Literature Review and Analysis: Economic Perspectives on Measuring Alcohol Policy Enforcement and Compliance

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I. INTRODUCTION

The economics discipline has produced a large literature that examines the relationship between criminal enforcement and the compliance with laws. This literature, known as the Economics of Crime literature, begins with Gary Becker's classic 1968 article, "Crime and Punishment: An Economic Approach." Not to be confused with Dostoevsky's work, Becker employs the utility maximization approach earlier developed by the philosopher Jeremy Bentham. Becker considers the costs vs. benefits of crime from the point of view of the average individual. This approach assumes constant preferences, and focuses on deterrence through governmental and non-governmental sanctions. This report will consider the economic approach to criminal sanctions.

Much of the economic literature is normative, developing models to prescribe the optimal level of enforcement against crime. However, the literature also provides positive (empirical) implications by examining the incentives faced by individuals, and a large literature provides empirical tests of the theory. This report focuses on empirical implications developed in the economic literature. Specifically, we consider the relevant empirical measures related to enforcement levels and penalties and their relationship to compliance.

The economics literature follows a unified theoretical framework stemming from the work of Becker. Rather than considering three separate frameworks, we examine the basic framework and two related topics: the structure of laws and the scale of enforcement efforts. These topics are of direct relevance to the empirical issues involving the enforcement of and compliance to policies addressing alcohol-related problems.

Because the economic literature on crime has become so vast, this report draws mostly from the seminal article by Becker and recent summaries/reviews of the theory and evidence by Eide (1999), Polinsky and Shavell (2000) and Cohen (1999). We also consider recent papers that show how implications in the economic literature have been implemented in empirical studies. The papers were selected based on a preliminary list of citations provided by the Government Project Officer, on-line database searches conducted by two librarians, suggestions by two expert reviewers, Drs. Marc Cohen and Donald Kenkel, and the discretion of the David Levy, an economist at the Pacific Institute for Research and Evaluation, the author of this report. Details regarding the methods used for selecting materials are attached as Appendix A.

II. BASIC MODEL

A. Theory

Becker (1968) provides a normative model of the optimal level of enforcement of laws against crime. The model considers the trade-off between the costs to members of society from criminal activity and the net benefits to the potential/actual violator of the law. The benefits to the violator of committing a crime (monetary and psychic) are weighed against the expected costs of crime.

In the economic model, the primary costs of engaging in crime are from the sanctions generally imposed through government. From a potential criminal's vantage point, the costs are the probability of detection multiplied by the reduced utility associated with penalties for criminal behavior. If the individual is risk neutral, the probability of detection and the commensurate penalty are essentially weighted the same by the individual. Risk-averse (preferring) individual would tend to place more (less) weight on penalties (Eide 1999). We note that differences in individual reactions to sanctions are implied by variations in their attitude toward risk.

Penalties and risks of detection have direct empirical counterparts. Penalties generally take the form of fines or imprisonment but may also involve a loss of reputation. The probability of detection can be considered the likelihood of being convicted, since direct penalties are imposed only if convicted. However, apprehension in the absence of conviction may also impose implicit costs due to loss of reputation and time spent in jail and defense, and explicit costs for legal representation and providing bail.

For the purposes here, the term "enforcement" refers below to resources used to detect and prosecute criminal activity. These policies affect the likelihood of conviction. "Deterrence policy" and "sanctions" are used to denote both the levels of penalties and enforcement.

B. Evidence and Applicability to APIS

In empirical studies, the probabilities of arrest, of clearance by arrest and of conviction given as a result of arrest have all been used as measures of the probability of detection. The rates of clearance by arrest are usually considered the better measures of certainty of sanction than the rates of conviction (Andenaes 1975; Eide 1999). In addition, higher crime rates may lower rates of conviction as resources devoted to law enforcement become more strained, while reported arrest rates may increase more than the actual number of crimes as resources devoted to criminal enforcement increase. The severity of punishment has been measured by fines, the length of sentence and time served.

Compliance in the economics literature is generally measured in terms of the number or rates of criminal activity (e.g., crimes per capita). Studies that have examined the relationship of enforcement and penalty levels to criminal activity have obtained mixed results, but most studies find that the probability of punishment is negatively related to criminal activity (Eide 1999). The results for severity of punishment also tend to find a negative relationship, but are less clear cut and generally weaker (Eide 1999). The stronger and more consistent effects of probability of punishment (rather than severity) would suggest that the criminal element has a preference for risk.

