THE EFFECT OF DNA DATABASES ON PLEA BARGAINING

An Undergraduate Research Scholars Thesis

by

SARAH KATHLEEN ARMSTRONG

Submitted to Honors and Undergraduate Research
Texas A&M University
in partial fulfillment of the requirements for the designation as an

UNDERGRADUATE RESEARCH SCHOLAR

Approved by
Research Advisor: Dr. Jonathan Meer

May 2014

Major: Economics
Political Science

TABLE OF CONTENTS

ABSTRACT

The Effect of DNA Databases on Plea Bargaining. (May 2014)

Sarah Kathleen Armstrong
Department of Economics
Texas A&M University

Research Advisor: Dr. Jonathon Meer
Department of Economics

Plea bargaining is a defining characteristic of the United States criminal justice system; according to the Bureau of Justice Statistics, 95% of the 1,079,000 felons convicted in state courts during 2004 pleaded guilty rather than face jury by trail.[1] Despite the prominence of plea negotiations in the American judiciary, the implications of this process have not been subject to analysis that sufficiently matches its importance. Meanwhile, the increasing use of high-tech law enforcement tools like DNA databases, which increase the probability that repeat offenders are caught for their crimes, affect parties' relative bargaining power and incentives. Most importantly, defendants have an incentive to negotiate lesser charges in order to avoid being added to their state's DNA database, in exchange for longer sentences. We examine whether the introduction and expansion of DNA databases across the United States have affected plea bargaining by defendants. We use difference-in-differences analysis and State Court Process (SCP) data from the Bureau of Justice Statistics, which is collected every two years and tracks felony cases from charging by prosecutors until final disposition. We test for the impact of DNA database expansions on the likelihood of pleading guilty to a crime, the likelihood of charge bargaining, and other sentencing outcomes. Estimates provide evidence that database eligible offenders are more likely to accept charge bargains and less likely to accept sentence bargains

[1] BJS (2011).

relative to defendants that do not face database collection, indicating that plea bargaining may help parties involved in plea negotiations to assist offenders in avoiding DNA database registration.

ACKNOWLEDGEMENTS

I would like to thank Dr. Jonathan Meer of the Texas A&M Department of Economics and Dr. Jennifer Doleac of the University of Virginia Frank Batten School of Leadership and Public Policy for their great support during this process. Dr. Meer's teaching during my undergraduate career and both professors' guidance throughout this experience have proven invaluable in producing this work, as well as my personal and professional growth during the year.

CHAPTER I

INTRODUCTION

Despite the prominence of plea negotiations in the American judiciary, the implications of this process have not been subject to analysis that sufficiently matches its importance. In identifying whether there exists a connection between plea bargaining and DNA databases, we expand our understanding of plea negotiations, as well as more completely identify the role of DNA profiling in the criminal justice system by observing how it influences defendant behavior through this defining characteristic of the American judiciary.

While the economic literature concerning plea bargaining and DNA profiling can be identified by a relatively small number of studies,[2] both plea negotiation behavior and that of defendants facing DNA profiling can be partially explained by Becker's (1968) model of criminal decision-making. Outlining how individuals compare the expected costs and benefits of committing a crime, the model defines the expected cost of committing a crime as a function of the probability of conviction (conditional on reoffending), a discount factor and the punishment.[3] Increasing the expected value of these cost-factors reduce individual incentive to offend, and the model predicts that an individual will commit a crime only if:

$$\mathrm{E(Benefit)} > \mathrm{E(Cost)} = \mathrm{f}(\tau, \delta, \rho) \mid \mathrm{I(Incarcerated)} = 0$$

where τ := probability of conviction, δ := discount rate, ρ := punishment and I(Incarcerated) indicates whether the individual is incarcerated at time of decision.

[2] A review of literature concerning plea bargaining and DNA profiling is included below.

[3] Sentence length is chosen as the punishment of interest in this paper.

A key focus of this literature considers the effectiveness of deterrence, a policy strategy to reduce recidivism rates by increasing the expected costs of committing crime by increasing τ or ρ.[4] Increasing use of high-tech law enforcement tools raises the probability that offenders are caught, and policy-makers have looked to DNA databases and DNA profiling of criminals as an effective method of decreasing recidivism. The overall impact of a policy on crime can depend on both the effect of deterrence and an incapacitation effect, which is determined by an individual being incarcerated[5] and, consequently, physically unable to reoffend. This method of reducing crime is considerably more costly to the public relative to the use of databases in criminal investigations,[6] so identifying the relative deterrence and incarceration effects of databases and plea negotiations—and, specifically, how negotiating defenders perceive the relative importance of τ (for future offenses) and the ρ they are negotiating—is an important policy question.

If a negotiating defendant faces database entry and intends to reoffend upon release, they could potentially stop this increase in their probability of conviction for future crimes by seeking a bargain in which they are not entered into a database. In particular, the defendant has incentive to bargain their charges down to a less serious offense that does not qualify for DNA collection, which may likely be in exchange for some increase in the sentence. Identifying whether defendants are able to pay this "price" in order to avoid database entry provides insight into how defendants that are likely to reoffend perceive the relative importance of future τ and current ρ, as well as the relative magnitudes of the deterrence and incarceration effects of databases on criminal behavior. We find that, while DNA eligible offenders are generally less likely to plead

[4] Specifically, by increasing the probability of future convictions, conditional on reoffending, and the determined punishment for the present crime

[5] Where the individual is convicted with probability τ

[6] INSERT: notes on prison population costs v. dna databases

guilty, they are more likely to accept charge bargains and less likely to accept sentence bargains relative to defendants that do not face database collection.

Overview of Plea Bargaining

A plea bargain can be thought of as a negotiation between the defense, prosecution and judge that settles a criminal case short of trial and is treated as a contract between prosecutors and defendants. Under this arrangement, a defendant agrees to plead guilty to some or all of the charges against them in exchange for concessions from the prosecution, including: a reduction in the number of charges, a reduction in the severity of charges, and/or a recommendation that the defendant receive a reduced sentence.

