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ORIGINAL PAPER

Does Prison Deter Drunk-Drivers?

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Abstract

Objective To examine the specific deterrent effect of prison on driving under the influence of alcohol (DUI) recidivism.

Method The study outcomes were the probabilities of DUI re-offending over 6 months, 24 months and 5 years 'free time' (i.e. time not spent in custody). The comparison group consisted of offenders convicted of DUI offending who received a suspended sentence of imprisonment. The effect of imprisonment was examined in a series of 2SLS models; employing an extensive set of controls (age, gender, race, remoteness of residence, socio-economic status, legal representation, number of concurrent offences, DUI blood alcohol range, number of prior court appearances, prior penalties) and variation in the judicial proclivity to imprison convicted drunk drive offenders as an instrument to identify the effect of prison on DUI re-offending.

Results Our free-time analyses reveal no evidence that imprisonment reduces the risk of DUI recidivism. Separate analyses for first-time DUI offenders revealed a slight (5%) reduction in re-offending over 24 months free time but no effect over 5 years.

Conclusion We conclude that the funds currently spent on imprisoning DUI offenders could be more fruitfully be invested in measures that show more promise in reducing DUI recidivism.

Keywords DUI · Recidivism · Deterrence · Incapacitation · IV methods · Suspended sentences · Imprisonment

Introduction

Driving while under the influence of alcohol (hereafter referred to as DUI) is a major cause of premature death. In 2016, 10,497 people died in alcohol impaired driving crashes in the United States, accounting for around 29% of all traffic-related deaths in that country (Centers for Disease Control and Prevention 2018). The situation is somewhat better in Australia, but even in this country 17% of fatal road accidents involve DUI (WHO 2018). Not surprisingly, a great deal of attention has been given by scholars and policy makers to

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the question of how best to reduce the rate of recidivism amongst those convicted of DUI. The range of interventions that have been tried and evaluated include licence disqualification (e.g. Siskind 1996; Watson et al. 2017), fines (e.g. Weatherburn and Moffatt 2011), ignition interlocks (e.g. Roth et al. 2007), victim impact panels (e.g. Rojek et al. 2003), intensive supervision programs (e.g. Lapham et al. 2006), driver education (e.g. Robertson et al. 2009) and imprisonment[1] (e.g. Martin et al. 1993).

Among these interventions, one of the least well studied is that of imprisonment. This is perhaps partly because it is difficult to evaluate the effectiveness of prison as a deterrent in any setting (see below) and partly because offenders convicted of DUI offending are not normally imprisoned. In New South Wales (NSW), for example, only about 1% of persons convicted of PCA[2] (DUI) receive a prison sentence in any given year (NSW Bureau of Crime Statistics and Research 2018). Prison, however, is an expensive sanction even if not frequently used for DUI offenders. In 2018, 182 offenders in New South Wales (NSW) were sentenced to prison for a DUI offence. These offenders spent an average of 6 months (120 days) in custody. It costs approximately $173/day (recurrent) to keep someone in prison in NSW. The recurrent cost of imprisoning DUI offenders in this state is therefore close to $4 million ($3,778,320) per year (SCRGSP (Steering Committee for the Review of Government Service Provision) 2020). If prison is an ineffective deterrent, this is money that could usefully be invested in other more promising measures for reducing DUI re-offending; such as intensive supervision and education or alcohol interlocks (Willis et al. 2009). Alcohol-interlocks in NSW cost between $2200 and $2500 per year, the cost of which must be met by the offender (Transport, Roads & Maritime Services 2019), so this option would be far cheaper than prison and also arguably more effective (Elder et al. 2011).

There are three channels through which prison might be expected to reduce recidivism. The first is incapacitation (the reduction in crime obtained while an offender is in custody); the second; general deterrence (the effect of prison on the general proclivity to offend); and the third: specific deterrence (the effect of imprisonment on the likelihood of reoffending). The incapacitation effect of prison on DUI recidivism is not known but is likely very small because most DUI offenders spend relatively short periods in custody. Wagenaar et al. (2007) reviewed research on the general and specific deterrent effect of changes to DUI fine or jail penalties for first-time offenders between 1976 and 2002. Most of the studies his team examined concerned general deterrence and most of these showed no effect. The same is true of the only Australian study to examine the general deterrent effect of changes in the statutory maximum prison penalty for drink driving (Briscoe 2004). Only two studies have examined specific deterrent effects and one of these measured stated intentions to re-offend rather than actual re-offending.

The sole study in the review that examined actual re-offending (Socie et al. 1994) found deterrent effects for repeat offenders but not first-time offenders. Socie et al. (1994) selected a random sample of drivers charged with DUI in Franklin County Municipal Court

[1] In the US prison and jail are separate institutional forms of sanction but for the purposes of this article we use the terms 'jail' and 'prison' interchangeably as they both involve a custodial sanction.

[2] In Australia DUI offenders are those convicted driving under the influence of alcohol based on evidence other than the result of a blood alcohol test. Those who are convicted based on the result of a blood alcohol test are known as 'PCA' offenders (where the term 'PCA' refers to the 'prescribed concentration of alcohol. The penalties for PCA offending depend on the blood alcohol level. As this term is likely unfamiliar to most readers, in what follows we use the term DUI offender to capture both types of offender.

during 1987 who had been sentenced either to jail (n = 124) or to a certified driver intervention program (DIP) (n = 218). The dependent variable in the study was conviction for another DUI offence within 4 years of the index charge. After controlling for gender, age, race, blood alcohol concentration, additional charges filed at the time of the arrest and driving history, their logistic regression analysis revealed that DIP attendees had significantly lower rates of impaired driving (i.e. DUI). Socie et al.'s findings mirror those of a much earlier study by Homel (1980). He examined the association between various penalties and DUI reconviction rates using a sample of 1000 offenders sanctioned for DUI in New South Wales (NSW) courts in 1972. After adjusting for the effects of a number of other factors (e.g. age, gender, occupational status, number of previous DUI convictions, he concluded that 'imprisonment [is] no more effective than any other penalty for any group of offenders, and there is strong evidence that long periods of imprisonment, especially beyond 6 months, encourage re-offending, especially for drinking and driving' (Homel 1980, p. 3).

The central problem facing all attempts to estimate the specific deterrent effect of prison on re-offending is selection (omitted variable) bias (Nagin et al. 2009). It is extremely rare to find situations in which the allocation of sanctions to offenders is random (although see Nagin et al. 2009 for examples). The traditional response to the problem of selection bias, evident in the studies just discussed, has been to conduct some form of regression analysis and include controls for factors that might be correlated both with the choice of penalty and recidivism. This strategy has a number of limitations as a means of dealing with selection bias. It is often difficult to identify and measure all the factors that are potentially associated with both penalty choice and recidivism. The results of any analysis may depend on the assumed functional form of the relationship between dependent and independent variables. And standard regression methods generally lack of any diagnostic test for covariate balance in treatment and comparison groups (for more detail on this see: Apel and Sweeten 2010).

