Abstract: When considering federal legislation to encourage states to raise the drinking age to twenty-one, public officials faced a common problem: assessing the efficacy of a proposed policy change from evidence that is deficient in quality and quantity. This paper shows how the political system yielded an assessment that was substantially more optimistic than merited by the evidence available at the time. This outcome was strongly shaped by the failure of academia and of the federal agency that oversees traffic safety to provide the intellectual background needed to assess the evidence effectively.

JEL Codes: I18, K14, N42

Keywords: drunk driving; traffic safety legislation; policy analysis

1 This research was sponsored by a grant from Choose Responsibility. A companion paper, Grant (2011), documents how academic findings on the effects of three major laws—the minimum legal drinking age, zero tolerance laws, and .08 per se laws—become much less favorable over time and explains this evolution in terms of changes in study design and an “early adopter effect.” I appreciate comments from Hui-Chen Wang and from participants at the 2011 meetings of the Public Choice Society and the Southern Economic Association, the research assistance of Kristin Boykin, and the cooperation of several interviewees.
ACRONYMS USED IN THE PAPER

AAA:   American Automobile Association
BAC:   Blood Alcohol Concentration
DWI:   Driving While Intoxicated (drunk driving)
GAO:   General Accounting Office, a federal government “watchdog” agency
IIHS:  The Insurance Institute for Highway Safety, an industry research and lobbying group
MADD:  Mothers Against Drunk Driving, a group that lobbies for the enactment of various drunk driving countermeasures
MLDA:  Minimum Legal Drinking Age
NHTSA: The National Highway Traffic Safety Administration, the federal agency with primary responsibility for traffic safety
NIAAA: National Institute on Alcohol Abuse and Alcoholism
NMDAA: National Minimum Drinking Age Act, which strongly encouraged states to raise the drinking age to 21
NSC:   National Safety Council
NTSB:  National Transportation Safety Board, a federal agency that investigates vehicle accidents, plane crashes, etc., and makes safety recommendations
TSCS:  Time-series cross-section, data that contains variation over time across a number of cross-sectional units, such as states
In general the influence of the public, whether directly or through political institutions, has been pernicious to traffic safety. It comes and goes, filling in the troughs between peaks of more exciting events; it seizes on issues without concern for the relevance or tractability of the problems; it proposes “solutions” which are at best naïve and at worst absurd, and above all it demands action even where action may be only a waste of money.

—Frank Haight (1985)

Although it is hard to challenge Haight’s characterization of…the political process in the area of traffic safety, his proposed solution of entrusting the issue to low-profile agencies...seems wishful and unrealistic. His viewpoint neglects the fact that the recognition of any condition as a social problem is a political matter. It is not helpful for underdogs in the political game to pick up their chips, denounce the rules...and look elsewhere, when the political game is the only game in town. Even the experts are forced to play it, often as mere adjutants to parties with less sophistication but greater involvement and determination.

—H. Laurence Ross (1992, p. 174)

A primary motivation for undertaking economic analysis is to inform public policy. Economists’ penchant for highlighting the policy implications of their results is so widespread it has caused one respected economist to warn against its overuse.¹ Our federalist system, in which the states, “laboratories of democracy,” experiment with alternative solutions to social problems, is predicated to some extent on accurate assessments of these experiments, to ensure the most promising solutions thrive. Economists and other policy analysts fill this role.

Yet it is a fruitless quest to peruse the pages of academia for insight into just how the results of formal policy analyses are integrated into policymaking.² The subject appears to fall

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² After an exhaustive search in journals in public policy, policy studies, and applied economics, the closest related works appear to be Henig (2008), who compares how academia and the media resolve differences about research findings on the effectiveness of charter schools, and
in a no-man’s-land between the topical research itself, on the one hand, and general theories of the policy process, on the other. This latter literature acknowledges the frequent dissonance between the technocratic merit of a proposed policy and its political feasibility (e.g., Majone, 1989; Stone, 2001), and the role of learning in policy formation and diffusion (Keikkila and Gerlak, 2013; Meseguer, 2005), but does not examine the evaluative process in detail.3

Such an examination might not be needed for policies governed by technical experts, who can independently assess research on the topic and assimilate its findings into their work. Such situations certainly exist, as for example in the Federal Reserve. But policy is often governed by political actors, rather than technical experts, because it is necessary to trade off competing interests, “recognize a condition as a social problem,” or consider non-technical factors such as the social acceptance of a new law. In assessing the state of knowledge, these actors often face a daunting task. The relative and absolute merits of any given policy are often uncertain, because of differences across studies in research design, data, and the interpretation of the evidence, while the often-compressed time scales of policymaking heighten deficiencies in the quality and quantity of the evidence available at the point of decision.

Altogether, these elements comprise a difficult optimization problem. Surely it is

Tanenbaum (2009), who examines how Pay for Performance came to be implemented in Medicare despite little concrete evidence on its effectiveness. While neither focuses on the questions posed by this study, similar themes—excessive enthusiasm for favorable early findings and the lack of an effective institutional mechanism to evaluate and synthesize the evidence—pervade all three papers, suggesting some degree of universality. See also a related literature examining how politicians and bureaucrats utilize cost-benefit analysis (Boardman, Wining, and Waters, 1993; Scott, Zerbe, and Scott, 2013).

3 Formal evidence on policies’ likely effects plays little role in multiple theories of the policy process; see Sabatier (2007) and the papers introduced by Schlager and Weible (2013). Similarly, learning appears regularly in Berry and Berry’s (2007) overview of the policy diffusion literature, but the role of formal analysis in that learning goes mostly unexplored.
worthy of examination, which could increase our understanding of the evaluative process, improve the quality of its outcomes, and help dispel a certain fatalism that hovers over the existing literature, which treats this problem as intractable rather than a consequence of intellectual, institutional, and political arrangements that can be ameliorated.

The form of this examination is shaped by three key impediments to its execution. First, many relevant “variables,” such as political forces or institutional characteristics, cannot be quantified, prohibiting a purely statistical approach. Second, wide variation across policies in the technical issues, political constituencies, and institutions involved heightens the relevance of context and prevents a broad, deductive approach centered around a priori theorizing. Third, the unusual combination of statistical, political, organizational, and policy-specific technical knowledge that must be invoked precludes an analytical approach that fits cleanly into a well-defined academic field. These impediments necessitate a multifaceted, narrative approach that induces general principles from specific situations.

Using this approach, this paper investigates how evidence on the effects of raising the minimum legal drinking age (MLDA), “one of the most thoroughly evaluated social interventions of our time,” (Ross, 1992) was evaluated in the prologue to the passage, in 1984, of the National Minimum Drinking Age Act (NMDAA), which provided strong and ultimately successful incentives for all states to raise their MLDA to 21. We examine how well the federal government assessed the extant evidence on the effects of the raised MLDA, how well it assessed the limitations of that evidence, how underlying intellectual and institutional factors influenced these assessments, and whether subsequent assessments of drunk driving legislation exhibited similar features.
The paper proceeds in three stages. Sections I and II describe the social and political context of the NMDAA and offer a retrospective look at how this legislation has affected traffic fatalities. Next, Sections III and IV examine how the political system evaluated, at the point of decision, the available evidence and its potential weaknesses. Finally, Sections V and VI consider the intellectual and institutional factors shaping this evaluation. Section VII concludes.

We are, we believe, able to induce general principles from this specific situation. They are, in economic terms, fundamental, based on agency, specialization, and exchange. They explain the excessive optimism about the effects of the NMDAA and subsequent drunk driving legislation, and the powerful intellectual and institutional factors underlying this result.

Section I. A Brief History of the National Minimum Drinking Age Act.

Legislation to curtail drunk driving and youth drinking began in the late 1970s, a reversal of the increased permissiveness earlier that decade, when many states lowered their drinking ages. From 1976-1980, thirteen states raised their drinking ages, generally by one year. Between 1981 and 1983, twelve more states raised their drinking ages, thirty-four states adopted per se blood alcohol concentration (BAC) limits, and eleven adopted administrative license revocation. Activity crested between 1984 and 1986, with the passage of hundreds of state laws, as documented in Table 1.