Plea negotiations begin once a defendant has been arrested and charged with a crime. This process may result in two types of plea bargains: sentence bargains and charge bargains. Under a sentence bargain, the defendant may plead guilty to the original charge in exchange for a reduced sentence. Similarly, the prosecutor may offer the defendant to be charged with a lesser crime in order to secure a conviction. Because the specific charge affects the expected cost of other crimes (through the probability of getting caught), we assume that players' utility is determined by both the charge name and length of the sentence. [7] Adopting the standard conceptualization of plea negotiations found in the literature, we assume that a plea bargain is offered once,[8] with the case going to trial if the plea offer is rejected.

[7] The game-theoretic literature of plea bargaining largely offers models that only consider sentence bargaining, assuming that defendants are influenced by the length of their incarceration, but not by the type of charge. See Bebchuk (1984), Grossman and Katz (1983), Reinganum (1988) and da Silveira (2012). The empirical literature, more similar to the strategy that we employ here, allows for variation in bargain type. See Agan (2013), Bjerk (2005), Kuziemko (2006) and Thaxton (2013).

[8] See Agan (2013), Kuziemko (2006)

The debate surrounding plea bargaining has been marked by varying forms of support and criticism. While some critics of plea bargains hold that the process allows defendants to get off too easily, many believe that it promotes prosecutorial coercion[9] and undermines constitutional rights of defendants since entering into a bargain requires defendants to waive three rights protected by the Fifth and Sixth Amendments, including: right to trial by jury, right against self-incrimination and right to confront hostile witnesses. One concern is that risk-averse, potentially innocent, defendants may be easily convinced to cede these civil liberties when jury by trial could result in harsher punishment.[10] Furthermore, some hold that equity in plea negotiations is undermined by an excess of prosecutorial discretion[11] and that bargains can be shaped by personal biases of prosecutors.[12] Characteristics that have been identified as connected to prosecutorial discretion and the likelihood of bargaining include: seriousness of current charge and the defendant's prior record, strength of evidence, use of a private or public defender and the detention status of the defendant.[13] Furthermore, the race of the defendant is thought to influence the likelihood that they will be offered a plea bargain, with black defendants being less likely to receive a reduced charge relative to white defendants.[14]

[9] Finkelstein (1975) argues that prosecutorial coercion occurs under insufficient evidence.

[10] Dervan and Edkins (2013) find that, when study participants acting as defendants are provided with a specific probability of conviction for jury trial, they are relatively risk-adverse relative to when participants are offered a bargain without a specified probability of conviction. Also, it is generally recognized that defendants face harsher penalties if convicted through trial by jury for comparable offenses, with this harsher punishment being a product of prosecutorial discretion. See Albonetti (1991), Britt (2000), Dixon (1995), Engen and Gainey (2000), King et al. (2005), Kurlychek and Johnson (2004), Piehl and Bushway (2007), Steffensmeier and Demuth (2000, 2001), Steffensmeier and Hebert (1999), Steffensmeier et al. (1993) and Ulmer and Bradley (2006).

[11] See Burke (2007), Finkelstein (1975) and Ma (2002).

[12] See Burke (2007) and Ma (2002).

[13] See Champion (1989), Kellough and Wortley (2002), Meyer and Gray (1997) and Ulmer and Bradley (2006).

[14] See Farnworth and Teske (1995), Johnson (2003), Kellough and Wortley (2002) and Ulmer and Bradley (2006). Research on the relationship between other demographic characteristics (e.g. sex and age) is inconclusive.

Despite these concerns, the Supreme Court of the United States maintains that plea negotiations are constitutional since defendants voluntarily enter into a bargain and are cognizant of potential consequences.[15] Conversely, many hold that plea bargaining is an equitable practice[16] and that it allows for greater efficiency, minimizing prosecutorial costs by circumventing time-consuming and expensive jury trials.[17]

Rigorous analysis of plea negotiations is needed not only as a response to the contention that surrounds the procedure, but also for the prevalence of plea bargains in the American judiciary system. Of the 75,573 federal criminal cases that were concluded by trial or plea in 2003, 95% ended in a guilty plea.[18] Despite the significant role of plea negotiations in the American criminal justice system, we do not understand the full impact of the process. Rigorous analyses are limited to a small number of empirical studies, with the majority of the literature offering game-theoretic models that conceptualize the negotiation process.[19] The studies described below specifically examine behavioral changes of prosecutors and defendants in negotiations following changes in sentencing.

---

[15] The Supreme Court of the United States has historically rejected arguments that plea bargaining is unconstitutional. See Brady v. United States, 397 U.S. 742 (1970).

[16] See Bar-Gill and Gazal-Ayal (2006), Bowers (2008), Brown and Bunnell (2006), Goodman and Porter (2002), Lee (2005), and McDonald and Cramer (1992).

[17] See Stuntz (2004).

[18] See Pastore and Maguire (2003). The literature estimates that the proportion of criminal cases concluded by plea bargains in the United States to be between 90 and 95 percent (Bureau of Justice Statistics (2005), Flanagan and Maguire (1990)).

[19] Landes (1971) offers the first economics-based analysis of plea bargaining, examining how the process conserves resources by reducing the input demanded from both the prosecution and defense.[19] Landes theorizes that, the lesser the sentence faced if convicted at trial and the greater a trial imposes a resource cost to the defendant relative to the negotiated plea, the more likely the defendant is to plead guilty. This prompted a number of subsequent papers that considered variations of the model developed by Landes (Rhodes (1976), Weimer D.L. (1978), Forst & Brosi (1977), Reinganum (1988)). Grossman (1983) models how plea bargaining can reduce the overall societal cost of a wrongful conviction, since the interest of the state should coincide with that of an innocent defendant, and how plea bargaining functions as a screening device by prompting guilty defendants to self-select into a guilty plea, evening the asymmetrical distribution of information between the defense and prosecution. Bebchuk (1984) models litigation and settlement processes under imperfect information to identify the likelihood of settlement and settlement amount.