Instrumental variables (IV) analyses are often used as an estimation strategy when omitted variable bias is a potential threat. One of the key requirements of IV analysis is a suitable instrument; that is, a variable that affects selection into treatment but which has no effect on the outcome of interest other than through treatment (Bushway and Apel 2010). It is sometimes difficult to find a variable that meets this requirement. One approach that has found favour with a number of deterrence researchers, however, is to exploit the disparities in sentencing evident when different judges confront similar cases. Green and Winik (2010) used this strategy in a study on the specific deterrent effect of prison and probation on re-offending among drug offenders. The same strategy has since been used by other researchers examining specific deterrent effects (e.g. Aizer and Doyle 2015; Weatherburn and Moffatt 2011; Nagin and Snodgrass 2013; Loeffler 2013; Dobbie et al. 2018).

Martin et al. (1993) exploited judicial disparity in sentencing in their study of first-time drunk-drive offenders in Hennepin County (Minneapolis) where, at the time, judicial policy mandated a 2-day jail sentence for all first-time DWI offenders. Martin et al. collected data on 383 cases dealt with by two judges; one of whom sentenced 73% of first time DUI offenders to jail and the other of whom sentenced only 14% of first time DUI offenders to jail. They regressed DUI reconviction against judge ID as a proxy for penalty severity and adjusted for the effects of age, gender, blood alcohol concentration, prior accident record, prior traffic record, the seriousness of the offence (as measured by additional charges), the authors found no significant difference in reconviction for a DUI offence between those who received a jail sentence and those who received a fine. This is an intriguing finding but the small sample size raises some doubt over the power of the analysis to detect a significant difference in DUI reconviction.

The Present Study

The evidence to date is clearly insufficient to draw any firm conclusions about the effect of prison on DUI recidivism. First of all most studies have been concerned with the general deterrent effect of penalties (particularly license disqualification) for DUI or treatment interventions for those who commit this offence. Very few have examined the specific deterrent effect of custodial penalties for DUI. Second, most of the studies that have been conducted on the specific deterrent effect of custodial penalties on DUI have generally had weak designs (on this point see Miller et al. 2015) or small sample sizes (although see Homel 1980), thus limiting their power to detect a specific deterrent effect. Finally, much of the evidence on the specific deterrent effect of custodial penalties in relation to DUI comes from the United States where the custodial penalties for DUI are fairly mild (e.g. a few days in custody as compared with an average sentence of 6 months in NSW.

In the present study we capitalise on some unique features of the NSW legal context to obtain a clearer picture of the effect of prison on DUI recidivism. In NSW, the sentencing of convicted offenders is a three-step process. First, the judicial officer has to decide on the objective facts of the case whether a sentence of imprisonment is warranted. If the court reaches the view that a prison sentence is warranted, it then has to decide the length of the sentence. If the court forms the view that a sentence of not more than 2 years is appropriate, it then has to decide whether to suspend the sentence or impose a full-time prison sentence. Although courts can attach conditions to a suspended sentence, the most common condition is a requirement to be 'of good behaviour'. The suspended sentence is not intended to be a rehabilitative measure. It is supposed to act as a 'Sword of Damocles' in that any further offence committed during the term of the sentence is supposed to result in immediate imprisonment for the original offence plus whatever additional term may be required for the new offence. In practice, courts usually but do not always imprison a person for offending during the period of the suspended sentence. This is especially true if the new offence is regarded as minor.

The fact that a suspended sentence can only be imposed after a decision has been made that a prison sentence is appropriate creates a natural comparison group for prison which helps reduce (although it does not eliminate) differences between the treatment (prison) and control (suspended sentence) groups. The availability of a rich set of controls (see below) helps further eliminate differences between treatment and comparison groups. Our key defence against selection bias, however, is an instrumental variable analysis. We exploit the effectively random allocation of cases to judicial officers in an instrumental variable analysis which accounts for observed and unobserved differences between DUI offenders who were given a suspended prison sentence and DUI offenders who were imprisoned.

Two other features set the current study apart from previous studies of the specific deterrent effect of custodial penalties on DUI recidivism. The sample is very large; consisting of 9384 individuals appearing in NSW criminal courts for DUI offences from 1 January 2000 to 30 June 2018. The average custodial penalty amongst those in the sample who received a custodial penalty (approximately 6 months) is also quite long compared with the custodial penalties imposed on DUI offenders in many other overseas jurisdictions. We find that our judicial severity instrument strongly predicts the likelihood of receiving a prison penalty relative to a suspended sentence. In order to separate deterrence from incapacitation effects we proceed with analyses of re-offending at 6 months, 24 months, and 5 years, measured two ways: (a) elapsed days post-sentencing (including time in and out of custody) and (b) free days post-sentencing (days out of custody post-sentencing). To

foreshadow our conclusion, we find no strong evidence that prison exerts a significant incapacitation or deterrent effect on DUI offending although we later acknowledge that the low rate of DUI reconviction probably limits our ability to detect an incapacitation effect.

Method

Data Source

The data source for this study was the NSW Bureau of Crime Statistics and Research (BOCSAR) Re-offending Database (ROD). ROD links all cautions, all conferences, all finalised criminal court appearances and all movements in and out of custody in NSW for each individual from January 1994 to the present (Hua and Fitzgerald 2006). Finalised cases were selected if they:

1. Involved an adult offender; who
2. Had been convicted of 'exceed the prescribed content of alcohol' (DUI) as their principal offence (ANZSOC code 1431: see Australian Bureau of Statistics 2011a), where:
3. The blood alcohol concentration in relation to the principal DUI offence was 'Medium' or 'High'; and
4. Where the principal penalty was imprisonment or a suspended sentence; and
5. Where the offender was not charged with any indictable offence.

These selection rules resulted in a dataset of 11,282 appearances by 9384 individuals appearing in NSW criminal courts from 1 January 2000 to 30 June 2018. 1898 individuals had more than one appearance meeting these criteria.

ROD includes a range of information on offender characteristics. We use the following variables coded as:

- **Age** 0–22, 23–29, 30–34, or 35 and above;
- **Sex** Female or male;
- **Indigenous status** Indigenous, non-Indigenous or missing;
- **Remoteness of postcode of residence** (Australian Bureau of Statistics 2011b)
  - Major cities;
  - Inner regional;
  - Outer regional, remote or very remote;
  - Missing.
- **Socioeconomic disadvantage of area of residence** (Australian Bureau of Statistics 2011c) reverse-coded as highly advantaged, advantaged, disadvantaged or highly disadvantaged
- **Legal representation** yes or no;
- **Number of concurrent offences at the index appearance** 1, 2, or 3 or more;
- **DUI range of principal offence** medium or high;
- **Number of prior court appearances** 1, 2, 3, 4 or more;
- **Prior penalties** (separate dummy variables for whether a person had a court appearance in the 5 years prior to the index appearance where they were sentenced to)

- Fine;
- Licence disqualification;
- Imprisonment.

