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Impact of Environmental and Enforcement Factors on the Alcohol Related Road Traffic Deaths in Japan

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Introduction

One of the most devastating outcomes of the presence of alcohol in modern society is the high number of traffic accidents and fatalities attributed to alcohol impaired driving (Homel 1988; Jacob 1989). The direct connection between level of blood alcohol concentration (BAC) and driving problems has been shown both in the laboratory experiments using simulated driving tasks and in the studies of BAC in persons who have been involved in traffic crashes (Moskowitz and Robinson 1988; Zador 1991; Borkenstein et al. 1974). There is clear evidence that the risk of accident increases with the increase in BAC; significant effects started to be observed when the percent of blood volume containing alcohol is 0.05 percent (Ross 1984).

The effect of alcohol consumption on driving has been known for a long time, and beginning in the 1930s many countries, i.e. Scandinavian and European countries, Canada, USA, Australia, New Zealand and Japan, have enacted laws making driving while having a certain level of BAC itself a violation. On April 1, 1970, Japan implemented a series of new driving-under-the influence (DUI) laws which essentially recast the government's (DUI) statues. These laws established the so-called per se illegality of driving with a blood alcohol concentration (BAC) 0.05/mg of alcohol per 100 milliliters of blood (0.05%), thereby defining a DUI offense in objective terms rather than by subjective evidence of behavioral impairments, but retained presumptive standard. This insured that convictions could still be obtained for impaired drivers who exhibited sufficient behavioral evidence of impairment while

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testing below the per se limit. Together, the new laws introduced new penalties, adjudication and enforcement procedures designed to increase the certainty and severity of punishment for DUI offenders, and contained provisions intended to assure greater uniformity in court sentencing. Research shows that adoption of these laws can have a deterrent effect on driving while impaired (DWI) and reduce accidents, deaths and injuries on the road.

Shimisu (1991), Kono (1991), Tsunoda et al. (1992), Desapriya and Iwase (1996, 1997) found that laws such as these have been highly instrumental in producing significant reductions in alcohol related fatal accidents nationwide. Recently increased attention at the international level has been directed toward finding ways to reduce the incidence of drunken driving. This paper evaluates the impact of environmental and enforcement factors on the alcohol related road fatalities, while explaining the relative effectiveness of drunken driving prevention policies in Japan.

Since 1973, Japan's road fatalities have fallen to levels significantly lower than those which were common in the 1960s and early 1970s. The 1979 Japanese road fatality figure of 8,466 is the lowest recorded since 1958, despite the population increase since 1958 of 26% and the increase in the associated risk factors involved in road traffic deaths i.e. vehicle numbers of 1312%, VMT (Vehicle Miles Traveled) of 1893% and license drivers of 581% increase over the same period. The 1996 ratios of fatalities per 10,000 vehicles (1.2) and per 100 million vehicle Miles traveled (1.35) were the lowest ever recorded. This can be attributed to a series of traffic safety measures. It may not be entirely coincidental that the period since 1970 has seen the implementation of a range of drink-drive countermeasures, some of which are of unprecedented rigor and scope by world standards.

In addition to specific deterrent effects among DUI offenders who experience the punitive effects of the new laws of 1970 (Desapriya and Iwase 1996), it was expected that these new laws would also cause a general deterrent effect among potential DUI offenders who would be deterred from driving under the influence of alcohol by the mere threat of the new law's punitive nature. According to the general deterrence model (as presented by Ross in 1982), the threat of punishment can operate to deter potential violators, the potential drinking drivers - from driving drunk. The major factors contributing to the general deterrent effect of legal sanctions are the

perceived certainty, severity, and swiftness of punishment in the event of a violation of the law. Specific deterrence may be obtained through increased enforcement efforts, but general deterrence is possible only if a potential offender is aware of the enhanced legal threat and is deterred from driving drunk, either to avoid the legal consequences or in response to a moral commitment to the new laws (Votey 1984). Using a more sophisticated model, Votey (1984) further concluded that the severe deterrence policies reduced the incidence of alcohol impaired driving.