This activity was associated with three concomitant social changes, each also documented in Table 1. The first was an increased social awareness of the dangers of drunk driving: media coverage of the issue, almost wholly absent during the 1970s, grew rapidly after
1981. Hundreds of stories appeared in major newspapers, and dozens of stories in magazines, during the next quadrennium. Coverage in other media increased as well:

I can see it from my experiences of ten, twelve years ago as Secretary, when if I could get one TV camera to come to a hearing or a meeting about drunk driving, I thought we were very fortunate. They might stay as long as ten minutes. Our first hearing in Oklahoma City [of the Presidential Commission on Drunk Driving] we had four television cameras, twelve radio stations, and eight or nine newspaper people there. Two of the cameras stayed half a day and two stayed all day long. (John Volpe, former Secretary of the Department of Transportation and then-Chairman of the Presidential Commission on Drunk Driving, H1, 1983, p. 273.)

This awareness translated into action: hundreds of organizations were founded whose purpose was to curtail drunk driving. The best known of these, Mothers Against Drunk Driving (MADD), played a key role in lobbying for the NMDAA and subsequent legislation, including .08 per se BAC limits, open container laws, and zero tolerance laws, and is still active today.

These two social changes contributed to the third, in attitudes. The public became much less accepting of driving after drinking:

The American public is far less tolerant of drunk driving that they were ten years ago. It’s no longer funny for Johnny Carson to joke about the issue. (Judith Stone, Director, Federal Affairs, National Safety Council, H5, June 1988, p. 24.)

For...decades, the enormous toll of death and injury that occurred in the United States was regarded as accidental in almost a cosmic sense. The statistical toll of road accidents was collected and reported with an air of fatalism similar to attitudes toward earthquakes, tornadoes, or other natural disasters. At the same time, the...paradigm of responsibility began and ended with the personal fault of the parties to the accident. The public perception now in the United States...is that the manner in which...laws are drafted and enforced can have important effects on highway deaths and injuries (Zimring, 1988).

While most legislative activity occurred at the state level, the issue also received federal

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4 This quote, like many others to follow, comes from the transcript of a Congressional hearing or Congressional debate. These events are each listed in the chronology in the Appendix, labeled H0-H6, and cited within the text using that appellation.
attention, partly from concern about youth driving across state lines to take advantage of a lower MLDA. Transportation bills offered financial incentives to the states to adopt various drunk driving countermeasures, including but not limited to higher drinking ages. President Reagan appointed a highly-visible Presidential Commission on Drunk Driving, which held nationwide hearings and ultimately issued dozens of recommendations on the issue. Both NHTSA and the National Transportation Safety Board (NTSB) weighed in with written reports and testimony before Congressional subcommittees, which held several hearings on the problems of drunk driving and teenage drinking. The Appendix contains an extensive chronology of the activity surrounding the passage of the NMDAA.

In 1983 and 1984 these forces built to a fever pitch and provided the impetus for strong federal action. A Gallup Poll taken in early 1983 established the popularity of raising the drinking age, and multiple bills or amendments to mandate or encourage this were proffered in Congress. In November, 1983, the Presidential Commission on Drunk Driving, following in the footsteps of MADD, the National Safety Council (NSC), the Insurance Institute for Highway Safety (IIHS), and the NTSB, formally recommended establishing a national drinking age of twenty-one in order to improve traffic safety. President Reagan signaled his support in June, 1984; the NMDAA was law one month later. Challenges to the law’s constitutionality were exhausted by 1987; the last two states raised their MLDAs to 21 the next year.

Section II. Evidence on the Effects of the Minimum Legal Drinking Age: Then and Now.

The country’s enthusiasm for a raised MLDA was matched by its supporters’ optimism
about its expected effect on traffic safety:

> Nearly every state that has raised the drinking age to twenty-one has produced a significant drop in the (sic) teenage driving fatalities. In the state of New Jersey...the rate dropped by twenty-six percent; Illinois, it has fallen twenty-three percent; in Michigan, thirty-one percent. (President Ronald Reagan, Remarks on Signing HR 4616 into Law, July 17, 1984.)

This optimism, however, contrasted with the incompleteness of the evidence on how the drinking age affects traffic safety—the law’s raison d’être.

The complete academic literature through 2009, forty years in length, is illustrated in Figure 1, taken from Grant (2011).^5^ On this “bubble plot,” the horizontal axis represents the publication date, which is generally a couple of years after the data terminate, and the vertical axis represents the estimated percentage effect on fatalities involving affected drivers, with insignificant estimates set to zero. The diagonal line separates studies of lowered drinking ages, in the first part of the literature, from subsequent studies of raised MLDAs. The volume of each bubble represents the number of academic citations in Google Scholar as of June 2009, with a minimum bubble size so that uncited studies are not eliminated. (Later studies have less time in which to be cited, of course.) Bubbles ringed in black circles are supported by external funding, generally from the National Institute on Alcohol Abuse and Alcoholism (NIAAA).

The color of the bubble represents the study design. Red represents cross-section

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^5^ This includes all studies published in an academic book or refereed journal that estimate the effect of the raised MLDA on the affected population (generally 18-20 year olds), omitting regression discontinuity analyses that cover only one edge of this age range, along with a few panel analyses that go far beyond this range. For further discussion, see Grant (2011). While regression discontinuity analyses find larger effects than panel estimates of similar vintage, this should be expected. Compared to 18-20 year olds as a whole, drinking involvement in fatal accidents is much higher along the 20-21 year old “border” along which the discontinuity is estimated (Grant, 2014). At this point it is unclear how to reconcile the two sets of estimates.
regression, and blue quasi-experimental designs, which generally compare the change in fatalities in one, or a few, law-adopting states with the change in control states that do not adopt the law. (Occasionally alternative control groups are used instead, based on age or time of day, while the pre-existing trend is sometimes modeled using an ARMA process.) The spatial and temporal dimensions are combined in pooled time-series cross-section (TSCS) regressions, in purple, which include control variables but not state and year fixed effects, and panel regressions, in white, which do include these fixed effects. Panel designs are preferred: they combine the before-after quality of quasi-experimental analyses with the breadth of data and explicit inclusion of control variables that are found in pooled TSCS regressions.

The variation in findings is tremendous in both the raised-MLDA and lowered-MLDA components of this literature, with estimated effects spanning more than thirty percentage points. Some of this is relatively unsystematic, stemming from differences in the dependent variable (crashes or fatalities, scaling by population or miles travelled, etc.), the states and control groups used in quasi-experimental analyses, and the control variables included in regression analyses.

But some is systematic. This variation stems from the following evolutionary process. Early studies, dominated by quasi-experimental methods, yield highly variable yet relatively favorable conclusions. As the number of law-adopting states and post-law years grow, these are supplanted by pooled TSCS and, eventually, panel regressions, which are less variable and much less favorable. This can be seen for studies of lowered drinking ages and, more strikingly, studies of raised drinking ages, where the number of law-adopting states and post law-adoption years becomes large, permitting extensive use of panel methods. The two panel
analyses of lowered MLDA's, Cook and Tauchen (1984) and Weinstein (1987), find traffic fatalities among the affected ages increase by six or seven percent. Early panel analyses of raised MLDA's, discussed below, find an effect of about 12%, but later studies’ estimates again average six or seven percent (Dee, 1999; Eisenberg, 2003; Young and Likens, 2000; Young and Beilinska-Kwapisz, 2006; Polnicki et al., 2007; and Miron and Tetelbaum, 2009).

This trend in findings stems partly, but not wholly, from the evolution in methods. As documented by Grant (2011) for three Congressionally-incentivized drunk driving laws and by Miron and Tetelbaum (2009) for the MLDA specifically, fatality changes associated with new laws are consistently larger in those states that adopt them earliest, without being spurred to do so by Congress, even when the estimation method is kept the same. This too causes estimates of these laws’ effects to trend toward zero over time.

