An Empirical Investigation of European Drivers' Self-Assessment

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ABSTRACT

Evaluating motorist self-assessment has attracted much interest in the literature. This is mainly due to the profound impact various parameters of self-assessment can have on the way motorists deal with hazardous traffic situations and, most importantly, in the effectiveness of safety information campaigns. Much of the previous work in this area has been hampered both by the lack of adequate sample sizes and, because of the small samples, the evaluation methodologies used. This paper extends previous research in two significant directions; first, it utilizes the SARTRE 2 data base which provides more than 17,000 questionnaires from most European countries; second, it employs the ordered probit modeling approach which recognizes the latent nature of self assessment and explicitly links its dimensions to a set of relevant explanatory variables such as age, gender, region, income, etc. The results indicate that drivers who rate themselves as both more dangerous and faster than others are, usually, younger men, with higher income, break the speed limit more frequently, avoid wearing seat belts and have been involved in more accidents in the past than other drivers. Interestingly, more experienced and more highly educated drivers assess their driving as less dangerous, but admit to driving faster than other drivers

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Introduction

Road accidents pose an intense social problem. In the European Union, 1.25% of the population will die on average 40 years earlier and 33% will need hospital treatment as a result of traffic accidents. In the 15 countries members of the European Union, almost 45 thousand people are killed every year and 1,6 million are injured due to road accidents. Researchers have frequently suggested that some of the factors that are responsible either independently or in combination for the cause of a road accident are three: i. the human factor; ii. the road environment; iii. the vehicle. The human factor is exclusively responsible for the cause of almost 60% of road accidents and is involved in almost the 90% of the cases (Sabey and Taylor, 1980; Green and Senders, 1997). Drivers themselves most frequently attribute the main responsibility for accidents to the human factor (SARTRE 2, 1998), while unfavorable weather and bad vehicle condition also seem to play a significant role in the cause of a road accident (Badger, 1996; Beenstock and Gafni, 2000).

The term "human factor" does not clearly define which characteristics of the drivers contribute to the cause of road accidents. As a result, it is not possible to center on the target groups of "high danger" (Wilde, 1997; Sabey and Taylor, 1980; Badger, 1996). Some researchers believe that the main factors related to road users are the lack of abilities, the perception errors, the influence of alcohol, excessive speed, incorrect handling, lack of experience, and fatigue (SARTRE 2, 1998; Sabey and Taylor, 1980). On the other hand, Badger (1996) reports that most drivers do not become dangerous due to limited abilities but because their attention is detached, even if only for a moment.

In the available literature accidents have been associated with everything from mud flaps to poor eyesight, low barometric pressure, anti-social tendencies, road geometry, speeding, alcohol use, driver age and gender, weather conditions, and so on. Despite the extensive work done connecting various exogenous factors to road accidents, the "human factor" still remains relatively under-researched especially when considering its involvement in traffic accidents. In an effort to further examine the human involvement in accidents this paper extends previous work in

the area of motorist self-assessment. This aspect holds a significant role in the road behavior of motorists and in their reaction towards a road safety campaign (Delhomme, 1997; Delhomme, 1991). It is important to note that this topic, despite its theoretical and practical importance, has been dealt with in the available literature either with the use of fairly simple statistical testing techniques or with the use of limited samples of drivers. The aim of this paper is to investigate and quantify various exogenous factors affecting motorist self-assessment. To achieve this, the present paper develops an ordered probit model with the use of more than 17000 questionnaires that were collected during the SARTRE 2 research. The remainder of this paper is organized as follows. The next Section reviews many of the concepts and findings of previous work in the area of motorist self assessment. The third Section briefly describes the data set used for this study and discusses the ordered probit approach used. The fourth Section presents the estimation results and the fifth Section offers some concluding remarks.

Background

Motorist self-assessment is defined as the value that a driver attributes to his personal driving characteristics. When a driver declares that he has “greater driving abilities than the average driver”, it is possible to believe that he complies better with the rules of a situation for the handling of which the driving abilities need to be "good" (Delhomme, 1991). Motorist self assessment is a *comparative* dimension, using other motorists as the reference point, and there are many parameters on the basis of which motorists, intentionally or unintentionally, cultivate their opinions regarding how much better or worse they consider their driving.