Table 1: Comparison of international road fatality rates

<u>Country</u>	<u>Year</u>	<u>Fatalities per 10,000 vehicles</u>
<u>Australia</u>	<u>1995</u>	<u>1.84[†]</u>
	<u>1996</u>	<u>1.8</u>
<u>Canada</u>	<u>1995</u>	<u>2.0[‡]</u>
	<u>1996</u>	<u>1.8</u>
<u>Germany</u>	<u>1995</u>	<u>1.9[§]</u>
	<u>1996</u>	<u>—</u>
<u>Japan</u>	<u>1995</u>	<u>1.3^{**}</u>
	<u>1996</u>	<u>1.2</u>
<u>New Zealand</u>	<u>1995</u>	<u>2.5^{††}</u>
	<u>1996</u>	<u>2.2</u>
<u>Sweden</u>	<u>1995</u>	<u>1.45^{‡‡}</u>
	<u>1996</u>	<u>—</u>
<u>UK</u>	<u>1995</u>	<u>1.4^{§§}</u>
	<u>1996</u>	<u>1.42</u>
<u>USA</u>	<u>1995</u>	<u>2.1^{***}</u>
	<u>1996</u>	<u>2.1</u>

[†] Federal Office of Road safety

[‡] Transport Canada, Canadian Motor Vehicle Collision Statistics

[§] Figure derived from Data on federal Statistics office of Germany Web page

^{**} Road Traffic Statistics in Japan, Traffic Bureau, National Police Agency

^{††} Land Transport Safety authority

^{‡‡} Derived from Sweden in figures on Internet

^{§§} Transport Statistics Report, government Statistical Service, UK

^{***} Insurance Institute for Highway Safety

By tightening the adjudication process, enhancing penalties, and generating prolific media coverage, the 1970 DUI laws were viewed as a means of strengthening the perception among potential offenders that punishment upon detection would be unavoidable and severe. The introduction of the per se standard was considered likely to facilitate obtaining convictions - increasing the swiftness of punishment as well as its certainty - because less proof of behavioral impairment would be required. In short, because they were likely to increase the perception of threat with respect to all three critical factors, these laws were considered likely to have substantial general deterrent effects.

Most of the alcohol related traffic safety literature are mainly available in Scandinavian countries, Australia, the UK and the US. Very little research has been done on the subject in Japan. Even though, the literature on the subject is extensive in other countries, only a minority of published reports relate to evaluations of policy initiatives. This study attempts to fill this vacuum by the evaluation of policy initiatives while discussing their impact on the overall traffic safety. This research has two major objectives:

First, if alcohol impaired driving related deaths could be reduced by legal intervention and extensive enforcement of laws, based on this fact, try to find out when traffic accidents relating to exogenous factors (i.e. Alcohol consumption, VMT, and Vehicle density) are in a rapidly upward trend.

Second, try to find out what the expected direction of the influence of independent variables (i.e. Alcohol consumption, VMT, and Vehicle density, prevalent Impaired driving, and conviction for DUI) on the alcohol related road fatalities is.

In addition, understanding each variables' impact on traffic safety should help in designing and implementing effective prevention strategies. Moreover, empirical investigation of the issue can be beneficial, whatever the results are. Confirming findings may help to enhance understanding of the relationship between these factors on traffic safety and possibly yielding implications for appropriate policy.

In order to test these objectives this study utilized major methodology as follows:

It is well known alcohol impaired driving causes several exogenous variables (Votey 1984; Legge 1990). According to the literature, drunken

driving has been influenced by social and distinctive environment, which may expose people to higher or lower risks of drunken driving. Therefore, without controlling these environmental factors, an evaluation study on the effectiveness of legal policies may be less valid. In addition, any evaluation of the impact of legislative changes will have to account for these extra-legal determinants of drinking driving behavior. Only then will we have a clearer understanding of the role of legal and extra-legal factors in alcohol related fatal crashes (Vingilis 1990; Norstrom 1983; Berger and Snortum 1986).

Among possible environmental factors, such as per capita alcohol consumption, traffic conditions like vehicle miles traveled (per license driver), vehicle density (road lengths divided by the registered motor vehicles) and the degree of traffic congestion (i.e. traffic volume, traffic flow or speed) and extensive enforcement of laws are widely acknowledged to play critical roles in producing and preventing traffic fatalities (Legge 1990; Yokoyama 1992; Desapriya and Iwase 1996, 1997; Muller 1989; Ross 1973, 1984; Votey 1984; Snortum 1984).