- **Prior proven offences** (separate dummy variables for whether a person had a court appearance in the 5 years prior to the index where one of the following offences was proven)
  - Violent (homicide, assault, sexual assault or related offences or robbery);
  - Traffic;
  - Driving while disqualified or suspended:
  - Justice procedures/breach.

Sample Characteristics

Table 1 shows the distribution of observed characteristics among all DUI offenders in our sample, stratified by the type of penalty they received. There are significant differences between those who are imprisoned and those who received a suspended sentence in terms of age, clear differences exist in terms of sex (females were much less likely to be imprisoned), Indigenous status (Indigenous offenders were over-represented among those imprisoned), remoteness of the area of residence (offenders in remote areas were over-represented among those and socioeconomic disadvantage.

There are also differences between the groups in some characteristics of their index appearance and their prior criminal history. Offenders who are legally represented are less likely to be imprisoned. Those with a single concurrent offence are more likely to receive a suspended sentence than imprisonment. Nearly 60% of the imprisoned group (57.4%) had four or more prior court appearances with a proven offence. A majority of those imprisoned had previously received fines (63.9%) and licence disqualification (63.8%). Notably, there was little difference in penalty outcomes at index appearance by DUI range.

Sentencing

The explanatory variable of interest is a binary variable denoting whether a person was sentenced to imprisonment at case finalisation (coded 1 if they were imprisoned and 0 if they received a suspended sentence).

Table 2 presents statistics on rates of imprisonment (relative to suspended sentences) for DUI offenders over our study period. The average length of prison penalties given for DUI offences has remained largely stable over the study period. The proportions who are sentenced to prison compared to receiving suspended sentences have varied somewhat. Most notably, in the first 4 years of the sample, DUI offenders were sentenced to prison at the same rate as they were being sentenced to suspended sentences. From then on, prison penalties have been given out to roughly a third of the sample.

Reoffending

In order to estimate the impacts of prison on reoffending we measured reoffending in terms of both elapsed time and free time. Elapsed time is simply the time between case finalisation and of the date of death, reconviction, or the end of the observation period. It does not

Table 1 Sample characteristics, by penalty received at index

Factor	Level	Imprisonment (n = 3946)		Suspended sentence (n = 7336)	
		n	%	n	%
Age group	18–22	165	4.2	400	5.5
	23–29	576	14.6	1229	16.8
	30–34	590	15.0	997	13.6
	35 and above	2614	66.3	4709	64.2
Sex	Female	235	6.0	1101	15.0
	Male	3711	94.0	6235	85.0
Indigenous status	Indigenous	563	14.3	521	7.1
	Non-Indigenous	2285	57.9	4198	57.2
	Unknown	1098	27.8	2617	35.7
Remoteness area	Major cities	1616	41.0	3712	50.6
	Inner regional	1202	30.5	2284	31.1
	Other	1128	28.6	1340	18.3
Socio-economic disadvantage of postcode	Highly advantaged	319	8.1	976	13.3
	Advantaged	799	20.2	1717	23.4
	Disadvantaged	1076	27.3	2231	30.4
	Highly disadvantaged	1236	31.3	1994	27.2
	Missing	516	13.1	418	5.7
Legal representation	No	322	8.5	856	12.1
	Yes	3445	91.5	6198	87.9
Number of concurrent offences	1	1223	31.0	4177	56.9
	2	1317	33.4	1866	25.4
	3+	1406	35.6	1293	17.6
DUI range at index	High	2673	67.7	5073	69.2
	Medium	1273	32.3	2263	30.8
Number of prior court appearances	0	261	6.6	1043	14.2
	1	431	10.9	1452	19.8
	2	523	13.3	1362	18.6
	3	462	11.7	945	12.9
	4+	2269	57.5	2534	34.5
Prior penalties—fine	No	1425	36.1	3653	49.8
	Yes	2521	63.9	3683	50.2
Prior licence disqualification	No	1427	36.2	3848	52.5
	Yes	2519	63.8	3488	47.5
Prior imprisonment	No	2373	60.1	6356	86.6
	Yes	1573	39.9	980	13.4
Prior violence	No	2835	71.8	6083	82.9
	Yes	1111	28.2	1253	17.1
Prior traffic offence	No	1314	33.3	3659	49.9
	Yes	2632	66.7	3677	50.1
Prior driving offence	No	2695	68.3	6488	88.4
	Yes	1251	31.7	848	11.6

Table 1 (continued)

Factor	Level	Imprisonment (n = 3946)		Suspended sentence (n = 7336)	
		n	%	n	%
Prior justice procedure offence	No	2784	70.6	6209	84.6
	Yes	1162	29.4	1127	15.4

Table 2 Imprisonment rates and sentence lengths for DUI offenders over the study period

Years	Sample n	Imprisoned (%)	Average sentence length (standard deviation)
2000–2003	1631	835 (51.2)	5.446 (3.087)
2004–2006	2268	763 (33.6)	6.375 (3.380)
2007–2009	2342	839 (35.8)	6.259 (3.109)
2010–2012	1962	651 (33.2)	5.747 (2.872)
2013–2015	1715	535 (31.2)	5.846 (2.798)
2016–2018	1364	323 (23.7)	6.137 (3.107)
Whole sample	11,282	3946 (35.0)	5.959 (3.098)

exclude time spent in custody and therefore captures both deterrence and incapacitation effects. To conduct the elapsed time analysis, we created three dummy variables capturing any re-offending from case finalisation:

- Re-offending with a DUI offence within 6 months (coded 1 if 'yes' and 0 if 'no'); and
- Re-offending with a DUI offence within 24 months (coded 1 if 'yes' and 0 if 'no'); and
- Re-offending with a DUI offence within 5 years (coded 1 if 'yes' and 0 if 'no').

ROD contains information on the duration of each and every period spent in custody by every person in the database (including time spent bail refused). We used this data to examine 'free time' re-offending using the custody data from ROD. 'Free time' is the number of days from disposal to the earliest of their date of death or the end of the observation period of the data (30 June 2018), excluding all further custodial episodes. To carry out a 'free-time' analysis we constructed indicator variables for whether a person re-offended with a DUI offence within 6 months, 24 months and 5 years of free time. For each timeframe of interest, these variables take the values of:

- 1 if the person had enough (i.e. 6 months, 24 months or 5 years) free time and was observed reoffending within the period of interest
- 0 if they had enough free time (i.e. 6 months, 24 months or 5 years) but did not reoffend within that period, or reoffended outside that period
- Missing for offenders with insufficient follow-up time (i.e. those who did not have 6 months, 24 months or 5 years free time post-disposal)

