Punishment and Deterrence: Evidence from Drunk Driving

By Benjamin Hansen

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Punishment and Deterrence: Evidence from Drunk Driving is a paper published from the American Economic review in 2015 that examines the effects of harsher punishments and sanctions on offenders of driving a vehicle under the influence of alcohol (DUI) and how the consequences of this offense affect the perpetrators actions in the future. The author describes the invention of the automobile as a catalyst for drunk driving thus becoming a public health concern. This led to the creation of the breathalyzer, a standardized measurement tool that measures blood alcohol content (BAC) for drivers suspected to be under the influence. The term used in this paper to describe committing and being charged with a DUI for a second time is recidivism. This paper takes an in-depth look at what punishment and sanction combinations work to reduce recidivism and maximize social welfare.

Throughout much of the United States today there is a standard BAC threshold where an individual can be charged with a DUI. However, this has not always been the case. According to historical records, much of the United States has changed their thresholds from an initial .15 to establish impairment, to .10 in the 1980's and finally .08 becoming the "quasi-uniform standard in the late 1990s and early 2000s." Statistically, this reduction has shown to reduce fatal car accidents by an overwhelming 7.2% nationwide.

The way an individual can receive a DUI is through a traffic stop or accident where the person is thought to be suspicious by a police officer and their BAC is measured using a handheld device. Officers typically measure the individual twice using a breathalyzer device that utilizes a 3-digit scale with an accuracy of .99, taking much of the burden of proof off the police officer and onto the individual. If the individual tested is above one of the established thresholds, the individual's license is suspended immediately and a variety of punishments and sanctions are imposed by the local courts system. Some of these punishments for receiving a DUI could include jail time, a fine, license suspension, mandatory alcohol anonymous meetings, a victims panel and probation. Important to note, many states maintain an "Implied Consent" law that an individual's refusal to take a BAC test is punished identically to those found guilty of drunk driving.

The author utilizes the BIC BAC and the Washington State Impaired Driver Testing Program datasets provided by Washington's administrative records, which supply 512,964 samples where the DUI threshold has been consistent at .08 and .15. The data taken from 1999-2007 omits those who are under the legal age, as the consequences for youths can differ. A strength of this paper's dataset is that the sample demographics (i.e., for Washington state) mirror those of the United States at large. According to the Washington FARS data, "75.3 of drunk drivers are male, are on average 40.2 years old, and have a BAC of 16.4."

TABLE 1—PUNISHMENTS FOR DUI CONVICTION BASED ON BAC AND PRIOR OFFENSES

	1st offense		2nd offense		>=3rd offense	
	DUI	Agg. DUI	DUI	Agg. DUI	DUI	Agg. DUI
BAC	[0.08, 0.15]	(0.15, 1]	[0.08, 0.15]	(0.15, 1]	[0.08, 0.15]	(0.15, 1]
Min. penalty	$865.50	$1,120.50	$1,120.50	$1,545.50	$1,970.50	$2,820.50
Max. penalty	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Min. jail time	24 hours	48 hours	30 days	45 days	90 days	150 days
Min. home release	14 days*	28 days*	60 days**	90 days**	120 days**	150 days
License susp./ revok. period	90 days^{+}	365 days^{++}	2 years^{++}	900 days^{++}	3 years^{++}	4 years^{++}
SR-22 insurance	Yes	Yes	Yes	Yes	Yes	Yes

Table 1 outlines the Washington statutes of sanctions and punishments depending on the BAC measured by the police officer. There is a combination of fines for each offense, jail time and other restrictions on driving. The statutory punishments for future DUIs are based primarily on two factors: measured BAC and prior offenses. Where a second offense is categorized as having enhanced punishments, it is important to note that the available punishments are identical to those who committed a prior offense within the first threshold DUI of .08 up to .15. Receiving a second DUI above the .15 threshold will receive the same punishment as Aggravated DUI at the second offense level.

