Is a Plea Really a Bargain?

Evidence from the Chinese Criminal Justice System

Yupei Ma*

Abstract

This paper studies the effect of plea bargaining on sentencing outcomes in China. By exploring the staggered rollout of plea bargaining across courts from 2014 to 2020, I find that plea bargaining reduces average sentence lengths. However, a heterogeneity analysis suggests substantial dispersion in court-level treatment effects. Consistent with theoretical predictions, sentencing uncertainty at trial, prosecutors' caseload, and the local prevalence of privately retained attorneys are important factors driving the dispersion.

*University of British Columbia (UBC), Email: mayupei39@gmail.com. I thank Marit Rehavi, Siwan Anderson and Matt Lowe for their invaluable guidance and mentorship. This project also benefited from comments from Patrick Francois, Sam Norris, Raffaele Saggio, and seminar participants at UBC. This research was undertaken, in part, thanks to funding from the Canada Excellence Research Chairs program awarded to Dr. Erik Snowberg in Data-Intensive Methods in Economics.

1 Introduction

Plea bargaining, a process in which defendants forego a trial and plead guilty, often in return for a concession from prosecutors or the court, is a common form of case resolution worldwide. In 2015, 66 out of 90 surveyed countries had some form of plea bargaining system in place (Russell and Hollander, 2017). In the United States, over 90% of federal criminal cases are resolved through plea bargaining (Motivans, 2022).

Despite its widespread use, relatively little is known about the effect of plea bargaining on sentencing outcomes. Theoretical predictions vary widely depending on assumptions about individual preferences, resource constraints, the information structure of the game, and often turn on the relative values of unestimated parameters (Landes, 1971; Grossman and Katz, 1983; Bebchuk, 1984; Priest and Klein, 1984; Reinganum, 1988; Baker and Mezzetti, 2001; Kim, 2010; Lee, 2014; Jordan, 2020). Empirical research, mostly based on the United States, suffers from several challenges. Most notably, defendants and prosecutors strategically and endogenously select into plea agreements based on largely unobserved information, making direct comparisons between sentences received via guilty plea and conviction at trial problematic without a strong research design.

I address this issue by examining a policy experiment conducted in China. Unlike in the United States, plea bargaining was not practiced in the Chinese criminal justice system until recently. In 2014, China implemented a policy experiment on plea bargaining in 18 pilot cities in response to rising caseloads. Courts in non-pilot regions first had a staggered rollout of plea bargaining on a voluntary basis, and later transitioned to mandatory adoption after it was formally incorporated into the criminal procedure law in 2018. The introduction and geographical rollout of plea bargaining provide an excellent setting to investigate the causal effect of plea bargaining on sentencing outcomes.

To systematically examine the impact of various parameters on bargaining outcomes, I begin by presenting a Nash bargaining model that highlights two parties' bargaining considerations

and bargaining power. In this model, both prosecutors and defendants compute a plea offer that makes them indifferent between accepting the plea deal and going to trial (henceforth, *trial equivalent offer*). A plea deal is reached if and only if the prosecutor's trial-equivalent offer is lower than the defendant's, ensuring both parties can achieve a positive surplus from the settlement. The exact sentence from the plea deal is determined from a Nash bargaining problem with asymmetric bargaining power. The model makes 3 key predictions: 1) due to the defendant's risk aversion, the plea offer increases with sentencing uncertainty at trial; 2) higher trial costs for prosecutors result in more favourable plea deals for defendants; and 3) defendants secure better plea deals when they possess greater bargaining power. These predictions will guide my analysis of heterogeneous treatment effects in plea bargaining in the empirical work.