The amount of alcohol consumption, Vehicle Miles Traveled (VMT), vehicle density, prevalent DWI and conviction for DUI, all have a direct relationship to alcohol related fatalities and accidents, therefore it is appropriate to employ these factors as independent variables in the regression analysis equation. Many researchers have employed all these factors as independent variables and found statistically significant coefficients (Muller 1989; Legge 1990; Wagenaar 1984). Accordingly, a hypothesis related to environmental factors' impact on alcohol related fatalities can be as follows:

Because traffic fatality rates are influenced by the amount of driving that people do as well as by their use of and access to alcoholic beverages, this analyses included vehicle kilometers traveled and per capita alcohol consumption. Higher average VMT per licensed driver, means to any society, is that it increases the possibility of traffic accidents. The increase of traffic flow due to the increase of vehicle density, may increase traffic related accidents and fatalities, and specially the seriousness of the accident itself. Higher per capita alcohol consumption has a higher risk of alcohol impaired driving.

Researchers have indicated that implementation or enforcement activities play an important role in producing the designed effects of DWI

policy (Suwaki and Bojestien 1983; Shimizu 1992; Yokoyama 1992; Desapriya and Iwase 1996; Ross 1984, 1987; Homel 1994; Andenaes 1988; Snortum 1984) and increased police enforcement activities and high conviction rate have resulted in reduced alcohol related fatalities by improving the certainty of punishment.

Table 2: Expected direction of influence of independent variables

<i>Independent variable</i>	<i>Expected sign</i>	<i>Rationale</i>
VMT	+	Higher average VMT per licensed driver, means to any society, is that it increases the possibility of traffic accidents and fatalities.
vehicle density	+	Increase traffic flow due to increase vehicle density, may increase the traffic related accidents and fatalities, and specially the seriousness of the accident itself.
per capita alcohol consumption	+	Higher per capita alcohol consumption has a higher risk of alcohol impaired driving.
conviction for DUI	-	More arrests and convictions mean better enforcement, which increases the certainty of punishment.
prevalent DWI	+	Prevalent alcohol impaired driving has a positive relationship with the traffic fatalities. Generalization of this hypothesis is that, alcohol impaired driving, increases risk of having traffic fatality tremendously, by impairing motor skills by effects of a high dose of alcohol.

Data and Methods

We employ national level data on alcohol related fatal accidents from 1963 -1995. Counts of traffic deaths were obtained from the Traffic Bureau, National Police Agency (new data since 1970's) and Diet Library (old data since 1950's), from all of which have collected these data since 1950's. In order to concentrate on crashes with high probability of alcohol involvement, these analyses include only alcohol related fatal accidents, involving passenger vehicles. The best available data on drunk driving is the road fatality data (Ross, McCleary and Epperlein 1983). Drunken drivers are frequently involved in fatal traffic crashes. Therefore an alternative indicator of alcohol involved traffic crashes is fatal accidents (Heeren et al. 1985). Yokoyama (1990) noted that in Japan Government statistics are more reliable than those in other countries due to being compiled under the centralized bureaucratic system. Accordingly we can assume that in Japan the road traffic data are highly reliable as they have been processed and analyzed by National Police Agency with their close scrutiny.

Justification of the data selected for dependent variable

Had been drinking (HBD) accidents are a police-designated category of accidents for which the reporting officer indicated evidence of alcohol consumption in one or more of the involved drivers. Non-HBDF accidents were all other reported fatal accidents, including those nighttime and SVNF (Single Vehicle Night Time Fatal accidents), for which alcohol was not judged to have been a factor. To the extent that the reporting officer's judgment was accurate and the record complete, these non-HBD accidents should represent a defensible control series.

None of these measures represents a perfect alcohol or non alcohol measure. Some incidents included in the night time FA series and its subset, SVNF accidents, for example, contain measurement error resulting from the misclassification noted above. The HBD designation is subjective and tends to be under reported (Waller 1971). Ross (1984) has suggested that analyses involving the night time surrogate series (i.e. SVNF accidents) are potentially less biased than are analyses involving HBD accidents, because they are not

influenced by historical changes in police reporting and investigation procedures.

