



Editorial

Road safety, alcohol and public policy

As one of the leading causes of death and injury that exact a high societal cost, motor vehicle highway crashes are a major public policy concern. The direct economic cost of global road crashes has been estimated conservatively at US\$518 billion a year (Peden et al., 2004), with US\$207 billion accruing to the European union countries and US\$230 billion to the United States of America. Although there are many factors contributing to the frequency and severity of road crashes, drunk driving (also known as drink driving, driving while intoxicated, driving under the influence of alcohol) is among the principal reasons for crashes in many countries. Of the 38,252 fatal crashes in the US in 2003, for example, 40% were alcohol related, a percentage that has remained relatively stable over the past few years. Consistent with this, the National Highway Traffic Safety Administration, in a study based on 2000 US crash data, has estimated that alcohol related crashes imposed a \$114.3 billion total cost on society.

This Special Issue on *Road Safety, Alcohol and Public Policy* highlights recent work in highway safety that enlightens our understanding of the relationships that exist between alcohol consumption, driver regulations, and highway safety. The first two papers in the *Issue*, authored by Vollrath et al. and Mathijssen, respectively, focus upon alcohol related policies in Germany and the Netherlands whereas the next two papers explore the relationship between alcohol consumption and crash severity in New Zealand (Keall and Firth) and the state of Ohio in the United States (Traynor). In their paper, Noland and Karlaftis comparatively analyses alternative statistical methodologies commonly used in highway safety analyses. Each of these papers, although diverse in geographic scope (North American, European, and Australian continents), methodological approach, and policy orientation, provides additional insights on an aspect of alcohol and highway crashes that deepens our understanding of these events and will assist policy-makers charged with implementing highway safety interventions that are more efficacious in reducing the frequency, severity, and societal costs associated with alcohol related crashes.

In the highway safety environment, rarely do researchers have an opportunity to analyse the effects of large natural experiments on a country-wide basis. But the reunification of East and West Germany, which led to a number of adjustments in the legal system, provided such an occasion. One significant change for East German motorists was a relaxation of the legal blood alcohol concentration (BAC) limit with no change in the legal limit for West German motorists. Combining the results of roadside breath alcohol tests administered to drivers with other data collected from three roadside surveys conducted from 1992 through 1994 in an East German region and a comparable West German region, Vollrath, Kruger, and Lobmann analyse the immediate, short term, and longer term effects of raising the BAC

limit in East Germany. A major finding of this study is that the relaxed BAC limits led to an increase in BAC levels among East German drivers but generally did not increase the frequency of drinking and driving. The exception was younger drivers who not only increased their alcohol consumption subsequent to the relaxation in the legal limit but also increased their frequency of drinking and driving. Other results from the study indicate that East German drivers opposed drinking and driving behaviour more strongly than did West German drivers. Also, in East Germany, younger drivers opposed a 0% BAC limit more than older drivers; whereas in West Germany, younger drivers were against drinking and driving more strongly than older drivers. These latter results likely reflect the different legal environments faced by East and West German motorists prior to the legal change. In addition to assessing the effects of unification on drinking and driving behaviours, this study highlights the importance of institutions and calls for more research on the how alternative institutions affect drinking and driving behaviours as well as research on optimal ways to manage and adapt to institutional changes that ensure a continuation of past successes in reducing drinking and driving behaviour.

Also focusing upon drinking and driving policy, Mathijssen conducted a retrospective analysis of anti-drunk driving campaigns (most of which have also been implemented in many countries around the world) that the Netherlands implemented during a thirty year period, 1970–2000. This study found significant deterrent effects following the introduction of a statutory BAC limit, random breath testing and evidential breath testing, and changes in the enforcement level; the study reported mixed effects for publicity and educational campaigns; and little or no effect was identified for changes in penalties and driver improvement programs. This research also utilised results from a large case-control study to identify some of the salient characteristics associated with drunk drivers and recommended that future policies on drinking and driving should specifically target young drivers, drivers with high BAC levels, and drivers who combine alcohol and drug use.

Mathijssen's study provides an informative analysis of the major road safety policies targeting drinking and driving behaviour and reports chi-square statistics that test for various policy effects. An interesting question is whether the estimated effects for changes in drink driving enforcement and driver improvement programs are the result of confounding factors. Several researchers (Cameron et al., 1993; Newstead et al., 1995; Cameron and Vulcan, 1998; Macpherson and Lewis, 1998; White et al., 2000; Cameron and Newstead, 2000; Tay, 1999, 2001, 2004, *forthcoming a*, *forthcoming b*) found mixed results on the effects of both enforcement and publicity campaigns when using statistical models that control for different confounding factors.