Much of the empirical literature on alcohol-related problems has focused on drinking and driving. Some studies directly examine the extent of drinking and driving, but most studies consider the socially harmful outcomes associated with drinking and driving, such as traffic fatalities. Some studies consider the more direct measure of alcohol-related fatalities (those in which one of the drivers has a positive BAC) or single vehicle fatalities (which tend to be more alcohol-related), but these measures have measurement error in distinguishing alcohol-related events.

The literature on drinking and driving sanctions has considered measures directly related to the economic theory of crime. Wilkinson (1987) considered the effects of likelihood of arrest, the likelihood of conviction and the effect of penalties on traffic fatalities. He further distinguished the effects through alcohol consumption on traffic fatalities. While his results provided some evidence that the probability of arrest reduces alcohol consumption, he failed to distinguish an independent deterrent role for enforcement policies and penalties on traffic fatalities. His results were not affected when he considered criminal sanctions as simultaneously determined with the extent of traffic problems, but his equations may have been poorly specified.

Kenkel (1993) modeled drinking and driving policies in terms of laws and administrative policies that influence the likelihood and severity of sanction. In his estimation equations, he included preliminary breath tests and the use of sobriety checkpoints as indicators of the likelihood of arrest, anti-plea bargaining laws and administrative per se laws as indicators of the probability of conviction given arrest, and laws establishing mandatory punishment as an indicator for the severity of punishment. He considered heavy drinking and drinking and driving episodes, and found that each of the policies affected these outcomes.

Other papers have also considered the role of deterrence policies and obtained mixed results. Chaloupka et al. (1993) found that having a high minimum mandatory fine, no plea bargaining laws, a 1-year administrative license action, and preliminary breath tests decreased drunk driving, but found little or no effect of mandatory jail sentences and the weak administrative penalties. Ruhm (1996) considered the sensitivity of the results for drinking and driving policies. He generally found that the effects were highly sensitive to model specification, with only administrative per se laws approaching reliable effects. He attributes some of the deterrence effects found in previous studies to grass roots activities directed at drinking and driving and the failure to account for economic conditions. Stout et al. (2000) also did not find deterrence effects for many of the drinking and driving laws. They did, however, find effects of open container laws, mandatory minimum first offence fines and jail time, all of which affect the certainty of punishment.

C. Measurement Issues and Challenges

The economic literature provides some convincing evidence that sanctions affect the extent of drinking and driving problems. However, results appear to be quite sensitive to the specification of the empirical equations. Some of that may be due to a high degree of collinearity between the laws directed at drinking and driving and between the laws and other factors. Multicollinearity problems might be overcome by combining the different measures of laws into indexes for the probability of detection and for the severity of punishment.

The sensitivity of results in past studies may also arise from problems in the specification of equations. The effect of policies directed at alcohol-related problems may depend on other policies in effect. In Becker’s model, the tendency to engage in criminal activities depends on other costs besides sanctions, such as direct costs associated with the activity. In the context of alcohol-related problems, the costs of consuming alcohol will depend on the price of alcoholic beverages and time costs in obtaining beverages. Alcoholic beverage prices (e.g., Wilkinson 1987; Chaloupka et al. 1993; Kenkel 1993; Ruhm 1996) and the number of outlets per square mile (Wilkinson 1987) have been found to be important factors related to alcohol consumption

and/or traffic fatalities. However, none of the studies have explicitly examined how the effect of criminal laws associated with drinking and driving may depend on and be inter-related with the non-criminal policies in effect, e.g., through interactive terms in the estimation equations.

Other laws may directly affect the harmful activities that may be associated with alcohol use. For example, laws against speeding or other traffic violations have been found to be important in reducing the harmful effects of drinking and driving (Wilkinson 1987). These policies may have a synergistic effect on policies directed at the enforcement of laws against alcohol-related problems.

A general problem in examining the relationship between sanctions and criminal behavior is that the level of sanctions may reflect the extent of criminal behavior. If a higher crime rate leads to more law enforcement resources and stiffer penalties, a problem of reverse causality may arise in empirical applications. The literature on the economic incentives for regulation, also known as the "economics of politics" literature (see Cohen 1999), provides an understanding of this reverse causation process by examining how politicians and bureaucrats react to different interests. This problem may be less of a concern in studies using individual (rather than aggregate) level data, where societal levels of enforcement attempt to explain the behavior of the individual (Eide 1999). Some studies have used simultaneous equation methods to directly control for the problem of two-way causality (e.g., Levitt 1997).