Agan (2013) considers whether the presence of a sex offender registry cause the cases of those accused of sex crimes to more or less likely end in plea bargaining. Using a difference-in-differences (DD) strategy, [20] Agan compares plea and sentencing outcomes of accused sex offenders with those accused of other violent crimes before and after the effective dates of registry laws.[21] Agan employs a sample of felony cases from the Bureau of Justice Statistics (BJS) State Court Process (SCP) [22] that was collected every two years between 1990 and 2004,[23] integrating this with state-level effective dates for registration.[24] Plea bargaining by accused sex offenders increased after registration went into effect, relative to other violent offenders and defendants accused of sex crimes were more likely to plead guilty to the same offense they were charged with compared to other violent offenders. Agan interprets this as an increase in the prosecutor's bargaining power since "sex offenders were less likely to receive more 'generous' charge bargains" (Agan, 21).[25]

Kuziemko (2006) examines whether the threat of capital punishment causes defendants charged with potentially capital crimes to enter plea bargains in exchange for lesser sentences. Kuziemko employs two separate identification strategies through which she: (a) exploits a natural experiment prompted by the 1995 reconstitution of capital punishment in New York to allow for

[20] Similar to difference-in-difference strategy used in Kuziemko (2006) study on the effect of death penalty on plea bargaining by accused murderers.

[21] Defendants arrested for violent crimes that are not sex offenses are considered the control group, as Agan holds that sex offender registry laws should not affect the behavior of this group.

[22] Same dataset used in Bjerk (2005) study on the effects of three-strike laws on plea bargaining. From ICPSR: cover 40 counties (25 states); while not nationally representative, mean to represent the 75 most populous U.S. counties

[23] All included cases were filled in May of each year. Difference-in-differences employed to diminish state-year shocks. Agan includes state-fixed effects. The population includes sex offense cases, as well as other types of felony cases, that were filed in 70 U.S. counties. The data details the criminal offense charges, but does not note if these are arrest or charge offenses; the adjudication outcome, i.e. whether the process ended with a trial conviction, guilty plea, dismissal, or acquittal; the conviction offense; and the sentencing.

[24] This data is taken from Agan (2011). Six states represented in this data had a registry for the entire sample period. The effective date of registry laws for these states would not properly capture the effect of registries on plea bargaining since these laws went into effect prior to the time period of the CPA data.

[25] Agan draws interpretation from Kuziemko (2006) conclusions.

a differences-in-differences-in-differences (DDD) analysis of felony charges in New York and (b) performs a DD analysis of a cross-section of 1988 murder cases across 33 counties. In response to the reinstatement of the death penalty, some district attorneys publicly rejected pursuing capital punishment, allowing Kuziemko to identify those defendants charged with murder[26] in counties where district attorneys did pursue capital punishment after the 1995 statute went into effect as the treatment group for the DDD analysis.[27] The cross-sectional data employed in the DD analysis included first-degree murder cases, as well as a variety of homicide cases, allowing Kuziemko to utilize cases in which the defendant was charged with second-degree murder, or lesser charges, as the control group since these individuals would not face capital punishment under 1988 law. The results of both of analyses indicated that the potential for capital punishment encouraged defendants to accept harsher bargains, but did not increase the propensity of defendants to enter into a plea bargain. Kuziemko holds that these results indicate that, while capital punishment does not diminish the high costs associated with capital punishment trials, the threat of capital punishment does increase the bargaining power of the prosecution.

In response to Kuziemko's findings, Thaxton (2012) examines the impact of capital punishment on plea bargaining and concludes that the death penalty does in fact increase the likelihood of a defendant to plead guilty. Thaxton argues that Kuziemko's results are inherently flawed due to selection bias caused by the assumption that the threat of the death penalty affects the decision-

[26] Kuziemko considers defendants charged with both first- and second-degree murder in response to the expansion of the definition of first-degree murder in the 1995 statute. Prior to the 1995 change, first-degree murder only included the willful killing of a law-enforcement officer and second-degree murder denoted various homicide offenses.

[27] Kuziemko identifies defendants arrested for burglary, forcible rape, or armed robbery as the control group. This was performed using individual-level, time-series data that included all felony charges in New York between 1985 and 1998.

making process of the defense in death-eligible cases, regardless of whether the death penalty was explicitly threatened. Thaxton holds that in reality prosecutors do not deem all death-eligible cases worth of capital punishment and that a defendant may not consider their case eligible for the death penalty; consequently, defendants not affected by the threat of capital punishment are likely included in the treatment group.[28, 29] Thaxton also notes that Kuziemko's selection of New York as the jurisdiction of interest is problematic in that the New York death penalty is relatively inactive,[30] which could undermine the external validity of her research. Thaxton employs data on homicide cases in Georgia between 1993 and 2000 that Thaxton holds accurately details prosecutorial decisions to seek capital punishment and, therefore, corrects the selection bias issues present in the Kuziemko analysis. Thaxton employs a conditional fixed-effects logit model to determine that the threat of capital punishment increases the likelihood that death-eligible cases will end with a guilty plea.

Bjerk (2005) similarly examines the relationship between mandatory minimum sentencing laws and prosecutorial discretion. The presented descriptive statistics and results of probit model analysis, cause Bjerk to conclude that prosecutorial discretion (i.e. plea bargaining) diminishes the effectiveness of mandatory minimum sentencing laws; specifically that prosecutors are more

[28] While Kuziemko's assumption may not hold as strongly as she argues, the threat of capital punishment should still impact the decision calculus of the defense in any death-eligible case, regardless of the degree to which the prosecution actually threatens capital punishment. That being said, we are unlikely to encounter equivalent issues in our consideration of the impact of DNA databases since the presence of DNA-evidence is determined prior to plea negotiations and the death penalty can only be threatened prior to sentencing.