In general, a person usually presents himself to be more compliant with the regulations of a situation than other people do and believes that his achievements are far above the average (Delhomme, 1991). This can be observed for both positive and negative features: individuals tend to state that they behave more frequently in a positive manner and less frequently in a negative manner than others do. This could be attributed, according to Delhomme (1997), to a *false consensus*. Motorists for example have, incorrectly, the belief that attitudes condemnable by a

legal authority (negative behaviors) exist in the majority of people, so there is a majority of people who find it normal to adopt negative behaviors (Delhomme, 1997). The opposite can be observed in the case of behaviors that are acceptable by a legal authority (positive behaviors). Most people believe that very few others display the same positive behavior as they do (Delhomme, 1997). In this way, people legitimize their own negative behaviors and distinguish themselves from others with regard to positive behaviors. In other words, people consider their errors as something normal and their abilities as something rare (Delhomme, 1997). This phenomenon is related to the conflict between two simultaneous, complementary and contradictory procedures: on one hand is the need of a person for social conformity, standardization and de-individualization and on the other hand is a person's search for social differentiation and individualization (Delhomme, 1991; Codol, 1975). This *superior conformity of self-behavior* explains the sense of relative superiority of humans (Delhomme, 1991). It is a bias that has been empirically shown in many self-versus-others comparison contexts (Codol, 1975) and therefore finds an application in the subject of motorist self assessment as well since according to Delhomme (1997), during the last twenty years it has been shown that drivers disguise their judgment when they refer to their own driving characteristics compared to that of other drivers. This disguise is expressed among others as a sense of singularity, exaggerated self-confidence, unrealistic optimism, personal superiority and bias that somebody is invulnerable. All these implications can have a direct impact on the effectiveness of a road safety campaign (Delhomme, 1997).

Driving is not an exception to this bias, as most of the drivers overestimate their own driving abilities compared to that of others (bias of personal superiority) (Delhomme, 1997; Delhomme, 1991). A survey of French drivers showed that almost 60% believe they are superior to other drivers (Delhomme, 1991), while the 90% of the drivers in Finland consider themselves better than the “average driver” (Näätänen and Summala, 1974) This assessment in terms of ability and of a sense of safety regarding driving abilities has also been reported in a percentage between 75% to 90% of the drivers in Sweden and in the U.S.A. (Delhomme, 1991; Svenson, 1981) and 69% among the drivers in Poland (Delhomme, 1991). This excessive self-assessment has also been reported in Great Britain, in Spain and in West Germany (Delhomme, 1991), while

it has been observed and in a percentage of almost 80% among the drivers in New Zealand. It is probable that the confidence drivers have on their abilities gives them a sense of driving safely, when in fact they may not. Moreover, the majority of drivers who believe that they drive "safer" than the average driver do state that they avoid driving on a motorway at night, thinking that other drivers are dangerous thus strengthening their impression that they drive safely. Consequently, drivers from all over the world consider (in percentages between 60% and 90%) that their driving "is better than that of the average driver"; but, this high assessment is limited when the drivers compare themselves with the "very skillful" driver (Delhomme, 1991). This exaggerated confidence on their abilities is a characteristic of the drivers who believe that they are more skillful than others (Matthews and Morgan, 1986), and could motivate the road users not only to display dangerous behaviors but also to persist on these behaviors (Delhomme, 1997).

Previous work relating motorist self-assessment with various exogenous characteristics has shown varying degrees of bias depending on gender, age and driving experience, even though authors do not agree on the magnitude of these effects (Delhomme, 1991; Matthews and Morgan, 1986). For example, there is no clear evidence of a systematic relation between gender and self-assessment (Delhomme, 1997; Delhomme, 1991), but age and self-assessment are related (Delhomme, 1991; NHTSA, 1993). Young drivers (18-24 years old) have higher self-assessment than other drivers even when compared to their peers (NHTSA, 1993), despite the fact that it is quite probable for these drivers to be involved in road accidents (in France 30% of people killed are between 18 and 24, even though these ages represent only 10% of the driving population); this shows that young drivers tend to neglect their lack of experience and do not possess a realistic aspect of their own driving capabilities (Delhomme, 1991; Badger, 1996). In recent work the influence of previous accident involvement in motorist self assessment has been investigated. It generally appears that the connection is uncertain and that further empirical evidence is required (this may be due to the lack of adequate sample sizes) (Delhomme, 1991). Moreover, motorists who have been involved in an accident persistently refuse the idea that they can be responsible for the cause of an accident and overestimate their driving abilities considering that they handle better than anyone else the complicated driving situations (Delhomme, 1997).