Further study may go outside of economics for help in specifying the estimation equations. Economic theory examines how individuals respond to changes in incentives, i.e., sanctions and economic conditions. In comparison, biological/psychological approaches tend to focus on different traits of the individual (especially aberrant traits), and sociological approaches tend to focus on societal norms.

As indicated above, attitudes toward risk may be important. In fact, they may influence the effect of sanctions. An important bridge between the empirical literature in economics and that in psychology may be through identifying which individuals are most likely to be affected by sanctions. These inter-relationships may be examined through the interaction of individual and policy terms in explaining criminal behavior.

Attitudes toward risk may also affect *perceptions* of risk. One of the criticisms sometimes leveled against the economics of crime literature is that criminals may not be aware of the likelihood of arrest/conviction or the extent of penalties. While there is some evidence that criminals are more informed than the general public about enforcement and penalties (Eide 1999), there may also be a tendency for individuals to think that they will not be caught or imprisoned (i.e., underestimate probabilities of harm and likelihood of being caught). Although economic applications are often couched in terms of actual probabilities of conviction and penalties, they can also be applied to perceived values of these variables (e.g., Viscusi 1989, 1992). By providing information on alcohol deterrence policies, government media campaigns, publicity regarding new laws and policies, and information by grass roots organization (e.g., MADD) may increase compliance with the laws. For example, publicity about sobriety checkpoints has been found to reduce drinking and driving fatalities (Lacey et al. 1986, 1989) and Kenkel (1993) finds that an index of health information is an important predictor of heavy

drinking. Government can also publicize violators of laws (e.g., businesses selling alcohol to youth) as an additional way to encourage compliance.

Social norms have recently received attention by those applying the economic approach. Posner and Rasmussen (1999) have defined a norm as "a social rule that does not depend on government for either promulgation or enforcement." Norms may promote compliance even in the absence of government sanctions, and may reinforce or act in lieu of laws. Studies on the enforcement of pollution control find that norms play an important role in compliance (Cohen 1999).

While the emphasis in the economics literature is mostly on how norms may act independent of laws and or how government may reinforce norms, laws may also reinforce and even help to create particular norms. For example, the literature on Federal and state tobacco policies argues that laws affect the attitudes of smokers and non-smokers in a way that discourages smoking (Friend and Levy 2002; Levy and Friend 2001; USDHHS 2000).

Grass roots and social movements that are devoted to changing laws may play an important role in the development of norms. As more laws are promulgated, there may be a synergy from laws that make a behavior less desirable. In consequence, it may be easier to enforce laws. Police may receive more support from the community and may devote more resources, and judges may be more willing to mete out stiffer penalties. Evidence from Levitt (1997) indicates the importance of political process in affecting police resources.

In empirical studies of criminal sanctions, it is difficult to distinguish the deterrent effect of policies from the role of norms (Eide 1999). If laws and policies just reflect norms, they may have little independent effect. Studies that attempt to distinguish the respective roles of norms from law and enforcement often still find a distinctive effect of policies. For example, Chaloupka et al. (1993) include religious affiliations as an indicator of drinking sentiment, and continues to find that laws affect drinking and driving problems. However, further work along these lines is needed combining insights from sociology with economic studies of crime.

III. THE STRUCTURE OF POLICIES

A. Theory

The effect of enforcement policies and penalties may also depend on how they are structured in terms of liability, penalties and enforcement related to prior history, and other factors. This structure has received considerable attention in the economics literature (Polinsky and Shavell 2000; Cohen 1999).

In some cases, liability may be directed at parties other than the directly offending individual, such as penalizing a parent for harmful activities of their child (Cohen 1999). This approach has been extensively used in alcohol control policy, where the judgment of the consuming individual, especially that of youth, is considered to be less than optimal. Instead of focusing on the injurer (consumer of alcohol), deterrence policies are directed at others such as businesses serving or selling alcohol to youth or intoxicated individuals. Like individuals, businesses have direct economic incentives to obey the laws. Besides fines and prison terms, their reputations

(both to potential buyers and stockholders) may be hurt by engaging in socially undesirable activities (Cohen 1999).

Legal mandates requiring burden of proof may affect compliance with the law. A negligence standard is expected to require more enforcement efforts and imply a lower expected penalty compared to a strict liability standard (Polinsky and Shavell 2000; Cohen 1999). Sanctions through private parties may also create an additional penalty associated with violating a law (Cohen 1999; Polinsky and Shavell 2000). For example, if a drinking driver or businesses or individuals serving to that party can be sued by a private party for damages caused by drinking, then additional costs are imposed for violating or contributing to the violation of the law.