[29] Thaxton does highlight an important issue in the data utilized by Kuziemko in that her sample population does not consider the process following sentencing. As Thaxton notes, most jurisdictions, including New York, allow offenders in capital cases to enter a plea bargain up until the penalty phase of their case. Plea bargaining could occur subsequently, though this issue should, again, not be found in our analysis of DNA databases and plea bargaining since there does not exist a legal precedent allowing those convicted to enter plea bargains in non-capital cases (at least to my knowledge).

[30] An average of six death penalty notices per year were issued between 1995 and 2000. Additionally, only six offenders were considered to be members of "death row" by 2000 and no executions had occurred since the 1995 reinstatement of capital punishment.

likely to reduce a felony charge to a misdemeanor if the initial charge would cause the defendant to be tried under the "three strikes" condition of a mandatory minimum sentencing law. Bjerk holds that, because plea bargaining allows for significant prosecutorial discretion, these negotiations undermine the deterrent effect mandatory minimum sentencing laws are presumed to enforce.[31]

Rather than identify the effect of a particular treatment to sentencing as the studies above, Da Silveira (2012) analyzes a non-parametrically identified variation of the model developed by Bebchuk (1984) in order to identify how plea bargaining is generally affected by the harshness of trial-assigned sentencing. Specifically considering the reduction in minimum mandatory sentences and expansion in non-jail punishment for mild offenses, Da Silveira implements a non-parametric estimator of the model using case-level data that details all criminal cases filed at the North Carolina Superior Courts between 1996 and 2009. Da Silveira estimates that, on average, cases will settle so that the defendant is receives approximately half of the sentence that would be assigned through trial conviction. Da Silveira concludes that prosecutors face high opportunity costs in going to trial, while defendants act as though trials are costless. Furthermore, Da Silveira finds that a reduction in mandatory minimum sentences reduces the total jail-time assigned by courts, while increasing the proportion of cases resulting in jail-time, and that an increase in alternative sentencing for less serious crimes reduces conviction rates and has no effect on total jail time assigned by the courts.

Overview of DNA Databases

Beginning in the 1980's, state and federal legislation was enacted that required the collection of DNA samples from certain types of convicted criminal offenders. The usage of DNA analysis in

[31] Bjerk uses Bureau of Justice Statistics data that includes cases in which defendants were arrested for a state felony between 1990 and 2000. U.S. Department of Justice, State Court Processing Statistics, 1990-2000.

the criminal justice system increased in the mid-1990's, and the legislation authorizing the creation of a national DNA database was enacted by Congress in 1994.[32] Since then, the usage of DNA databases has increased as federal statutes have expanded the scope of collection by including anyone arrested under the authority of the United States into the national database (known as the Combined DNA Index System, or CODIS), which also includes DNA profiles of offenders convicted of state and local crimes. CODIS is specifically comprised of the Local DNA Index System (LDIS), State DNA Index System (SDIS) and National DNA Index System (NDIS).[33] Varying across states, DNA samples from certain types of arrestees and convicted offenders are included in these databases, with many states increasing the number of classifications of offenders added to these databases. The National Conference of State Legislatures (NCSL) lists 49 states as establishing DNA profiles for all convicted felons[34] and 27 states having authorized this for certain classifications of arrestees.

In response to certain arrestees' genetic information being entered into the database system without the individuals being convicted of any crime, Fourth Amendment and privacy debates have arose, prompting judicial hearings that ruled samples may be added to a DNA database if probable cause exists.[35] Despite this contention, state legislation expanding DNA databases to include new categories of offenders is passed every year. The expansion of these databases has allowed investigators to more effectively leverage the potential of DNA analysis and, consequently, increasingly integrate DNA analysis into their practices.

[32] 42 U.S.C 14132(a)

[33] In order to make their DNA profiles nationally searchable, states must adhere to quality assurance standards mandated by the FBI.

[34] Idaho has not adopted this policy. The NCSL considers California to have the most expansive program concerning the collection of information on convicted criminals because it creates DNA profiles for all convicted felons and offenders of misdemeanors.

[35] These hearings occurred in Maryland, Minnesota and Tennessee. In *Maryland v.* King, the Supreme Court ruled that the collection of DNA profiles from arrestees is constitutional.

The rising demand for greater capacity for DNA analysis by policy-makers and criminal justice professionals is reflected by increases in federal funding opportunities that are available to state and local laboratories through the Justice for All Act.[36] These initiatives include: expanding the capacity of state and local labs to analyze DNA samples,[37] supporting the analysis of DNA samples by medical professionals in order to treat victims of sexual crimes (e.g. sexual assault examination programs)[38] and supporting post-conviction DNA testing efforts.[39]

DNA profiling is intended to increase the efficiency and accuracy of investigations and trials by comparing the DNA of potential offenders with crime scene evidence, effectively increasing the probability of accurate conviction. As DNA profiling and analysis technologies develop and the use of databases in criminal investigations increases, offenders will be further incentivized to avoid being charged with a crime that would require their DNA profile be shared with CODIS. The furthering of collection and analysis technologies, together with the expansion of potential profiles through state legislation, are establishing DNA profiling as an essential tool of the criminal justice system. However, little research has been produced on how this technology affects criminal behavior.