Apart from personal characteristics, self assessment has also been related to the conformity of motorists to road safety regulations. Violations during driving are defined either as failure to comply with the Highway Code (Delhomme, 1997; Stradling et al., 1998), or as a deliberate deviation from those practices believed to be necessary in order to maintain the safe operation of a potentially dangerous system (Reason et al., 1990). However, there is a discrimination between the violations that are related with personal protection (seat belt use) and violations that increase other road users' risk as well (Delhomme, 1997). Most drivers, independently of whether they consider themselves better, same or worse than others, believe that they generally commit violations less frequently than other drivers do.

Interestingly, the concequences of exaggerated self assessment on road safety campaigns and on risk-taking are significant (Delhomme, 1991). On one hand, this phenomenon could offer drivers a sense of safety, as they overestimate the degree of control that they reserve upon all traffic situations (*optimism bias*) (Delhomme, 1991). As a result, the drivers with a sense of driving superiority do not believe that road safety campaigns refer to them and this must be taken into account during the planning of such campaigns (Delhomme, 1997; Delhomme, 1991). On the other hand, this exaggerated motorist self-assessment may also have positive effects on driving behavior since it leads to a greater attention towards the behavior demonstrated by other motorists, showing a promptness of drivers to be ready to face unexpected actions from other motorists (Delhomme, 1997; Delhomme, 1991).

New and continuously evolving technologies adopted in vehicles are expected to facilitate the interaction between humans, vehicles and the road environment, as they supplement and assist human actions (Rekenthaler, 1998); this will probably result in the human factor participating at a decreasing pace in the activity of driving (SARTRE 2, 1998). The main goal of traffic safety is then to make it easier for the driver to read and understand the road signs, to find the quickest and/or most efficient route to a destination, to avoid collisions and to remain in his own lane. But, all this rapidly evolving technology will probably have an effect on motorist self-assessment. The use of automated systems into a vehicle could give a driver the illusion of more control during driving and could quite conclusively affect his self assessment (Matthews and

Desmond, 1995). A theme of current research interest is then to try and control how information can be provided at the right time and under the proper form to improve driver abilities (Rekenthaler, 1998).

The Data and Methodological Approach

The Data

This paper is based on the data provided by the second SARTRE (1998) survey. The objective of this survey is to describe actual driving population opinions and self-reported behaviors toward traffic risk and road safety issues in the participating countries (Table 2).[3] The SARTRE survey is repeated every three to four years, with the first survey completed in 1995 and the third being currently completed, to further attempt to track changes in self-reported behaviors with time. The basic data set of the second SARTRE survey used in this paper contains 20,725 observations from 19 European countries.[4] In all, the questionnaire comprised of 131 questions covering four main categories of driver behavior: speeding, seat belt use, drinking and driving, and general reckless driving. The survey began on the 1st of October 1996 in The Netherlands and ended on the 17th of April 1997 in Hungary.

In each country, the survey attempted to select a representative sample of the actual car drivers. To this end, each country provided a sample of at least 1,000 respondents, representative of the general driving population in terms of rural/urban balance, education, sex, age, and city size. The survey itself was done using personal home-based face-to-face interviews with eligible respondents at randomly selected households. In cases where more than one eligible respondents were present at the time of the interview, a random selection key, based on date-of-birth, was applied to choose the actual respondent. Unfortunately, no consistent records were kept across

[3] 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.

[4] The original data set of 20,725 observations was truncated to almost 17,000 observations because of the missing values of the dependent variables; that is, the models presented in the next Section cannot account for missing values in the *dependent* variable and, as such, the observations with missing values were discarded.

different countries regarding either the unavailability of eligible respondents or the refusal to participate in the survey.