Legal rules may also affect the probability of conviction (Cohen 1999). For example, the ability to find a person guilty of speeding may be greater when the law is set at lower levels (Lee 1985). The burden of proof may be easier, and courts may be more willing to evoke stronger penalties. This issue arises in setting the legal limit for intoxication.

The economics literature has also examined the effect of having sanctions depend on the past history of the offending party (Polinsky and Shavell 1998, 2000). For example, previous offenders may receive greater penalties and/or increased surveillance compared to those without a record. Although future penalties for repeat offenders are often discounted (Eide 1999), potentially higher future penalties will create an added incentive for first time offenders not to violate the law. Since jail sentences and enforcement are costly, this type of structure becomes a viable alternative in increasing compliance. Past history may also provide an indication of the danger of particular individuals and their likelihood to commit future offences, and thus provide justification for increased sentences. Attention to the nature and number of prior convictions gets built into the system as way to reduce future criminal activity.

B. Evidence and Applicability to APIS

Stout et al. (2000) considered the effects of dram shop and social host laws liability laws. They found that dram shop liability laws were associated with less drinking and driving. These results are consistent with those of Chaloupka et al. (1993), Kenkel (1993) and Ruhm (1996). Stout et al. (2000) also found that social host liability laws were associated with less heavy drinking and less drinking and driving episodes.

Studies have examined how third party liability laws affect socially harmful behavior. A large literature on tobacco control policies examines how youth access enforcement policies affect compliance with laws affecting access to laws regarding sales of tobacco to youth (Levy and Friend 2002; Forster and Wolfson 1998). These studies indicate that the number of enforcement checks and more comprehensive policies affect retailer compliance. Based on economic theories, Levy and Friend (2000) suggest that retailer compliance with underage tobacco purchase laws may not be linearly related to reductions in harmful activity. They posit and find support for the hypothesis that compliance by retailers must be at high levels (implying increasing returns) before youth are deterred from cigarette purchases.

Similar tendencies might be expected for youth purchase of alcohol as that found in the tobacco control literature. A particularly large literature has examined the impact of minimum legal

drinking ages. For example, Cook and Tauchen (1984) and others (Shults et al. 2001) have found that higher drinking ages are associated with fewer traffic fatalities in the 18-20 age group. Ruhm (1996) found that this relationship is robust to other variables included in the equations. However, few studies have examined retailer compliance with the youth access laws, and the factors that affect retail compliance.

Liability rules have a special application to drinking and driving policies. Per se rules may be more enforceable when set at lower levels, i.e., 0.08 rather than 0.10 BAC, because a 0.08 rule may be necessary to convict at a BAC of 0.10. For example, studies have found that 0.08 rules were associated with fewer alcohol-related fatalities (Shults et al. 2001).

Greater enforcement directed at and higher penalties to repeat offenders may be particularly relevant to policies directed at alcohol-related problems. Alcohol consumption is generally not viewed as undesirable unless it leads to alcohol-related problems, especially when they are imposed on another (non-drinking) individual. If the potential for such harm varies from individual to individual, attention to the past history of violations may increase the ability to mete out tougher sentences. However, evidence must be garnered that the past history of violations is a good indicator of the likelihood of future violations.

C. Measurement Issues and Challenges

Little attention has been devoted in the literature on alcohol control policy to the effects of legal structure. Some studies have examined social host and server liability and obtained promising results. Studies of the effect of 0.08 BAC have also found strong results, but further work might consider how these laws interact with other laws.

Information needs to be collected on how laws affect the structure of penalties and enforcement and how individuals react to that structure. In particular, more attention may be given to laws affecting third party liability, negligence standards, and the treatment of past history. The interaction between these factors and other laws mentioned above must be carefully considered and their effects untangled or the their role combined in a meaningful index.

IV. SCALE OF ENFORCEMENT EFFORTS

A. Theory

In gauging the effectiveness of public policies, it is useful to know how compliance varies with the level of enforcement activities. In Becker's original article, a typical "production function" from economics is posited, whereby enforcement capability depends upon manpower, materials, capital and the state of technology. Their use is defined for a well specified outcome and period of time.