[36] H.R. 5107, Public Law 108-405

[37] The Debbie Smith Act of 2004—42 U.S.C.A. §§ 14136(a) through (d); $151 million appropriated to the attorney general for grants under subsection (a) for each of fiscal years 2009 through 2014

[38] The DNA Sexual Assault Justice Act of 2004—42 U.S.C. 14136(e); $30 million is appropriated for each of fiscal years 2009 through 2014

[39] The Innocence Protection Act of 2004 (Kirk Bloodsworth Post-Conviction DNA Testing Program)—42 U.S.C. 14136(e); $5 million is appropriated for each of fiscal years 2005 through 2014

CHAPTER II

METHODS

Data Overview

This paper uses data from the Bureau of Justice Statistics' (BJS) State Court Processing (SCP) Statistics 1990-2009 database to identify how DNA collection legislation affects defendants' plea negotiation behavior. The SCP Statistics are collected every two years, tracking a representative sample of felony cases that are filed in May of each collection year until final disposition.[40] The dataset details several characteristics that determine whether or not a defendant qualifies for DNA collection, as well as when a defendant may qualify for DNA collection.[41] For example, a non-juvenile criminal convicted of a felony in Alabama would have their DNA collected at incarceration after 1994, but someone (regardless of age) would have their DNA collected upon conviction if their conviction offense was categorized as a sex offense in Arizona in 1993. The inclusion of details concerning adjudication outcome (e.g. guilty plea and dismissal/acquittal) allows us to identify the relationship between the threat of DNA collection and plea outcomes. The dataset also includes demographic information, the number of prior arrests and convictions (as well as what these charges were) and the type of attorney representing the defendant.

[40] Or for one year, whichever comes first.

[41] Most serious conviction charge, most serious conviction category, most serious conviction offense, most serious arrest charge, most serious arrest category, adjudication type, adjudication category, sentencing outcome, incarceration outcome, age and year of arrest.

DNA collection qualification was determined by whether an individual case included every characteristic necessary for qualification at time of arrest (May of arrest year). Consider the two examples given above for reference. The dataset does not contain specific variables for certain factors that determine qualification (e.g. whether a charge was a sex offense, or arson). In response to this, specific variables were created in order to represent these characteristics when assessing DNA qualification through a similar approach used by Agan (2013) in order to identify sex offender registrable offenses. The control for all DNA qualified cases are those cases that did not qualify for DNA collection upon the individual's arrest. Explicitly stated: if an individual was arrested under circumstances that did not qualify for DNA collection prior to an effective

Table 1: Summary of BJS SCPS Data (Mean & Std. Dev.)

(a) Case Covariates	DNA Eligible	DNA Ineligible
Black	0.44 (0.50)	0.48 (0.50)
White	0.37 (0.48)	0.36 (0.48)
Hispanic	0.23 (0.42)	0.20 (0.40)
Other Race	0.02 (0.16)	0.02 (0.14)
Race Type Missing	0.16 (0.37)	0.14 (0.34)
Age of Defendant	35.35 (65.29)	38.82 (94.44)
Private Attorney	0.16 (0.37)	0.10 (0.30)
Public Attorney	0.41 (0.49)	0.35 (0.47)
Assigned Attorney	0.15 (0.36)	0.09 (0.29)
Other Attorney	0.001 (0.03)	0.002 (0.04)
Attorney Type Missing	0.27 (0.44)	0.46 (0.50)
Male	0.84 (0.37)	0.83 (0.38)
Female	0.16 (0.37)	0.17 (0.37)
Gender Type Missing	0.001 (0.03)	0.004 (0.07)
No Prior Fel. Conv.	0.59 (0.49)	0.57 (0.50)
More than 4 Prior Fel. Conv.	0.08 (0.27)	0.05 (0.23)
Prior Fel. Conv. Missing	0.03 (0.17)	0.07 (0.26)
(b) Adj. Outcomes by Case Type	DNA Eligible	DNA Ineligible
Dismissal	0.22 (0.42)	0.23 (0.42)
Trial Acquittal	0.01 (0.10)	0.01 (0.09)
Trial Conviction	0.03 (0.17)	0.04 (0.19)
Guilty Plea	0.53 (0.50)	0.55 (0.50)
Pending	0.13 (0.33)	0.11 (0.31)
Missing	0.03 (0.16)	0.02 (0.13)
(c) Guilty Plea Types by Charge	DNA Eligible	DNA Ineligible
Same Charge	0.36 (0.48)	0.38 (0.49)
Diff. Charge (Misd.)	0.10 (0.29)	0.11 (0.32)
Diff. Charge (Fel.)	0.08 (0.27)	0.06 (0.24)

date of legislation that would require collection under those conditions, then this analysis does not consider those defendants as facing the threat of database entry during plea negotiations. The data includes 24,520 cases in which the defendant was arrested under conditions that determined the individual to be subject to the threat of database inclusion, or "DNA eligible," and 80,895 cases in which defendants were not DNA eligible. Table 1 includes summary statistics for demographic characteristics of defendants (1a), as well as adjudication outcomes (1b), for defendants that are and are not DNA eligible. The table also details charge outcomes, conditional on the defendant pleading guilty. As indicated by the potential for defendants to enter a plea negotiation, offenders do not necessarily face the same conviction charge that they were subject to during arrest. The BJS data details both arrest and conviction offenses and charges, allowing for an intuitive distinction between sentence and charge bargaining to be made. Considering our previously stated definitions of charge and sentence bargaining, it is reasonable to assume that an individual that is convicted under a different charge (felony or misdemeanor) and pled guilty negotiated a charge bargain with their counsel. Similarly, we could assume that a sentence bargain was negotiated if the conviction and arrest charges are equal (conditional on a guilty plea). Table 1c shows the distribution of these cases across the cases in which the defendant was and was not DNA eligible.

Empirical Analysis

This paper considers the effect of DNA databases and of DNA criminal profiling on plea behavior by estimating how negotiation behavior by a defendant charged with some crime under a given set of conditions changed after legislation went into effect that required an individual charged with the same crime (under the same conditions) to have their DNA sample collected,

processed and entered into a database. We are not able to rely on within-year-state variation across cases because the dataset only includes cases filed in May and would either qualify for collection or not, i.e. the variation in DNA eligibility occurs at the state-year level. Including these fixed-effects would control for variation such that the only variation present in a given year (in a given state) would be differences among those charged with different crimes. This is problematic since those defendants charged with DNA eligible crimes are inherently different than those charged with crimes for which the defendant is ineligible for DNA collection.

