Deterring Rearrests for Drinking and Driving

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1. INTRODUCTION

There are considerable negative externalities from driving while intoxicated (DWI), prompting policymakers to enact and enforce laws promoting safe driving, such as investing in roadways, controlling entry of alcohol sellers, and, more recently, implementing programs to deal with underlying addictions that may lead to harmful driving behaviors. While there was a drop in alcohol related fatalities in from 1980 to 1990, DWI remains a significant cause of motor vehicle injury (Wallace 2011). In 2007, 1.4 million people were arrested for DWI and 32% of all fatal motor vehicle crashes were alcohol related (National Highway Traffic Safety Administration 2011; Wallace 2011). Of equal importance as the frequency with which DWI is committed, is that an estimated one third of offenders are recidivists and have been convicted of DWI in the past (National Highway Traffic Safety Administration 2005). The focus of the creation of DWI treatment courts is to treat the addiction of these individuals, and end the cycle of recidivism.

The public policies enacted to address the problem of DWI represent a mix of strategies. At its core, the strategies include the threat of criminal sanctions using a combination of license revocation, jail terms, and fines to deter roadway accidents and personal injuries. Another set of public policies aims to improve roadway safety by increasing the price of alcohol and other addictive substances through a combination of excise taxes, licensure of sellers, and law enforcement to reduce frequency of illegal sales. These approaches vary in detail among states but often not fundamentally within states. Some jurisdictions implemented treatment courts such as drug and DWI courts. DWI courts are aimed at reducing DWI violations involving alcohol; driving after using illicit and licit drugs also result in DWI violations. Use of multiple substances is also commonplace. Another type

of court, mental health courts, also potentially affect DWI violations given the strong association between mental illness and substance use.[1]

Treatment courts seek to reduce repeat offenses by treating the underlying addictions and otherwise reducing barriers to keeping sober. In addition to these three approaches, there are policy approaches that limit the opportunities to reoffend, e.g., ignition interlock and SCRAM devices. These approaches specifically address self-control problems and severe addiction that DWI offenders often face.

Repeat offenders have been the focus for good reason. Many individuals reoffend after arrest for DWI, estimates are as high as 20-50% (Fell 1995). Many of these reoffenders are responsible for DWI fatalities; a report by the National Highway Traffic Safety Administration estimates that drivers convicted of DWI cause 2-3 percent of highway death [cite], but that this figure could be as high as 8 percent (Jones and Lacey 2000). Further, recidivists have higher rates of alcohol abuse or dependence than those in the general population (Lapham, Stout et al. 2011). This suggests that an emphasis on repeat offenders,

[1] DWI courts have increased in popularity as a method to treat individuals who are arrested for DWI crimes. In the U.S. from 2005 through 2009, the number of DWI courts more than doubled (from 74 to 172). Like other specialty courts (for example, family, mental health courts), the motivation to create such a court is to improve the efficiency of the judicial system, but additionally, treat offender's underlying addictions. Participants in DWI treatment courts in North Carolina, the state from which our data come, enter voluntarily, thus voluntarily agreeing to the treatment process.

DWI courts offer several advantages over general jurisdiction courts including increased coordination between the judiciary and various other public and private organizations for both treatment and monitoring and reduced duplication in judicial attention. Limiting the number of judges which an offender can appear before and retaining jurisdiction promote continuity of supervision and accountability (Rottman 2000). Evaluations of DWI courts have not been as consistently positive as evaluations of drug courts, a fact that proponents of DWI courts attribute to deficiencies in research design and poorly designed DWI courts (Marlowe, Festinger et al. 2009; Huddleston and Marlowe 2011)

One major motivation behind the creation of DWI and drug courts in North Carolina, as elsewhere, is to reduce the incidence of drug and alcohol-related crimes (N.C. Gen. Stat. § 7A-791). Treatment of an individual's addiction may be a more effective method of deterring re-offense as compared with traditional deterrents (such as fines and jail time). Another possibility is that treatment and other more traditional deterrents, such as jail or fines, are complements to each other. Finally, treatment courts may reduce recidivism by treating the underlying causes of the issue, alcohol abuse or dependence. This is supported by study which found that rehabilitation sentences reduce the likelihood of recidivism more than traditional punishment sentences (Taxman and Piquero 1998). In addition, there are several studies that have shown the utility in preventing re-offense by utilizing ignition interlock devices along with treatment or traditional punishments (Coben and Larkin 1999; Voas, Tippetts et al. 2010; Zador, Ahlin et al. 2011)

and more specifically, those that demonstrate alcohol abuse or dependence, will yield an even further drop in rates of DWI fatalities and related injury.

There is empirical evidence that individuals with prior arrests are more likely to be involved in subsequent drunk driving events (Woodall, Kunitz et al. 2004; Kingsnorth 2006; Hilton, Harris et al. 2007; Ahlin, Zador et al. 2011). This may be due to inadequate controls and failure to consider the endogeneity of prior arrests.

This study uses criminal court data for the state of North Carolina from 1998 to 2008 to assess determinants of the probability of re-arrest for DWI. We evaluate the effects of being prosecuted and convicted and of the availability of treatment courts in the county on the probability of re-arrest. Using North Carolina criminal court data we also examine the extent of which recidivism exists among individuals who participate in the DWI court. Conditional on being convicted for DWI, a person in North Carolina faces near certainty of some jail time, but may also serve time on probation, perform community service and/or pay a fine. Theoretically, decisions about whether or not to commit an act of DWI are based on a Bayesian process of updating subjective beliefs. Individuals have prior beliefs about consequences of being arrested for DWI based on actual practice in their areas. An individual's own experience with an index arrest leads to belief updating.

Our empirical analysis exploits within state and within prosecutorial and judicial districts in the probabilities of prosecution and conviction and inter-temporal changes in these probabilities and in implementation of specialty courts to gauge effects of specific causes of DWI recidivism. We find that prosecuting and convicting persons arrested for DWI reduces the probability that they will be re-arrested for DWI in two years following the DWI arrest.

Our study aims to rectify the shortcomings of previous examinations of determinants of DWI recidivism. We improve on past research in these important respects. First, we

account for possible endogeneity of outcomes of the baseline DWI arrest. In particular, parties to the process of resolving the baseline DWI arrest are likely to have information on the offender and the circumstances involving the offense that are not available to researchers. To deal with endogeneity of case outcomes, we use an instrumental variables (IV) strategy based on decisions of prosecutors and judges assigned to each index arrest for DWI in our sample. Second, rather than base our empirical analysis on a single cross section as has been common practice in this literature, we construct a panel which allows us to include fixed effects for individuals arrested for DWI. Third, we evaluate the effects of both traditional deterrents and of treatment in the same study. Previous studies of DWI have focused deterrence or treatment. Fourth, while most studies have been based on small samples, often from a single geographic area, our sample consists of over 300,000 DWI arrests spanning a state with a population of nearly 10 million persons.

2. CONCEPTUAL FRAMEWORK

Imposition of penalties may deter crime and arrest through several pathways. One channel is through affecting the probability of a penalty conditional on committing a crime. Thus, relevant probabilities involve: (1) arrest, conditional on committing a crime; (2) prosecution conditional on an arrest; (3) and conviction conditional on being prosecuted. As beliefs about the probabilities increase, the propensity of committing another offense is expected to decrease.