Figure 2 summarizes Miron and Tetelbaum’s results. The top pane estimates the percentage change in youth traffic fatalities generated by raising each state’s MLDA to twenty-one, taken from a sequence of individual state time-series regressions, plotted against the year that state raised its MLDA. (These regressions each cover the same span of years and include the same control variables. States maintaining an MLDA of 21 since 1975 are excluded.) The bottom pane contains a cumulative estimate, from all states adopting this MLDA up to that point in time. Over the time period in the figure, this falls from 10% to less than 5%.

Overall, the literature converges to reasonable extent. This is, in part, a natural consequence of the ethos of academia, which is organized as an “independent, collective, cumulative, open-ended enterprise of knowledge creation and testing” (Henig, 2008, p. 232). Over the decades, one could observe the slow resolution of conflicts in the MLDA literature
over measurement (Williams et al., 1983 vs. Males, 1986; Hammond, 1973 vs. Zylman, 1974), specification (Garber, 1988), and execution (General Accounting Office, or GAO, 1987). But it took decades to achieve. Policymakers contemplating action in 1984 did not have this luxury. The evidence to be evaluated at that time was highly disparate in method, sample, and result.

Section III. The Evaluation of the Evidence in Four Congressional Hearings.

We examine how the political theatre evaluated the evidence on this issue through the lens of four Congressional subcommittee hearings surrounding the passage of the NMDAA. In each, a range of witnesses spoke extensively about the evidence on the effects of a raised MLDA. The studies discussed in these hearings are more numerous than those cited on the floors of the House and Senate, while the positions argued by the same individual or organization varied little across time. These hearings thus provide a reasonably detailed and comprehensive record of the various perspectives on the evidence, the way these perspectives were presented and examined, and the political and technical skill of the participants.

The first hearing was held in October, 1983, by the House Subcommittee on Commerce, Transportation, and Tourism, shortly after the introduction of bill to directly establish an MLDA of 21 nationwide. This well-attended hearing, held when there was increasing momentum for federal action but ambiguity about the form that action might take, featured an exhaustive witness list and active participation from committee members.

The next two, held by the Senate Subcommittees on Surface Transportation and Drug and Alcohol Abuse in June, 1984, were pro forma, as legislative and executive support for the
NMDAA was already established. No members other than the chair attended. Each witness read a prepared statement, but there were few questions.

The last hearing occurred in September, 1986, before the Subcommittee of Investigations and Oversight, House Committee on Public Works and Transportation, to discuss a draft report prepared by the GAO that assessed the evidence on the effects of the raised MLDA. This hearing’s existence testifies to prior hastiness evaluating the evidence:

Congress did take an action in 1984, admittedly without…full committee exploration of the issue, but just on the basis of data at hand, and Congress acted. All right. Now we are trying to come back and analyze the benefits of that action. (Rep. James Oberstar, D-MN, H4, 1986, p. 200.)

No other hearing focused on the MLDA as did these four. However, we also reviewed several others that were peripherally related to the issue, along with the relevant Congressional debate, all of which are listed in the chronology in the Appendix.

Despite this variety of purpose, each hearing’s format was similar. Witnesses appeared in homogenous groups (government agencies, industry representatives, etc.), read a prepared statement and answered questions. Most witnesses, except perhaps a handful of academics, had a material or governmental interest in the hearing’s outcome. Along with NHTSA and the NTSB, the higher drinking age was favored by the insurer-funded IIHS, elite safety organizations such as the NSC, and grassroots advocates such as MADD. All have extensive experience with policymaking; most also have some analytical skill. NHTSA manages the data used in many traffic safety analyses, the NSC edits the well-regarded *Journal of Safety Research*, and the IIHS

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6 The NTSB’s advocacy was unusual, as its mission is investigating the causes of particular accidents in detail, not assessing the merits of traffic safety legislation. The MLDA is the only such law it has forcefully advocated. While NHTSA consistently argued that raising the MLDA dramatically improved traffic safety, prior to June, 1984, it also argued that the decision to do so should be left to the states, consistent with the views of the President at that time.
regularly publishes solid quasi-experimental analyses of traffic safety laws in academic journals.

The opposition, on the other hand, consisted mostly of groups representing students and the restaurant and beverage industries, such as the National Restaurant Association, the United States Students Association, and the Wisconsin Tavern League. They possessed less policymaking experience and little analytical skill. Thus, in contrast to academia, the evidence on the effects of the MLDA was assessed in an adversarial, political environment under significant time pressure, between two sides that were mismatched in technical skill and political experience.

Any hope that this competition would result in median-voter-style moderation is quickly dispelled by a review of the evidence cited. On both sides, this was a highly selective subset of the whole. Consider, for example, the work of one influential researcher, Alexander Wagenaar. Wagenaar (1981) found that in the year after Michigan raised its drinking age from 18 to 21, in 1978, crashes involving 18-20 year old drivers whom police reported had been drinking fell by 31%. Because police-reported drinking can be unreliable, a common “three-factor surrogate” was also analyzed; it fell by 18%. There was little change in control groups. Later Wagenaar (1983) found that after Maine raised its drinking age from 18 to 20, in 1977, crashes by affected drivers with police-reported drinking rose slightly, while the three-factor surrogate fell by 19%. Witnesses supporting a raised MLDA repeatedly cited only the largest number, a 31% reduction, while their opponents only cited the increase in police-reported drinking crashes after the MLDA rose in Maine. (The mean finding of each study was used in forming Figure 1.)

A review of all the evidence cited in these hearings, reflected in the bubble plots in Figure 3, confirms this selectivity. As before, each bubble represents a study, but its color now
indicates the authors’ affiliation, while its area is proportional to the number of entities that cited it; studies ultimately published in refereed journals are circumscribed in black. As before, the horizontal axis is the year of release or publication; the vertical axis is the percentage change in fatalities involving affected drivers.

The top plot in the figure depicts the evidence cited by three high-profile raised-MLDA advocates—MADD, the IIHS, and the AAA—across the three hearings held prior to July, 1984. The weighted or unweighted means or medians of this evidence all indicate a fatality reduction of at least 20%. In contrast, raised-MLDA opponents, having few supportive studies to cite, instead referred to the experiences of states where MLDA increases were not associated with fatality changes at all. These assessments were intransigent even after the NMDAA became law (H4, 1986, pp. 51, 174, 186):

Allan Williams, VP for Research, IIHS: There is no question that raising the alcohol purchasing age results in fewer alcohol-related motor vehicle crash deaths and injuries in this high-risk group. It reduces them by 10-20%, and it does so year after year...If anything, too much research has been done on this topic.

Michael Birkley, Board Member, National Licensed Beverage Association: Despite the frequently recurring theme in popular accounts of selected studies, we have found no consistently reliable basis for the conclusion that raising the legal drinking age has, can, or is even likely to save lives among the affected age group in any jurisdiction. In our opinion, none of the so-called drinking age impact studies conducted to date are capable of supporting such a conclusion.

These excesses were not temporized by testimony from government agencies. In fact, these agencies were unreservedly supportive of the raised MLDA’s effects, and cited evidence that was even more favorable than that cited by advocates. The middle plot in Figure 3 illustrates the evidence cited by five government entities, identified in the note to the table, in these same three hearings. This time, the weighted or unweighted means or medians always
exceed 25%. These numbers resemble those quoted in President Reagan’s signing statement, but vastly exceed the best estimate that could have been obtained at the time.

That estimate comes from the GAO, which, in 1986, conducted a systematic literature review and evaluation, the subject of the fourth hearing listed above. The evidence cited therein, fourteen mostly quasi-experimental studies of fatal or injury crashes meeting reasonable methodological standards, is listed in the bottom plot in Figure 3. With three (not unusual) exceptions, identified in the plot, each study was produced by 1984. The mean and median effect of a raised MLDA across these fourteen studies is a more modest 13%.