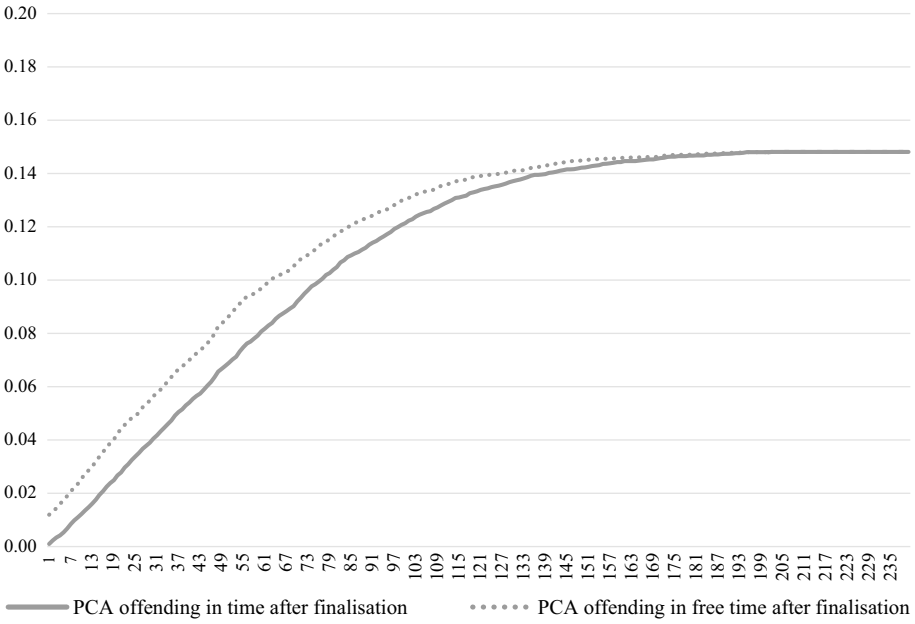

Fig. 1 Proportion re-offending as a function of months since case finalisation (elapsed time vs. free time)

Table 3 Comparative DUI re-offending rates, DUI offenders sentenced to prison and suspended sentences

Months	Re-offending (elapsed time)		Re-offending (free time)	
	Suspended sentence	Prison	Suspended sentence	Prison
6	57 (0.8)	19 (0.5)	87 (1.3)	83 (2.4)
24	227 (3.1)	140 (3.5)	235 (4.0)	219 (6.7)
60	532 (7.3)	379 (9.6)	420 (8.8)	393 (14.4)

Figure 1 shows the cumulative proportion reoffending as measured in terms of both elapsed time and free time. The cumulative proportion re-offending, if judged in terms of elapsed time, is generally lower in the first 120 months of elapsed time than the proportion re-offending in the first 120 months of free time, although both rates eventually converge over the follow-up period to 14.8%. The initial difference in rates of re-offending over elapsed time is suggestive of incapacitation but at this stage we have not controlled for differences between those imprisoned and those who received a suspended sentence. Table 3 provides data on comparative rates of offending for those sentenced to imprisonment against those given suspended sentences.

There are several results of note about Table 3. The first is that DUI re-conviction is uncommon; within 6 months of case finalisation, only 0.8% of those receiving suspended sentences have been convicted of a further DUI offence whereas the corresponding proportion for those sentenced to imprisonment is 0.5%. DUI re-conviction in the first 6 months of free time after finalisation is slightly higher for those imprisoned; with

2.4% of those imprisoned committing a further DUI offence in that time, compared with 1.3% of their counterparts given a suspended sentence.

The second point to note is that, while there is a nominally higher rate of reoffending amongst the suspended sentence group at the 6-month mark, beyond this point it is the prison group that has the higher rate of reconviction. The lower rate observed among those imprisoned during the first 6 months may be because offenders in the prison group are incapacitated for much of the first 6 months, however once again, without correcting for the likely differences between offenders who are sentenced to imprisonment and suspended sentences, we cannot be sure of this.

Statistical Analysis

Judge Severity Instruments

As noted earlier, instrumental variable (IV) techniques (Imbens and Angrist 1994) are often used in cases where selection bias may confound the estimates of the treatment effect. These techniques use plausibly exogenous variation in a variable which affects treatment which otherwise does not affect the outcome variable (the instrumental variable). IV analyses estimate two equations to obtain the treatment effect: first, the treatment equation, which specifies treatment as a function of all observed variables, fixed effects and the exogenous factor (the IV). The predicted probability of treatment from the first equation is then used to estimate the second equation, which specifies the outcome as a function of the predicted treatment, observed variables and fixed effects.

In NSW, courts have no control over the cases they hear. When offenders are charged with an offence, their case is heard in the court nearest to where the offence occurred. Judicial officers are assigned to a court for a particular period and hear all the cases rostered for that court during that period. Judicial officers do not remain in one court but are rotated across courts in both metropolitan and country courts. The listing of cases at each court is done by an administrator, who assigns a new case to a judicial officer whenever he or she concludes the case they are dealing with. Except in the case of the Drug Court (which is not included in this study), judges play no role whatsoever in supervising the offenders they release into the community or send to prison. If the offender re-offends or breaches the conditions of a release order, their case is simply assigned to the next available judicial officer at the court closest to where the offence or breach took place. The sentencing judge's severity is therefore a suitable candidate instrument for IV analysis.

There are approximately 268 judges in our sample or, on average, 106 judges in each year of our dataset. In terms of temporal and spatial turnover, judges in our sample are active for roughly 7.56 years on average. Judges also vary in where they preside over time, with judges averaging 7.4 unique court locations across the sample period, and averaging 15.5 unique location-year combinations. The movement in judge locations across time (including within years) provides a potentially rich variation in sentencing outcomes for DUI offenders.

A judge *j*'s severity in this context may be measured as the proportion of DUI cases where they impose a sentence of imprisonment. However, a problem arises in using this as an instrument as the outcome of the index appearance at which the penalty is imposed would be included in the calculation of the judge's average level of leniency, which makes the instrument co-determined with the treatment. To address this, researchers commonly employ a 'leave one out' strategy of calculating the measure at the appearance level. This

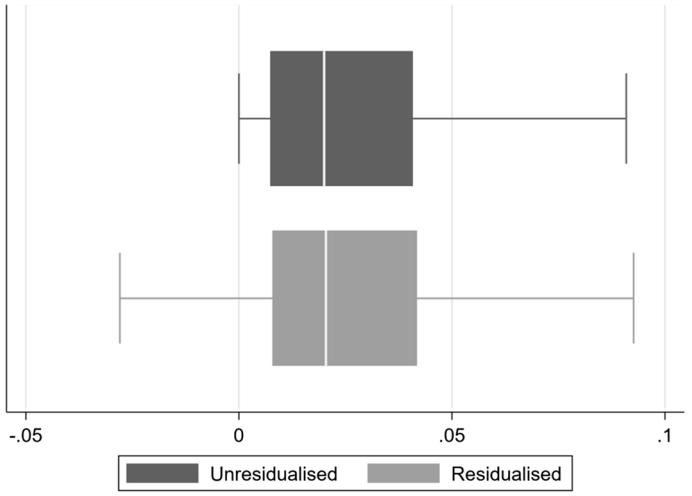

Fig. 2 Distribution of measures of judge severity

involves excluding the appearances d involving index defendant i from both the numerator (the number of decisions d by that judge to imprison p) and the denominator (the total number of sentencing decisions made by the judge n_{jd}) of the measure of average leniency or severity.