From economic theory, efficiency implies that inputs are used in the area of diminishing returns, whereby increases in the use of one input (holding others constant) leads to successively smaller increments in the level of output. Thus, the incremental contributions of individual inputs to output are expected to decline, at least after some level. These tendencies imply that the effect of individual inputs may vary non-linearly with their level of use. As the overall scale of all inputs

in the production process increases, output may be expected to increase more than proportionately (i.e., increasing returns) up to some point (e.g., some threshold level) and then to increase less than proportionately (i.e., decreasing returns). Such relationships imply that the overall effects of enforcement activity may vary non-linearly with the overall level of resources devoted to those activities.

The effectiveness of enforcement efforts may also depend on the scale of penalties. In the absence of a penalty, enforcement efforts may have nil or no effects. At too high a level, judges may be reluctant to enforce penalties.

B. Evidence and Applicability to APIS

A relatively small literature examines how inputs into the enforcement process affect compliance with laws. Levitt (1997) found that the number of police reduced the level of crime, but potential non-linearities in this relationship were given little attention. In the ranges at which inputs are used, diminishing returns might be expected. For example, Levy and Friend (2000) posit and find some support for diminishing returns to the number of enforcement checks per outlet per year in the compliance of laws regarding the sale of cigarettes to underage youth.

C. Measurement Issues

Future research might consider the intensity of enforcement efforts, rather than just the existence of laws or penalties and rates of arrest/conviction. In gauging the impact of enforcement inputs devoted to alcohol-related problems (or for that matter any individual type of crimes), it may be difficult to determine input levels, because it would be difficult to distinguish the contribution of police and other inputs to alcohol-related harms from their contribution to other crimes. However, resources are sometimes devoted specifically to the enforcement of alcohol control laws. Such resources may be measured in terms of hours allocated, budgets earmarked, or number of officers dedicated to alcohol-related or substance abuse-related crimes. Media messages related to alcohol-related problems, in terms of number or dollars spent, may also be considered.

Instead of focusing on resources, it may be possible to measure the enforcement efforts in terms of levels of alcohol-related enforcement activities. Examples are the number of sobriety checkpoints or the number of enforcement checks of bars or stores selling alcohol.

In developing measures of enforcement efforts, a number of measurement issues should be considered. Enforcement levels may be measured in terms of quantities or dollar amounts or numbers. They may be further scaled to the size of the population, number of outlets selling alcohol (when the policy is directed at businesses). or geographic area. The geographic area and temporal period of observation (i.e., the observational frequency) should be well defined and correspond to the compliance measure. In measuring the temporal allocation of resources, timing may be important. Enforcement efforts may be limited to a specific period or spread over the entire time period considered.

The relationship of the enforcement efforts to the compliance measure also merits particular consideration. Estimation equations should allow for the possibility of non-linear relationships to

compliance. Percentage changes (log) or absolute changes (linear) or some variation may be relevant. Interactive effects between the different inputs should also be considered.

V. CONCLUSIONS AND SUGGESTED FUTURE DIRECTIONS

The economic approach has spawned a large literature on the relationship between criminal sanctions and compliance. The theoretical framework focuses on the incentives facing individuals regarding acts harmful to society. Because of its focus on measurable variables, economic theory has provided testable implications. An empirical literature has provided support for the use of deterrence policies to reduce criminal behaviors.

In the area of alcohol control policy, a number of studies have examined the impact of laws directed at curbing drinking and driving problems. The results generally indicate that these laws have been effective, but the results for specific laws have often been mixed. Future research from the economics literature and other literatures might be directed at further specifying the nature of the relationship of sanctions to alcohol-related problems. These changes may be based on economic theory or knowledge from other disciplines.

Future research might draw from the theoretical and empirical economics literature in further specifying the nature of the relationship of criminal sanctions. Most literature focuses on the existence of laws related to drinking and driving problems. There appears to be problems in disentangling the effects of the different policies. An index of the overall level of sanctioning ability of laws may be created based on how the different laws affect probabilities of arrest and conviction and the extent of penalties for drinking and driving. In addition, attention might be directed toward obtaining information on the structure of laws, including treatment of past offenders, negligence standards, and legal rules, and towards the level of enforcement activity.

In the “black box” of economics lies somewhat concealed how characteristics of the individual and how social attitudes as reflected in norms affect those relationships. Future research may benefit from better incorporating psychological and sociological aspects into economic studies of crime (Eide 1999).

References

Andenaes, J. General prevention revisited: Research and policy implications. *Journal of Criminal Law and Criminology* 66: 338-365, 1975.