More or less, the 20-25% figure put forward by raised-MLDA advocates was adopted by Congress. The wide-ranging, relatively philosophical Congressional debate did not focus on the empirical evidence. Most claims of the NMDAA’s effects devolved to an influential IIHS study of nine MLDA-raising states (Williams et al., 1983, well-represented in Figure 3), which found an average fatality reduction of 28%. These claims were rarely disputed.

Citations of this figure collapsed shortly afterwards, however, when five new studies, each analyzing several law-changing states, supplanted the single-state studies that had predominated. Saffer and Grossman (1987), Hoxie and Skinner (1987), DuMouchel, Williams, and Zador (1987), Arnold (1985), and Hoskin, Yalung-Mathews, and Carraro (1986) found that raised MLDA reduced fatalities by 8%, 11%, 13%, 13%, and 15%, respectively.² Twenty years later, as Figure 1 shows, large-scale panel estimates were notably smaller.

Section IV. The Evaluation of the Evidence in Four Congressional Hearings: Part 2.

² These findings suggest single-state studies utilized states where the estimated impact of the raised MLDA was relatively large. Certainly the distribution of studies across states in 1984 was not uniform. Of nineteen MLDA-raising states, three—IL, MI, and ME—were studied thrice each, while eight others—MD, NJ, RI, GA, OH, TX, CT, and NE—had never been studied.
Quantifying the mean effects implied by the evidence is necessary, but not sufficient, because it takes each study’s estimates (or those deemed methodologically sound) at face value. Given the potential weaknesses of this evidence, evaluators should also attempt to identify the sign and rough magnitude of any potential bias in the estimates.

This is particularly important for the quasi-experimental studies that dominated the early MLDA literature, because of two acknowledged limitations in study design. As no controls are present, other factors that could influence outcomes are not explicitly accounted for. And the short sample period, generally four or five pre-law years and one or two post-law years, complicates attempts to account for pre-existing trends.

The results to date of studies increasing (sic) the drinking age have generally been favorable. However, these laws have been in place for only a short time. During that time, other factors which could produce a reduction in accidents have been present...the question of whether increasing the legal age of purchase will reduce accidents remains to be proven when longer experience with these higher age laws generates sufficient data for a more definitive analysis of impact, from which the effect of transient economic factors can be eliminated. (Alcohol and Highway Safety: A Review of the State of Knowledge, 1984, p. 49.)

Any bias thereby engendered is likely to be favorable. A longstanding theme in social science, a product of the law and economics literature, emphasizes that estimates of a law’s effect on social outcomes are influenced by the circumstances of its adoption (see Andenaes, 1975, and Siegelman, 2002). They will be favorably biased for laws inspired by changes in social attitudes, adopted as part of a package of broader reforms, or passed because of a temporary flare-up in an undesirable behavior. As the substantial social changes documented above coincided with the adoption of early laws raising the drinking age, this theme is potentially significant, as some contemporaneous observers recognized:
Most research published to date is based on faulty premises such as assuming a direct cause and effect relationship between drinking age and crashes without taking into account other variables...[such as] changes in DWI enforcement and increased public education...and covering only short time periods which are inadequate for determining whether changes occurring after a lowering or raising of the drinking age are indicative of long-term effects. (Ronald Sarasin, Director of Government Relations, National Restaurant Association, H2, 1984, pp. 44-46.)

A corollary to this theme emphasizes how public support helps make laws effective:

I have read over most of the papers I have written on this general subject during the past thirty years. In nearly every one of them, I state that the weakest link in attacking this problem has been public support. What we perceive as low-level action against the drunken driver is probably a direct result of lack of public support. We can inform and we can enforce and as a result change behavior through fear for a while. But when we fail to change attitudes, regression is bound to occur (Borkenstein, 1985).

[A late-1980s decline in media attention is] one of the reasons I suspect we are seeing a slow-down in the progress, because research continues to show that the most effective laws are those that have a combination of enforcement and repeated publicity. (Brian O’Neill, IIHS, H5, Aug., 1988, p. 36.)

Thus, even if a law’s effect in voluntarily-adopting states is known with accuracy, the effect will be smaller in states that adopt it because of Congressional incentives like those in the NMDAA:

[Lack of enforcement] points up some of the concern that I have...Particularly in the South and the West—there is a resentment of federally imposed standards of that type, and therefore it tends to be discounted at the enforcement level and in the courts. (Jim Burnett, NTSB Chairman, H1, 1983, p. 236.)

And sometime, a federal mandate is...more highly resented than any other single factor concerning a law. And in some states the governor’s [highway safety] representative, for example, may not even mention that a requirement is a federal law for fear of raising a red flag. (John Hanna, Deputy Commissioner, Virginia Department of Motor Vehicles, H5, Aug., 1988, p. 48.)

Retrospectively, this theme and its corollary suggest that early-MLDA-raising states will yield more favorable estimates than late-adopting states do, fostering the trends depicted in Figures 1 and 2. Prospectively—from the perspective of a policymaker in 1984—they imply that
the early evidence under consideration would probably overstate the effect of laws that would be “imposed” on states by the NMDAA. This concept was not just theoretical, but experiential:

In the field of alcohol control, there have been many examples of programs and control strategies which ultimately have proved ineffective, even when first advocated and employed they seemed to show great promise. (American Automobile Association, or AAA, H0, 1982, pp. 671-672.)

Such overoptimism was also apparent in the lowered-MLDA literature, which terminated in 1984 and accurately presaged the evolution of the raised-MLDA literature, as Figure 1 shows.8

This theme was acknowledged in two ways in the testimony we reviewed: explicitly, as in some of the quotes above, or implicitly, through a tempered or judicious assessment of the effects implied by the assembled evidence:

It seems...clear that establishing a 21-year minimum nationwide drinking age would have a salutary impact on drunk driving statistics, although the extent of the prospective improvement is far from certain. (Sen. Charles Mathias, R-MD, Senate Debate on the NMDAA, 1984, p. S8226.)

I suspect that you have had some testimony about the overwhelming evidence statistically about this, and I suspect that I am hindered by my 35 years as a researcher when I say that the research is not as overwhelming as we would like it to be. (Morris Chafetz, former director of the NIAAA and member, Presidential Commission on Drunk Driving, H2, 1984, p. 71.)

Given the strong claims documented in the previous section, however, it would be surprising to see such judiciousness in abundance. Indeed, it was not common. Acknowledgement of potential biases or of the social science theme articulated above was nearly absent from government agencies and raised-MLDA advocates, while their opponents

8 One might expect the long term effect of raising the drinking age from 18 to 21 to be equal and opposite that of moving in the reverse direction, or smaller, if the lower drinking age develops social conventions that prove difficult to dislodge. Nevertheless, evidence on the effects of lowered MLDA was almost wholly absent from the hearings reviewed, though the best of this evidence (Cook and Tauchen, 1984) spanned more states and years than any raised MLDA study could then muster. It is unclear why this was the case.
criticized the evidence so broadly that their valid criticisms were more easily overlooked. In the end, these criticisms could not overcome the general legitimacy of the techniques utilized and the absence of a broad academic consensus on this issue (see below). In Congressional debate the validity of the evidence supporting the raised MLDA was not questioned.

Thus optimism prevailed both in amalgamating the existing estimates of the MLDA’s effect and in determining the confidence that could be placed in those estimates. Did this optimism alter the political outcome—the passage of the NMDAA? The answer is speculative, and not central to the theme of this paper, but it may have, by influencing President Reagan’s decision to switch from opposition to support. While the only roll call vote on the NMDAA had a veto-proof majority (81-16 in the Senate), legislative progress on the NMDAA did not proceed until (immediately) after President Reagan changed his position on the issue.

Section V. Intellectual Underpinnings.

It would be too facile, and wrong, to ascribe the outcomes in Sections III and IV merely to an adversarial system headed by political actors. Democracies themselves, after all, are adversarial systems headed by political actors. Such an explanation neglects the powerful intellectual and institutional underpinnings that undermine the effectiveness of this system. To maximize the generality of the ensuing discussion, these underpinnings are developed from first principles, applied to the NMDAA, and then related to subsequent drunk driving legislation.