The author decides the regression discontinuity approach would be the best method to measure this data, which I agree is the correct method. Unlike OLS regression, the author must measure a difference in linearity at each threshold to calculate the variations in BAC. This allows for a more precise measurement of policy and a more distinctive visualization. In OLS regression you have a single fitted regression line, whereas an RDD design allows you to have a fitted line for each threshold. For regression discontinuity to deliver consistent estimates, several assumptions must be met. First, the assignment of a treatment group is not random. The treatment group is determined by the value of an observable covariate on either side of the threshold, in this case the drivers BAC. If the driver is above the BAC thresholds when he is stopped on suspicion of a DUI or is involved in an accident, they are administered into the treatment group for this case study. These assumptions also imply that "both the unobservable and observables are expected to remain unchanged across the threshold with only the treatment status changing."

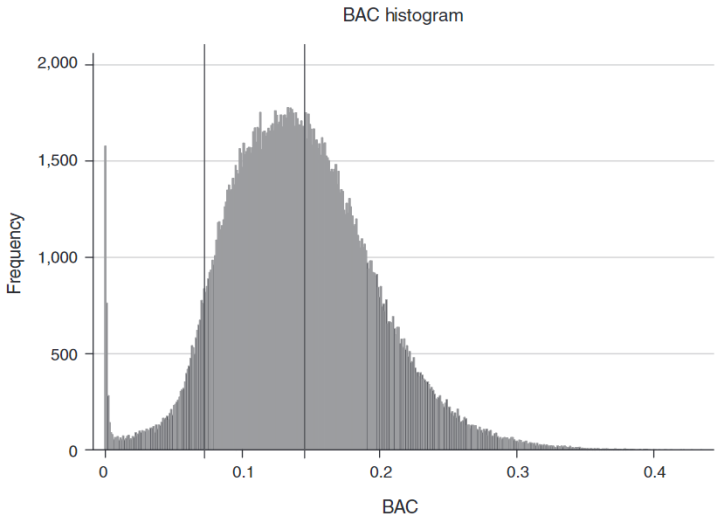


Figure 1 above shows the observed frequency and levels of BAC for all drivers recorded by the Washington State BIC BAC test. The data are normally distributed, with most of the results falling within the middle of the histogram. It is important to know that neither the drivers or the police officers cannot manipulate the results of the two administered BAC tests, and the driver is further unable to distinguish which side of the threshold they would be on prior to operating a vehicle and getting pulled over. If this were not the case, there would be apparent clusters around the thresholds. Above, the two vertical lines represent the two thresholds for DUI held in the state of Washington with a BAC of .08 and .15. This figure gives

credibility to proceed with the RDD design in that we see a spike after the designated .08 threshold.

$$y_i = X_i'\gamma + \alpha_1 DUI_i + \alpha_2 BAC_i + \alpha_3 BAC_i \times DUI_i + u_i$$