A difference-in-differences identification strategy controls for all within state-year shocks to negotiation behavior that equally affect all defendants by estimating how plea bargaining changes for DNA eligible defendants after legislation goes into effect relative to how this behavior changed for those that are not required to submit a DNA sample for their arrest charge. The treatment group consists of defendants charged with some crime under a given set of conditions at arrest that requires them to have their DNA sample collected if convicted of their arrest charge, while the control group is those defendants with arrest charges and conditions that would not qualify them for database entry if convicted of that charge. Thus, the DD estimation equation[42] is:

$$\Pr(Plea_{it}) = \beta_1\left(DNAEligible_{i,s,t}\right) + \beta_2 X_i + \gamma_s + \varepsilon_{i,s,t} \quad (1)$$

Such that *i* indexes cases, *s* indexes states and *t* indexes year. $DNAEligible_{s,t}$ is an indicator variable that defines whether the case was DNA eligible at arrest, X_i is a vector includes demographic characteristics and γ_s is state-fixed effects. $Plea_{i,t}$ is an indicator variable specifying whether a case resulted in a guilty plea,[43] and the model estimates the effect of DNA qualifying

[42] Estimated using a generalized linear model (GLM).

[43] $Plea_{i,t}$ = 1 regardless of whether the individual plead guilty to the same crime for which they were charged with at arrest.

legislation on the likelihood that a case results in a guilty plea. The difference-in-differences coefficient, β_1, estimates the effect of legislation that qualifies cases for DNA collection[44] on the likelihood of pleading guilty for defendants arrested for qualifying cases relative to those arrested under charges that would not require the individual to submit a DNA profile if convicted of their crimes. Four models, each conditional on a different plea case, are included below. These provide insight into how DNA eligibility influences sentence and charge bargaining outcomes by considering cases in which offense and conviction charges were and were not equal, respectively.

As stated above, we are also interested in what impact DNA collection eligibility may have on a negotiating defendant's perception of sentencing and whether the treat of database entry increases defendant willingness to accept harsher sentencing in exchange for lesser charges that would allow them to avoid database entry. The sentencing effect estimation equation is:

$$Sentence\ Outcome_{i,t,k} = \beta_1\left(DNAEligible_{i,s,t}\right) + \beta_2(X_i) + \gamma_s + \varepsilon_{i,s,t} \qquad (2)$$

such that $SentenceOutcome_{i,t,k}$ measures the type of sentencing, conditional on conviction, for case i that is sentenced to adjudication outcome k.[45] This equation estimates, conditional on a guilty plea, how DNA eligible cases are distributed across sentencing outcomes (probation, jail time and prison time). It is important to note that sentencing is conditional on conviction and that the relationship between conviction and DNA eligibility may reduce the internal validity of these model estimates. However, the findings are useful in that the estimates provide a direct (though not necessarily causal) insight into the relationship between DNA eligibility and sentencing that the model estimating the probability that offenders plead to a crime equivalent to their arrest charge does not allow.

[44] This can be thought of as estimating what effects may result as DNA database eligibility expands.
[45] Sentencing outcomes are categorized by probation, jail time and prison time.

CHAPTER III

RESULTS

Table 2 shows estimates of the described difference-in-differences models, detailing the effect of DNA eligibility on the propensity of a defendant to plead guilty and how they react to DNA eligibility during plea negotiations. The first column simply estimates the probability that the outcome of a given case was determined by the defendant pleading guilty, while the remaining three columns provide estimates for the probability that a defendant agreed to one of our previously defined plea types. The coefficient of interest, the difference-in-differences estimator for DNA eligibility, is significant in all but one of the model estimates. The first model shows that cases in which the defendant is eligible for database inclusion as determined by the conditions of their arrest are 7.1% less likely to end in a plea bargain relative to the control group of offenders whose arrest conditions do not qualify them for DNA eligibility.

Table 2: Difference-in-Difference Results: Effect of DNA Eligibility on Plea Bargains

	(1) Plea	(2) Plea Same	(3) Plea Diff. Fel.	(4) Plea Misd.
DNA Eligibility	-0.071** (.021)	-0.088** (0.035)	0.026** (0.007)	-0.004 (0.022)
Covariates	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

The models estimated in columns (2) through (4) are variations on the initial model, varying by the type of plea bargain a defendant enters, conditional on the case concluding with a guilty plea. The second model considers the probability that an offender's conviction charge, determined by a guilty plea, is equivalent to their arrest charge. As described above, these conditions indicate that the defendant has agreed to a sentence bargain (the prosecutor has agreed to recommend a shorter or less severe sentence for a certain charge to which the defendant has agreed to plead

guilty). The DID coefficient shows that cases in which the defendant faces database inclusion are 8.8% less likely to end in a plea bargain (such that the defendant's arrest and conviction charges are equivalent) relative to offenders that are not DNA eligible, indicating that DNA eligible offenders are less likely to enter into a sentence bargain relative to those that are not eligible. The third model estimates the probability that a DNA eligible defendant pleads guilty to a felony charge that is different than their arrest charge, which we assume to indicate that the defendant entered a charge bargain with the prosecution. The model estimate shows that DNA eligible offenders are 2.6% more likely to plead guilty to a different felony charge relative to those that are not subject to DNA collection and are, therefore, more likely to plead guilty in response to a charge bargain. The last model that would provide alternative insight concerning charge bargaining (since a misdemeanor conviction charge necessarily differs from a felony arrest charge) does not yield positive results.

Identifying what relationship exists between sentencing outcomes determined through plea negotiations and DNA eligibility may help us to understand how defendants and/or the prosecution perceive the relative importance of DNA registration and time spent incarcerated. In addition to conviction charges determining whether an offender's DNA profile will entered into state and national databases, however, the decided sentencing for a defendant shapes DNA eligibility. This relationship proves problematic when seeking to independently understand the effect of DNA eligibility on sentencing outcomes. Furthermore, the ability to differentiate between defendant and prosecutor sentencing preferences is limited. Conditioning estimate interpretations on these considerations, we examine the distribution of DNA eligible cases, conditional on the defendant pleading guilty, across three potential sentencing outcomes: prison time, jail time, or probation. The resulting estimates are shown in Table 3.