Imagine a new policy intended to address a social problem, which is implemented in a small number of jurisdictions. Soon, interest naturally arises as to this policy’s effectiveness,
though the outcomes data available for analysis is limited. Initially, the social net benefits of an analysis of the policy’s effect would increase by waiting for more data, like in Barzel’s (1968) theory of patents, where technological progress reduces the cost of making a given discovery over time. But, as in Barzel (1968), studies appear as soon as they yield positive net benefits to the parties conducting them. In a world of policy advocacy, this could be quite early.

With little post-policy data available, these studies may only be able to use crude analytical methods; in general, both limitations inhibit these studies’ accuracy. If the policy seems sufficiently promising, however, it will diffuse across the country, increasing the breadth and span of post-policy data available for analysis and facilitating the use of improved methods. Generally the accuracy of these later studies improves, and this continues going forward, probably at a diminishing rate. Ideally, the literature eventually reaches a reasonable degree of convergence in method and result.

This process adequately describes the evolution of the raised-MLDA literature in Figure 1. But it is incomplete, because it omits the essential fact that evaluation of studies in any scientific field is conducted within a body of assumptions, techniques, etc., that are generally accepted by the experts working in that field—namely, a paradigm. But there need not be only one. Where the convergence of academia is slow, and answers are needed quickly, specialization according to comparative advantage suggests the emergence of two paradigms, one geared to the urgent needs of policy, the other to “pure knowledge.” This appears to be the case in several policy-related areas (Dror, 1971; Henig, 2008, Ch. 8).

Certainly it is true in traffic safety, where two paradigms use different research designs suited for these disparate objectives. Early evaluations of new state laws typically employ the
quasi-experimental methods described above. Conducted mostly by—for lack of a more precise term—“program evaluators” with strong links to policymaking, these are often found in well-regarded safety journals such as the *Journal of Safety Research* or *Accident Analysis and Prevention*. In contrast, late studies, typically large-scale, retrospective panel regressions of laws’ long-run effects, are conducted by academic social scientists (particularly economists) and published in the *Journal of Health Economics*, among others. This second group of analysts is less closely linked to policymaking; their primary audience is other academics, and their focus accuracy in estimation rather than immediate policy influence. (The transition period in between contains both types of studies, along with pooled TSCS analyses published in both types of journals.) While obviously generalizations, these statements also adequately describe the MLDA literature in Figure 1, along with more subtle divisions between policymaking and academia depicted in that figure and in Figure 3 (which identifies published studies with a black ring). Those studies that were most influential in the policy process have not been heavily cited within academia, while many influential quasi-experimental studies were never published.

Being geared to different purposes, these paradigms are segmented, to a reasonable degree, and coexist more than they compete. Drunk driving studies in safety journals rarely highlight the potential biases in their estimates, while those in economics journals rarely acknowledge that their panel estimators work best only when the policy in question has long been settled. This segmentation is perpetuated by cultural and philosophical differences between the two fields, which “seem to be too many...to permit cooperation” (Dror, 1971, Chapter 6, and p. 34), and by a substantial temporal divide in their studies of any given issue, clearly visible in both the raised-MLDA and lowered-MLDA literatures in Figure 1.
This is not pre-ordained or universal. Quasi-experimental and traditional regression methods are vigorously compared, for example, in highly visible literatures on the employment effects of the minimum wage and job training programs. It is, rather, a matter of practice. There is no question that quasi-experimental traffic safety studies focus on estimating short run effects, for which the technique was designed (Robson et al., 2001; Campbell and Ross, 1968), or that panel techniques’ comparative advantage lies in estimating long-run effects using nationwide data. Safety journals clearly consider quasi-experimental methods adequate to the task, while economics journals strongly prefer panel estimates instead.

Most importantly, there has been little comparison within traffic safety of the relative efficacy of these techniques. The closest paper we could find, a theoretical, multi-technique critique by Garber (1988), has been virtually ignored. Some literature reviews (Shults et al., 2001; Wagenaar and Toomey 2002) do identify higher-quality and lower-quality studies, but this is based only on the execution of a given study design. The relative merits of these designs are not compared in these reviews or in reviews by the GAO or NHTSA, as discussed below. Thus, in practice, these two techniques are generally used in different spheres for different purposes, and accepted within that sphere as valid for the purpose for which it is used.

Because the scientific competence of a study is determined within a given paradigm, this segmentation complicates the already-challenging task facing political actors assessing the evidence, who now must weigh paradigms in addition to assessing the studies themselves. This is not much facilitated by the presence of experts, who tend to hail from one paradigm or the other, but not both. This was certainly true for the NMDAA. NHTSA, the NSC, and the GAO all utilized the quasi-experimental paradigm, and never acknowledged that a judicious assessment
of the evidence might be merited—even when asked (H4, 1986, p. 13-14):

Rep. Nancy Johnson (R-CT): How do you take into account whether or not, for example, there has been a strong movement within a state among high school students to focus on this problem?

GAO Official: That is the beauty of the control group.

Rep. Johnson: In your control group, you have states that have not changed their policy…but do you have all of those same groups that are springing up throughout the Nation, the teenage groups, the MADD parents and so forth?

GAO Official: [Without directly answering the question, simply notes that some control groups are age-based, such as 21-25 year olds, while others are geographical, such as a neighboring state.]

This has an important consequence: to shift, somewhat, the assessment criteria used by the political system away from scientific competence toward something very different: credibility.

Factual conclusions are not easily separable from considerations having to do with the plausibility of [the researcher’s] assumptions and his selection of the evidence or choice of methodology. And because there seems to be no objective way of checking the conclusions of analysis, the credibility of the expert becomes as important as his competence (Majone, 1989, p. 4).

This shift reinforces the bifurcation between these two paradigms, as one is more directly linked to policymaking than the other. Its practitioners are more familiar with this adversarial process, more likely to have alternate sources of credibility (Innvaer et al., 2002).

Increasingly, public debates about regulatory decisions [and other modern policy issues] resemble adversary proceedings in a court of law, but with an important difference—the lack of generally accepted rules of evidence. Some participants are able to take advantage of the relative informality of the process, but to scientists even codified adversary procedures seem inappropriate and alien to their tradition. In science the issue is not a witness’s credibility but his specific competence…and this is not reliably established by an adversary debate (Majone, 1989, p. 4). This was also true for the NMDAA. Several supporters of a raised drinking age, including
NHTSA, the NTSB, and the NSC, have institutional credibility before Congress, as does the IIHS, which interacts with policymakers on a wide range of traffic safety issues. Technical prowess only reinforces this other source of credibility. Thus, there was no imperative for NHTSA to publish three in-house MLDA studies from the early 1980s, discussed below, or for the NTSB’s support of a raised MLDA to be based on a formal evidence review. (In fact, its widely-repeated calculations of lives saved, used to support its recommendation, were erroneous: Males, 1986.) This contrasted with academic witnesses, who possessed competence but no alternate source of credibility, and raised MLDA opponents, who generally lacked both. This imbalance further limited the self-correcting properties of an adversarial system.

Two other drunk driving laws have received NMDAA-like Congressional incentives: .08 laws that lower the per se illegal BAC limit from (generally) .10 to .08, and “zero tolerance” laws that lower this limit to .01 or .02 for drivers under twenty-one. Grant’s (2011) exhaustive review of their sizeable literatures shows that they too are segmented, following patterns in study design and result that closely resemble Figure 1. In both cases strong, quasi-experimental findings for early-adopting states are, much later, supplanted by notably smaller estimates from panel regressions conducted by academic social scientists. And, while neither law was subject to Congressional hearings as was the raised MLDA, the evidence employed in support of .08 laws was similarly segmented, as discussed below.

Section VI. Institutional Underpinnings.

The political actors who must ultimately assess the evidence often possess limited
technical knowledge. A common remedy is to locate this knowledge in an agency overseen by those political actors. Here that agency is NHTSA, founded in 1970 to address both vehicle and behavioral factors. The former took precedence in the agency’s early years, consistent with the spirit of the times (Gusfield, 1988), but from the 1980s forward behavioral factors, particularly drunk driving and restraint use, have received increasing attention (see H6, 2002).