We assume that the person contemplating committing a crime is a Bayesian updater. The person starts with a prior belief about the probabilities of various outcomes occurring conditional on choices he/she makes. These probabilities are updated as the person receives new information about the probabilities in part based on personal experiences with the criminal justice system.

Let p_j be the person's prior belief about outcome j, arrest, prosecution, conviction, and penalty conditional on conviction and q_j be the person's subjective belief about the probability of outcome j after learning about outcomes from a particular arrest (s_j).[2] The parameters γ_j and ε_j represent precision associated with the prior assessment of the probability and with information the individual obtains from personal experience, respectively. Prior beliefs reflect experiences of other persons in the area.[3] This conceptual framework has been used in previous studies of individual risk perceptions (e.g., Smith, Barrett et al. 2001; Viscusi and Evans 2006; Lochner 2007).

$$q_j = \frac{(\gamma_j p_j + \varepsilon_j s_j)}{(\gamma_j + \varepsilon_j)} = (\gamma'_j p_j + \varepsilon'_j s_j) \qquad (1),$$

where

$$\gamma'_j = \frac{\gamma_j}{(\gamma_j + \varepsilon_j)} \quad \text{and} \quad \varepsilon'_j = \frac{\varepsilon_j}{(\gamma_j + \varepsilon_j)}.$$

In our empirical analysis of the probability of recidivism, the p_j are defined as (1) prosecutorial district-specific mean probabilities of prosecution conditional on arrest (j=1) and (2) judicial district-specific mean probabilities of conviction conditional on prosecution (j=2). We assume that individuals' prior subjective beliefs about penalties reflect these district-specific probabilities. Cet. par., high probabilities of adverse outcomes (p_j) reduce recidivism. Personal experiences with the law lead to modifications in prior beliefs. By affecting subjective beliefs, higher values of the p_j reduce probabilities of a repeat arrest. Adverse personal experiences with an arrest as reflected in the s_j raise q_j, making recidivism even less likely.

[2] We suppress subscripts for individuals here and elsewhere.
[3] Little is known about how people learn from the experiences of others in forming subjective beliefs about consequences of personal actions. For a review of the empirical evidence as it applies to use of illicit substances and driving, (see Watling, Palk et al. 2010)

The only direct empirical test of this Bayesian updating process applied to crime is Lochner (2007), who had direct retrospective measures of q_j and s_j from the National Longitudinal Survey of Youth 1997 (NLSY97). He found that the q_j, where j refers to the subjective probability of arrest, is lower among youth who engage in criminal activity. Yet the q_j were only weakly related to county-measures of arrest-per-crime rates. Although the findings generally lend support to the notion that subjective beliefs are affected by actual events the person experiences, the study did not empirically evaluate the link between risk perceptions and *actual* arrest or crime rates. Moreover, since NLSY data are based on respondents' self reports, Lochner did not attempt to relate outcomes of particular arrests to the probability of repeating criminal acts or being re-arrested.

3. METHODS

3.1 Data

We obtained access to a unique database for purposes of this study. NC's Administrative Office of the Courts (AOC) maintains a database containing information on criminal arrests and case disposition at the charge/individual arrestee level called the Automated Criminal Infractions System (ACIS). ACIS includes each criminal charge organized by the day that the charge was made and lists the NC General Statute Code and offense descriptions. The data used in our study span 1998 through 2008. These data cover all charges tried in courts of general jurisdiction, including convictions that subsequently led to enrollment in treatment courts. All charges associated with a particular DWI are also flagged, whether or not they themselves constitute DWI. [4]

[4] Offenses considered DWI are: DWI – Drugs, DWI – Alcoholic Beverage, DWI - Second Offense, DWI – Third Offense, DWI – Fourth Offense, Driving While Impaired, DWI – Driving Instructor, Drive w/ 0.1 or more Blood Alcohol, DWI Level 1 – DWI Level 5, DWI (0.10) Level 1 – DWI (0.10) Level 5, Habitual Impaired Driving DWI Commercial Vehicle, Commercial DWI Under Influence, Commercial DWI>=0.04, Commercial DWI Schedule I Controlled Substance

These data have several advantages. First, they allow analysis at the level of the individual offender as opposed to an aggregate at the county or state level, as in many studies of criminal behavior. Although the data do not contain a unique identifier to link records for individuals over time, the data contain identifying information, including the person's name, birth date, and gender that can be used to generate unique identifiers with reasonable accuracy. Data on the person's address at the time the index offense occurred is also provided.

Second, with created unique identifiers, ACIS data permit tracking of offenses and associated outcomes over time. Information on how the defendant arrived in court (for example, citation, warrant, criminal summons), the type of legal representation the defendant had (such as, court-appointed, public defender, waived, privately retained), and method of disposition of charge, including verdict and sentences (for instance, jail terms, fines, drivers' license revocation, community service hours). The method of disposition is listed in several categories, such as trial or dismissal. Third, most states do not have a central standardized system for maintaining court records; data must be obtained from individual courts.

A disadvantage of the data is that information is only available on a few demographic characteristics of the arrested individual and information on several pertinent individual characteristics, e.g., educational attainment, employment, and household income, are lacking.

We do not analyze the probability of being arrested since we lack data on whether or not an individual committed a crime, but we do analyze effects of being prosecuted and conditional on being prosecuted being convicted on the probability of a re-arrest for DWI during the two years following an index arrest. We organize the data into a file for index arrests. We define an index arrest as the first DWI arrest occurring in each calendar year from January 1, 2001 and through December 31, 2006. Thus, an individual may have had up

to six index offenses. The mean number of arrests is 1.29 (standard deviation= 0.58). In total, there are 305,310 index DWI arrests during our observational period.

Since the follow-up period is two years, data for 2007 and 2008 are exclusively used to measure DWI re-arrests. We also employ a three-year look-back period to track prior DWI offenses. Data for 1998-2000 are only used for the look-back period and for a separate analysis of the North Carolina DWI court to be described below.

To account for the severity of the index arrest and explain the resolution of the case, we include covariates for other non-DWI charges made on the same day as the index arrest categorized as: felony; misdemeanor; infraction; or traffic-related. These other offenses come from separate arrest records, which we linked to the index arrest data.

3.2. Specification

3.2.1. Overview. The major econometric problem in estimating deterrent effects with micro data is that the outcome of the case s_j may be correlated with unobserved personal characteristics such as the propensity to comment crimes. To the extent this is so, we may observe that people who have adverse experiences with criminal law enforcement are more, not less likely, to engage in repeat offenses. To deal with this issue, we specify a two-equation model, the main equation for the probability of re-arrest for a DWI in a two-year period following the index arrest for DWI which occurred in 2001-2006.

The main equation is for DWI re-arrest during a two-year follow-up from the date of the index arrest:

$$r = \theta_0 + \theta_1 q_j + + \theta_2 T + \theta_3 X + \theta_4 Y + \varepsilon \qquad (2),$$

where r is the probability of a re-arrest during the two-year follow-up period, and T, X and Y are area treatment court programs, individual characteristics of the person arrested, and other

area characteristics, respectively. Since all sample persons were arrested for the index offense, arrests in the follow-up are re-arrests.

