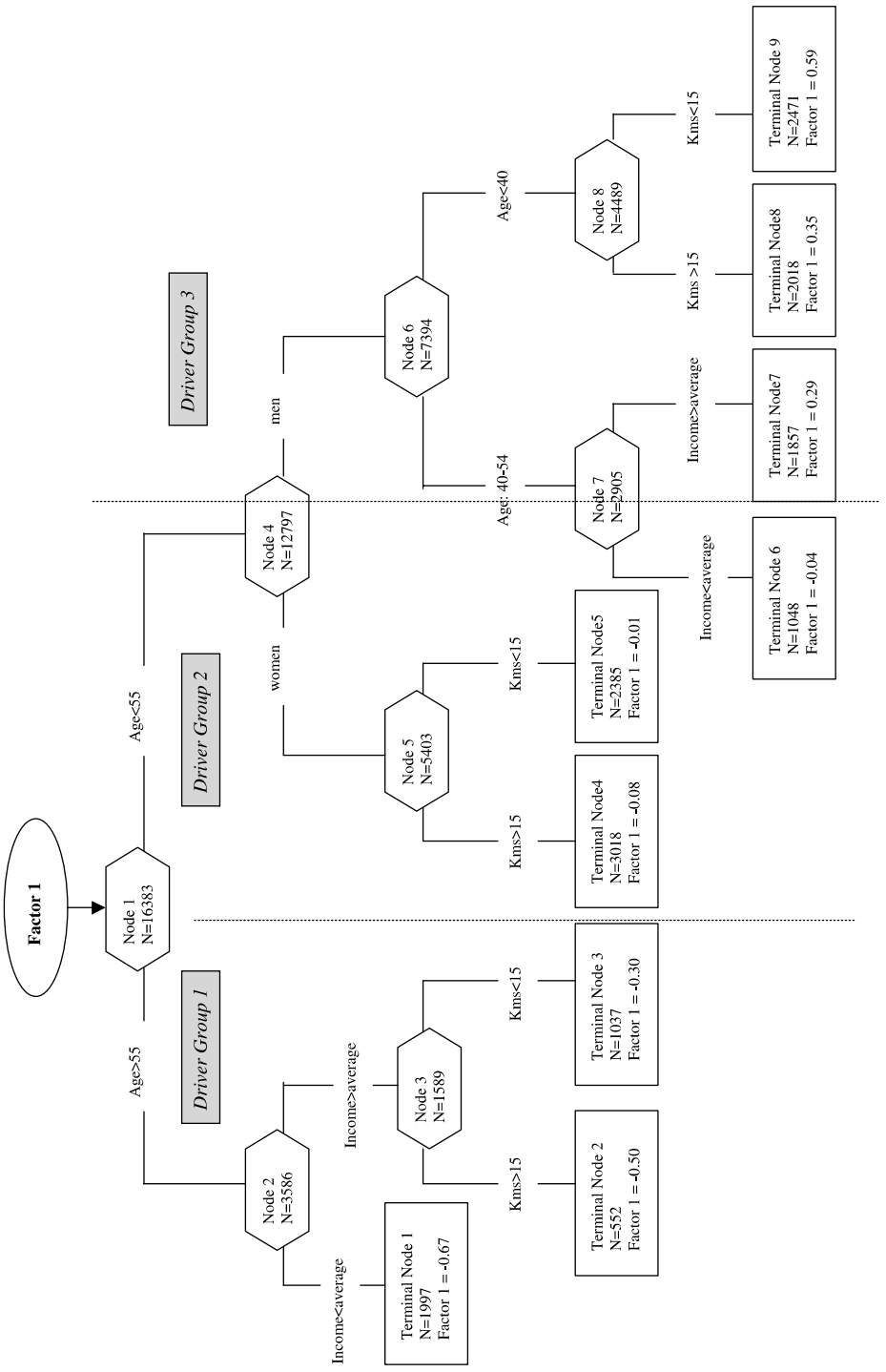

Fig. 2. Regression tree results for Factor 1.