The unavailability of consistent non-response statistics naturally raises the issue of *non-response bias* frequently present in similar surveys, especially those with lengthy questionnaires. To account, to the extent possible, for this bias, particular care was given both to the representative nature of the respondents to the survey (with respect to the demographic characteristics discussed above) and to completing an extensive sample from each country. This, of-course, does not mean that the covariance structure of the responses is unbiased or that the results reported are free from the non-response bias, but that an effort was explicitly made to address the problem. As previously mentioned, it is unfortunate that accurate non-response statistics were not kept for the entire sample and as such the non-response bias cannot be evaluated.[5] Nevertheless, it should be mentioned that, for the purposes of this analysis, the sample size of almost 17,000 respondents is high and, in any case, much higher than the sample sizes used in much of the previous research.

The Ordered Probit Approach

The ordered probit model, originally used in the social sciences to model unobservable characteristics in a population, assumes the existence of an underlying continuous unobservable random variable (McCullagh 1980). In the context of this analysis the ordered probit model is used to construct a discrete motorist self-assessment model where the rating given, which takes values ranging from 0 to 4 (Table 1), is an *indicator* of the true self-assessment. As a result, this type of model enables researchers to capture the *latent* (unobservable) nature of self-assessment.[6]

[5] Personal communication with the group that conducted the survey in Greece revealed a non-response rate of approximately 15% (for Greece).

[6] The ordered probit model is a well established econometric methodology which, as described above, attempts to account for answers to questionnaires where the scale of the possible responses is ordered in nature. In theory, a respondent to a questionnaire could select to give any response he/she felt would be appropriate; but, a questionnaire "constrains" the respondent to a pre-specified choice of outcomes. As such, a "true" response is not actually observed, only the pre-specified choice closer to the "true" response. It is in this sense, i.e. the inability to observe the "true" response, that the term *latent* is used. The ordered probit model does not belong in the general family of "latent variable models" nor is its estimation based on the same principles.

The dependent variable, y_i , is an *indicator* (rating) of the true latent self-assessment. This latent assessment, y_i^*, is a function of exogenous variables, X_i, such as age, experience, education, income, etc. Following Greene (1993), the ordered probit model is built around a linear-in-the-parameters latent regression, linking the latent self-assessment y_i^* and a set of observable exogenous variables as follows:

$$y_i^* = \beta' X_i + \varepsilon_i \quad (1)$$

where,

β = a vector of parameters to be estimated

X_i = a vector of exogenous variables for individual *i*

ε_i = random error term; and $\varepsilon_i \sim N[0,1]$

The variance of ε_i is assumed to be 1.0 since as long as y^*_i, β and ε_i are unobserved, no scaling of the underlying model can be deduced from the observed data (Greene 1993). The above relationship cannot be directly estimated, since y_i^* is unobservable. What is *actually observed* is the rated self-assessment in two questions (see Table 1). These ratings, y (i.e. the *indicators* of y_i^*) are used in the estimation of the self-assessment model. As a result, what is actually observed in the case of rated self-assessment is:

$y = 0$ if $y^* \le \mu_0$,

$y = 1$ if $\mu_0 \prec y^* \le \mu_1$,

$y = 2$ if $\mu_1 \prec y^* \le \mu_2$,

$y = 3$ if $\mu_2 \prec y^* \le \mu_3$,

$y = 4$ if $\mu_3 \prec y^*$.

The μ's are unknown parameters that are estimated along with β. Respondents to the survey have their own intensity of feelings regarding their specific self-assessment, which depends

on certain measurable factors, X_i (such as gender, experience, age, etc.), and certain unobservable factors, ε_i. Theoretically, respondents could assign their own y_i^* if they were "allowed" to do so. Given the five possible outcomes (Table 1), they choose that which *most closely represents their own evaluation of their self-assessment.* The parameters $\mu_0,\ldots,\mu_3$ represent the thresholds that map the continuous values of y_i^* into the discrete values of y .

To generalize this formulation, suppose that the possible responses to a question about self assessment, similar to the one shown in Table 1, are coded 0, 1, 2, ... , *J* (in our case *J* = 4). Then, the vector of normalized threshold parameters can be written as (Greene 1993):

$$\boldsymbol{\mu} = \mu_o \ \mu_1 \ \ldots \ \mu_{J-1}$$

in which $\mu_o = 0$

Then, for the *i*th individual (respondent), the basic ordered probit model can be written as (Greene 1990):

$$\Pr ob[y_i = j] = \Phi[\mu_j - \beta' X_i] - \Phi[\mu_{j-1} - \beta' X_i] \qquad (2)$$