$$IV_j = \frac{1}{n_{jd} - n_{ijd}} \left(\sum_{d=1}^{n_{jd}} p_{jd} - \sum_{d=1}^{n_{ijd}} p_{ijd} \right) \tag{1}$$

An additional step is also undertaken to remove variation in decisions caused by case characteristics in their measure of judge leniency (Dobbie et al. 2018). This first involves obtaining the residuals of the decision after accounting for offence, location and time fixed effects δ_d, i.e.:

$$p_d^* = p_d - \delta_d \tag{2}$$

Summing these residuals instead of decisions to impose a prison penalty yields the residualised measure of judge leniency:

$$IV_{ij}^* = \frac{1}{n_{jd} - n_{ijd}} \left(\sum_{d=1}^{n_{jd}} p_{jd}^* - \sum_{d=1}^{n_{ijd}} p_{ijd}^* \right) \tag{3}$$

We apply this strategy to obtain unresidualised and residualised measures of judge severity as measured by their propensity to imprison DUI offenders. In other words, the value of the unresidualised instrument for an individual is a measure of their sentencing judge's average severity in dealing with all other offenders. The residualised IV is similar with the exception that it also excludes variation caused by fixed effects.

Figure 2 presents boxplots of the measures of judge severity. The unresidualised measure ranges from zero to roughly 0.09 (i.e. one in ten DUI offenders sentenced to imprisonment). More judges tend to cluster around the lower range, with some distance between the 75th percentile (approximately 0.04) to the maximum (0.09). The median judge had an

unresidualised severity of 0.02, i.e. one in fifty DUI offenders sentenced to imprisonment. The median for the residualised measure is the same, however the distribution is more balanced. The 25th percentile of the residualised severity is 0.01 and its 75th percentile is 0.4.

We present the first-stage regression of both measures of judge severity on the probability of imprisonment in Table 4. The partial F statistics of both first-stage equations are large, confirming that our measures of severity are predictive of being given a prison sentence. The coefficients of the IVs on the likelihood of imprisonment are also positive and significant (Table 4). Given that the range of the unresidualised measure of judge severity is 0.09, being assigned the most severe judge in the sample increases the likelihood of imprisonment by 17 percentage points, compared to the most lenient judge. The corresponding increase in likelihood of imprisonment is 19 percentage points for the residualised instrument.

We also conduct randomisation and monotonicity tests of our IVs. We regress the value of the IV against all available covariates and fixed effects and run an F-test for the joint significance of the individual-level variables. This test was conducted for both IVs (Table 5). No significant relationship between the IVs and the explanatory variables was found at the 0.05 significance level. The monotonicity assumption means that our IVs should impact the probability of treatment in the same direction for each observation. To test this assumption we examine the coefficient of the IV on treatment probability when the first-stage regression is repeated on different subgroups within the sample. The estimates from these regressions (Table 6) confirms our expectations that judge severity increases the likelihood of imprisonment across the whole sample and most subgroups.

Econometric Specification

The effect of receiving a prison sentence (p_i) on DUI recidivism at a particular time period (Y_{it}) can be obtained by estimating the following linear probability model, with β_1 as the coefficient of interest:

$$Y_{it} = \beta_0 + \beta_1 p_i + \gamma X_i + \delta_i + \varepsilon \tag{4}$$

An OLS estimate of (4) may be biased in the presence of any unobserved factors which correlate with both p_i and Y_{it}. We implement the IV approach using 2SLS to obtain consistent estimates of β_1 by re-estimating (4) with the predicted probability of imprisonment from the first stage estimation presented in (1).

$$Y_{it} = \beta_0 + \beta_1 \hat{p}_i + \gamma X_i + \delta_i + \varepsilon \tag{5}$$

We estimate Eqs. (4) and (5) across all six outcome variables of interest, with Eq. (5) being estimated using the unresidualised and residualised measures of judge severity.

Our analyses involve both binary treatment and outcome variables. Thus instrumental variables analyses can be undertaken two ways: using a two-stage-least-squares (2SLS) linear probability approach or using a recursive bivariate probit model, where both equations are estimated using maximum likelihood. Several recent reviews (Nichols 2011; Chiburis et al. 2012) have covered the distinctions between the two instrumental variables estimators in the context of binary treatment and outcome variables. The 2SLS estimator has a number of strengths. It consistently estimates the average treatment effect on those who 'comply' with the IV. The coefficients can be straightforwardly interpreted as treatment

Table 4 First-stage regression of judge severity on probability of imprisonment

Instrument	Unresidualised	Residualised
Instrumental variable	1.916***	1.871***
	(0.327)	(0.326)
Aged 23–29	−0.0131	−0.0132
	(0.0282)	(0.0282)
Aged 30–34	0.0333	0.0333
	(0.0289)	(0.0289)
Aged 35+	0.0666***	0.0665***
	(0.0259)	(0.0259)
Male	0.130***	0.130***
	(0.0171)	(0.0171)
Non-Indigenous	−0.0120	−0.0117
	(0.0230)	(0.0230)
Unknown Indigenous status	−0.0254	−0.0253
	(0.0243)	(0.0243)
Inner regional	−0.0253	−0.0252
	(0.0252)	(0.0252)
Outer regional/remote/very remote	−0.0735***	−0.0735***
	(0.0358)	(0.0358)
Advantaged	0.0564***	0.0564***
	(0.0229)	(0.0229)
Disadvantaged	0.0281	0.0281
	(0.0243)	(0.0243)
Highly disadvantaged	0.0488	0.0488
	(0.0255)	(0.0255)
Missing	0.282***	0.282***
	(0.0394)	(0.0394)
Legally represented	0.0243	0.0242
	(0.0183)	(0.0183)
2 concurrent offences	0.0871***	0.0872***
	(0.0145)	(0.0145)
3 or more concurrent offences	0.167***	0.167***
	(0.0162)	(0.0162)
Medium DUI range	−0.0714***	−0.0706***
	(0.0131)	(0.0131)
1 prior court appearance	0.00873	0.00883
	(0.0225)	(0.0225)
2 prior court appearances	0.0287	0.0286
	(0.0236)	(0.0236)
3 prior court appearances	0.0490	0.0490
	(0.0255)	(0.0255)
4 or more prior court appearances	0.102***	0.102***
	(0.0248)	(0.0248)
Prior fine	−0.0176	−0.0176
	(0.0170)	(0.0170)
Prior licence disqualification	0.0863***	0.0865***
	(0.0286)	(0.0286)

Table 4 (continued)

Instrument	Unresidualised	Residualised
Prior imprisonment	0.169***	0.169***
	(0.0180)	(0.0180)
Prior violence	−0.00891	−0.00902
	(0.0175)	(0.0175)
Prior traffic offence	−0.00464	−0.00473
	(0.0288)	(0.0288)
Prior driving offence	0.122***	0.122***
	(0.0189)	(0.0189)
Prior justice procedure offence	0.0399***	0.0399***
	(0.0180)	(0.0180)
Constant	−0.110***	−0.111***
	(0.0489)	(0.0490)
N	9156	9156
Partial F		
R-squared	0.607	0.607

Robust standard errors in parentheses

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

effects. Furthermore, it offers a battery of tests for weak instruments and commonly-used diagnostics.