However, results obtained by Arstein-Kerslake and Peck (1985), Sadler and Perrine (1984), and Tashima and Peck (1986) suggest that the police report designations are superior, at least in some countries from the standpoint of providing a more sensitive measure of the role of alcohol factors. Drinking drivers are frequently involved in fatal crashes. Therefore, an alternative indicator of alcohol involved traffic crashes is fatal accidents (Heeren et al. 1985). Further Ross and McCleary (1983, p.417) endorse the use of fatality data by suggesting that fatalities and serious injuries have low dark figures because the need to treat injuries and to process cadavers brings virtually all cases to the attention of health and hospital authorities with well-introduced statistical systems. In addition, alcohol related fatality data are collected by number of reliable sources such as police accident reports, death certificates and emergency medical services reports. May and Baker (1974) have used the criterion of "alcohol-related" crashes, which would seem at first glance to be an attractive surrogate measure of drunk driving (Ross et al. 1991).

Justification of the data selected for independent variables

Data on four control variables (Conviction for DUI, Prevalent DWI, Vehicle miles Traveled (VMT), Vehicle Density and Annual per capita alcohol consumption) which are considered crucial in drunken driving literature were collected and analyzed in this research since 1963. One dimension of increasing certainty is to improve the possibility of arresting drunk drivers and convicting them. The other dimension of improving certainty is assuring punishment for convicted drunk drivers. Among these strategies, Japanese society adopted measures such as an illegal per se legislation in 1970. In addition, we assume that higher DUI conviction is the result of increased enforcement activities. DUI arrest rate for per license driver has been calculated. In any society if it could improve its enforcement and convictions on DUI, alcohol related fatalities are expected to be decreased. However, prevalent alcohol impaired driving has a positive relationship with the traffic fatalities. Generalization of this hypothesis is that,

alcohol impaired driving, increases risk of having traffic fatality tremendously, by impairing motor skills by effects of a high dose of alcohol. Therefore, in general, it makes no sense to seek legal strategies for solving or eliminating the drunken driving problem, it is better to employ these preventive strategies in terms of reducing or containing the prevalence of alcohol impaired driving (DWI) or of alcohol related traffic deaths (Bonnie 1985). Since 1970, alcohol impaired driving is declining or diminishing and as a result, traffic deaths related to alcohol impaired driving is also decreasing. This fact indicates that the concept of seriousness of driving after heavy drinking (DWI) has been diffused over the Japanese nation (Marumo et al. 1992; Shimizu 1991; Desapriya and Iwase 1996).

Regression Analysis

In this study, it has employed a regression analysis based on national level data from the 1963-1997. Compared to the interrupted time series analysis, which has been mainly utilized in most drunken driving literature, the regression analysis has the following hypothesis. If the coefficients of, enforcement factors DUI and DWI, with those environmental factors employed as independent variables are statistically significant and in expected sign, it may be inferred that the legal intervention aimed to reduce alcohol impaired driving and related fatalities has been successful. Regression analysis employed here posits the view that the problem of alcohol related fatalities is caused by environmental factors and DUI and DWI in Japan, which can be expressed as follows:

Alcohol related road traffic fatalities

= f (environmental factors; VMT, Vehicle Density, Alcohol consumption, and enforcement factors; conviction for DUI and prevalent DWI)

Table 3: Regression Results of alcohol related fatality rates per 100,000 population.

<i>Variable</i>	<i>Estimated Coefficient</i>	<i>Standard Error</i>	<i>t-statistics</i>	<i>P-value</i>
Constant	4.90421	2.32931	2.10544	*[.035]
Vehicle Density	.651445	.234584	2.77702	**[.005]
Consumption	.507094	.059042	8.58870	**[.000]
DUI	-.068835	.026369	-2.61044	**[.009]
Prevalent DWI	.276252	.021792	12.6767	**[.000]
VMT	-.683951	.158930	-4.30348	**[.000]

R.SQUARE.= .961508

N=32 Years

Results

An important result of this paper is that, at current levels, drunken driving deterrence policies appear to have effect on the traffic fatalities. Many people may be deterred or otherwise decide not to drink and drive because of current policies and its enforcement in the criminal justice system. In addition, results suggest that adding more resources to enforcement will deter more persons from drunken driving. Ross (1984) has compiled evidence from many countries that clearly shows that drunk driving is greatly reduced when the certainty of punishment is sufficiently high. In addition Desapriya and Iwase (1997) shows that heavy drinkers are often avoid driving for fear of the detection and punishment.