where, $\Phi(.)$ = the CDF (Cumulative Distribution Function) of the normal distribution

and, $0 \le j \le J$

For each of the individual respondents, the following are the resulting probabilities for the ordered probit model:

$$\begin{aligned}
\Pr ob(y = 0) &= \Phi(-\beta' X_i) \\
\Pr ob(y = 1) &= \Phi(\mu_1 - \beta' X_i) - \Phi(-\beta' X_i) \\
\Pr ob(y = 2) &= \Phi(\mu_2 - \beta' X_i) - \Phi(\mu_1 - \beta' X_i) \\
\Pr ob(y = 3) &= \Phi(\mu_3 - \beta' X_i) - \Phi(\mu_2 - \beta' X_i) \\
\Pr ob(y = 4) &= 1 - \Phi(\mu_3 - \beta' X_i)
\end{aligned}$$

Assume that a data set is available consisting of self assessment ratings, y_i, for *i* individuals. With these data, Maximum Likelihood Estimation is used to obtain the value of the parameter vector

$\boldsymbol{\beta}$ and the thresholds $\mu_0,\ldots,\mu_3$ simultaneously. The Likelihood Function of the ordered probit for self assessment rating *i* is given as follows (Greene 1993):

$$\ln L = \sum_i \ln L_i = \sum \ln \Pr ob[Y_i = y_i] \quad (3)$$

where,

Y_i = the theoretical random variable

y_i = the observed self assessment rating for a particular individual *i*

Estimation Results

As briefly mentioned in the previous section, the SARTRE survey examined two dimensions of motorist self-assessment (Table 1). The first question concerns how dangerous drivers consider themselves in relation to others, while the second question concerns driving speed in relation to other drivers. Of-course, self-assessment has a number of other dimensions that could be examined but these were not covered in the available survey; but, the two questions addressed are important based on previous research. Further, because of the large geographical coverage (Table 2) and the large number of completed questionnaires (more than 17,000) the insights gained can be important from both a qualitative and a quantitative point-of-view.

Interestingly, in the first question, which assesses how dangerous drivers think their driving is compared to that of others, 56% responded that that their driving is (much or a bit) less dangerous than that of other drivers, 38% responded that their driving is as dangerous as that of others, and only 6% responded that their driving is more dangerous. In the second question, which assesses how much faster or slower drivers rate themselves compared to others, 28% responded that their driving is (much or a bit) slower than others, 52% responded that they drive as fast as others, and 20% that they generally drive (much or a bit) faster than others.

The estimation results, for both questions, are shown in Table 3. The coefficients for the variables in the first question, that of dangerous driving, are interesting; female drivers consider

themselves less dangerous than others; of course, this result should be evaluated with caution because of the quite low t-statistic (-1.23) associated with the gender parameter. Increasing years of experience, age, annual kilometers, and education lead to an increased *belief* of being *less dangerous* than other drivers. Higher income, on the other hand, leads to the belief of being more dangerous. Regional differences are also observed; using Eastern Europe as the basis for comparison, Northern European drivers rate themselves as more dangerous compared to Eastern European drivers, while Southern European drivers rate themselves as less dangerous. Finally, drivers who break the speed limit more often consider themselves as more dangerous, while seat belt users consider themselves as less dangerous; as indicated by the t-statistic of the "drinking and driving parameter", there is no, at least statistical, connection between drinking and driving and the dangerous driving dimension of self assessment.

The last three parameters in Table 3 are the estimated values of the thresholds. Because the number of discrete self assessment ratings is 5, the only thresholds that can be statistically identified are $\hat{\mu}_1, \hat{\mu}_2, \hat{\mu}_3, \hat{\mu}_4$. However, due to the presence of a constant term in the specification of the models, it is not possible to identify the constant and the four thresholds. To overcome this problem, the estimation is normalized by setting: $\hat{\mu}_1 = 0$. The values of the thresholds reported in Table 4, are based on this normalization.

In terms of fast driving, European motorists who consider themselves slower usually are: female (this seems to confirm previous research (NHTSA, 1998)), older (also confirms some previous researches according to which the younger drivers consider speed as less dangerous and have the tendency to drive faster compared to older and more experienced drivers (NHTSA, 1993; Badger, 1996)), inexperienced, and have low income. Also, the motorists who report that they drive slower than other drivers also report breaking the speed limits more rarely, wear their seat belt more frequently and have been involved in relatively fewer accidents during the last three years than others do.