The subjective belief about incurring a penalty for DWI is a function of s_j and p_j. Thus, (2) can be rewritten as

$$r = \theta_0 + \theta_{11} s_j + \theta_{12} p_j + \theta_2 T + \theta_2 X + \theta_3 Y + \varepsilon \qquad (2').$$

The first-stage equation is

$$s_j = \phi_0 + \phi_1 p_j + \phi_2 IV + \phi_3 T + \phi_4 X + \phi_5 Y + v_j \qquad (3).$$

IVs are included in (3) but excluded from (2'); j=1 if the person is prosecuted conditional on arrest and j=2 if the person is convicted conditional on having been prosecuted.

Our first analysis is for all persons with an index arrest with s_1 a binary variable set to 1 if the person was prosecuted for the index offense and p_1 for the proportion of DWI arrests in the prosecutorial district that were prosecuted during the index year. Our second analysis is for all persons prosecuted for the index offense with s_2 set to 1 if the person was convicted for the index offense and p_2 the proportion of DWI prosecutions in the county's judicial district that resulted in a conviction in the index year.

3.2.2. Equation Specification. The *dependent variable* is the probability of re-arrest for DWI within two years following the date of the index arrest. Explanatory variables fall into these categories: subjective beliefs; DWI arrests and convictions in the look-back period; concurrent non-DWI-related alleged offenses; specialty courts in the offender's county as measures of T; individual characteristics, including type of legal representation employed by the defendant pursuant to the index arrest, and demographic characteristics of the defendant; and area and alternatively individual arrestee effects. We lack information on household income by individual, but the legal representation variables are plausibly systematically related to income.

Subjective beliefs reflect both components of q_j, the district-specific mean probability of being prosecuted and the district-specific probability of conviction, which is conditional on having been prosecuted. The other component refers to outcomes of the index arrest, which are defined as binary variables for being prosecuted and for being convicted, respectively. If convicted, the probability of serving some jail time was nearly 1.0. There are 42 prosecutorial and 42 judicial districts (prosecutorial and judicial districts not completely overlapping) in North Carolina (relative to 100 counties).

We define separate explanatory variables for the *number of prior arrests and convictions* for DWI during the look-back period, which is three years before the date of the index arrest. *Concurrent non-DWI-related alleged offenses* are felonies, misdemeanors, traffic offenses, and infractions. We define variables for the number of concurrent alleged offenses of each type. We use North Carolina structured sentencing policies to categorize traffic offenses in order of severity (NC Sentencing and Policy Advisory Committee 2009).[5] Traffic offenses are separated into two categories in increasing order of severity: first, category 1 has class 2 and 3 offenses with an upper range of community punishment from 10 to 30 days; and category 2 has class A1 and 1 offenses with an upper range of community, intermediate, or active punishment from 45 to 60 days. There is a third variable for unclassified offenses, which are offenses that do not have a required structured sentencing category. An infraction is a noncriminal violation of law not punishable by imprisonment. Unless otherwise provided by law, the sanction for a person found responsible for an infraction is a penalty of not more than one hundred dollars (N.C. Gen. Stat. § 14-3.1).

[5] Three categories of punishment are assigned for offenses in the classification system: active punishment (G.S. 15A-1340.11(1)), requiring that the offender be sentenced to jail or prison; intermediate punishment (G.S. 15A-1340.11(6)), requiring a sentence of supervised probation with at least one of the following conditions: special probation, residential program, house arrest with electronic monitoring, intensive supervision, day reporting center, or drug treatment court program; and community punishment (G.S. 15A-1340.11(2)) consisting of any authorized condition of probation except for those defined as intermediate punishments, outpatient drug and alcohol treatment, community service, referral to mental health or substance abuse services, restitution, or fines.

Variables for *treatment courts*, our measures of treatment (T), are binary variables for whether or not there was a specialty court in the offender's county during the year. The court types are: DWI; adult drug treatment; youth drug treatment; family drug treatment; and mental health. North Carolina has DWI and drug treatment courts in 22 of 100 counties. There are two DWI courts and 20 drug treatment courts. Unlike other states, North Carolina does not categorize hybrid courts as distinct from drug courts. A hybrid court by definition is a treatment court that accepts both DWI offenders and offenders with drug-related charges. Instead, the drug courts in the state include DWI offenders. Because the number of DWI offenders accepted into a drug court changes over time, all drug courts in the state can potentially be considered hybrid at one time or another.

Given that we include fixed effects and courts coincide with counties, the most relevant window for court implementation is the 2001-6 period. The most common court in both 2001 and in 2006 in North Carolina was adult drug treatment courts (Table 1). From 2001 to 2006, the number of counties with such courts increased from nine to 16. The next most common treatment court type was the family drug treatment court; during 2001-6, the number of counties with such courts increased from one to nine. Less numerous were DWI and mental health courts. DWI courts specialize in treating persons convicted of drunk driving offenses. However, DWIs can also arise from substance use. An additional factor to DWI offenses is that offenders frequently have co-occurring mental illness (Lapham, Stout et al. 2011).

Individual characteristics of the person as of the date of the index DWI arrest include binary variables for demographic characteristics—female gender, race and ethnicity, black, other race, and white (omitted reference group) and Hispanic, and age--21-25 (omitted reference group), 26-34, 35-44, 45-54, 55-64, and 65+ and type of legal representation. We

exclude persons who were under age 21 at the date of the index arrest because the laws pertaining to DWI of minors differed from those pertaining to adults.

ACIS reports the type of attorney assigned for defense and prosecution. Defense attorneys are categorized as: court appointed; public defender; attorney waived; privately retained (self); and waived. We define binary variables for each of these categories with privately-retained attorney, the omitted reference group. No direct measure of household income is available from arrest records, but defendants who retain a private attorney are likely to be relatively affluent. Furthermore, private attorneys may exert greater effort in representing the defendant's interests. For this reason, we expect that clients of private attorneys are less likely to incur penalties than are others.

We include *fixed effects* for year and for the arrested person's county of residence. Alternatively, we include individual fixed effects as a substitute for county fixed effects.

3.3 Estimation

A major econometric issue in microanalysis of recidivism is that researchers do not observe many characteristics of offenders observable to participants in the criminal justice system—police officers, prosecutors, judges, attorneys, and others that are likely to affect the probability of recidivism. To deal with omitted heterogeneity, we adopt an instrumental variables strategy.

Our key IVs refer to the relative stringency of prosecutors and judges. Although prosecutorial districts have policies regarding prosecution of specific offenses, in the end, the decision of whether or not to prosecute an individual defendant arrested for DWI is the individual prosecutor's decision. Similarly, judges view DWI cases differently. Within a certain range of strength of evidence on liability, judges decide on conviction differently. The same case heard by one judge may be decided differently by another. When a person decides

to drive under the influence or not become intoxicated or if intoxicated, seek another mode of transportation, s/he is likely to have no idea who the prosecutor or judge will be, although s/he may have general prior beliefs about probabilities of arrest, prosecution, and conviction based on own experience and what s/he has learned from others.

Identification in our study is achieved under assumptions that individual prosecutors and judge, though subject to the statutory standard as to what constitutes a blood alcohol content percentage for DWI, apply different standards to individual cases, some stricter on the quality of evidence provided by the arresting officer and prosecution and some more lenient, and cases are randomly assigned to prosecutors and judges. We cannot test whether or not assignment is random, but rather appeal to a couple of stylized facts. First, DWI is the most common single criminal offense. Prosecuting attorneys and courts deal with very many such cases. The additional cost of implementing a system to triage DWI cases based on detailed examinations of individual offenses would be very substantial. Second, DWI cases are typically not heard before juries. Thus, there is not the pre-trial scrutiny that may be typical of cases heard by juries.