Using the staggered rollout of plea bargaining at the court level, I empirically examine the effect of plea bargaining in a two-way fixed-effects event study framework. Data used in my analysis come from criminal verdicts written by judges. Beginning in 2014, all courts in China are responsible for uploading judicial decisions to the website "China Judgment Online". The verdicts contain detailed documentation of the case details and sentence outcomes, such as the defendants' demographics, crime descriptions, judging dates, court names, incarceration lengths, and whether a case is resolved by plea bargaining. I web-scraped all the criminal verdicts from county-level courts between 2014 and 2020 and developed a rule-based regular expression algorithm to extract information on case features. The final dataset contains 4.9 million criminal cases from 2,311 courts.[1]

I find that sentences decrease by 7%, on average, after the introduction of plea bargaining. However, estimates of court-level treatment effects suggest substantial heterogeneity: the standard deviation of court-level treatment effects in the second year following the adoption is 30%, with 8% (17%) of courts having treatment effects significantly higher (lower) than 0 at the 95% confidence interval.

[1]The raw dataset contains 5.5 million criminal cases. To work on a balanced panel, I only include courts that uploaded at least one case in each quarter-year. This drops courts that were opened or closed between 2014 and 2020 or those that did not upload cases consistently.

To understand the sources of the high dispersion in effects across courts, I examine whether the key parameters in the theoretical model can explain the empirical treatment effect dispersion. Sentencing uncertainty at trial, the prosecutor's trial cost, and the defendant's bargaining power are measured by the standard deviation of residualized sentences, the prosecutor's caseload, and the local prevalence of privately retained attorneys at the court level, using cases tried pre-plea bargaining. Consistent with model predictions, I find that sentencing uncertainty at trial, the prosecutor's trial cost, and the defendant's bargaining power all contribute to the treatment effect dispersion. A higher caseload and a higher prevalence of privately retained attorneys lead to lower sentences, while greater sentencing uncertainty at trial results in less favourable deals for defendants.

This paper contributes to the literature that investigates the sentencing effects of plea bargaining. Most papers focus on the United States and rely on direct comparisons between sentences received via guilty plea and conviction at trial (Rhodes, 1979; Uhlman and Walker, 1979; Brereton and Casper, 1981; Smith, 1986; Metcalfe and Chiricos, 2018; Kutateladze and Lawson, 2018; Yan, 2022). Abrams (2011) and Silveira (2017) explore exogenous variations for identification but find opposite results. Using the staggered rollout of the introduction of plea bargaining in China, I provide new evidence based on causal identification. Additionally, I delve into heterogeneity and examine the mechanisms by combining the introduction of plea bargaining with variations in pre-existing court-level characteristics. The high dispersion of the court-level treatment effects suggests that extrapolating empirical results from one context to another should be approached with caution.

This paper is also related to the literature on the criminal justice system in China. Due to data limitations, there is not much empirical research that studies the criminal justice system in China. This paper creates novel and comprehensive administrative data for criminal cases in China. To the best of my knowledge, there are only a few papers that use the same data source, most of which focus on civil cases or a specific type of criminal case (Liu et al., 2022a,b; Chen et al., 2022; Hou and Truex, 2022; Hu et al., 2024). My analysis of plea bargaining also provides

insights into how the rule of law operates in ordinary (non-political) criminal cases in China. The fact that I find that both the defendant's and prosecutor's bargaining considerations matter suggests that there is at least some degree of judicial independence in China.

2 The Model

I develop a Nash bargaining model that highlights the two parties' bargaining considerations and bargaining power. To accommodate a setting where plea bargaining is newly introduced, I allow defendants to be initially skeptical of the promises made by prosecutors and conceptually model the progression of plea rates as defendants update their beliefs regarding the system's trustworthiness over time. In a plea bargaining system that has reached a steady state, common explanations for imperfect plea rates include assumptions that defendants and/or prosecutors hold misbeliefs about trial outcomes (Priest and Klein, 1984) or face information asymmetry (Bebchuk, 1984; Reinganum, 1988). In Appendix A3, I present a model adapted from Priest and Klein (1984), which yields comparative statics similar to those of my baseline model.