Environmental variables are consistently significant in equation. The regression coefficients indicate that environmental variables have the greater importance in accounting for the alcohol related traffic fatalities and they are the only significant variables in general. An environmental variable 'Vehicle Density' is statistically significant in the equation. Vehicle Density refers to the number of registered vehicle per 1 kilometer of public road. It should be noted that the number of registered motor vehicles has greatly increased as a result of growing affluence since the 1960. By this variable it is intended to reflect traffic conditions, such as traffic volume. Therefore in this paper, it is

hypothesized that this variable exercises significant positive effects on traffic fatalities. In other words, the more registered vehicles per kilometer of public roads, the higher the alcohol related traffic fatalities. The coefficients of density is .651445. If vehicle density contributes to fatalities, then drunken driving fatalities can be reduced indirectly by reducing number of vehicle in use. This finding may have implications for public policy. That means like the Scandinavians (it is said that most successful overall alcohol impaired driving prevention policies are originated by the Scandinavian) Japanese policy makers should understand the institutional causes of drunk driving and should restrict easy access to alcoholic products, and explore possibilities to subsidy the systems of transportation other than the encouragement of own private automobile as a central social policy. In Japan there is a considerable amount of traffic congestion and measures to stop traffic growth is in discussion. In any event, the use of automobiles for nearly all social purposes is so fundamental in contemporary Japanese life that such immediate reduction may not be feasible.

Alcohol consumption is also quite significant in alcohol related traffic fatalities. The variable 'Alcohol Consumption' has coefficient .507094. This means that the higher the consumption of alcohol per capita, the higher the traffic fatalities, and vice versa. This relationship implies that, the Japanese governments' policies to reduce alcoholic beverage consumption and to reduce traffic fatalities further may be viable policies. If alcohol consumption contributes to fatalities, then drunken driving fatalities can be reduced indirectly by increasing the price of alcohol, reducing the availability, or increasing the excise taxes and increasing the expected legal costs of alcohol impaired driving. An old and attractive principle of justice is to let the punishment fit the crime, without unduly punishing innocent people. Higher excise taxes on alcohol and increasing the expected legal costs of alcohol impaired driving, combined with more certain and severe punishment of drinkers who cause serious accidents, would serve this principle well.

Other environmental variables, such as VMT, conviction for DUI and prevalent DWI, all are significant and have positive and negative relationships as hypothesized. The coefficient for DUI conviction (-.068835) is significant at that .009 level. The coefficient do support the deterrence hypotheses. This means that extensive enforcement of law in the criminal

justice system and this efforts expressed as DUI convictions per licensed driver is effective in reducing alcohol related fatalities. Therefore drunken driving fatalities can be addressed directly by increasing the deterrent threat: increasing the likelihood of apprehension and conviction.

The coefficient for prevalent DWI is (.276252). This means that more prevalence of DWI in any society, tend to increase alcohol related fatalities. In contrast, lower prevalence of DWI is contributed to less alcohol related traffic deaths in Japan. VMT variable has a relatively significant coefficient (-.683951). The coefficients of total miles traveled (VMT) are negative and are very significant in the model. But the sign of relationship contradicts with the hypothesis made in the introduction of this report. This results suggests that the more miles driven, the likelihood of having alcohol related fatal crashes is becoming less frequent. This may be due to the fact that after enacting the 1970's laws to combat alcohol impaired driving, VMT has increased every year in a rapid phase but in contrast alcohol related deaths declined and this opposite relationship must have made a contradictory sign. Further this negative relationship suggests that the VMT does not have a significant role in determining occurrence of alcohol related fatal accidents. Vehicle Density is highly correlated and signs as expected and moreover correlation coefficient is .9917.