This means that there is no systematic assignment of offenders to prosecutors and judges on the basis of characteristics we cannot observe. Nor do potential offenders have prior beliefs about the prosecutors or judges who would be assigned to them following an arrest for DWI.

Hence, at the margin, the threshold of evidence on defendant guilt leading to a specific penalty, in addition to BAC, is likely to vary among prosecutors or judges within a prosecutorial or judicial district. This introduces variation in the probability that an individual case at a fixed level of evidence of guilt will be prosecuted, convicted or jailed. This approach

has been used in previously (see e.g., Doyle 2007; Chang, Theodore et al. 2008; Doyle 2008; Hjalmarsson 2009; Green and Winik 2010).

ACIS data include a table listing both the prosecuting attorney and the defense attorney[6] for the case. To obtain information for the IV for index arrests, we use prosecutor names from this file. One problem is that the same names of attorneys are likely to be spelled in different ways. Unique identifiers are constructed using a Soundex code for last name, first initial, and prosecutorial district.[7] In some cases, an attorney's initials are used and the full name of the attorney is absent. To reduce data loss and increase accuracy of case match, we cross-referenced the attorney initials with initials of attorneys listed in the North Carolina Bar Association contact database. If the attorney is the only attorney listed with his/her initials this is considered a match. If the attorneys appear more than once in ACIS but only once in a particular county, this is also considered a match. Since the counties included in some prosecutorial districts changed between 1998 and 2010, each attorney is assigned to his or her 1998 district so that the prosecutor identifier would not change during the observational period.

We compute the mean fraction of DWI arrests leading to prosecution by prosecutor using data from four years, the three years before the index arrest and the index arrest year. The fraction is time varying in that it is computed for each year during 2001-6 (2001 based on data from 1998-2001, 2002 from 1999-2002 data, etc.). We require that each mean value be based on a minimum of 10 arrests per prosecutor. On average over the four-year period, prosecutors on average processed an average (mean) of 543 arrests for DWI.

[6] We do not use information on the defense attorney's name in this study, but this information might be useful in further research, e.g., to determine whether or not attorneys who defend a substantial number of DWI defendants achieve results more favorable to the defendant. In previous research, one of us found this to be so for plaintiffs' attorneys in medical malpractice cases (Sloan et al. 1995). It is difficult, however, to separate selection on nonobservables from differences in marginal product of attorneys.

[7] On Soundex, see http://searches.rootsweb.ancestry.com/cgi-bin/Genea/soundex.sh (accessed 7/8/11).

The IV for index arrests resulting in prosecution is Zp_{kd} constructed according to

$$Zp_{kd} = \left(\frac{P_{kd}}{N_{kd}}\right) - \left(\frac{P_d}{N_d}\right) \quad (4),$$

where P_{kd} is the number of DWI cases prosecuted by prosecutor k in district d and N_{kd} is the number of DWI arrests assigned to the kth prosecutor in district d. We subtract the rate of prosecution for DWI in the district from the kth prosecutor's DWI prosecution rate. The rate of prosecution in the district for DWI is an explanatory variable representing p_1.

We also construct IVs for the share of prosecuted cases that result in convictions by judge. ACIS data include an identifier for the judge assigned to a particular case. The identifier consists of the judge's initials (two or three initials or alternatively a three-digit number). To increase accuracy of the judge identifier since there may be judges in the same district with the same initials, we link ACIS data to North Carolina judge election data by district court or superior court district. The election data include the full name of elected judges in the state. Using the election data, we compute initials for each judge and compare the results to judges' initials from ACIS. If a judge is the only judge in the district with the initials listed, we consider the ACIS identifier to be valid. All valid identifiers for judges within districts are combined with a district identifier to create a unique judge identifier across the state. As with the prosecutor IV, the judge identifiers are defined for district/superior court districts in as they were in 1998 and the criterion of a minimum of 10 observations per mean value is applied here as well. There are 587 prosecuted cases per judge over the four-year period on average. We compute an IV for judges Zj_{kd} using a method analogous to the one defined for prosecutors (equation 4). Especially since the instruments are normalized by corresponding shares for the districts, it is extremely unlikely that the prosecutor- and judge-specific variables reflect the prevalence of DWI and the extent of DWI in the district.

Even with all of these precautions, there may be errors in assigning judges to arrested persons We test for weak instruments; if there are many errors in the data on the identity of prosecutors and judges trying individual cases, the F-values will be low.[8]

Because omitted heterogeneity is likely to be sufficiently accounted for with individual fixed-effects, we do not include a corresponding individual fixed-effects IV regression.

4. RESULTS

4.1 From Arrest to Penalty

Of persons arrested for DWI, 82.5 percent were prosecuted, and among those prosecuted, 89.1 percent were convicted. Thus, the probability of conviction conditional on arrest was 0.735. The number of arrests per capita population varies by county. Most of the counties with high ratios of arrest to population are in the eastern part of the state (Fig. 1), some on the coast, which have large numbers of tourists.

The probability of receiving a penalty conditional on being convicted ranged from 0.993 for some jail and 0.899 for some fine to 0.001 for some house arrest and less than 0.001 for referral to a residential treatment program (Table 2). Courts ordered drivers' license suspension in only 9.4 percent of convictions. Although with administrative per se laws, license suspensions also occur when the person was arrested. However, we do not access to Department of Motor Vehicle data, which is where these suspensions are documented.[9] Regular probation and supervised probation and requirements that the convicted individual perform community service were common.

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[8] We plan to add two other IVs; these are the fraction of cases prosecuted and the fraction of cases resulting in conviction by arresting officer. We expect officers to differ in terms of the decisions of whom they arrest for DWI as well as the quality of evidence they are able to present to prosecutors and courts, e.g., probable cause, accuracy of breathalyzer, paperwork.

[9] To obtain DMV records for North Carolina, one must obtain consent from the individual and provide confidential information for each record such as name, Social Security number, and current address. Since we are working with secondary data, and not directly with individuals, this is not feasible for our study. Obtaining permissions from hundreds of thousands of individuals is clearly infeasible.

The mean and median number of days served in jail for those with some jail was 162 and 60 days, respectively.[10] Relative to jail terms, fines were low. The mean fine was $231 and the median was $114. About five percent of convicted persons were required to pay restitution, but the mean amount paid was only $279.

4.2. Descriptive Statistics

Table 3 shows descriptive statistics for dependent and explanatory variables used in empirical analysis the probability of being rearrested during the two-year follow-up. For persons with index arrests during 2001-6, the mean probability of being re-arrested for DWI during the two years following the index arrest is 0.186. Among those with index arrests leading to prosecution, the mean probability of re-arrest is 0.183. For those whose index arrest was not prosecuted, the probability of re-arrest during follow-up is higher, 0.189 ($p<0.001$).

Among persons with DWI index arrests, 21.0 percent had arrests on this charge during the past three years prior to the index arrest. The prior arrest and conviction records of those who were prosecuted are different from those who were not prosecuted. The mean probability of prior arrests is higher for those not prosecuted than for those prosecuted for the index DWI arrest, 0.217 for those prosecuted versus 0.207 ($p<0.001$) for those not prosecuted. However, those not prosecuted for the index arrest are less likely to have had fewer prior previous convictions on average (0.136) than those who were prosecuted (0.172, $p<0.001$).