2.1 Actors' Choice

The case can be resolved by either plea bargaining or a formal trial. Prior to the trial, the defendant (he) has the opportunity to plead guilty and agree to the plea sentence $\widehat{S}$ offered by the prosecutor (she). I assume the plea offer is determined through a Nash bargaining process with asymmetric bargaining power. If a plea agreement is not reached, the case will proceed to trial, where the sentence is drawn from a distribution function $F(S)$. The average sentence at trial is denoted as $\overline{S}$ ($\int SdF(s) = \overline{S}$).

2.2 Prosecutor's Problem

A risk-neutral prosecutor's expected utility at trial is given by

$$EU_p^{trial} = \int SdF(S) - C_p = \overline{S} - C_p. \tag{1}$$

It increases with the average trial sentence and decreases with the trial cost C_p ($C_p > 0$). C_p reflects the resources and time needed for the prosecutor to take a case to trial.

The prosecutor's utility with plea deal $\widehat{S}$ is

$$U_p^{plea}(\widehat{S}) = \widehat{S}. \tag{2}$$

Thus, the prosecutor will accept the deal $\widehat{S}$ if and only if

$$U_p^{plea}(\widehat{S}) \geq EU_p^{trial} \Longrightarrow \widehat{S} \geq \overline{S} - C_p = \widehat{S_p}, \tag{3}$$

where $\widehat{S_p}$ is the plea deal that makes the prosecutor indifferent between a trial and a plea settlement (henceforth, prosecutor's trial equivalent offer). Note that since the prosecutor has a non-negative trial cost, her trial equivalent offer $\widehat{S_p}$ is smaller than the average trial sentence $\overline{S}$ ($\widehat{S_p} < \overline{S}$). This shows that the prosecutor is willing to make some concessions in the plea negotiation.

2.3 Defendant's Problem

The defendant is risk-averse and his expected utility at trial is

$$EU_d^{trial} = \int U(S)dF(S), \tag{4}$$

where $U^{'}(S) < 0$ and $U^{''}(S) < 0$.

In the first quarter following the introduction of plea bargaining, the average plea rate is only 9%, and this number ramps up to 77% in two years. To reflect the defendant's hesitation at the beginning of the rollout and the progression of plea rates over time, I assume there are two types of defendants - trusting ones ($type_d = trust$) and untrusting ones ($type_d = untrust$) and denote the proportion of trusting defendant in the criminal justice system as ρ, with $\rho = P(type_d = trust)$. Trusting defendants believe that once he settles on the plea deal $\widehat{S}$, he will receive the sentence $\widehat{S}$ with probability one. Untrusting defendants believe that plea bargaining is a system that manipulates defendants to admit their crimes and the court will not keep the promise if the realized trial sentence is higher than the plea deal $\widehat{S}$.

A trusting defendant's utility with plea deal $\widehat{S}$ is

$$U_d^{plea}(\widehat{S}, trust) = U(S), \tag{5}$$

and the trusting defendant accepts the deal $\widehat{S}$ if and only if

$$U_d^{plea}(\widehat{S}, trust) \geq EU_d^{trial} \Longrightarrow \widehat{S} \leq \widehat{S_d}, \tag{6}$$

where $\widehat{S_d}$ is the offer that makes the trusting defendant indifferent (henceforth, the defendant's trial equivalent offer). Because of risk aversion, a trusting defendant will have his trial equivalent offer $\widehat{S_d}$ higher than the average trial sentence $\overline{S}$ ($\widehat{S_d} > \overline{S}$).

An untrusting defendant's expected utility with plea deal $\widehat{S}$ is

$$U_d^{plea}(\widehat{S}, untrust) = F(\widehat{S})U(\widehat{S}) + \int_{\widehat{S}}^{\infty} U(S)dF(S) > \int U(S)dF(S) = EU_d^{trial}. \tag{7}$$

2.4 Model Solution

2.4.1 Plea Rates

Since $U_d^{plea}(\widehat{S}, untrust) > \int U(S)dF(S) = EU_d^{trial}$ for any $\widehat{S}$, untrusting defendants will never plead guilty.