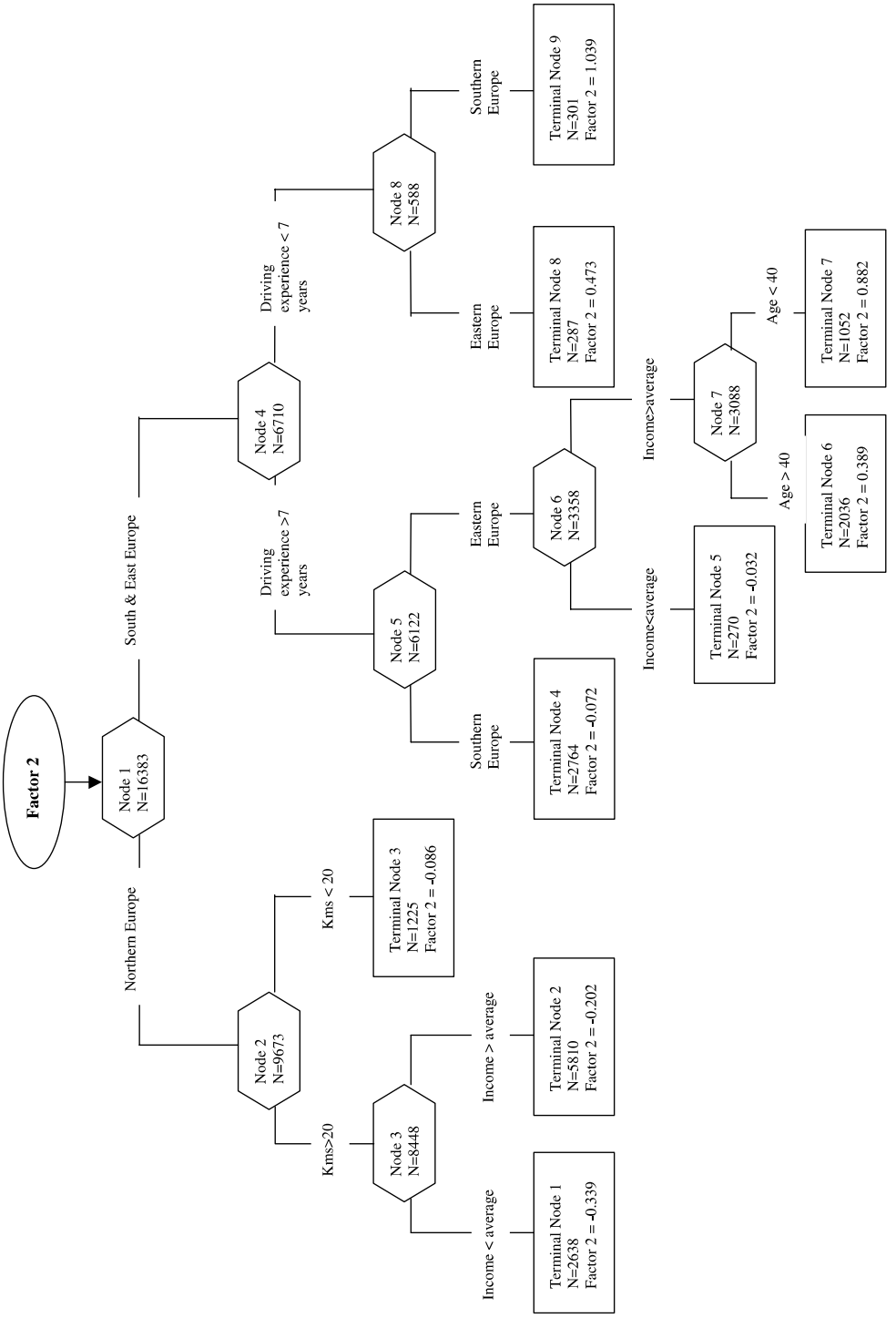

Fig. 3. Regression tree results for Factor 2.

Table 6
Independent variable importance for Factor 1: "full" tree model

Variable[a]	Relative importance (%)
Age	100
Kms.	73
Sex	68
Income	57
Penalties	47
Exper. 2	34
Exper. 1	32
Check 1	28
cc	25
Region	12
Fined 1	8
Area	7

[a] Description of the variables appears in Table 3.

Table 7
Independent variable importance for Factor 2: "full" tree model

Variable[a]	Relative importance (%)
Region	100
Exper. 1	51
Income	40
Kms.	38
Age	33
Sex	31
cc	23
Penalties	8
Exper. 2	7
Check 2	7
Area	3
Fined 2	1

[a] Description of the variables appears in Table 3.

in Table 3 were used as predictors in the tree-based regression analysis. The exclusion of some variables from Tables 6 and 7 was done on the basis of chi-square tests. Interpreting the trees is rather straightforward. The top of the tree, or root node, shows that for Factor 1 (speeding and general dangerous driving behavior), the first optimal split occurs on *age*, separating individuals over 55 from all others. In other words, the single best variable to explain the variability in Factor 1 is *age*. Assume for the moment that individuals under 55 are considered. Conditional on this, the next best explanatory variable is *sex*. For women, the next best split occurs with annual kilometrage (Kms); women driving more than 15,000 kms annually go to the left forming what is called a terminal node, or leaf of the tree. For this category of drivers, the mean factor score for

Factor 1 is −0.08. Terminal nodes to the left of this tree indicate drivers who do not report speeding or driving dangerously.