The existence of such agencies ameliorates this knowledge problem, but introduces a principal-agent problem in its place. In the early 1980s, interest in the effects of higher drinking ages, and the need for further evidence, heightened NHTSA’s roles as arbiter and facilitator of research. In both roles it is intended to act as an agent for the public and, by extension, Congress, discerning as accurately as possible how a raised MLDA would affect traffic safety. In light of the previous discussion, this would require incorporating insights, results, and techniques from both analytical paradigms. As public choice theory cautions, however, the agency may have private objectives that deviate from those of the public, such as enhancing its influence or quelling criticism. Its behavior may then deviate from the ideal in order to help achieve these objectives.

For the behavioral factors side of NHTSA, this organizational latitude could be used to influence the most pressing intellectual issue it then faced: the relative efficacy of two approaches for addressing drunk driving. One is based on deterrence, negatively sanctioning

9 The principal-agent problem also extends to the vehicle-factors side of NHTSA, though, in focusing on regulation and standard-setting, it differs greatly from its counterpart (see Breyer, 1982). During investigations of vehicle defects, Pecht et al. (2005) find NHTSA to be overly deferential to the automaker’s characterization of the problem and its severity, while Cavasos (2007) shows that, compared to the Federal Aviation Administration, rule-setting by NHTSA is more heavily influenced by industry. He attributes this to NHTSA’s youth: federal regulation of passenger cars, unlike that of the airlines, began long after the industry had been
alcohol possession (as in the MLDA) or driving under the influence of alcohol:

Americans place a high value on individualism. They see the world as malleable to individual will and responsive to choice and moral character. It is to the individual that Americans so frequently look in placing responsibility for social problems. It is the base assumption that supports the great faith we have that punishing the bad guys, the drivers, will deter drinking-driving in a society whose social institutions deter public transportation and support drinking practices with limited constraints (Joseph Gusfield, in Ross, 1992, pp. xi-xii).

The alternative stresses the limits of deterrence and “views drunk driving as a predictable consequence of existing social institutions” (Ross, 1992, p. 167):

My father was an alcoholic. And, boy, I am going to tell you: All I remember from when I was a kid was how alcoholism can just literally destroy a family... But I used to be a police officer years ago, and I guess because of my own background and the experience I had in law enforcement, I am convinced that alcoholism is a sickness that you just cannot cure by tougher penalties. It does not work. It did not work for my dad. And it does not work for anybody else either... So it just seems to me that we ought to be focusing more of our resources on treatment and recovery programs too. (Sen. Ben Nighthorse Campbell, R-CO, H6, Feb., 2002, p. 50.)

The deterrence approach prevailed during the 1980s. It was “understandably popular with people who have directly or indirectly, through friends and relatives, experienced harm in the course of alcohol-related crashes”—the natural constituency of drunk driving advocacy groups such as MADD, which rose to prominence during this period (Ross, 1992, p. 176, and multiple sources cited therein). This was buttressed by the concomitant political shift toward conservatism (Reinarman, 1988), the “inevitable change in style that happens when criminal justice initiatives trickle down from elites to the generally conservative crime-control ideology of local America,” and a “hardening of public attitudes about the dangers of driving after drinking...due in part to scientific demonstrations linking elevated blood alcohol with established, weakening the agency’s ability to resist “pressure from actors it regulates” (p. 234).
automobile crashes” (Zimring, 1988, pp. 379, 381).

Ross (1992) deftly analyzes the politics of the deterrence approach, pointing out that it was in NHTSA’s interest to support it:

Much of the effectiveness of the citizen’s movement [such as MADD] is due to its alliance with the traffic safety establishment. State and federal officials have found the movement useful for demonstrating popular support for statutes and other measures proposed by the safety agencies, while the programs endorsed by the movement have been rendered rational and politically sophisticated in the process. The NHTSA has explicitly recognized the value of this constituency and has taken steps to enlarge and strengthen it (p. 177).

In 1984, NHTSA’s support for deterrence in combatting drunk driving was clear in its publication Alcohol and Highway Safety (1984, Ch. 6), in which five of the seven key elements listed in its “current approach” to tackling the problem were deterrence-based.

Thus, the intellectual expression of the aforementioned principal-agent problem would be for NHTSA’s research strategy to be shaped to stress deterrence. Such a strategy would emphasize the quasi-experimental studies yielding the strongest findings supporting drunk driving laws, and would deemphasize the cautionary social science theme articulated above.

This was apparent in the four studies of raised MLDAs conducted by NHTSA. The first three, Maxwell (1981), Klein (1981), and Arnold (1985), included in the GAO review, used sound quasi-experimental designs to estimate short run effects in early-adopting states. Their effect sizes, a 9-15% reduction in fatalities, were typical of the time, and well-supported in two studies though not the third, which interpreted its findings very favorably.10 None addressed potential

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10 Klein focuses on fatalities from single-vehicle accidents involving male drivers. He finds that, after Maine’s MLDA was raised from 18 to 20, daytime and nighttime fatalities involving 18-year-olds fell, in about the same proportion, while daytime and nighttime fatalities involving 19-year-olds were both unchanged. Because daytime accidents are treated as a control group, this suggests the law had no effect. But Klein focused instead on a different finding: a 15%
bias in the estimates. The fourth, a follow-up to Arnold by Womble (1989), was the only study to be published, and the last to use traditional before-after quasi-experimental methods. As the MLDA literature had moved past these methods by then, this study attracted little notice. NHTSA continues to use Arnold (1985) to calculate the lives saved by the NMDAA (see the March 2005 Traffic Safety Facts Research Note), ignoring dozens of subsequent studies.

The next laws to receive similar Congressional incentives, .08 laws, were treated similarly. NHTSA first recommended their adoption in 1992, when there was virtually no evidence on their effectiveness. Though only 3% of traffic fatalities involve drivers with BACs of .08 or .09, who would be affected by such a law, double-digit fatality reductions are found in most of the evidence cited in NHTSA’s “Presidential Initiative for Making .08 BAC the National Legal Limit” and “Setting Limits, Saving Lives.” These referenced mostly quasi-experimental studies, omitting economists’ two regression analyses, Chaloupka, Saffer, and Grossman (1993) and Dee (2001), which obtained far smaller estimates. After identifying methodological problems with several of these quasi-experimental studies, including some conducted or sponsored by NHTSA, the GAO determined that “NHTSA’s position—that this evidence was conclusive—was overstated.”

In fact, since the NMDAA, this research strategy has become somewhat institutionalized, via NHTSA’s heavy reliance on contractors. Of its 21 analogous alcohol impaired-driving Behavioral Safety Research Reports, 18 were produced under contract. Interviews with several knowledge-producing federal agencies indicated that this is an unusual reduction in fatalities involving 18-year-old and 19-year-old male drivers in all nighttime accidents, not just those involving a single vehicle; no control group estimate was obtained. This generous interpretation was adopted by the GAO and thus included in Figure 3.
mechanism for producing this kind of study; NHTSA did not provide an explanation for using this approach.\textsuperscript{11} In other interviews, an independent traffic safety policy advocate and a former high-level NHTSA administrator both bemoaned the “lack of an independent research capability within the agency,” particularly on the behavioral factors side, and described its origins and consequences as mostly or wholly political, noting that its absence benefits stakeholders that gain from deterrence-oriented policies.

Contracting emphasizes deterrence in three ways. It makes NHTSA more susceptible to political influences, by limiting the in-house human capital available to evaluate the literature.

Where management decisions are based substantially on technical judgments...there must be sufficient technical competence within the Government so that outside technical advice does not become technical decisionmaking (sic). (Report to the President on Government Contracting for Research and Development, Bureau of the Budget, May 1962, pp. 9-10.)