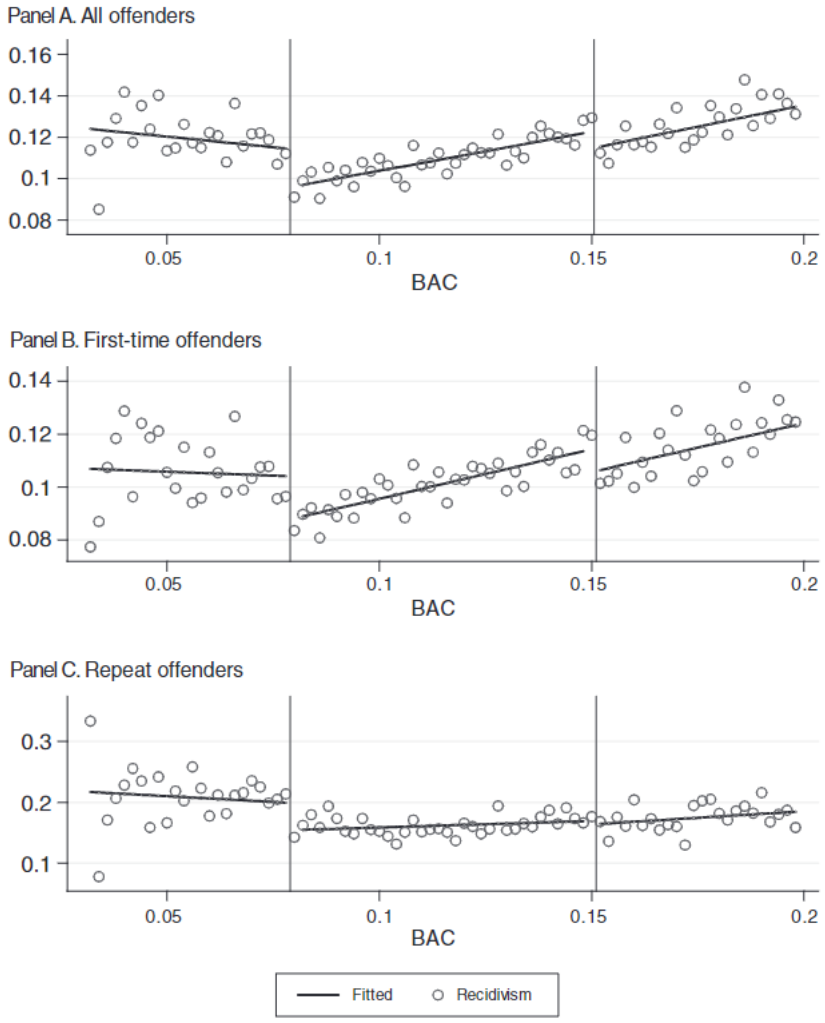
Pictured above is the formula for Hansen's regression discontinuity design model where all variables have a fixed effect $_i$ for each individual. Denoting from left to right, we have y_i that represents the case of recidivism. This is measured in a binary fashion where 0 indicates the individual was not pulled over under suspicion of drunk driving. A 1 indicates the individual was pulled over and if they are subjected to a test or refuse the test by a police officer within four years of the original offense. X_i is a control variable representing the demographic being age in years, gender and race. DUI_i in this equation is our focus and our treatment group that we will look at to estimate recidivism. BAC_i is a measured variable based on the reading from breathalyzer tests administered by the police officer. In this equation BAC is our forcing variable. A forcing variable is also referred to as an assignment variable, that is determined by a cutoff value or policy, where the assignment of a crime or DUI is prescribed as having a BAC above .08 while operating a motor vehicle. Lastly, we have alpha$_3$ our interaction term. This is a combination of the effects from our main effects DUI and BAC, in particular BAC's effect on DUI. It is important to note that "both the decision of how much to drink and the subsequent decision to drive drunk are endogenous". Meaning the variable is changed or determined by their relationship with another variable. This again would be the relationship between DUI and BAC.

TABLE 3—REGRESSION DISCONTINUITY ESTIMATES FOR THE EFFECT OF EXCEEDING THE 0.08 BAC THRESHOLD ON RECIDIVISM

	All tested drivers (1)	No prior tests (2)	At least one prior test (3)
Panel A. BAC ∈ [0.03, 0.13]			
DUI	−0.021***	−0.017***	−0.053***
	(0.004)	(0.004)	(0.015)
Mean	0.103	0.093	0.172
Controls	Yes	Yes	Yes
Observations	95,111	82,626	12,485
Panel B. BAC ∈ [0.055, 0.105]			
DUI	−0.019***	−0.018***	−0.038**
	(0.005)	(0.005)	(0.018)
Mean	0.103	0.093	0.172
Controls	Yes	Yes	Yes
Observations	49,396	43,070	6,326

Table 3 pictured above describes the authors most significant finding. It contains the estimates of the effect of having a BAC over the DUI threshold for all tested drivers in the state of Washington, including those with no prior tests as well as those with at least one prior test. From the estimates he concludes that having a BAC above the .08 threshold decreases recidivism by 2 percentage points during a four year follow up window for all drivers. The follow

up window ensures sufficient time has passed between the initial offense to the end of the punishment period, after which the individual would have their license reinstated. Additionally, those with no prior test have an estimate of -.017 and those with at least one prior test have an estimate of -.053. From this estimate we can see that there is a marginal difference, such that those who have received a prior DUI have a reduction in recidivism by 5.3% compared to those without a prior DUI who only show a 1.7% reduction in recidivism. This could be because the expected penalties, as listed in table 1, are much higher for repeat offenders and individuals who have more familiarity with the procedure are more informed of the severity of the punishments. The author points to a study by Helland and Tabarrok (2007) who found lower recidivism rates among convicts facing life in prison if convicted of a third strike, adding credence to this hypothesis.