The bivariate probit model mainly deals with one of the major criticisms of linear probability models; that they produce estimates based on implausible predicted values (i.e. those outside the bounds of zero and one). Although linear probability models have been said to yield similar estimates of treatment effects in inferential studies (Angrist and Pischke 2009), this tends to be the case when probabilities do not cluster at the extremes, as they do in our case. Chiburis et al. (2012) shed some light on which models should be chosen in these circumstances, modelling the performance of 2SLS and bivariate probit models under different circumstances. Their findings suggest bivariate probit performs better than 2SLS estimates when the sample size exceeds 5000 and the probability of treatment is relatively low.

There are two further advantages to the bivariate probit model. The 2SLS estimate is based on people who, save for judicial assignment, would have received a different treatment. The bivariate probit model estimates this impact for people who are similar on observables to those who were incarcerated, including those who received similarly severe judges. Recursive bivariate probit models may also be preferred in this context for efficiency. Using the baseline rate of 6-month free time re-offending among the suspended sentence group (1.3%), we have about 17% power to detect a one percentage point reduction in the risk of reoffending using simple OLS regression. The use of 2SLS compounds this as it is based on the subset of observations sensitive to the IV; the bivariate probit method estimates an ATE and does not suffer from a similar loss of efficiency.

We follow the recommendations for implementing both estimators from Chiburis et al. (2012). In addition to the OLS and 2SLS models, we estimate the probit analogue of (4) and the recursive bivariate probit analogue of (5) with bootstrapped standard errors. We conduct the Murphy (2007) score test in relation to our bivariate probit models to ensure that the assumption of joint normality is satisfied (and thus the model is correctly

Table 5 Tests of randomisation of instrumental variables

Variable	Unresidualised			Residualised		
	Coeff.	Std. err.	*p* value	Coeff.	Std. err.	*p* value
Age group (reference = 18–22)						
23–29	−0.0018	0.0013	0.186	−0.0019	0.0014	0.164
30–34	−0.0017	0.0013	0.207	−0.0018	0.0014	0.183
35+	−0.0018	0.0012	0.138	−0.0017	0.0013	0.183
Sex/Gender (reference = female)						
Male	−0.0007	0.0008	0.414	−0.0007	0.0008	0.387
Indigenous status (reference = Indigenous)						
Non-Indigenous	0.0001	0.0010	0.947	0.0000	0.0010	0.968
Unknown	−0.0003	0.0011	0.781	−0.0003	0.0011	0.787
Remoteness area (reference = major cities)						
Inner regional	−0.0011	0.0011	0.322	−0.0012	0.0011	0.291
Outer regional/remote/very remote	0.0007	0.0017	0.672	0.0007	0.0017	0.700
Socio-economic disadvantage (reference = highly advantaged)						
Advantaged	0.0008	0.0011	0.455	0.0011	0.0011	0.331
Disadvantaged	0.0002	0.0012	0.847	0.0005	0.0012	0.700
Highly disadvantaged	−0.0008	0.0012	0.512	−0.0005	0.0013	0.667
Missing	−0.0026	0.0021	0.207	−0.0020	0.0021	0.342
Legal representation (reference = no)						
Yes	−0.0011	0.0009	0.255	−0.0009	0.0009	0.322
Number of concurrent offences (reference = 1)						
2	−0.0003	0.0007	0.653	−0.0002	0.0007	0.754
3+	−0.0007	0.0007	0.371	0.0002	0.0008	0.770
DUI range at index						
Medium	0.0022	0.0006	0.001	0.0020	0.0006	0.002
Number of prior court appearances (reference = 0)						
1	0.0003	0.0011	0.771	0.0003	0.0011	0.797
2	0.0009	0.0011	0.433	0.0011	0.0011	0.354
3	0.0003	0.0012	0.798	0.0003	0.0012	0.802
4+	0.0005	0.0011	0.637	0.0010	0.0011	0.372
Prior fine (reference = no prior fine						
Yes	0.0015	0.0008	0.067	0.0010	0.0008	0.237
Prior licence disqualification (reference = no prior licence disqualification)						
Yes	−0.0029	0.0012	0.017	−0.0023	0.0012	0.066
Prior imprisonment (reference = no prior prison)						
Yes	−0.0007	0.0008	0.327	0.0003	0.0008	0.701
Prior violence (reference = no prior violence)						
Yes	−0.0012	0.0009	0.152	−0.0014	0.0009	0.110
Prior traffic offence (reference = no prior traffic offence)						
Yes	0.0009	0.0012	0.461	0.0010	0.0013	0.411
Prior driving offence (reference = no prior driving offence)						
Yes	−0.0002	0.0009	0.797	0.0003	0.0009	0.756
Prior justice procedure offence (reference = no prior justice procedure offence)						
Yes	0.0003	0.0009	0.688	0.0008	0.0009	0.346

Table 5 (continued)

Variable	Unresidualised			Residualised		
	Coeff.	Std. err.	*p* value	Coeff.	Std. err.	*p* value
N	9156			9156		
F-statistic	1.42			1.05		
p value	0.07			0.39		

specified). The standard errors from the bivariate probit models were also bootstrapped. One challenge of presenting both sets of results is that the coefficients do not have the same interpretation. For this reason, we transform the probit and bivariate probit coefficients into estimates of the average treatment effect, and report these against the OLS and 2SLS results to aid comparability. In addition to the main models, we explore two potentially important sources of heterogeneity. A longer sentence means a longer period of incapacitation. A longer prison sentence may also exert a stronger specific deterrent effect than a shorter sentence. The first test for heterogeneous effects therefore repeats the analyses using the length of the prison sentence as the main explanatory variable. In the second, we examine differences between first-time and repeat DUI offenders on the grounds that first-time DUI offenders may be more likely to be specifically deterred from offending from receiving a prison sentence, compared to repeat offenders.

Results

Table 7 presents the estimated effects of imprisonment on DUI re-offending compared to those given a suspended sentence. In the first row, we present the baseline rates of DUI offending among those given a suspended sentence for comparison. Further rows present the treatment effects estimated using OLS and probit (i.e. single-equation approaches) and the instrumental variables analyses using each instrument.