Table 3 indicates clearly that Vehicle Miles Driven (VMT) has a negative but significant relationship with alcohol related automobile fatalities. More driving leads to more automobiles on the roads, and thereby increases the risk of exposure to fatalities. One interesting finding is that, according to table 2, miles driven has a statistically significant negative effect on alcohol related traffic fatalities. The number of general traffic fatalities increased since the latter part of 1970s, par with the increase of VMT. Since 1970 in Japan alcohol related fatalities have fallen to levels significantly lower than those were common in the 1960s. The 1995 alcohol related traffic fatality figure of 395 is the lowest recorded since 1961 despite substantial changes in the associated risk factors involved in traffic deaths i.e. the license driver increase since 1960 of 639% and the increase in vehicle numbers of 1602% and vehicles miles traveled (VMT) of 2465% over the same period (Desapriya and Iwase 1997).

This finding makes the interpretation more complex. However, it is

clear that alcohol related fatal accidents have decreased, while the VMT have increased since 1970, and this may provide another good example of how the alcohol related traffic legislation has had positive effects on saving lives on the Japanese roads in the 1970s. In short, the alcohol related fatalities which increased dramatically from 1960-1970 because of the rapid increase of VMT, Vehicle density, per capita alcohol consumption and DWI, has been effectively controlled by the 1970's laws. In addition, the success of the national campaign may be related to changing social norms and attitudes toward drunken driving (Kono 1991; Tsunoda et al. 1992; Shimizu 1992). Although new punitive legislation may contribute to or reinforce changing norms, the legislation may be primarily a reflection or a product of the changing social norms.

Hedlund et al. (1984) showed that the state of economy is among the strongest factors influencing vehicle miles traveled (VMT) arguing that people tend to travel less, particularly on discretionary trips, when the economy worsens. In Japan, VMT were fairly stable prior to 1970, but between 1970-1995 there were substantial increases, which have continued each year thereafter (Desapriya and Iwase 1996). Despite the implication of the Hedlund et al; study, Zador et al. (1988) found evidence that alcohol related accidents are affected less by the economic climate than are other accidents. Taken together, this study suggests that the rapid economic growth and increased VMT may provide, a partial explanation for the large reduction in alcohol related fatalities nationwide since 1970s. Importantly, it cannot be ignored that the negative relationship in the model is due to the inclusion of the variability of other environmental factors.

Several studies indicate that the public's perception of the chances of being apprehended for driving drunk is considerably higher than actually the case is. Therefore, even a simple reminder of the potential consequences of apprehension could carry a relatively large deterrent potential (Ross 1984; Snortum 1984; Shimizu 1992). In Japan, a renewed wave of media attention began in 1970's, when the National Police Agency and prefectural Police Departments initiated a controversial (and therefore newsworthy) enforcement program of systematic roadside sobriety checkpoints in cities across the country. Nonetheless, checkpoint programs, when highly visible or used in conjunction with media attention, have tended to produce marked

general deterrence effects (Homel 1988; Mercer 1985; Ross 1982; Suwaki and Bojkenstin 1983; Desapriya and Iwase 1996; Watson 1986).

The checkpoints and their news worthiness appear to work together in conveying to drivers that an enhanced enforcement activities underway, placing violators at greater risk of arrest. Particularly, Japanese Police were the first in the world innovate passive sensing to detect drunken drivers since 1970's. The passive sensor unit developed under contract to Honda Motors by the Nippon-Seiki company. This sensor is capable to draw air from in front of the face and make a rough determination of the extent of drinking by measuring a combination of exhaled air and environmental atmosphere. Success of the unit in apprehension of drunken drivers in Japan led the American scientists to import these units to the USA. The laboratory and field tests indicated that the Honda unit, which was based on a semiconductor or Taguchi sensor, demonstrated number of desirable features for enforcement (Voas 1983). Compton (1985) obtained further evidence for the utility of passive sensing in his simulated check point study and found that police using the Honda unit identified 94 percent of drunken drivers accurately. Further, important technological innovations are also significant factors contributing to the successful enforcement of the laws. For example, Japan has already achieved the ability to detect breath alcoholic concentration below 0.25 mg%, with a high precision breath detector using infrared rays (Desapriya and Iwase 1996).