It also allows the sponsoring agency to shape the project’s scope and design (see Henig, 2008, p. 234). Thus, NHTSA’s contracted research in this area uses quasi-experimental designs almost

\textsuperscript{11} By mid-2011, NHTSA had published 302 Behavioral Safety Research Reports classified as “Impaired Driving—Alcohol”; 84% were produced by contractors. This is often understandable, such as for demonstration projects: a grant is not feasible, as this is not basic research of general interest, nor is in-house production, because of the project’s interdisciplinary nature and distant location. But one cannot justify using contractors to evaluate traffic safety laws in this way, as this involves analyzing publicly available data with straightforward statistical methods to study a topic of general interest. A grant would be superior, and more typical. These traffic safety law evaluations are the 21 reports referred to here.

Five knowledge-producing federal agencies were contacted: the Consumer Product Safety Commission (CPSC), the Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), the Federal Trade Commission (FTC), and the Agency for Healthcare Research and Quality (AHRQ). In each interview, which typically lasted half an hour, a medium-to-high level research administrator (or their representative) articulated that agency’s “strategy” for producing knowledge and gave a basic rationale for using that strategy. In contrast, we were unable to speak or correspond with the administrator in charge of NHTSA’s behavioral factors research or a member of the agency’s communication office, after multiple attempts.
exclusively, in marked contrast to analogous studies funded by NIAAA grants (see Figure 1).

In turn, the diversity of ideas and methods to which NHTSA is exposed is reduced. Thus, its most recent (2001, 2006) versions of Alcohol and Highway Safety, both produced by contractors, contain few regression-based evaluations of drunk driving legislation in their literature reviews, do not mention potential biases with any estimation method, and omit regression methods from discussions of research design (found in the 2001 edition, pp. 99-100). Similarly, NHTSA’s engagement with academia continues to be relatively weak.\textsuperscript{12} Political oversight is unlikely to change this status quo.\textsuperscript{13}

VII. Discussion and Conclusion.

...
to do so ideally, and this paper confirms that, for the NMDAA at least, it did not. Raised MLDA opponents were, in this theater, outmatched by advocates, fostering an overly optimistic assessment of the evidence available at the time.

On the other hand, it is equally ingenuous to assume that other mechanisms are superior. We found no evidence of this for the NMDAA or for subsequent research on drunk driving. Academia, segmented into distinct paradigms, has no effective mechanism for meshing and reconciling the findings of both, particularly on the time scales required by policymakers. Neither does the bureaucracy, NHTSA, which, overly wedded to deterrence, lacks the necessary quantity and diversity of in-house human capital.

Instead, all three mechanisms were complementary, in a perverse way, reinforcing each other’s weaknesses. The adversarial political process supports intellectual segmentation, which, in turn, weakens that process, complicating the task of evaluating the evidence and de-emphasizing competence in favor of credibility. NHTSA relies on segmentation to focus on one paradigm to the exclusion of the other, a practice that supports this segmentation in return.

Thus, political reforms are unlikely to be successful—and may not even be needed—without appropriate intellectual and institutional reforms. These institutional reforms would include enhancing NHTSA’s in-house knowledge base to incorporate a wider range of methodological prowess and greater familiarity with the social science theme articulated above; fusing stronger links between NHTSA and the academic community; and broadening NHTSA’s research focus to incorporate the long-run effects of older laws that have become widely adopted, in addition to the short-run effects of new laws. Research departments at some federal agencies, such as the FTC, already have this kind of intellectual diversity and links
to academia.

Intellectual reforms, on the other hand, can erode the segmentation dividing the two analytical paradigms. This can be done by searching for analytical methods of evaluating newly adopted laws that are more robust to the estimation problems identified above, and by “closing the loop,” comparing short run estimates of a law’s effect with retrospective evidence on its long run outcomes, as Grant (2011) does for the MLDA, .08 laws, and zero tolerance laws.

Such changes could lead to less enthusiastic empirical and political support for some traffic safety legislation, but that need not mean more traffic fatalities. Every action has an opportunity cost. Political and intellectual capital spent supporting laws that are relatively ineffective could be used to seek out and evaluate laws or other, non-deterrence-based mechanisms that may be more effective, and supporting those that ultimately pass the bar.
Table 1. Social Activity Aimed at Reducing Drunk Driving (constructed from Howland, 1988), and Drunk Driving Attitudes (from Greenfield and Room, 1997).

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Drunk Driving Groups Founded</th>
<th>Volume of Newspaper Coverage of Drunk Driving</th>
<th>Volume of Periodical Coverage of Drunk Driving</th>
<th>“Legislative Changes to Reduce Drunk Driving”</th>
<th>It is OK to drink before driving.</th>
<th>It is OK to drink a lot before driving.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978-1981</td>
<td>36</td>
<td>37</td>
<td>22</td>
<td></td>
<td>32%</td>
<td>8%</td>
</tr>
<tr>
<td>1981</td>
<td></td>
<td>17</td>
<td>13</td>
<td></td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>109</td>
<td>81</td>
<td>35</td>
<td></td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>117</td>
<td>169</td>
<td>50</td>
<td></td>
<td>129</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>103</td>
<td>162</td>
<td>42</td>
<td></td>
<td>108</td>
<td>18%</td>
</tr>
<tr>
<td>1985</td>
<td>89</td>
<td>76</td>
<td>36</td>
<td></td>
<td>223</td>
<td>5%</td>
</tr>
<tr>
<td>1986</td>
<td></td>
<td>45</td>
<td>9</td>
<td></td>
<td>178</td>
<td></td>
</tr>
</tbody>
</table>

Note: Newspapers include the *New York Times*, the *Washington Post*, the *Los Angeles Times*, and The *Wall Street Journal*. Periodical volume comes from the Magazine Index. The attitudinal questions were phrased: “A person should feel free to drink one or two drinks, or more, when going to drive a car,” and “A person should feel free to drink enough to feel the effects, or more, when going to drive a car.”
Figure 1. Bubble Plot of Academic Studies of the MLDA (from Grant, 2011).

Note: Black-ringed bubbles are supported by external funding. The year is the year of publication. The estimate of magnitude is the percentage change in the fatality or crash-involvement measure. The volume of the bubble is proportional to the number of citations it received in Google Scholar as of June 2009.
Figure 2. MLDA Effects vs. Time of Adoption (based on the findings of Miron and Tetelbaum, 2009). The top graph contains individual state estimates; the bottom graph cumulative estimates.
Figure 3. Evidence Cited across Four Hearings on the Effect of a Raised MLDA on Crashes.


Note: The advocates are MADD, the American Automobile Association, and the IIHS. The government organizations are NHTSA, the NTSB, the NSC, the National Association of Governor’s Highway Safety Representatives, and the Presidential Commission on Drunk Driving. The area of each bubble is proportional to the number of organizations citing that study in the hearings indicated. Bubble colors indicate the affiliation of the authors of each study; “raw statistics” indicates the organization simply cited the change in crashes or fatalities after the adoption of a law, without referring to any formal study. Bubbles ringed in black indicate studies published in a refereed journal. For such studies, the horizontal axis indicates the publication year; for the others it is the year the study was completed.

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Appendix: A Chronology of the Minimum Drinking-Age Issue
(excerpted almost verbatim from Appendix IV of GAO, 1987, with minor edits and additions; hearings or Congressional debate referenced in the text of this paper are italicized)

Jan. 5, 1933. Ratification of the 21st amendment repealed prohibition and granted the states substantial power to regulate the purchase and possession of liquor within a state.

Sept. 9, 1966. Enactment of the Highway Safety Act of 1966 (Public Law 89-564) provided the first major impetus for federal involvement in drinking and driving by requiring the Department of Transportation (DOT) to establish uniform safety standards for state highway safety programs and to provide funds to carry out such programs.

June 1967. The DOT issued its “Alcohol in Relation to Highway Safety Standard,” to broaden the scope and number of activities directed at reducing alcohol-related accidents.


July 1971. Ratification of the 26th amendment, extending the right to vote to 18-year-olds, helped prompt 29 states to lower their minimum drinking ages in the early 1970’s.

1973. NHTSA agreed by contract with the University of Michigan Highway Safety Research Institute to scientifically analyze the effects of lowering the legal drinking age from 21 to 18 on youths involved in crashes. The report showed a 10%-26% increase in crash involvement between 1968 and 1971.