Table 3: Difference-in-Difference Results: Effect of DNA Eligibility on Sentencing Outcomes

	(1) Prison	(2) Jail	(3) Probation
DNA Eligibility	0.013 (0.008)	-0.039** (0.013)	-0.028** (0.013)
Covariates	Yes	Yes	Yes
State FE	Yes	Yes	Yes

The DID coefficient in the first estimated model, which considers the probability that a DNA eligible offender that pleads guilty will spend time in jail, is insignificant. However, the model estimates in columns (2) and (3) show that plea negotiating defendants that face database inclusion are 3.9% less likely to spend jail time and 2.8% less likely to be placed on probation.

Robustness

A key assumption that must be met for difference-in-differences identification to be internally valid is common pre-treatment trends in the various response variables shared by the DNA eligible (treatment) and ineligible (control) groups. In other words, the DID coefficient must be shown to be unbiased. Consider the model that estimates the probability that a defendant pleads guilty: there may exist varying levels of the error term across states as new DNA profiling legislation is passed, but this must be random in terms of the change in the error term for the common pre-treatment trends assumption to be met.

For now, consider another threat to validity in that legislation, and perhaps general popular perception of DNA profiling technologies, may have a placebo effect on defendant behavior.[46] For example, a controversial bill could be passed in early 1999 that would greatly expand the population of offenders that qualify for database inclusion, but would not go into effect until January 1, 2000. During the time between the bill being passed and its effective dates, defendants

[46] Any placebo effect on prosecutors is likely to be small since this population is most likely to be knowledgeable of effective dates for this legislation.

may incorrectly understand whether or not they are eligible to be profiled. To test for the presence of this placebo effect, the same estimates listed in Table 2 and Table 3 were produced with lead DNA eligible variables, artificial indicators that apply treatment (eligibility) to the treatment group prior to the actual effective date of legislation.

Table 4: Difference-in-Difference Results: Placebo (Leading) DNA Eligible Effect

	(1) Plea	(2) Plea Same	(3) Plea Diff. Fel.	(4) Plea Misd.
DNA Elig. Lead(t-1)	-0.023 (0.015)	-0.019 (0.016)	-0.005** (0.002)	-0.002 (0.011)
DNA Elig. Lead(t-2)	-0.020 (0.012)	-0.018 (0.014)	-0.006** (0.002)	-0.003 (0.010)
DNA Elig. Lead(t-3)			-0.003 (0.002)	
	(1) Prison	(2) Jail	(3) Probabtion	
DNA Elig. Lead(t-1)	0.004 (0.007)	-0.010* (0.006)	-0.011 (0.010)	
DNA Elig. Lead(t-2)	0.005 (0.006)	-0.010 (0.006)	-0.009 (0.009)	
Covariates	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Table 4 shows that there does not exist any significant placebo effect on defendants besides what effect exists with regard to the relationship between DNA eligibility and the defendant pleading guilty to a felony charge that is different from the charge under which they were arrested. However, the estimate is shown to be relatively small.

CHAPTER IV

CONCLUSION

Plea bargaining generally decreased for defendants whose arrest conditions qualified them for potential inclusion in state and national DNA criminal database compared to those ineligible for database inclusion. However, the effect of DNA eligibility on plea bargaining behavior varied across plea outcomes. Conditional on a guilty plea, a case was less likely to end with equivalent arrest and conviction offenses (sentence bargaining) and more likely to end in the defendant pleading to a different felony offense than that with which they were charged at arrest (charge bargaining) when the defendant is required to consider the impact of their potential DNA profiling during plea negotiations.

The estimates detailed provide evidence that plea bargaining is used defendants and/or prosecutors to assist offenders in avoiding being DNA profiled and included in criminal justice databases. Following legislation expanding database eligibility, newly treated populations are estimated to be less likely to accept a sentencing bargain and more likely to accept a charge bargain, relative to ineligible populations and conditional on pleading guilty. This implies that defendants that are eligible and plead guilty, as well as prosecutors, collectively place less emphasis on shortening and/or lessening sentences, while being more likely to negotiate different (and often less severe) charges that may allow offenders to avoid collection. In the BJS State Court Process Statistics, 24,520 cases qualified defendants for DNA collection, but only 9,358 were convicted of crimes that ensured the offender would be profiled. It is important to keep in mind that, within the time frame detailed by the dataset, most passed legislation qualified offenders for inclusion upon conviction or incarceration. In recent years, legislation has trended

towards expanding eligibility for many groups so that offenders are eligible for collection upon arrest. Inclusion in databases is likely to affect the behavior of criminals following their release from incarceration (or probation), e.g. propensity for recidivism conditional on database inclusion.

REFERENCES

1. (2012) 42 USC § 14132 - Index to facilitate law enforcement exchange of DNA identification information.
2. Agan, A. Y. (2011). "Sex offender registries: Fear without function?" Journal of Law and Economics **54**(1): 207-239.
3. Agan, A. Y. (2013). "Sex Offender Registration and Plea Bargaining (Working Paper)."
4. Albonetti, C. A. (1997). "Sentencing under the federal sentencing guidelines: Effects of defendant characteristics, guilty pleas, and departures on sentence outcomes for drug offenses, 1991-1992." Law and Society Review: 789-822.
5. Bar-Gill, O. and O. Gazal (2005). Plea bargains only for the guilty. American Law & Economics Association Annual Meetings, bepress.
6. Bebchuk, L. A. (1984). "Litigation and settlement under imperfect information." rand Journal of Economics **15**(3): 404-415.
7. Bjerk, D. (2005). "Making the Crime Fit the Penalty: The Role of Prosecutorial Discretion under Mandatory Minimum Sentencing*." Journal of Law and Economics **48**(2): 591-625.
8. Bowers, J. (2007). "Punishing the innocent."
9. Britt, C. L. (2000). "Social context and racial disparities in punishment decisions." Justice Quarterly **17**(4): 707-732.
10. Brown, M. P. and S. E. Bunnell (2006). "Negotiating Justice: Prosecutorial Perspectives on Federal Plea Bargaining in the District of Columbia." Am. Crim. L. Rev. **43**: 1063.