The first optimal split for Factor 2 occurs on *region* (countries and regions are defined, as previously mentioned, in Table 1). That is, Northern European drivers report that they use seat belts and do not drive under the influence, in contrast to Southern and Eastern European drivers. Income, age, driving experience and annual kilometers driven are the other important splitters.

The HTBR methodology also permits the calculation of variable importance scores. To calculate this score, the software used in this research (CART, Steinberg & Colla, 1995) considers the improvement measure attributable to each variable in its role as a surrogate to the primary split. The values of these improvements are summed over each node and totaled, and are then scaled relative to the "best" performing variable. As a result, the variable with the highest sum of improvements scores 100, and all other variables will have lower scores ranging downwards towards zero. The relative importance of the independent variables in explaining Factors 1 and 2 appear in Tables 6 and 7. It is interesting to note the differences in the variables that "explain" Factors 1 and 2. While *age* is the most important variable for Factor 1 (Table 6), *region* is the most important variable for Factor 2.

4. Discussion

This work presented in this paper investigates the existence of different aspects of self-reported driver behavior as well as the possible relations among them, and attempts to uncover causal factors that affect these behaviors. The study used a two-step approach. First, factor analysis was used to determine the aspects of driver behavior that are related and, second, tree based regression was used to uncover which causal factors affect driver behavior.

The use of factor analysis revealed that speeding behavior is strongly related to other dangerous driving behavior, while seat belt use and driving under the influence of alcohol are also closely related, forming a separate driver behavior group. While drivers tend to think similarly about drinking and driving and seat belt usage, they do not seem to think the same about seat belt use and reckless driving or speeding. The results seem to imply that drivers who speed also tend to drive more dangerously (and vice-versa), while drivers who report driving under the influence of alcohol also report that they do not use seat belts, but speeding and general dangerous driving are not highly related to seat belt use and driving under the influence of alcohol. Interestingly, the literature on driving and drinking being related to seat belt usage reports mixed findings. Gregersen (1996) and Williams (1997) reported that sensation seekers drive very often without a safety belt and under the influence of alcohol. Schechtman et al. (1999), on the other hand, reported that use of safety belts and observing the speed limit were *not* systematically associated with drinking habits.

When age is considered, drivers seem to be more law abiding (Factor 2) and less risk taking (Factor 1) as they grow older (Fig. 1). It should also be mentioned that drivers over 55 years old, seem to drive distinctly more carefully than younger drivers, while those below 25 years

old seem to exert a distinctly less law abiding approach to driving or are more prone to during trip violations. With regards to sex, women drive, in general, considerably safer than men, while when it comes to obeying highway code restrictions, differences between them become less significant.

The above findings are reinforced by the tree structured data analysis methodology (tree based regression approach) carried out for Factor 1. The corresponding outcome shows that age, especially for drivers above and below 55 years old, is the variable with the best explanatory power. Then, for drivers below 55, the highest explanatory power is obtained with the variable sex, determining that men below 55 is the group with the most dangerous driving behavior. That is, in terms of dangerous driving, drivers can be separated into three relatively homogeneous groups: (i) drivers above 55 years old (demonstrating the least risk taking group); (ii) women drivers below 55 years old (exception to this more general split are men drivers between 40 and 54 years old with below average income who are included in this group); and, (iii) male drivers below the age of 40 (or between 40 and 54 with income above average). No other driver group can be clearly identified beyond the above three. It should be noted that, in this context, men and women above 55 years old do not present significant differences.

Stated behavior concerning seat belt use and driving under the influence, as captured by Factor 2, may be considered as reflecting a general willingness to abide by the highway code, i.e. "legal" driving behavior. The tree structure analysis on Factor 2 scores seems to reveal that *regional* differences is the most important determinant, with Northern European drivers demonstrating a more law abiding driving behavior. However, when it comes to each region separately, higher driving experience is related to more "obedient" driving behavior. Thus, three homogeneous driver groups may be distinguished for Factor 2, with experienced drivers from Northern Europe allocated to the most law abiding group, and inexperienced drivers from South and East Europe allocated to the least. The middle driver group includes inexperienced drivers from Northern Europe and experienced drivers from Southern Europe.