[10] Three categories of punishment are assigned for offenses in the classification system: active punishment (G.S. 15A-1340.11(1)), requiring that the offender be sentenced to jail or prison; intermediate punishment (G.S. 15A-1340.11(6)), requiring a sentence of supervised probation with at least one of the following conditions: special probation, residential program, house arrest with electronic monitoring, intensive supervision, day reporting center, or drug treatment court program; and community punishment (G.S. 15A-1340.11(2)) consisting of any authorized condition of probation except for those defined as intermediate punishments, outpatient drug and alcohol treatment, community service, referral to mental health or substance abuse services, restitution, or fines.

The most common charges concurrent with the index arrest are traffic violations and infractions. Misdemeanor and felony charges, especially the latter, rarely occur with DWI arrests.

Compared to demographic composition of North Carolina's population in 2005, females and persons over age 55 are substantially underrepresented among persons with index DWI arrests. Blacks are proportionally represented (blacks in North Carolina in 2006: 21.7%) and Hispanics are considerably overrepresented (Hispanics in state in 2006: 6.7%). [11] Hispanics are less likely to be prosecuted than whites following arrest for DWI.

4.3. Results of Regression Analysis

In the first stage, the IVs for the arrestee prosecutor's prosecution rate and the arrestee judge's conviction rate and highly correlated with the outcomes of individual cases (Table 4).[12] Using ordinary least squares (OLS), we find that persons who are prosecuted following the index arrest for DWI are less likely to be re-arrested for DWI during the next two years (Table 5: Panel A). The probability of re-arrest is reduced from over 0.015 to over 0.018, depending on the specification. Relative to the observational mean of the re-arrest rate, this reduction ranges from 8.1 to 9.7 percent. Further, among those prosecuted for the index arrest, the probability of a repeat re-arrest is lower if the person was convicted of the index DWI arrest. In the analysis of the all index arrests, Among those prosecuted for the index arrest, the deterrent effects of having been convicted are higher, ranging from reductions in the probability of re-arrest of over 0.026 to over 0.08. These reductions correspond to percentage changes in the 14.2 to 45.2 percent range.

Added to these effects are deterrence through the district-specific probabilities of being prosecuted and conditional on prosecution, the probability of being convicted. These

[11] Data on race/ethnicity come from *U.S. Statistical Abstract 2008*, Table 18, p. 23 (Bureau of the Census 2008).
[12] Table 4 is abbreviated, only showing results for the IVs and district-specific variables for the prosecution and conviction rates.

marginal effects on probabilities re-arrest are always much higher than for the outcomes of the index arrest for the individual with one exception. The implication is that outcomes of the index arrest lead to some updating of prior beliefs, but on average the prior beliefs are stronger. The exception is the analysis of re-arrest based on the total sample of index arrests in which we use county fixed effects. In this specification, the county fixed effects may be highly collinear with district-specific prosecution rates. However, in the parallel analysis of re-arrest based on the sample of those prosecuted for the index DWI offense, the implied marginal effect on the district-level conviction rate is far higher than is the marginal effect on the corresponding binary variable for whether or not the person was convicted of the index DWI offense. Using individual fixed effects increases the deterrent effects for the binary variables indicating whether or not the individual was prosecuted or convicted for the index DWI arrest.

The two-stage results also imply deterrent effects. The deterrent effects are weaker for those arrested for DWI (Table 5: Panel B). Overall, the parameter estimates on prior beliefs, both at the individual and district level, as in the OLS analysis, tend to imply that higher prosecution and conviction rates reduce the probability of re-arrest for DWI. However, only the effect of district level prosecution rates is statistically significant. In the sample of persons who were prosecuted for their index arrests, implied marginal effects exceed those from the OLS analysis, suggesting even more deterrence than reported above. Specification tests strongly reject weak instruments. Because instruments are exactly identified with the endogenous variables, we test for endogeneity using the Durbin-Hausman Wu test. The County-year fixed-effects specification for the arrested sample is the only specification where

we can reject the null that individual prosecution is endogeneous, however, this test assumes homoscedastic standard errors which is not likely to be the case in our data.[13]

Results on effects of prior DWI arrests on the probability of re-arrest do not appear to be sensitive to inclusion of county and year fixed effects (Table 6). [14] Not surprisingly, given that persons are arrest-prone for reasons we cannot measure, in specifications with and without fixed effects, the parameter estimates on binary variables for prior DWI arrests are positive. However, in the specification with individual fixed effects, the parameter estimates are negative, implying some learning from being arrested and/or the effects of higher penalties being imposed following each subsequent DWI arrest.

Among concurrent charges, persons also charged with a misdemeanor have a higher probability of re-arrest for DWI (Table 6). Index charges including concurrent traffic or infraction offenses probabilities of re-arrest were associated with a lower probability of re-arrest.

Females and Hispanics have lower and blacks have higher probabilities of re-arrest following the index arrest on average. With or without fixed effects included, the probability of re-arrest falls with age. Given the short observational period, individuals do not change age categories more than once (if at all).

The defense attorney variables incorporate both omitted heterogeneity in characteristics of persons arrested and prosecuted for an index DWI as well as omitted heterogeneity in index arrest outcomes. Perhaps, for example, a defendant is more likely to

[13] We are currently improving the specification by developing additional instruments based on the fraction of cases prosecuted by arresting officer and on the fraction of cases prosecuted leading to conviction, also by arresting officer.

[14] We only show results of covariates for variables other than the prosecution and conviction covariates in Table 6. These are results from TSLS. Results on these covariates using OLS are virtually identical to those presented in the table.

secure a plea agreement when s/he is represented by a private attorney. If so, the penalty may be less severe and the deterrent effect of the index offense corresponding lower.

We find that positive parameter estimates on binary variables for court-appointed attorney and public defender when we use no fixed effects or use county fixed effects.

In specifications without fixed effects, parameter estimates on several explanatory variables for the presence of a type of treatment court in the county are negative and statistically significant at conventional levels. However, these results may only imply that treatment courts tend to be implemented in geographic areas in which persons are less likely to be arrested for DWI, a possibility that seems unlikely but cannot be ruled out.

Without county-year fixed effects, the presence of specialty courts of were associated with lower probabilities of re-arrest. When county-year effects were added, only the presence of a mental health court was associated with lower probabilities of re-arrest. As seen in Table 1, only one North Carolina county added a mental health court during the observational period.

4.4. Analysis of Effects of Mecklenburg County DWI Court on the Probability of Re-Arrest for DWI

There is no inter-temporal variation in counties with DWI courts in North Carolina. Hence we employ an alternative analysis. First, we compute a difference in difference in difference (DD) estimates for Mecklenburg DWI re-arrest probabilities after versus before the court was implemented in 2000. Since the DWI court only accepts participants with a prior DWI conviction, we limit the analysis sample to persons with a baseline DWI conviction. We define two after periods, 2001-2 and 2003-4, selecting persons with a DWI conviction from arrests occurring in these years. The before period is 1998-9. Again we select individuals

with DWI arrests leading to convictions in these years. We use arrests in Wake County, the second most populous county in the states as a control county. The equation we estimate is:

$$r = \beta_0 + \beta_1 Meck + \beta_2 2001\text{-}2 + \beta_3 2003\text{-}4 + \beta_4 Meck.*2001\text{-}2 + \beta_5 Meck.*2003\text{-}4 \quad (5)$$

We find that the parameter estimate for β_5 is statistically significant and implies that the Mecklenburg DWI court reduced the probability of re-arrest by over 0.03 (Table 7). However, the short run effect as indicated by the estimate of β_4 is small and not statistically different from zero.