Becker, G. Crime and punishment: An economic approach. *Journal of Political Economy* 76: 169–217. 1968.

Chaloupka, F., Saffer, H., and Grossman, M. Alcohol control policies and motor-vehicle fatalities. *Journal of Legal Studies* 22: 161–186, 1993.

Cohen, M. Monitoring and enforcement of environmental policy. In Tietenberg, T. and Folmer, H. (Eds.) *International Yearbook of Environmental and Resource Economics, Volume III.*, 44-106. Edward Elgar Publishers, 1999.

Cook, P., and Tauchen, G. Effect of minimum drinking age legislation on youthful auto fatalities, 1970-1977. *Journal of Legal Studies* 13:169–190, 1984.

Eide, E. 1999. Economics of criminal behavior. *Encyclopedia of Law and Economics, #8100* 345–389. Online: http://allserv.rug.ac.be/~gdegeest/tablebib.htm

Forster, J., and Wolfson, D. Youth access to tobacco: Policies and politics. *Annual Review of Public Health* 19: 203–35, 1998.

Friend K., and Levy D. Reductions in smoking prevalence and cigarette consumption associated with mass-media campaigns, *Health Education Research* 17: 1, 85–98, 2002.

Kenkel, D. Drinking, driving, and deterrence: the effectiveness and social costs of alternative policies. *Journal of Law and Economics* 36: 877–913, 1993.

Lacey J., Stewart, J., Marchetti, L., et al. *Enforcement and public information strategies for DWI general deterrence: ARREST DRUNK DRIVING–The Clearwater and Largo, Florida experience.* Chapel Hill, NC: University of North Carolina Highway Safety Research Center, 1986.

Lacey, J., Stewart, J., Marchetti, L.M., et al. *An assessment of the effects of implementing and publicizing administrative license revocation for DWI in Nevada*. Chapel Hill, NC: University of North Carolina Highway Safety Research Center. Final report submitted to USDOT (DOT HS 807 600), 1989.

Lee, D. Policing cost, evasion cost, and the optimal speed limit. *Southern Economic Journal* 52:34–45, 1985.

Levitt, S. Using electoral cycles in police hiring to estimate the effect of police on crime. *The American Economic Review* 87(3): 270–290, 1997.

Levy, D., and Friend, K. Strategies for reducing youth access to tobacco: A review of the literature and framework for future research. *Drugs, Education, Prevention and Policy* 9(23): 285-303, 2002.

Levy, D., and Friend, K. A model of policies aimed at youth access to tobacco, *Journal of Health Politics, Policy and Law* 25:6, 1023–50, 2000.

Levy D., and Friend K. Clean air laws: A framework for evaluating and improving clean air laws, *Journal of Public Health Management and Practice* 7(5): 87–97, 2001.

Polinsky, A., and Shavell, S. On offense history and the theory of deterrence. *International Review of Law and Economics* 18(3): 305–324. 1998.

Polinsky, A. and Shavell, S. Public enforcement of law," *Encyclopedia of Law and Economics*, 2000. Online: http://allserv.rug.ac.be/~gdegeest/tablebib.htm

Posner, R. and Rasmusen, E. 1999. Creating and enforcing norms, with special reference to sanctions. *International Review of Law and Economics* 19(3): 369–382, 1999 (http://www.sciencedirect.com/science/article/B6V7M-3XFTG6T-5/1/666beae5bd7a229052874339e07d9ca0).

Ruhm, C. Alcohol policies and highway vehicle fatalities. *Journal of Health Economics* 15(4): 435–54, 1996.

Shults, R., Elder, R., Sleets, D., et al. Reviews of evidence regarding interventions to reduce alcohol impaired driving, *American Journal of Preventive Medicine* 21(4S): 66–88, 2001.

Stout, E., Sloan, F., Liang, L., and Davies, H. Reducing harmful alcohol-related behaviors: effective regulatory methods. *Journal of Studies on Alcohol* 61(3): 402–412, 2000.

United States Department of Health and Human Services. *Reducing Tobacco Use: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2000.

Viscusi, W. Prospective reference theory: Toward an explanation of the paradoxes. *Journal of Risk and Uncertainty* 2(3): 235–64, 1989.

Viscusi, W. *Fatal Trade-offs: Public and Private Responsibilities for Risk.* New York: Oxford University Press, 1992.

Wilkinson, J. Reducing drunken driving: which policies are most effective? *Southern Economic Journal* 54(2): 322–34, 1987.