For trusting defendants, since $\widehat{S}_p < \overline{S} < \widehat{S}_d$, conditions (3) and (6) are satisfied for any $\widehat{S} \in \left[\widehat{S}_p, \widehat{S}_d\right]$. Since there exist plea deals that give both parties a positive surplus from the plea settlement, a plea will always be reached with trusting defendants. This is intuitive because both parties have an incentive to settle on a plea deal to avoid trial costs or sentencing uncertainty at trial. Thus, plea rate $= \rho$.

Progression of Plea Rates Over Time The plea rates in the Chinese justice system progressed rapidly following the rollout, increasing from 9% in the first quarter to above 75% two years after adoption. In 2023, the plea rate has reached over 90%. I do not model this progression formally. However, we can conceptually think about this progression as untrusting defendants updating their beliefs throughout time. In practice, judges and prosecutors kept their promises in more than 95% of plea deals.[2] The untrusting defendants observe this outcome and update their beliefs accordingly over time. Thus, we see an increasing proportion of trusting defendants and a higher plea rate.

2.4.2 Effects on Sentencing

The exact value of the plea deal between the trusting defendant and the prosecutor is determined by the Nash bargaining problem

$$\max_{S^*} [U_d^{plea}(S^*, trust) - EU_d^{trial}]^{\alpha} \times [U_p^{plea}(S^*) - EU_p^{trial}]^{1-\alpha}, \tag{8}$$

where $\alpha \in [0,1]$ represents the defendant's bargaining power.

[2] Source: 2023 Work Report of the Supreme People's Procuratorate. https://www.gov.cn/xinwen/2023-03/17/content_5747234.htm

Plea bargaining's effect on the average sentence (the post - pre change in the average incarceration length) is

$$\Delta S = (S^*(\alpha, U(), F(), C_p) - \overline{S}) \times \text{Plea rate} + 0 \times (1 - \text{Plea rate}) \tag{9}$$

$$= (S^*(\alpha, U(), F(), C_p) - \overline{S}) \times \rho \tag{10}$$

where $S^*(\alpha, U(), F(), C_p)$ is the value of the plea deal and $\overline{S}$ is the average trial sentence. I focus on plea bargaining's effect on the average sentence instead of its effect on those who plead guilty to circumvent the selection issue in the empirical analysis.[3] The measurement of ΔS only requires capturing the post-pre difference in the average sentence, without the need to explicitly pin down the types of defendants taking plea deals, and it corresponds to the "Diff-in-Diff" estimates in the empirical analysis. The sign of ΔS is ambiguous because it is unclear whether the plea deal is higher or lower than the trial sentence. It can be any value between $\widehat{S}_p$ and $\widehat{S}_d$, and depends on multiple parameters such as the defendant's risk aversion, the sentence distribution at trial ($F(S)$), the prosecutor's trial cost (C_p), the defendant's bargaining power (α), etc.

2.5 Comparative Statics

I derive three comparative statics on ΔS, focusing on variations that can be empirically measured in my data. I provide mathematical proofs for these predictions in Appendix A2.

Sentencing Uncertainty at trial (assuming a mean preserving spread)

Higher sentencing uncertainty at trial leads to a higher ΔS. Risk-averse defendants have a higher certainty equivalent as uncertainty increases, making them more eager to settle on a plea and agree to less generous plea deals.

[3] I do not explicitly model the differences between trusting and untrusting defendants. However, defendants who choose to trust the policy at the initial stage may differ from those who are untrusting. They may commit different crimes, have different social statuses and educational backgrounds, etc. Thus, the counterfactual sentencing outcomes may vary between trusting and untrusting defendants, creating a selection issue.

Prosecutor's Trial Cost (C_p)

When the prosecutor's trial cost increases, ΔS decreases. When C_p rises, the prosecutor has a stronger incentive to avoid trial and is therefore more willing to make concessions in plea bargaining.