The variable with the next highest explanatory power appears to be the level of income, with higher income leading, in general, to less law abiding driver behavior. However, it is noted that consideration of this variable does not lead to considerably different behaviors, except for experienced East European drivers who, on the basis of low or high income, are allocated to the middle or least law abiding driver group. Finally, as far as Factor 2 is concerned, it should be noted that inexperienced Southern European drivers show a distinctly less law abiding behavior not only within their group, but in total. The above results seem to indicate that efforts toward convincing people to drive in a less risky way (as captured by Factor 1), should mainly be directed toward younger male individuals, preferably less than 25 years old. As far as seat belt usage and driving under the influence is concerned, policies should be directed toward inexperienced and lower income drivers.

Finally, it should be noted that significant regional differences exist, reflecting perhaps the individualities related to the mentality and history of each region; these differences should play an important role in planning safety campaigns and policies. For example, the findings suggests that, on one hand, regional differences in self-reported behavior toward speeding and general reckless driving do not appear significant, while on the other hand regional differences are the most important determinant of self-reported behavior toward seat-belt use and driving under the

influence. This could imply that safety campaigns and policies targeting speeding and reckless driving should concentrate on characteristics such as age, experience, sex and income, while policies targeting seat-belt use and driving under the influence should concentrate primarily on regional differences and characteristics and, within regions, on characteristics such as experience and income.

Acknowledgements

The authors would like to thank two anonymous reviewers and the editor for helpful comments on earlier versions of this paper.

References

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley and Sons.

Breiman, L., Friedman, J., Olshen, R., & Stone, C. (1984). *Classification and regression trees*. Belmont, CA: Wadsworth International Group.

Caetano, R., & Clark, C. L. (2000). Hispanics, blacks and whites driving under the influence of alcohol: results from the 1995 National alcohol survey. *Accident Analysis and Prevention*, *32*, 57–64.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavior Research*, *1*, 245–276.

Gregersen, N. P. (1996). *Young car drivers, (VTI rapport 409A)*. Linkoping: Swedish Road and Transport Institute (VTI).

Kim, J. C., & Mueller, C. W. (1978). *Factor analysis: statistical methods and practical issues*. Beverly Hills, CA: Sage.

Lajunen, T., Parker, D., & Stradling, S. G. (1998). Dimensions of driver anger, aggressive and highway code violations and their mediation by safety orientation in UK drivers. *Transportation Research F*, *1*, 107–121.

Loehlin, J. C. (1987). *Latent Variable Models*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Lourens, P. F., Visser, J. A. M. M., & Jessurun, M. (1999). Annual mileage, driving violations, and accident involvement in relation to drivers' sex, age, and level of education. *Accident Analysis and Prevention*, *31*, 593–597.

McKnight, A. J., & McKnight, A. S. (1999). Multivariate analysis of age-related driver ability and performance deficits. *Accident Analysis and Prevention*, *31*, 445–454.

Morgan, J. N., & Sonquist, J. A. (1963). Problems in the analysis of survey data, and a proposal. *Journal of the American Statistical Association*, *58*, 415–434.

Quimby, A., Maycock, G., Palmer, C., & Buttress, S. (1999). *The Factors that influence a driver's choice of speed—a questionnaire study*. Crawthorle: TRL (TRL Report 325).

Parker, D., Lajunen, T., & Stradling, S. (1998). Attitudinal predictors of interpersonally aggressive violations on the road. *Transportation Research F*, *1*, 11–24.

Social Attitudes to Road Traffic Risk in Europe (SARTRE) (1998). *The attitude and behavior of european car drivers to road safety*. Brussels: Belgium.

Schechtman, E., Shinar, D., & Compton, R. C. (1999). The relationship between drinking habits and safe driving behaviors. *Transportation Research F*, *2*, 16–26.

Shin, D., Hong, L., & Waldron, I. (1999). Possible causes of socio-economic and ethnic differences in seat belt use among high school students. *Accident Analysis and Prevention*, *31*, 485–496.

Shinar, D. (1995). Drinking and driving of pub patrons in Israel. *Accident Analysis and Prevention*, *27*, 65–71.

Shinar, D., Schechtman, E., & Compton, R. (1999). Trends in safe driving behaviors and in relation to trends in health maintenance behaviors in the USA: 1985–1995. *Accident Analysis and Prevention*, *31*, 497–503.

Shinar, D., Schechtman, E., & Compton, R. (2001). Self-reports of safe driving behaviors in relationship to sex, age, education and income in the US adult driving population. *Accident Analysis and Prevention*, *33*, 111–116.

Steinberg, D., & Colla, P. (1995). *CART: classification and regression trees*. San Diego, CA: Salford Systems.
Williams, A. F. (1997). *Graduated licensing and other approaches to controlling young driver risk taking*. Arlington: Insurance Institute for Highway Safety.
Yagil, D. (1998). Gender and age-related differences in attitudes toward traffic laws and traffic violations. *Transportation Research F*, *1*, 123–135.