Japan toughened it's alcohol impaired driving laws in 1970 and 1978 by increasing the severity of penalties in the areas of license suspension, revocation, fines and possible jail terms. Theoretically, as the severity of the penalties for alcohol impaired driving increases, more people should be deterred from drunken driving activity, all other things being equal. However, no legislation in any society can itself guarantee enforcement. The enforcement of the 1970 and 1978 laws depends primarily on the methods used by law enforcement, by the Criminal Justice System (i.e. police, courts and prison). As Yokoyama (1992) noted in general, Police, Public prosecutors and judges all took part in criminalization against traffic offenders. The judges exercised substantial discretion in the application of various penalties in Japan. The rate of prosecution of suspects of the road traffic law increased from 86.5% in 1960 to 97% in 1990. Public prosecutors

prosecute almost all suspects of the road traffic law without considering their extenuating circumstances (Yokoyama 1990). Drunken driving fatalities can be reduced directly by increasing the deterrent threat: increasing the likelihood of apprehension and the conviction (Watson 1986; Willkinson 1987).

Tsunoda et al. (1992) found significant differences in drinking and driving attitudes between Japanese and Americans and they emphasized that these differences in this situation may be a reflection of drunk driving laws and law enforcement policies in the two countries. When explaining the observed differences in drink and driving behavior across national samples it is necessary to consider large range of variables that may have influence behavior. National difference in deterrence systems (Ross 1984) may have a strong influence on offending patterns, and these differences are to some extent a reflection of what is deemed acceptable within the culture. There is no doubt about the preventive effect of Criminal Law (Andenaes 1988; Ross 1984). But law that is not enforced does not inspire fear. If the probability of punishment is so low as to be negligible, then severity, celerity of the threatened punishment cannot be expected to influence behavior. Since 1970 in Japan alcohol impaired driving fatalities have declined. At the same time chances of being arrested have increased.

The general deterrence model suggests that the effectiveness of a legal threat depends on the function of the perceived certainty, severity and celerity of the punishment in the event of a violation of the law. The greater the perceived likelihood of apprehension, prosecution, conviction and punishment, the greater will be the deterrent effects of the threat if the severity and swiftness are held constant (Ross 1984). Overall, the time series analysis of alcohol related traffic data in 1996 and 1997 by Desapriya And Iwase (1996, 1997) and present supplement regression analysis on drunken driving laws doesn't seem to support the Ross (1984) hypothesis of the short term or negligible nature of deterrent effects of the drunken driving laws.

Desapriya and Iwase (1996, 1997) suggest a new perspective for long term deterrence of drunken driving laws by analyzing Japanese data. In addition, several researchers found that DUI laws are generally effective in reducing motor vehicle fatality rates. For example, Zador et al. (1988) use a cross-sectional time series data set for 48 states from 1978 to 1985 to study

laws which affect the probability of conviction and severity of punishments. They found that high DUI conviction rate has significant effects in reducing highway fatalities.

As Mann et al. (1991) noted many factors that appear to influence the severity of penalties assigned by judges (e.g. employment status and occupation of the offender; whether the arrest resulted from a chance encounter such as a roadside check or from hazardous driving) are also related to traffic safety outcome. Homel (1981), Jacob (1989), Yokoyama (1992), and Mann et al. (1991) suggest that if the legal system is to be used as a tool to influence the behavior of offenders, then judges, lawyers and policy makers need be convinced of the necessity of randomized experimental research so that philosophy, opinion, and bias can be tempered by fact.

In a review of recent DUI trends and the social climate surrounding them Howland (1988) argued that laws are not generated in a "moral vacuum" but are generally written in response to a social concern and not simply for the sake of generating legal change. Some current evidence suggests that attitude changes in Japanese drivers in recent years have made drunk driving is not socially tolerable (Kono 1991; Shimizu 1992; Suwaki and Bojestein 1983). In addition in a study of legislative changes in Minnesota's driving while intoxicated (DWI) laws, Rodgers and Clearly (1989) found evidence of sustained deterrence, which they attributed to such social factors. Rodgers and Clearly suggested that the legal-threat factors implicit in the law changes have the effect of contributing toward the awareness of the problem and that sustained deterrence springs from the accumulation of the awareness developing into a moral and social commitment to the law. It is interesting to note that the differences in perceived safe and legal consumption limits may reflect both "moral attachment" (Snortum and Berger 1986) and "safe and responsible drinking habits" (Desapriya, Iwase and Shimizu 1998; Tsunoda et al. 1992; Kono 1991).

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