Defendant's Bargaining Power (α)

α affects how the surplus is divided. Greater bargaining power makes the plea deal more favourable to defendants (decreasing ΔS).

3 Institutional Background

3.1 Criminal Justice System in China

China's legal system consists of the public security authorities, the People's Procuratorates, and the People's Court. The public security authorities are responsible for the investigation and charging of criminal cases. The People's Procuratorates examine cases charged by the public security authorities and make decisions on the prosecution. In 2013 (prior to the introduction of plea bargaining), the prosecution rate was 4.9%.[4] If a case is prosecuted, and the outcome is not settled by guilty pleas, it will proceed to the People's Court for a formal trial. Conditional on prosecution, the conviction rate at trial is nearly 100% in China, so the uncertainty of the trial outcome mostly comes from the intensive margin (the sentence length) rather than the extensive margin (guilty or innocent). However, plea negotiations can happen at any stage of the process, so plea bargaining can potentially affect conviction by impacting prosecutors' prosecution decisions.

[4] Source: The Past Decade in China: A Series of Thematic News Releases. https://epaper.gmw.cn/gmrb/html/2022-07/19/nw.D110000gmrb_20220719_1-04.htm

3.2 The Introduction of Plea Bargaining in China

The number of criminal cases in China doubled in 15 years from 0.56 million in 2000 to 1.13 million in 2015 (Law Yearbooks of China). Facing an upward trend of caseload, the government introduced plea bargaining in 2014 to expedite the criminal sentencing process. The development of the plea bargaining system in China unfolded in three stages between 2014 and 2018.

Stage One: Speedy Trial Pilot

In June 2014, the Standing Committee of the National People's Congress approved a speedy trial pilot program proposed by the Supreme People's Court and the Supreme People's Procuratorate.[5] The speedy trial pilot was conducted in 18 cities (Figure A1) for roughly two years.[6] Similar to other policy experiments implemented in China, the pilot cities for the "speedy trial" were positively selected in terms of economic development and political status (Wang and Yang, 2021).[7]

As a pilot of plea bargaining, "speedy trial" allowed defendants to plead guilty in exchange for a faster criminal process in 11 types of minor offences and crimes whose incarceration length might be less than one year.[8] Specifically, if the defendant pleads guilty and agrees to the evidence and sentencing recommendation presented by the prosecutor, the prosecutor is expected to make the decision of prosecution within 8 working days, and the judge is required to finalize the trial outcome within 7 working days after the case is received. Although it is not mandatory for the judges to accept the prosecutors' sentencing recommendation, they are expected to do so unless the recommendation is deemed inappropriate.[9]

[5]Prior to the "speedy trial" pilot, defendants who confess their guilt can have their cases tried by a simplified procedure, which allows parties attending the trial to, inter alia, omit the statement on criminal facts, fasten the process of cross-examination, present crucial evidence only, and confine courtroom debate to key issues in dispute (Li, 2022). However, the simplified procedure only requires the defendant's acknowledgment of guilt and does not encompass an agreement on sentences.

[6]The 18 cities are Beijing, Tianjin, Shanghai, Chongqing, Shenyang, Dalian, Nanjing, Hangzhou, Fuzhou, Xiamen, Jinan, Qingdao, Zhengzhou, Wuhan, Changsha, Guangzhou, Shenzhen, and Xi'an.

[7]The average GDP per capita in the pilot cities is 1.66 times of the national GDP per capita in 2020, and 14 out of the 18 pilot cities are either a provincial capital or centrally-administered municipality.

[8]The eleven types of crimes are dangerous driving, traffic accidents, larceny, fraud, intentional assault, robbery, picking quarrels, false imprisonment, drug-related crimes, bribery, and causing a disturbance in public.