First, we examine DUI reoffending after finalisation without adjusting for free time. In the first 6 months following finalisation, OLS estimates indicate that those imprisoned are 0.4 percentage points less likely to be convicted of a further DUI offence than those who receive a suspended sentence. This estimate is statistically significant at the 0.05 level and is corroborated by the probit estimate. Since the average length of imprisonment among DUI offenders is 6 months, this suggests that some level of incapacitation is occurring. Both the two-stage least-squares and bivariate probit estimates are negative, suggesting that, after correcting for potential unobserved differences between those given different penalties, there is a minor, non-significant effect of imprisonment. The OLS and probit estimates suggest lower rates of DUI reoffending among those imprisoned at 24 months and 5 years but, again, neither effect is statistically significant. At 24 months, the 2SLS and bivariate probit results produce opposite signed results but in both cases they are non-significant. At 5 years, 2SLS estimates suggest a slightly higher (0.24–0.27 percentage point) increase in the likelihood of a re-offence for those imprisoned compared with the 0.10 percentage point increase estimated by bivariate probit but these results are also non-significant.

Turning to the free-time analyses, virtually none of the estimates are negative, with the exception of the bivariate probit estimates at 6 months' free time. All other estimates

Table 6 Coefficients of judge severity in first-stage regressions predicting the likelihood of imprisonment conducted on various subsamples

Instrument group	Unresidualised		Residualised	
	Coefficient	*p* value	Coefficient	*p* value
Age group				
0–	−3.87	0.076	−3.05	0.140
23–	1.80	0.054	2.28	0.010
30–	1.33	0.153	2.16	0.018
35–	1.37	0.000	1.93	0.000
Sex/gender				
Female	2.12	0.017	2.19	0.014
Male	1.35	0.000	1.91	0.000
Indigenous status				
Indigenous	−1.98	0.161	−0.79	0.563
Non-Indigenous	1.86	0.000	2.32	0.000
Unknown	1.51	0.002	2.06	0.000
Remoteness area				
Major cities	2.31	0.000	2.70	0.000
Inner regional	0.32	0.585	1.01	0.073
Outer regional/remote/very remote	0.74	0.247	1.32	0.034
Socio-economic disadvantage of postcode				
Highly advantaged	3.06	0.000	3.43	0.000
Advantaged	2.42	0.000	2.96	0.000
Disadvantaged	1.43	0.015	1.91	0.001
Highly disadvantaged	0.33	0.535	0.93	0.075
Missing	2.24	0.058	3.04	0.006
Legal representation				
No	3.34	0.001	3.61	0.000
Yes	1.25	0.000	1.62	0.000
Number of concurrent offences				
1	1.77	0.000	2.08	0.000
2	1.68	0.006	2.30	0.000
3+	1.03	0.122	1.47	0.021
DUI range at index				
High	1.29	0.000	1.82	0.000
Medium	1.17	0.033	1.77	0.001
Number of prior court appearances				
0	1.82	0.169	1.93	0.137
1	1.69	0.037	1.80	0.024
2	2.02	0.005	2.24	0.002
3	2.02	0.063	2.41	0.025
4+	1.08	0.012	1.73	0.000
Prior penalties—fine				
No	1.75	0.000	2.17	0.000
Yes	1.15	0.003	1.77	0.000
Prior penalties—licence disqualification				

Table 6 (continued)

Instrument group	Unresidualised		Residualised	
	Coefficient	*p* value	Coefficient	*p* value
No	2.04	0.000	2.40	0.000
Yes	1.08	0.005	1.72	0.000
Prior penalties—imprisonment				
No	2.01	0.000	2.22	0.000
Yes	−0.13	0.849	0.71	0.300
Prior offences—violence				
No	1.32	0.000	1.84	0.000
Yes	1.82	0.016	2.25	0.003
Prior offences—traffic				
No	1.97	0.000	2.33	0.000
Yes	1.04	0.007	1.66	0.000
Prior offences—driving				
No	1.54	0.000	1.90	0.000
Yes	0.99	0.184	1.65	0.023
Prior offences—justice procedures				
No	1.47	0.000	1.89	0.000
Yes	1.92	0.007	2.64	0.000

suggest that those who are imprisoned experience a slight increase in the likelihood of committing a further DUI offence, although we observe differences in the effects estimated by the 2SLS and bivariate probit approaches. None of the effects are statistically significant at the 0.05 level.

Earlier noted that one potential reason for divergence between the 2SLS and bivariate probit findings is that the former estimates a LATE, while the latter estimates an ATE. The score test results, however, suggest a different explanation. In every case, the bivariate probit models appear to violate the assumption of joint normality. For this reason, we prefer the 2SLS estimates to the bivariate probit estimates, despite the lower standard errors produced by the bivariate probit models.

Heterogeneous Treatment Effects

Table 8 presents the results of several OLS and 2SLS analyses conducted to examine heterogeneous treatment effects of imprisonment on DUI offenders. Panel A of Table 7 shows the estimates where length of prison sentence is used as the explanatory variable of interest. Except in the short term (consistent with a small incapacitation effect of imprisonment) there is very limited evidence that additional months of a prison sentence reduce DUI reoffending,

Panels B and C of Table 8 show estimates of the effect of imprisonment on first-time offenders and those with prior convictions. While there is little by the way of significant effects in 6 months, the 2SLS estimates show a reduction in the likelihood of DUI offending at 24 months for first-time offenders, including when using free time offending. This suggests that there is a significant specific deterrent effect of imprisonment on DUI

Table 7 Estimates of the effect of imprisonment on DUI re-offending at 6 months, 24 months, and 5 years post-finalisation and free time post-finalisation

Outcome	DUI reoffending			Free time DUI reoffending		
Time period	6 months	24 months	5 years	6 months	24 months	5 years
Proportion	0.0078	0.0309	0.0725	0.0133	0.0395	0.0876
	(0.0010)	(0.0020)	(0.0030)	(0.0014)	(0.0025)	(0.0041)
OLS	−0.0039*	−0.0035	−0.0039	0.0033	0.0071	0.0126
	(0.0019)	(0.0038)	(0.0060)	(0.0031)	(0.0050)	(0.0080)
Probit	−0.0039	−0.0033	−0.0036	0.0026	0.0064	0.0113
	(0.0020)	(0.0038)	(0.0058)	(0.0028)	(0.0047)	(0.0076)
2SLS (unresidualised IV)	−0.0010	0.0095	0.0270	0.0145	0.0186	0.0292
	(0.0053)	(0.0146)	(0.0221)	(0.0113)	(0.0196)	(0.0309)
Bivariate probit (unresidualised IV)	−0.0053	−0.0090	0.0108	−0.0042	0.0070	0.0117
	(0.0038)	(0.0142)	(0.0202)	(0.0082)	(0.0227)	(0.0293)
Score test (p value)	44.11	32.6	38.7	45.24	32.6	42.7
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
2SLS (residualised IV)	−0.0018	0.0069	0.0243	0.0138	0.0211	0.0329
	(0.0051)	(0.0142)	(0.0217)	(0.0111)	(0.0195)	(0.0308)
Bivariate probit (residualised IV)	−0.0055	−0.0100	0.0102	−0.0044	0.0098	0.0152
	(0.0050)	(0.0116)	(0.0217)	(0.0087)	(0.0197)	(0.0308)
Score test (p value)	44.13	35.9	35.6	45.21	35.9	41.9
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
N	10,819	9920	8211	9594	8790	7159

Robust standard errors in parentheses

*$p<0.05$; **$p<0.01$; ***$p<0.001$

offenders who are first-time offenders. However, turning to the results at 5 years following finalisation, there is little evidence that this deterrent effect persists: the estimated treatment effects drop in magnitude and none are significant. Our analyses do not detect any significant incapacitation or deterrent effects at any of the follow-up points for repeat offenders.