Finally, it should be noted that for this type of non-linear models the measure of goodness of fit most commonly employed is ρ^2 (rho-squared). Although this is a more informal goodness-of-fit

index, it is analogous to the R^2 from regression. It is defined as $1-\left(L(\hat{\beta}) / L(0)\right)$, and measures the fraction of the initial log likelihood value explained by the model. The value of ρ^2 obtained from these models can be characterized as good for both questions (ρ^2 = 0.49 and 0.43). Unfortunately, in non-linear models the measure of fit ρ^2 is not as intuitive as in the regression framework and as such it is most frequently used to compare statistical models.

Conclusions

This paper presented a new methodological approach, based on the ordered probit technique for describing and, more importantly, quantifying some dimensions of driver self-assessment. This methodology explicitly recognizes that self-assessment ratings are ordinal numbers. This method, contrary to the existing methods of parametric and non-parametric statistical testing, recognizes the latent nature of self-assessment and links its dimensions to a set of relevant explanatory variables such as age, gender, region, income, etc. Finally, this methodology provides models that are intuitively appealing, theoretically sound, and are a useful tool in quantifying the various dimensions of self-assessment.

The results obtained are quite interesting. First, drivers who rate themselves as both more dangerous and faster than others are, usually, younger men with higher income, break the speed limit more frequently, avoid wearing seat belts and have been involved in more accidents in the past than other drivers. Second, drinking and driving showed no statistical connection to either dimension of self-assessment, while both more experienced and more highly educated drivers assess their driving as less dangerous, but admit to driving faster than other drivers. Third, previous involvement in accidents is associated with more dangerous and faster driving self-assessments. As a final note it is worth mentioning that the questionnaire did not contain questions on self-rated driving skills that represent a fundamentally different dimension of self-assessment than do driving speed and recklessness.

It has been well established in the literature that drivers overestimate their own driving abilities compared to that of others. It has also been postulated that the confidence drivers have on their abilities gives them a sense of driving safely, when in fact they may not. This exaggerated

confidence on their abilities is a characteristic of drivers who believe that they are more skillful than others and could motivate them not only to display dangerous behaviors but also to persist on these behaviors. The methodology used and the results obtained in this paper can be of significant help in identifying drivers with high and low self-assessment ratings; these results can be very useful in practice and especially in planning and implementing road safety information campaigns. These campaigns, which have to be targeted toward groups of individuals and especially those that display dangerous driving behaviors, in order to be most effective must be based on solid quantitative findings regarding the profiles of potentially dangerous drivers.

References

Armsby P., Boyle A. J. and Wright C. C., "Methods for Assessing Drivers' Perception of Specific Hazards on the Road". *Accident Analysis and Prevention*, Vol. 21, No. 1, 1989.

Badger J. E., "Human Factors Affecting Perception". *Law and Order Magazine*, August 1996.

Beenstock M. and Gafni D., "Globalization in road safety: explaining the downward trend in road accident rates in a single country". *Accident Analysis and Prevention*, Vol. 32, pp. 71-84, 2000

Codol J. P., "On the so-called 'superior conformity of the self' behaviour: Twenty experimental investigations". *European Journal of Social Psychology*, 5(4): pp. 457-501, 1975.

Delhomme P. and Meyer Th., "Control Motivation and young drivers' decision making". *Ergonomics*, Vol. 41, No. 3, pp. 373-393, 1998.

Delhomme P., "Comparing one's driving with others': assessment of abilities and frequency of offences. Evidence for a superior conformity of self-bias?". *Accident Analysis and Prevention*, Vol. 23, No.6, pp. 493-508, 1991.

Delhomme P., "The modification of unsafe driving behaviour - The links between attitude and behaviour". *Recherché Transports Sécurité* – English Issue No. 10, 1997.

Greene, W.H., *Econometric Analysis*, MacMillan Publishing Company, New York, 1993.

Greene M. and Senders J., "Human Error in Road Accidents". ERGO/GERO *Human Factors Science*, 1997

Leon J., "Traffic Violence. A crisis in Community Mental Health". Innercom, Newsletter of the Mental Health Association in Hawaii, June 1987.