11. Burke, A. S. (2007). "Prosecutorial passion, cognitive bias, and plea bargaining." Marq. L. Rev. **91**: 183.
12. Bushway, S. D. and A. M. Piehl (2007). "Social science research and the legal threat to presumptive sentencing guidelines." Criminology & Public Policy **6**(3): 461-482.
13. Champion, D. J. (1989). "Private counsels and public defenders: A look at weak cases, prior records, and leniency in plea bargaining." Journal of Criminal Justice **17**(4): 253-263.
14. DA SILVEIRA, B. S. (2012). "BARGAINING WITH ASYMMETRIC INFORMATION: AN EMPIRICAL STUDY OF PLEA NEGOTIATIONS."
15. Dervan, L. E. (2013). "The Innocent Defendant's Dilemma: An Innovative Empirical Study of Plea Bargaining's Innocence Problem." Journal of Criminal Law and Criminology **103**(1): 1.
16. Devers, L. (2011). Plea and Charge Bargaining: Research Summary. B. o. J. Statistics. Arlington, VA, USA, CSR, Incorporated.
17. Dixon, J. (1995). "The organizational context of criminal sentencing." American Journal of Sociology: 1157-1198.
18. Doleac, J. L. (2012). The effects of DNA databases on crime.
19. Engen, R. L. and R. R. Gainey (2000). "MODELING THE EFFECTS OF LEGALLY RELEVANT AND EXTRALEGAL FACTORS UNDER SENTENCING GUIDELINES: THE RULES HAVE CHANGED*." Criminology **38**(4): 1207-1230.
20. Farnworth, M. and J. Teske, Raymond HC (1995). "Gender differences in felony court processing: Three hypotheses of disparity." Women & Criminal Justice **6**(2): 23-44.

21. Finkelstein, M. O. (1975). "A statistical analysis of guilty plea practices in the federal courts." Harvard Law Review: 293-315.

22. Forst, B. and K. B. Brosi (1977). "A theoretical and empirical analysis of the prosecutor." The Journal of Legal Studies **6**(1): 177-191.

23. Goodman, J. C. and P. Porter (2002). "Is the criminal justice system just?" International Review of Law and Economics **22**(1): 25-39.

24. Grossman, G. M. and M. L. Katz (1983). "Plea bargaining and social welfare." The American Economic Review **73**(4): 749-757.

25. James, N. (2011). DNA Testing in Criminal Justice: Background, Current Law, Grants and Issues. C. R. Service.

26. Johnson, B. D. (2003). "RACIAL AND ETHNIC DISPARITIES IN SENTENCING DEPARTURES ACROSS MODES OF CONVICTION*." Criminology **41**(2): 449-490.

27. Kellough, G. and S. Wortley (2002). "Remand for plea. bail decisions and plea bargaining as commensurate decisions." British Journal of Criminology **42**(1): 186-210.

28. King, N. J., et al. (2005). "When process affects punishment: Differences in sentences after guilty plea, bench trial, and jury trial in five guidelines states." Columbia Law Review: 959-1009.

29. Kurlychek, M. C. and B. D. Johnson (2010). "JUVENILITY AND PUNISHMENT: SENTENCING JUVENILES IN ADULT CRIMINAL COURT*." Criminology **48**(3): 725-758.

30. Kuziemko, I. (2006). "Does the threat of the death penalty affect plea bargaining in murder cases? Evidence from New York's 1995 reinstatement of capital punishment." American Law and Economics Review **8**(1): 116-142.

31. Landes, W. M. (1971). "Economic Analysis of the Courts, An." JL & econ. **14**: 61.

32. Lee, S.-H. (2005). "The scales of justice: balancing neutrality and efficiency in plea-bargaining encounters." Discourse & Society **16**(1): 33-54.

33. Ma, Y. (2002). "Prosecutorial discretion and plea bargaining in the United States, France, Germany, and Italy: A comparative perspective." International Criminal Justice Review **12**(1): 22-52.

34. Meyer, J. and T. Gray (1997). "Drunk drivers in the courts: Legal and extra-legal factors affecting pleas and sentences." Journal of Criminal Justice **25**(2): 155-163.

35. Reinganum, J. F. (1988). "Plea bargaining and prosecutorial discretion." The American Economic Review: 713-728.

36. Rhodes, W. M. (1976). "The economics of criminal courts: A theoretical and empirical investigation." The Journal of Legal Studies **5**(2): 311-340.

37. Steffensmeier, D. and S. Demuth (2000). "Ethnicity and sentencing outcomes in US federal courts: Who is punished more harshly?" American Sociological Review: 705-729.

38. Steffensmeier, D. and S. Demuth (2001). "ETHNICITY AND JUDGES'SENTENCING DECISIONS: HISPANIC-BLACK-WHITE COMPARISONS." Criminology **39**(1): 145-178.

39. Steffensmeier, D. and C. Hebert (1999). "Women and men policymakers: Does the judge's gender affect the sentencing of criminal defendants?" Social Forces **77**(3): 1163-1196.

40. Steffensmeier, D., et al. (1993). "Gender and imprisonment decisions." Criminology **31**(3): 411-446.

41. Stuntz, W. J. (2004). "Plea bargaining and criminal law's disappearing shadow." Harvard Law Review: 2548-2569.

42. Thaxton, S. (2012). "Leveraging Death." Journal of Criminal Law and Criminology, Forthcoming.

43. Ulmer, J. T. and M. S. Bradley (2006). "VARIATION IN TRIAL PENALTIES AMONG SERIOUS VIOLENT OFFENSES*." Criminology **44**(3): 631-670.

44. Weimer, D. L. (1978). "Plea bargaining and the decision to go to trial: The application of a rational choice model." Policy Sciences **10**(1): 1-24.