Discussion

Despite the large volume of research on DUI offending, little attention has been paid to date to the effectiveness of prison as a specific deterrent to driving while intoxicated. Among the studies that have been conducted, some suffer from small sample sizes while others employ research designs that make it difficult to draw strong conclusions about the effectiveness of prison as a specific deterrent to DUI offending. The central problem facing all attempts to estimate the specific deterrent effect of prison on re-offending is selection (omitted variable) bias. Penalties are not allocated at random, which makes it difficult to tell whether differences in re-offending arise from differences in the characteristics of offenders who receive different sanctions or differences in the effect of sanctions on behaviour.

Table 8 Estimates of effects of sentence length on DUI recidivism, and effects of imprisonment on DUI recidivism for first-time and repeat offenders

Outcome	DUI reoffending within			Free time DUI reoffending within		
Time period	6 months	24 months	5 years	6 months	24 months	5 years
Panel A: Sentence length						
OLS	−0.00061*	−0.00071	−0.00108	0.00086	0.00176	0.00166
	(0.00031)	(0.00073)	(0.00114)	(0.00061)	(0.00110)	(0.00167)
2SLS (Unresidualised)	−0.00015	0.00144	0.00410	0.00223	0.00288	0.00456
	(0.00081)	(0.00222)	(0.00335)	(0.00173)	(0.00303)	(0.00482)
2SLS (Residualised)	−0.00029	0.00106	0.00370	0.00210	0.00325	0.00513
	(0.00078)	(0.00216)	(0.00329)	(0.00169)	(0.00300)	(0.00479)
N	10806	9996	8287	9584	8780	7149
Panel B: First-time offenders						
OLS	0.02519	−0.01515	−0.02671	0.02258	−0.01873	−0.05521
	(0.02099)	(0.03662)	(0.04100)	(0.01892)	(0.04052)	(0.05865)
2SLS (Unresidualised)	−0.00076	−0.05611*	−0.00371	−0.00481	−0.05395	0.00037
	(0.00542)	(0.02544)	(0.05090)	(0.00668)	(0.02760)	(0.07336)
2SLS (Residualised)	−0.00091	−0.05616*	−0.00577	−0.00474	−0.05454*	−0.00033
	(0.00537)	(0.02511)	(0.05016)	(0.00650)	(0.02727)	(0.07257)
N	1258	1127	941	1210	1093	873
Panel C: Repeat offenders						
OLS	−0.00472	−0.00457	−0.00160	0.00377	0.01132	0.01622
	(0.00249)	(0.00547)	(0.00863)	(0.00419)	(0.00772)	(0.01187)
2SLS (Unresidualised)	−0.00116	0.01435	0.02834	0.01561	0.02260	0.02829
	(0.00582)	(0.01604)	(0.02400)	(0.01265)	(0.02179)	(0.03351)
2SLS (Residualised)	−0.00213	0.01143	0.02554	0.014782	0.02560	0.03246
	(0.00562)	(0.01562)	(0.02353)	(0.01239)	(0.02162)	(0.03341)
N	9589	8869	7346	8374	7687	6276

Robust standard errors in parentheses

*$p<0.05$; **$p<0.01$; ***$p<0.001$

Our aim in this study was to examine the impact of prison on DUI re-offending using methods that overcome the limitations of earlier studies. We employ an extensive set of controls and instrumental variables analyses to remove any selection bias associated with observable and unobservable differences between offenders who receive different sanctions. The sample we employ is very large (n = 9384) and the custodial penalty imposed on those who receive a custodial penalty is quite significant in length. The comparison group consists of offenders who were given a suspended prison sentence. We examine re-offending over 6 month, 2- and 5-year time horizons. Despite all this, our analyses provide little evidence that imprisoning persons convicted of drink driving reduces the likelihood of a further DUI offence compared to imposing a prison sentence but suspending it on condition of law-abiding behaviour. These results are in accord with those obtained by Socie et al. (1994) and Homel (1980).

There are a few caveats surrounding the study that deserve mention and which suggest further lines of enquiry for research in this area. Firstly, our preferred 2SLS analysis only estimates a LATE effect. Whether the results of the current study apply beyond the domain

of offenders affected by changes in judicial severity remains unknown. Secondly, there is no way of knowing whether the lack of difference in recidivism between those given a suspended sentence and those imprisoned arises because both reduce the risk of re-offending by the same amount or (what amounts to the same thing), neither has any effect on the risk of re-offending. It would be interesting, for this reason, to compare trends in re-offending among propensity score matched offenders in a jurisdiction that introduces (or removes) suspended sentences as an alternative to prison with one that never had (or always had) suspended sentences as an option. A third concern is that, despite the large sample size, the current study did not have the power to detect small differences in re-offending. As Blumstein and Larson (1971) pointed out nearly 50 years ago, reconviction is a fairly weak signal of changes in crime repetition. It may be that some other more fine-grained measure, such as crime days (i.e. days on which the offender is shown to have committed one or more offences) would provide a more sensitive indicator of differences in re-offending between imprisoned DUI offenders and those given a suspended sentence.

There are two other limits to the inferences that can be drawn from the current study. Although our primary interest was in the specific deterrent effect of prison, we made some effort to examine incapacitation effects and found only weak evidence that they exist. Accurate measures of incapacitation, however, require accurate measures of offending frequency. The problem for us is that our measure of offending frequency, namely reconviction, may only capture a small proportion of all incidents of DUI offending. So long as there is a monotonic relationship between offending frequency and likelihood of reconviction this is not a problem when comparing two groups in terms of their likelihood of re-offending. It is a problem, however, when trying to estimate the amount of crime avoided as a result of incapacitation.

Prison has several adverse effects on offenders and their families (Lerman 2009; Johnson 2009). This fact and the current results suggest that the funds currently invested in imprisoning drink drivers might more fruitfully be invested in programs and interventions that show more promise in reducing DUI reoffending. It might be argued that we have only examined the specific deterrent effect of prison, not its general deterrent effect. This is true but there seems little reason to believe that the threat of imprisonment acts as a general deterrent to drink-driving (Wagenaar et al. 2007). Experimental studies suggest that the risk of arrest is a much stronger deterrent to drink driving than the penalty if caught (Nagin and Pogarsky 2001). Perhaps more importantly, there is now clear evidence that that Ignition Interlocks are much cheaper and much more effective in reducing alcohol-impaired driving and alcohol-related crashes.

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