Marottoli R. and Richardson E. D., "Confidence in, and self-rating of, driving ability among older drivers". *Accident Analysis and Prevention*, Vol. 30, No. 3, 1998.

Matthews G. and Desmond P. A., "Stress as a factor in the design of in-car driving enhancement systems". *Le Travail Humain*, 58, pp. 109-129, 1995.

Matthews M. L. and Morgan A. R., "Age differences in male drivers' perception of accident risk: The role of perceived driving ability". *Accident Analysis and Prevention*, 18, pp. 299-313, 1986.

McCullagh, P. (1980), "Regression Models for Ordinal Data," *Journal of Royal Statistical Society*, Vol. 42, No. 2, pp. 109-142.

Näätänen R. and Summala H., "A model for the role of motivational factors in drivers' decision making". *Accident Analysis and Prevention*, No. 6, pp. 243-261, 1974.

National Highway Traffic Safety Administration (NHTSA), "Results from a study according to a random national sample of drivers surveyed by telephone". 1998.

Office of Program Development and Evaluation Traffic Safety Programs, "Addressing the Safety Issues Related to Younger and Older Drivers". A Report to Congress, January 19, 1993 on the Research Agenda of the National Highway Traffic Safety Administration – U.S. Department of Transportation.

Reason J. T., Manstead A. S. R., Stradling S. G., Baxter J. S. and Campbell K. A., "Errors and violations on the road: a real distinction?". *Ergonomics*, 33 (10/11), pp. 1315-1332, 1990.

Rekenthaler D. J., "The Human Factors Field Research Vehicle: FHWA Takes Its Show On The Road". Vol. 61, No. 4, U.S. Department of Transportation Federal Highway Administration, 1998.

Sabey B. E. and Taylor H., "The known risks we run: The Highway". Transport and Road Research Laboratory (TRRL), Supplementary report 567, Crowthorn (UK), 1980.

SARTRE 2 reports, "The attitude and behaviour of European car drivers to road safety. PART 1 – Report on principal results". Project on SARTRE, April 1998.

Stradling S. G., Parker D., Lajunen T., Meadows M., Xie C. Q., "Normal Behaviour and Traffic Safety: Violations, Errors, Lapses and Crashes". 4th Annual Conference on Transportation, Traffic Safety and Health, Tokyo, Japan, October 21-22, 1998.

Svenson O., "Are we all less risky and more skillful than our fellow drivers?". *Acta Psychologica*, 47, pp. 143-148, 1981.

Waters M., "Some angry drivers think they're not, study finds". *The American Psychological Association* (APA), Vol. 30, No. 9, October 1999.

Table 1. Dimensions of self assessment evaluated with the SARTRE survey

	Rated Answer				
Question	0	1	2	3	4
Compared to other drivers, do you think your driving is…? (dangerous)	Much more	A bit more	About the same	A bit less	Much less
Compared to other drivers, do you generally drive…? (…than average speed)	Much faster	A little faster	About the same	Little slower	Much slower

Table 2. Region Separation[1]

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

[1] Ad-hoc separation

TABLE 3. Estimation results for the ordered probit model

	Dangerous Driving		Fast Driving	
Variable Name	Coefficient Estimate	t-ratio	Coefficient Estimate	t-ratio
Constant	2.51	23.52	1.07	37.69
Northern Europe (dummy)	-0.13	-4.61	-0.13	-5.11
Southern Europe (dummy)	0.06	1.72	-0.15	-4.91
Gender	-0.03	-1.23	-0.11	-5.19
Age	0.04	2.36	0.12	8.18
Annual kilometers	0.03	6.09	-0.04	-7.67
Driving experience (years)	0.02	1.03	-0.07	-4.21
Education	0.05	2.25	-0.03	-1.51
Income	-0.008	-1.56	-0.01	-6.27
Proponsity to break speed limit	-0.09	-10.96	-0.35	-46.94
Seat belt use	0.05	5.27	0.07	9.61
Drinking and driving	-0.007	-0.75	0.04	0.44
Involvement in traffic accidents	-0.09	-4.36	-0.09	-5.44
μ_1	0.89	20.26	0.47	49.33
μ_2	1.37	50.54	2.12	97.01
μ_3	3.31	69.22	3.37	120.1
Summary Statistics				
# of Observations	17425		16535	
Rho-squared	0.49		0.43	