Observed in Figure 3 above, you can see initial evidence that the increase in punishments and sanctions at the thresholds is effective in reducing future drunk driving. The first panel contains recidivism rates for all suspected drunk drivers; the second contains rates for those with no prior tests; and lastly those who have had at least one prior test. Across each panel, having a BAC over the threshold is associated with lower recidivism rates. This is visually

represented by the fitted line in each of the three subsections for Panel A, B & C. The drop from the fitted line in the first section at the threshold to the fitted line in the next section is indicative of the attitudes of the perpetrators. As you can see in Panel C, repeat offenders, have a much more neutrally sloped line, largely due to the difference in scale on the y axis, as opposed to first time offenders or the aggregate of all offenders. This again suggests that those who have experienced the consequences of at least one DUI are deterred more from committing the crime.

TABLE 7—REGRESSION DISCONTINUITY ESTIMATES OF CHANGES IN JUDICIAL OUTCOMES AT THE BAC THRESHOLDS

	Fine	Jail	Any fine	Any jail	Home Mon.
Panel A. Fines and incarceration					
DUI	159.7***	3.84***	0.157***	0.112***	0.042***
	(23.72)	(0.564)	(0.014)	(0.013)	(0.004)
Mean (at 0.079)	523.5	8.61	0.69	0.31	0.19
Median (at 0.079)	425	0	1	0	0
Agg. DUI	73.5**	1.40***	−0.001	0.010*	0.005*
	(29.2)	(0.569)	(0.004)	(0.006)	(0.003)
Mean (at 0.149)	918.8	19.4	0.805	0.61	0.20
Median (at 0.149)	662	1	1	1	0

Panel B. Probation and suspensions	Court suspension	Suspension length	Probation	Probation length
DUI	0.008***	−28.3	0.081***	66.67***
	(0.002)	(41.01)	(0.010)	(15.22)
Mean (at 0.079)	0.011	241	0.25	768.1
Median (at 0.079)	0	90	0	730
Agg. DUI	−0.001	78.8***	0.001	25.9***
Mean (at 0.149)	(0.001)	(15.98)	(0.004)	(7.33)
Median (at 0.149)	0.056	246.2	0.36	1256
	0	90	1	1095

Panel C. Alcohol-related court-ordered treatments	Victims panel	Alcohol assess	Alcohol treatment	Alcoholics Anonymous	Any alcohol treatment
DUI	0.17***	0.14***	0.028***	0.002***	0.154***
	(0.016)	(0.014)	(0.004)	(0.0003)	(0.014)
Mean (at 0.079)	0.58	0.43	0.43	0.01	0.416
Median (at 0.079)	1	0	0	0	0
Agg. DUI	0.001	−0.008***	0.007**	0.002	−0.004
	(0.01)	(0.003)	(0.003)	(0.009)	(0.004)
Mean (at 0.149)	0.67	0.53	0.53	0.030	0.587
Median (at 0.149)	1	1	1	0	0

To determine what sanctions or punishments directly affects recidivism, Hansen conducts another regression discontinuity on the change in court-ordered sanctions at the two given thresholds shown above. The author subsets the regression based on findings from the broader criminology literature, highlighting the three main channels that serve to determine criminality of convicted individuals: incapacitation, rehabilitation, and deterrence.

He states that incapacitation, such as license suspension and probation, addresses some fundamental issues on the time of reoffending and their respective windows. Noting the estimated reduction in recidivism is largest in the 91-to-365-day window, when most suspensions have ended. Hinting that those drivers may be more deterred after experiencing the inconvenience of the suspension. The author then references a couple figures presented in the appendix (4 and 5), deriving a massive conclusion that the punishments associated with DUIs lead to both short-term and long-term reduction in recidivism. Stating, “Over the first two years, having a BAC above the DUI threshold decreases recidivism by 30 percent for all potential offenders. As the recidivism window expands to 6 years, the long-run effect of having

a BAC over the DUI threshold decreases in absolute magnitude to 10 & 20 percent for those with no prior test and at least one test."