1976. From this year on, no state lowered its drinking age, partly because of empirical evidence that suggested a link between lowering the drinking age and increased traffic fatalities. Between 1976 and 1980, thirteen states raised their drinking ages by at least one year.

April 14, 1982. The president appointed a 32-member commission to study the national problem of drunk driving.

April 27, 1982. H.R. 6170 was introduced by members of the Congress from New Jersey and Maryland and others to encourage the states to strengthen programs to control drunk driving.

April 29, 1982. The House Subcommittee on Surface Transportation held hearings on H.R. 6170; the legislation was generally supported by both the beverage and insurance industries.

May 12, 1982. H.R. 6170 was incorporated into H.R. 6211, which became the Surface Transportation Assistance Act of 1982.

July 22, 1982. The National Transportation Safety Board recommended a national minimum drinking age of 21.

Oct. 1, 1982. The Senate unanimously approved its counterpart bill to H.R. 6170, and the bill was sent to the president.

Oct. 25, 1982. Enactment of H.R. 6170 as Public Law 97-364 provided for a two-tier incentive grant program to improve traffic safety. The Congress mandated that the secretary of the Department of Transportation would consider a state minimum drinking age of 21 as one criterion to be met for supplemental grants.

Nov. 30, 1982. House and Senate resolutions were introduced on the legal minimum age for drinking and the purchase of alcohol.

Dec. 13, 1982. The Presidential Commission on Drunk Driving recommended a uniform minimum drinking age of 21 in an interim report intended to allow state legislatures time to consider this recommendation early in their 1983 sessions.

Jan. 6, 1983. The Surface Transportation Assistance Act of 1982 contained a small section strongly encouraging the states to raise the minimum drinking age to 21. On the day the law was enacted, House Concurrent Resolution 23 was introduced, expressing the sense of the Congress that all states should establish a minimum drinking age of 21.

Jan. 27, 1983. A Gallup poll showed that 77 percent of Americans supported a uniform drinking age of 21 for all states.

April 7, 1983. H.R. 2441 was introduced by a member of the Congress from Illinois to prohibit the use of federal highway funds by states whose minimum drinking age was lower than 21.

April 20-21, 1983. Senators from Missouri, Oregon, and Rhode Island introduced S. 1108, the Highway Safety Act of 1983, which provided more incentive grants to states for efforts to deter drunk driving. The bill was never voted out of committee. A member of the Congress from California introduced H.R. 2693, a counterpart bill to S. 1108.

May 6, 1983. A Senator from Pennsylvania introduced Concurrent Resolution 32 to express the sentiment of the Congress that all states should establish a minimum drinking age of 21.

Sept. 13, 1983. Members of the Congress introduced H.R. 3870, a bill to prohibit the sale of alcoholic beverages to persons under 21 years of age under certain conditions.


Nov. 1983. The Presidential Commission on Drunk Driving issued its final report, keeping the recommendation for a uniform minimum drinking age of 21 for the purchase and public possession of all alcoholic beverages.

Jan. 1984. The president publicly rejected the support of the Presidential Commission on Drunk Driving for a uniform minimum drinking age of 21.

Feb. 7, 1984. Several senators introduced S. 2263, the Uniform Minimum Drinking Age Act, to amend the Surface Transportation Assistance Act of 1982 by reducing the amount of federal highway aid for states that do not enact a legal minimum drinking age of 21.


Feb. and March 1984. The House Subcommittee on Surface Transportation held hearings on surface transportation issues, including a discussion of the drinking-age issue.

April 5, 1984. Members of Congress introduced H.R. 5383, a bill to reduce a state's apportionment for federal aid for highways in specific fiscal years for states with drinking ages below 21.


May 24, 1984. Senators from New Jersey and Rhode Island introduced S. 2719 as a revision of S. 2263, a counterpart to H.R. 5383, and an attachment to H.R. 4616, the Child Safety Restraint Act.

June 7, 1984. The House approved H.R. 5383 as an amendment to H.R. 5504, which would reduce federal highway funds by 5 percent in fiscal year 1987 and 10 percent in fiscal year 1988 for states not enacting a minimum drinking age of 21.

June 13, 1984. The administration reversed its position on the minimum drinking-age issue through support of H.R. 4616 from the secretary of the Department of Transportation.

June 14, 1984. [H2] The Senate Subcommittee on Surface Transportation held hearings on measures to combat drunk driving.

June 19, 1984. [H3] The Senate Subcommittee on Alcoholism and Drug Abuse held hearings on a national minimum drinking age.

June 26, 1984. The Senate passed S. 1948 by a vote of 81-16, as an attachment to H.R. 4616. The Senate then passed its version of H.R. 4616 by a voice vote.

June 27, 1984. The House cleared the Senate version of H.R. 4616, including H.R. 5383.

July 6, 1984. The Senate version of H.R. 4616 was approved and sent to the president.

July 17, 1984. The Child Safety Restraint Act (H.R. 4616), which included legislation for a national minimum drinking age of 21, was signed into law (Public Law 98-363) amending the Surface Transportation Assistance Act of 1982. This act was strongly lobbied for by the Mothers Against Drunk Driving, the Parent Teachers Association, the National Safety Council, the National Council on Alcoholism, and the insurance industry.

Sept. 21, 1984. South Dakota brought an action against the secretary of the Department of Transportation in the U.S. District Court for the District of South Dakota, asking the court to declare the uniform national drinking age sanction of the Surface Transportation Assistance Act of 1982 unconstitutional, on the grounds that it violated the 10th and 21st amendments of the U.S. constitution.

May 3, 1985. The U.S. District Court issued a memorandum opinion and judgment dismissing the South Dakota case against the national drinking-age legislation.
May 16, 1985. Members of the Congress from Louisiana and Vermont introduced H.R. 2537 to apportion federal highway funds withheld from states for failing to establish a minimum drinking age of 21 if certain alcohol-related traffic fatalities are significantly reduced.

June 3, 1985. A member of the Congress from Louisiana introduced H.R. 2645 to repeal the national minimum drinking-age law.

June 26, 1985. South Dakota appealed the District Court’s decision to the Court of Appeals for the Eighth Circuit, contending again that the 10th and 21st amendments were violated by the national drinking-age legislation. Nine other non-complying states supported South Dakota’s appeal.

July 11, 1985. Senators from Missouri and New Jersey introduced S. 1428, to make permanent the withholding of 10 percent of the apportionment from the Highway Trust Fund to states that have not adopted the national minimum drinking age.

Sept. 27, 1985. NHTSA and the Federal Highway Administration issued a notice of proposed rulemaking to implement section 6 of Public Law 98-363, which refers to the withholding of federal-aid highway funds.

Oct. 21, 1985. The Chair of the House Subcommittee of Investigations and Oversight, Committee on Public Works and Transportation, asks the GAO to review “existing evaluation[s] of drinking age laws to determine the extent to which they provide empirical support for federal and state initiatives to change the legal drinking age.”

Nov. 12, 1985. S.1428 was amended to S. 1730, the Consolidated Budget Reconciliation Act.

Dec. 20, 1985. S. 1730 was folded into H.R. 3128, the Budget Reconciliation Act, which did not pass but was carried over into the next year.

April 7, 1986. The president signed the Budget Reconciliation Act, which made permanent the withholding of 10 percent of federal highway funds from states not complying with a uniform drinking age.

May 21, 1986. The court of appeals for the eighth circuit affirmed the district court’s dismissal of South Dakota’s complaint challenging the constitutionality of the national drinking-age legislation.

Sept. 16, 1986. [H4] Relying on an early draft of the GAO report, the House Subcommittee of Investigations and Oversight, Committee on Public Works and Transportation, conducts hearings to assess evidence on the efficacy of minimum drinking age laws.


Feb. 27, June 27, 2002. [H6] The Senate Subcommittee on Transportation and Related Agencies, followed by the House Subcommittee on Highways and Transportation, hold hearings on various traffic safety related issues.