Keall and Frith argued that case-control studies are relatively rare due to the difficulty of obtaining a representative sample of motorists to act as the control sample and due to the lack of BAC readings for a majority of crash involved drivers. More importantly, crash involved drivers with BAC readings available are likely to be different from those without, and in particular, drivers showing signs of intoxication may be more likely to be tested, which biases the data obtained. To partially overcome this problem, the authors developed a methodology to estimate the risk of driver involvement in injury crashes for case-control data where control drivers have reliable BAC measures but crash involved drivers do not. The methodology enables the authors to estimate the risks associated with confounding factors such as age and night-time driving while controlling for the effects of BAC. The study uses the proposed procedure on New Zealand data to estimate the crash risks associated with different levels of BAC.

The reported results were broadly consistent with those found using alternative approaches which argues for a need to conduct additional research in order to improve and validate the methodology, explore the statistical and properties of the estimator, and determine whether the solution achieves a local or global optimum.

In a state specific aggregate analysis, Traynor uses driver impairment as a proxy for alcohol consumption in order to analyse the effect of alcohol consumption on crash severity. And recognizing that there are no unique measures for crash severity, Traynor estimates empirical models using alternative definitions for crash severity and using measures that distinguish at-fault drivers from external parties to a crash. It is not surprising that at-fault drinking drivers are more likely to be involved in crashes involving serious injuries. However, an important finding from this research is that at-fault drinking drivers are involved in more serious crashes relative to at-fault non-drinking drivers and that at-fault drinking drivers produce more serious injuries to other parties than do at-fault non-drinking drivers. As Traynor notes, this has important implications for identifying and measuring the external costs associated with highway crashes involving drinking drivers and how state and federal governments target highway safety policy.

Among the implications for further research are model robustness and measurement. Similar to many US studies, data for this analysis focus upon a particular state, whose population and travel may not be representative of the nation as a whole. A natural extension is to examine whether the reported results are robust when the analysis is repeated using a broader and more representative sample. A related issue concerns Traynor's use of driver impairment as a proxy for alcohol consumption. Measures of alcohol use based, for example, upon actual or estimated BAC levels, would sharpen the relationship between consumption and crash severity and lead to greater insights on the external costs associated with drinking and driving behaviours.

The past two decades has seen significant progress in developing and employing probability models for highway safety data that are discrete, non-negative, and that oftentimes have a high frequency of zeroes. Among this class of models, the Poisson regression model and its extensions offer a number of advantages relative to more traditional linear regression methods. Based upon a panel of US states from 1990 to 1997, Noland and Karlaftis empirically explore the highway safety policy implications of administrative license restrictions (ALR) under alternative functional form specifications. The authors comparatively analyse fixed effects linear regression models that control for serial correlation with negative binomial regression fixed effects models. After estimating a series of models, the authors find that an ALR policy had little impact upon fatalities in the negative binomial models and the autocorrelation-adjusted OLS models. Further, and more generally, the authors find that negative binomial models produced results that were more robust and whose parameter estimates had smaller confidence intervals, which could have important implications for policy evaluations and recommendations.

This paper raises a number of interesting questions that argue for additional research on functional form in highway safety. As noted by the authors, adjusting for heteroskedasticity and serial correlation is straightforward in linear regression relative to Poisson regression models. Yet [Johansson \(1996\)](#) notes that in some Poisson-type models, overdispersion and serial correlation are present together, which indicates that the attendant effects of serial correlation may well be a concern when overdispersion is detected. And he presents evidence of sign reversal and changes in statistical significance in policy-relevant variables after adjusting for serial correlation. A second area of interest focuses upon the modelling implications of generalized linear models, in which maximum likelihood estimation, given a correctly specified conditional mean, produces consistent estimates even in the presence of non-normality and heteroskedasticity. Related to this, a third area of interest are the policy effects of functional form misspecification when a normal density is misspecified as Poisson density. Poisson distributions approach normal distributions as the mean value increases. If the true density function is normal, then a Poisson density is misspecified and maximum likelihood estimation produces inconsistent estimates.

The papers in this Special Issue have provided both of the co-editors with a deeper understanding of the empirical effects (and associated methodological issues underlying these effects) that institutional change and policy intervention have in helping to reduce the incidence and severity of drinking and driving behaviours. We hope that the readers of this Volume find these papers to be equally interesting and enlightening.

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