Next, we use propensity score matching (PSM) to assess differences in re-arrest rates for three groups of persons arrested for a DWI during 2001-6. Again we only assess re-arrests for persons convicted of arrests for DWI during these years. There are three alternative treatment groups: (1) persons convicted of DWI in Mecklenburg County; (2) persons convicted of DWI in Mecklenburg County who entered the DWI treatment court; and (3) persons convicted of DWI in this county who completed the DWI treatment court program. We match on all covariates in the previously discussed regression analysis except we exclude variables for DWI offenses in the look-back period since our data start with arrests in 1998.

In terms of the criterion that standardized differences not exceed 10 percent, the vast majority of covariates are well matched, however less so in the analysis with the Mecklenburg DWI court population as the treatment groups (not shown). The average treatment effects on the treated (ATT) are not statistically significant at conventional levels in any of the comparisons (not shown).

5. DISCUSSION

Conceptually, the framework of Bayesian updating of subjective beliefs seems highly appropriate in this context. People presumably learn about the workings of the criminal justice system from direct experience with it. They are likely to have a prior belief about probabilities

of arrest, prosecution, conviction, and penalties conditional on conviction. In this study, we assume that these prior beliefs reflect district-wide outcomes following arrest for DV. The offender updates his/her beliefs based on his/her own experience with the system. We hypothesize he/she learns differently from encounters with strict prosecutors and judges than from more lenient ones.

Our results indicate that the threat of prosecution and conviction does serve to deter future arrests for driving while intoxicated. This is evident from parameter estimates on a binary variable for whether or not the individual's arrest led to a prosecution and conditional on being prosecuted, from parameter estimates on a binary variable for being convicted. A result that arrests prior to the index arrest deter recidivism following the index arrest when we include individual fixed effects provides further evidence of deterrence.

We considered the possibility that individual prosecutions and convictions may be endogenous to future DWI re-arrests. If so, one would anticipate that the effect of the threat of being penalized for DWI following a DWI arrest would be underestimated and even result in sign reversal in which case, being prosecuted or prosecuted and convicted of a DWI offense would seem to raise the probability of DWI re-arrest. In this study, we find that using an instrumental variables strategy has the opposite result. If anything, the implied deterrent effects are lower using instrumental variables than with ordinary least squares.

The persistence of DWI violations in spite of the many public policy interventions that have been implemented has led to a growing emphasis on treatment of the underlying addiction and the multifaceted consequences of substance abuse, of which DWI is only one. This study employs several empirical strategies to evaluate the effective of courts, which specialize in treating persons convicted of various crimes associated with substance abuse. First, we include binary variables, which identify counties/years with specific types of

treatment courts. In this analysis, with the exception of mental health courts, we find little or no effect of court implementation on probability of re-arrest.

Second, we perform a difference in difference analysis between the two counties, after versus before the DWI court was implemented compared to a pseudo "after" versus "before" in Wake County. Here we do find a difference.

Third, we use propensity score matching to compare probabilities of re-arrest for persons convicted following index DWI arrests in Mecklenburg County (Charlotte), the only county in North Carolina with a DWI treatment court and persons convicted of this offense during the same period in Wake County (Raleigh), the second most populous county in the state. This analysis reveals in the probability of re-arrest between the two counties. Alternatively, we assess use the same approach to compare probabilities of re-arrest in the two counties between persons who participated in Mecklenburg's DWI court program with similarly situated individuals except for the presence of the DWI court in Wake County, again with no difference in recidivism. Finally, we compare graduates of the DWI court program with similarly situated persons in Wake with no difference in recidivism. In sum, our results on treatment courts are mixed, and at least based on our analysis, a conclusion as to the effectiveness of this approach seems premature.

Previous economic studies of criminal activity have found an empirical relationship between imprisonment and deterrence of crime (Durlauf and Nagin 2010). In contrast to our study, most empirical studies have been based on aggregate data. For example, using the technique of Granger causality, with within-state time series data, Marvell and Moody (1994) found a 10 percent increase in the prison population led to a 1.5 percent fall in crime rates. Using an IV for the prison population of prison overcrowding, Levitt (1996) showed that reductions in the prison population as a result of litigation led to an increase in crime rates in

states which experienced this litigation . His estimates of the effect of incarceration rates were two to three times larger than Marvell and Moody's. Using microdata from the Longitudinal Survey of Youth 1997, Sweeten and Apel (2007) used propensity score matching to estimate that between 6.2-14.1 annual offenses per juvenile offender and between 4.9-8.4 annual offenses per adult offender are prevented by incapacitation. The lack of negative findings suggest publication bias in that it may be difficult to publish findings that do not demonstrate that the threat of consequences deters criminal activity deters.

To our knowledge there are no studies of deterrence of DWI in the economic or law and economics literatures. Several studies in other disciplines have studied deterrent effects of traditional penalties on DWI recidivism.

Wagenaar et al. (1995) performed a meta-analysis of drink-drive control efforts including mandatory jail sentence, community service, license suspension, and fines. Although the findings were uniformly consistent with deterrence, the authors cautioned that the studies were often, if not typically, weak methodologically in that they lacked a control group, did not report standard errors, among other deficiencies. They also cautioned again publication bias in that studies that report no effects may not be published.

Other studies focus on determinants of recidivism, e.g., on characteristics of reoffenders, effects of treatment, but do not focus on outcomes from an index arrest that may deter re-arrest reported that repeat DWI offenders are more likely to have been convicted of non-DWI offenses in a study of 228 individuals (e.g., Lucker, Kruzich et al. 1991; Schell, Chan et al. 2006; Timko, Desai et al. 2011). In a comparison of 48 one-time DWI offenders with 29 repeat offenders, Cavailoa et al. (2007) reported that repeat DWI offenders were more likely to have had a revoked driving license before the initial DWI offense, and were more likely to have been cited for reckless/careless driving, had a revoked driving license, and had

at least one accident after the initial DWI offense. In a study with a much larger sample, Taxman and Piquero (1998) found similar results in an empirical analysis of recidivism of first-time DWI offenders. Ahlin et al. (2011) concluded that drivers with a prior DWI were at relatively high risk of incurring a repeat offense irrespective of how they were sanctioned for their first-time offenses. Such findings that a higher number of a sanctions are positively associated with the probability of re-arrest most likely reflect endogeneity of such sanctions rather than imply that sanctions cause individuals to repeat a DWI offense. Constant et al. (2010) reported that a crackdown on drinking and driving in France failed to deter DWI, but the study is not specific on what the "crackdown" entailed, to what extent the crackdown reflected higher probability of arrest, higher prosecution and conviction rates, and/or higher penalties conditional on charges.

There have been studies evaluating the effectiveness of DWI courts. These evaluations, many of which are unpublished reports, generally apply to a few courts in a single state. Many studies are process rather than outcome oriented. The process studies, focusing on how courts operate, are an essential step in understanding how such courts could achieve better outcomes. However, the ultimate measure of success of such courts is the extent to which they decrease the rate of DWI and its consequences (Marlowe, Festinger et al. 2009).