Rehabilitation includes some of the more discrete sanctions administered by the courts, including attending a victims panel and taking an alcohol abuse assessment. It is thought that these might change the beliefs or preferences of drunk drivers causing them to consider the external costs of driving under the influence. It is important to note that the treatments do not change significantly from the .08 to .15 threshold that was seen in jail time and incapacitation. Hansen notes that under both the previous circumstances we see a reduction in recidivism at the .08 and .15 level, he concludes that this is not driving the findings.

"Given that the prior channels did not explain the reduction in repeat drunk driving, deterrence remains an alternative mechanism." The deterrent mechanism in this case is the punishments and sanctions at each threshold increase with each offense, resulting in a 97% increase in future punishments. This would have a deterrence elasticity of -.22. Having a BAC over the .15 threshold increases current punishments and sanctions but does not directly affect statutory sanctions for future offenses. Therefore, a reduction in recidivism could be consistent with what criminologists call specific deterrence: a criminal offends less because of the punishments they have already received.

Hansen concludes his paper stating that alcohol abuse continues to be a major public health concern. "In dollar values, the externality associated with each incident of drunk driving may be as high as $8,000." He references his significant findings that having a BAC above .08 reduce repeat drunk driving in the short and long run with an estimated effect of 2% reduction over 4 years as well as an additional 1% for driver above the .15 threshold. He identifies the criminologist theory that the presence of more severe punishment deters "those who would have otherwise been first-time drunk drivers". He then investigates the three major channels that could explain reductions in recidivism: incapacitation, rehabilitation, and deterrence, noting deterrence as the primary channel. He then references a variety of policy measures that have been proposed, such as further reducing the BAC limit to .05, and suggests alternatives policies including increasing marginal punishments more sharply along the BAC distribution or constructing more thresholds, rather than only two.

Hansen does an excellent job explaining the thought and methodology in this paper, he is incredibly thorough and looks at the issue of DUI's and recidivism from multiple angles. I believe his logic around criminality is correct in that those that are more familiar with tiered punishments are less likely to commit them in the future. However, his major finding of a 2% decrease in recidivism at the .08 threshold is fairly underwhelming alone. He attempts to expand upon this with models referenced in the appendix (Appendix 4 and 5) but are not brought in well throughout the paper but are presented to be a major finding. Additionally, the structure of his data was not well presented, and it left the reader wondering where he obtained the data for each model. He highlights the plethora of administrative data from FARS and BIC DUI but it is not clear where they were tied in independently or cumulatively into to the study.

One of my personal interests for this equation would be further explanation of the control variable X. It includes some general demographics such as age, race and gender, however it is unable to relate some of the additional factors that may cause individuals to be pulled over and suspected more often, which could include things such as socioeconomic background and the type of car the individual drives. For example, having a red car, accounts for 16% of all traffic stops while accounts for only 10% of today's market. These omissions are subsequently put into the error term, which could have correlation with the Xi variable. Including them into the Xi variable could make more sense. Another major concern I see is that Hansen mentions criminality of individuals but pays little attention to the police officers and their behavior in administering the DUI. It is fairly-well known that more police officers are deployed in areas with higher crime. He assumes that since police officers are purely reactive that this study contains a random treatment group based on the individual's actions. I would argue that it is a combination of both the police officer and the individuals' actions that lead to a every DUI. This assumption discounts the potentially discriminatory bias of the police officer.

If this data was able to track a large group of individuals over time, such as in a panel data format, we may get more robust results. I can see this type of policy being implemented as an alternative to jail time, where an individual would submit to being a part of a study and given access to track their habits such as spending. This type of data would be indicative of a person's behaviors and how it evolves overtime, giving us a more in depth understanding of what habits the individual has and whether that influenced them in receiving a second DUI. This type of method is fairly intrusive; therefore it most likely wouldn't be gain much ground here in the United States. However, I believe it would provide the clearest of pictures if the punishments and sanctions implemented undoubtably reduced rates in recidivism.