Most research on adult DTCs suggests that they significantly reduce recidivism, though impact varies over time and by court (2010). In one of the stronger studies methodologically, Peters & Murrin examined graduates and non-graduates of 2 drug programs in terms of recidivism (any arrest), substance abuse, and employment (2000). The control group was offenders placed on probation rather than being enrolled in DTC. DTC graduates had lower recidivism rates than non-graduates and non-participants. A U.K. study followed

persons with substance abuse problems from a year before treatment to five years post-entry (Gossop, Trakada et al. 2005). It found statistically significant reductions in convicted offenses post treatment. Spohn, Piper et al. studied DTC participants, diversion program participants, and felony arrestees without treatment (2001). Those in DTC and diversion program arrestees had lower subsequent felony arrests than the third group. In a review of 42 studies on DTCs, 37 studies reported lower recidivism rates among drug court participants (2001).

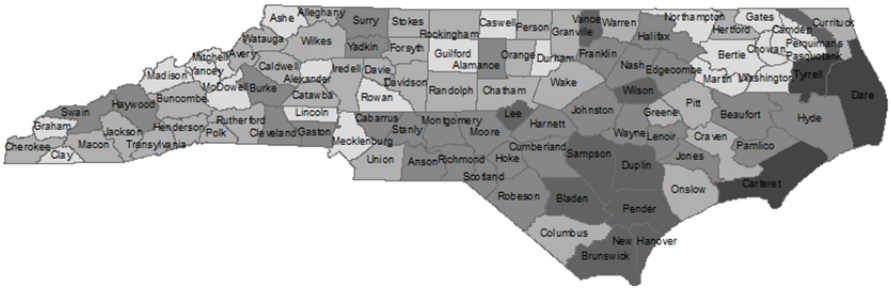
A strength of our study is the use of a longitudinal state-wide database on arrests for DV and our treatment of endogeneity of sanctions, as applied to individual arrests, although in this particular application, accounting for endogeneity did not increase the absolute size of deterrent effects as one might expect. While there is a substantial amount of previous literature, most studies have been small-scale, both in terms of sample sizes and geographic areas included and/or include a limited amount of time to follow-up. Most other studies on this topic, like ours, are observational. Furthermore, there is limited empirical evidence on the effectiveness of policies to deter DWI. This study contributes to research on deterrence by: (1) making a special effort to control for factors other than outcomes of the index arrest, and endogeneity of outcomes penalties, that might affect recidivism; (2) use of a longer follow-up period than many studies; and (3) a much larger sample covering a broader geographic area than in almost all previous studies.

A deficiency of our study is attributable to a weakness of the administrative data on arrests--lack of information on arrestees. It would have been desirable to have data on such objective characteristics as income, educational attainment, family structure, mental health, and use of addictive substances as well as information on preferences, including motivations for committing DWI, and subjective beliefs about probabilities of adverse consequences from

such behavior—not only what the probabilities are but also on what information individuals rely on to form these probabilities.

In sum, DWI provides a context in which being tough of offenders pays in terms of a reduced probability of re-arrest. Extensions of this research should examine the impacts of specific penalties and penalty mixes on recidivism as well as on the probabilities of other decisions, such as those affecting employment and voluntary treatment seeking. To fully realize the potential of administrative data on criminal arrests, it will be useful to link the data with other administrative data bases such as on employment (e.g., Social Security data) and treatment (e.g., treatment court records as we have done for the Mecklenburg DWI court).

Fig. 1. County DWI charges per capita in 2001-2006



Charges per capita

- 0.00693 - 0.0126
- 0.0127 - 0.0164
- 0.0165 - 0.0217
- 0.0218 - 0.0304
- 0.0305 - 0.0434

Table 1. Number of specialty courts by year

Court type	2001	2002	2003	2004	2005	2006
DWI	1	1	1	1	1	1
Adult drug treatment	10	13	14	13	17	17
Youth drug treatment	2	3	5	5	5	5
Family drug treatment	1	2	2	2	7	9
Mental health	1	1	1	1	2	2

Table 2. Penalties conditional on conviction 2001-2006

Variable	Fraction receiving penalty	Penalty amount			
Punishment type		**Mean**	**Std. Dev.**	**Min**	**Max**
Jail†	0.993	162	416	1	133,225
House arrest†	0.00117	103	97.8	6	1,080
Supervised probation†	0.294	633	304	6	2,190
Regular probation†	0.617	507	286	2	2,555
Community service††	0.409	34.1	19.3	2	720
Residential program†	0.000324	116	185	7	720
Driver's licenses suspension†	0.0941	73.6	191	1	18,030
Fine†††	0.899	231	294	1.12	45,600
Restitution†††	0.0538	279	1678	2.28	113,413
N	200,590				

†In days

††In hours

†††In 2006 $

Table 3. Descriptive statistics by sample

	Arrested	Prosecuted	Not prosecuted
Variable	**Mean**	**Mean**	**Mean**
Dependent variable			
DWI re-arrest	0.186	0.183	0.189***
Deterrence			
Prosecuted	0.827		
Prosecution rate [0.480,0.923]	0.752	0.752	0.872***
Any conviction		0.846	
Conviction rate [0.552,0.977]		0.879	0.872***
Charges per capita [0.00189,0.160]	0.0172	0.0172	0.0173***
Past DWI offenses			
DWI arrest	0.210	0.207	0.217***
DWI conviction	0.167	0.172	0.136***
Concurrent offenses			
Felony [0,4]	0.00253	0.00201	0.00418***
Misdemeanor [0,5]	0.0294	0.0298	0.0246***
Traffic category 1 [0,4]	0.178	0.156	0.274***
Traffic category 2 [0,4]	0.0148	0.0136	0.0188***
Uncategorized traffic [0,3]	0.000940	0.000725	0.00170***
Infraction [0,8]	0.172	0.172	0.165***
Demographic Characteristics			
Female	0.166	0.171	0.137***
Age 21-25	0.251	0.250	0.269***
Age26-34	0.301	0.300	0.318***
Age 35-44	0.258	0.259	0.243***
Age 45-54	0.137	0.138	0.122***
Age 55-64	0.0414	0.0417	0.0370***
Age 65+	0.0115	0.0114	0.0111***
Black	0.230	0.234	0.204
Hispanic	0.185	0.171	0.283***
White	0.586	0.596	0.511***
Other race	0.0352	0.0344	0.0411***
Legal representation			
Court appointed attorney	0.128	0.127	0.137***
Public defender	0.0718	0.0704	0.0783***
Attorney waived	0.192	0.193	0.190***
Private attorney	0.607	0.610	0.593***
Specialty courts			
DWI court	0.068	0.069	0.0886***
Adult drug treatment court	0.340	0.343	0.333***
Youth drug treatment court	0.168	0.168	0.171***
Family drug treatment court	0.106	0.108	0.127***
Mental health court	0.0285	0.0281	0.0335***
N	285,119	236,005	65,366

Difference-in-means (prosecuted vs. not prosecuted): *p<0.05, **p<0.01, ***p<0.001

Table 4. Probability of re-arrest: First stage results

Variables	Arrested		Prosecuted	
Deterrence				
District: Prosecuted	0.668***	0.420***		
	(0.00947)	(0.0275)		
Prosecution instrument	0.872***	0.886***		
	(0.00610)	(0.00624)		
District: Any Conviction			1.061***	0.739***
			(0.0124)	(0.0396)
Judge instrument			0.968***	0.979***
			(0.00180)	(0.00196)
Constant	0.333***	0.633***	-0.137***	0.214***
	(0.00825)	(0.0263)	(0.0120)	(0.0378)
County FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
Observations	244,707	244,707	193,211	193,211
R-squared	0.128	0.142	0.303	0.307

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Probability of Re-arrest: OLS and Two Stage Least Squares (TSLS) Results

Panel A: OLS[a]						
Variables	**Arrested**			**Prosecuted**		
Deterrence						
Prosecuted	-0.0150***	-0.0144***	-0.0176***			
	(0.00201)	(0.00202)	(0.00656)			
District: prosecuted	-0.0821***	-0.0165	-0.131***			
	(0.00931)	(0.0272)	(0.0476)			
Any conviction				-0.0261***	-0.0255***	-0.0828***
				(0.00236)	(0.00236)	(0.00871)
District: any conviction				-0.0339***	-0.121**	-0.0434
				(0.0121)	(0.0482)	(0.0715)
County FE	No	Yes	No	No	Yes	No
Year FE	No	Yes	Yes	No	Yes	Yes
Individual FE	No	No	Yes	No	No	Yes
N	285,119	236,005	285,119	236,005	285,119	236,005
R-squared	0.014	0.015	0.429	0.014	0.015	0,440
Number of groups			249,282			211,196

Panel B: TSLS				
Variables	**Arrested**		**Prosecuted**	
Deterrence				
Prosecuted	-0.00999	0.000327		
	(0.00711)	(0.00726)		
District: Prosecuted	-0.0973***	-0.0204		
	(0.0110)	(0.0295)		
Any Conviction			-0.0317***	-0.0312***
			(0.00609)	(0.00618)
District: Any Conviction			-0.0345**	-0.0959*
			(0.0152)	(0.0540)

County FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
N	244,707	244,707	193,211	193,211
R-squared	0.014	0.015	0.013	0.015
Durbin-Hausman-Wu (p-value)	0.323	0.0197	0.263	0.295
First stage F-statistic	20439	20141	290953	249435

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[a]Included but not shown: DWI arrest/conviction in lookback; concurrent felonies, misdemeanors, category 1-2 traffic offenses, uncategorized traffic offenses, infractions; female gender; Age; Race; court appointed, public defender and attorney waived legal-representation, DWI, adult drug treatment, youth drug treatment, family drug treatment, and mental health specialty courts; charges per capita

Table 6. Probability of re-arrest: Other results

	TSLS			
Variables	**Arrested**		**Prosecuted**	
Past DWI offenses				
DWI Arrest in Lookback	0.0694***	0.0690***	0.0659***	0.0647***
	(0.00284)	(0.00285)	(0.00313)	(0.00314)
DWI Conviction in Lookback	0.00613**	0.00538*	0.00178	0.00133
	(0.00310)	(0.00311)	(0.00335)	(0.00336)
Concurrent offenses				
Other Charge: Felony	-0.0132	-0.00991	-0.0194	-0.0161
	(0.0129)	(0.0130)	(0.0185)	(0.0185)
Other Charge: Misdemeanor	0.0132***	0.0127***	0.0186***	0.0185***
	(0.00461)	(0.00463)	(0.00514)	(0.00517)
Other Charge: Traffic Category 1	-0.00733***	-0.00784***	-0.00526**	-0.00618**
	(0.00222)	(0.00227)	(0.00253)	(0.00258)
Other Charge: Traffic Category 2	-0.00174	-0.00225	-0.00415	-0.00477
	(0.00653)	(0.00655)	(0.00747)	(0.00749)
Other Charge: Uncategorized Traffic	-0.00918	-0.0101	-0.0280	-0.0298
	(0.0275)	(0.0277)	(0.0328)	(0.0330)
Other Charge: Infraction	-0.0131***	-0.0145***	-0.0138***	-0.0146***
	(0.00211)	(0.00216)	(0.00236)	(0.00242)
Demographic characteristics				
Female	-0.0123***	-0.0119***	-0.0125***	-0.0119***
	(0.00212)	(0.00212)	(0.00231)	(0.00231)
Age 26-34	-0.0238***	-0.0243***	-0.0267***	-0.0275***
	(0.00216)	(0.00216)	(0.00242)	(0.00242)
Age 35-44	-0.0200***	-0.0212***	-0.0229***	-0.0242***
	(0.00228)	(0.00229)	(0.00255)	(0.00256)
Age 45-54	-0.0441***	-0.0449***	-0.0459***	-0.0470***
	(0.00264)	(0.00266)	(0.00295)	(0.00296)
Age 55-64	-0.0724***	-0.0732***	-0.0821***	-0.0833***
	(0.00378)	(0.00380)	(0.00412)	(0.00413)
Age 65+	-0.0932***	-0.0940***	-0.0923***	-0.0936***
	(0.00619)	(0.00620)	(0.00701)	(0.00702)
Black	0.0157***	0.0146***	0.0191***	0.0171***
	(0.00204)	(0.00213)	(0.00229)	(0.00239)
Hispanic	-0.0171***	-0.0163***	-0.00457*	-0.00516**
	(0.00221)	(0.00226)	(0.00252)	(0.00259)
Other Race	0.0351***	0.0395***	0.0342***	0.0367***
	(0.00458)	(0.00474)	(0.00536)	(0.00551)
Legal representation				
Court Appointed Attorney	0.0335***	0.0350***	0.0395***	0.0411***
	(0.00251)	(0.00258)	(0.00285)	(0.00292)

Public Defender	0.0333***	0.0379***	0.0364***	0.0401***
	(0.00346)	(0.00362)	(0.00375)	(0.00394)
Attorney Waived	-0.00404*	-0.00276	0.00280	0.00412*
	(0.00212)	(0.00220)	(0.00239)	(0.00247)
Specialty courts				
DWI Court	-0.0133***	0.0766**	-0.00891	0.0560
	(0.00491)	(0.0365)	(0.00548)	(0.0379)
Adult Drug Treatment Court	-0.00546**	-0.00229	-0.00599***	0.00250
	(0.00214)	(0.00465)	(0.00228)	(0.00522)
Youth Drug Treatment Court	-0.0122***	-0.00199	-0.0173***	-0.00890
	(0.00262)	(0.00505)	(0.00282)	(0.00550)
Family Drug Treatment Court	-0.00853**	-0.000449	-0.0101**	0.00230
	(0.00416)	(0.00552)	(0.00455)	(0.00631)
Mental Health Court	-0.0251***	-0.0216***	-0.0196***	-0.0206***
	(0.00445)	(0.00648)	(0.00502)	(0.00696)
Charges per Capita	1.002***	0.710	0.827***	0.0327
	(0.134)	(0.434)	(0.154)	(0.497)
Constant	0.260***	0.0928**	0.236***	0.215***
	(0.00863)	(0.0425)	(0.0136)	(0.0626)
County FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
Observations	244,707	244,707	193,211	193,211

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Difference-in-differences estimation of probability of recidivism in Mecklenburg versus Wake County from 1998-1999 to 2002-2003 and 1998-1999 to 2004-2005

Variables	
Mecklenburg	0.00456
	(0.00796)
2002-2003	-0.00430
	(0.00816)
2004-2005	0.00372
	(0.00791)
Mecklenburg*2002-2003	-0.00596
	(0.0110)
Mecklenburg*2004-2005	-0.0390***
	(0.0108)
Constant	0.165***
	(0.00586)
Observations	27,899
R-squared	0.001

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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