[9]95% of sentencing recommendations were accepted by judges in 2020 when plea bargaining has been ex-

Stage Two: Plea Bargaining Pilot

In September 2016, the speedy trial pilot program was transformed into the plea bargaining pilot program in the same 18 cities. The plea bargaining pilot took a similar procedure as "speedy trial" but advanced it in the following aspects: 1) the guideline explicitly mentions that prosecutors are expected to give lenient sentencing recommendations in the plea agreement, whereas only a faster criminal process is guaranteed in the "speedy trial"; 2) the decision on prosecution is included in the scope of negotiation besides sentence negotiations; 3) the plea bargaining pilot extends its scope to all crimes. In the plea bargaining pilot, "Speedy trial" is reserved as an additional option for defendants who plead guilty and whose incarceration length might be lower than three years, and thus can be viewed as a subset of "plea bargaining" cases.

Stage Three: Expansion

In non-pilot regions, courts were allowed to participate voluntarily in the two pilots. Approximately 15% did so mainly due to the attorney general's career incentives or to address the case congestion issue. In October 2018, several articles about plea bargaining, largely inherited from the guidelines of the plea bargaining pilot program, were formally added to the criminal procedure law. The plea bargaining system then became mandatory and was expanded to all non-pilot regions within two years.

4 Data and Descriptive Statistics

4.1 Data

Data on criminal sentencing comes from the website "China Judgment Online" (https://wenshu.court.gov.cn/). Beginning in 2014, all courts in China are responsible for uploading judicial decisions onto this website. These documents are written in a standardized format across provinces and years (Liebman et al., 2020). I web-scraped all criminal verdicts from

panded nationwide. https://www.spp.gov.cn/spp/zdgz/202103/t20210308_511524.shtml

county-level courts between 2014 and 2020 and used a rule-based regular expression algorithm to extract variables on case features.[10] There were 5.5 million criminal cases between 2014 and 2020.

I extract the following variables from the verdicts:

- Defendant's demographics: ethnicity; gender; education; age
- Case facts: date the crime was conducted; date the defendant was caught; date of prosecution; date of trial; crime type; whether the defendant has a lawyer; judge name; court name; whether the case was resolved by plea bargaining and speedy trial
- Aggravating and mitigating factors: criminal history; whether the defendant surrendered; whether the defendant is disabled, deaf or blind, or pregnant; whether the defendant has a mental illness;
- Case outcomes: sentence length; sentence type; whether the defendant receives probation

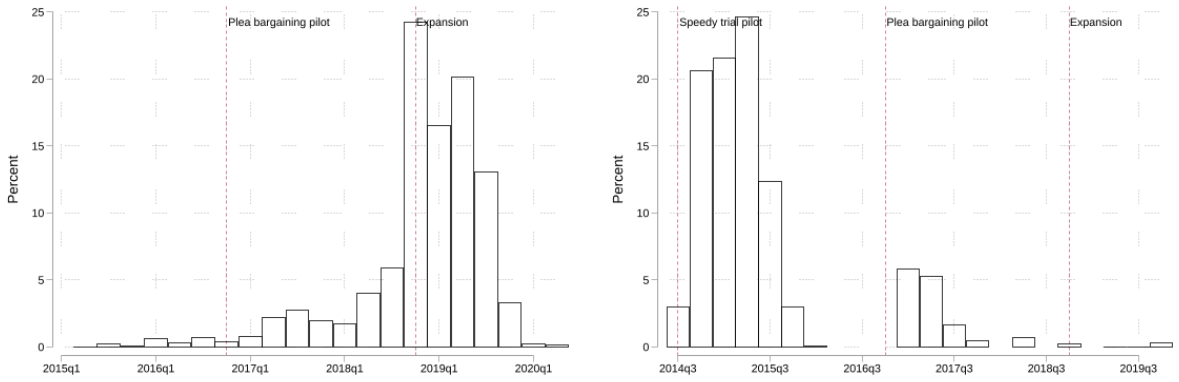
Almost all verdicts have complete information on core variables needed in my analysis, such as the trial date, court name, sentencing outcome, crime type, and whether the case was resolved by a guilty plea. However, some of the defendants' demographics and case details have non-negligible missing rates. Information on gender, age, ethnicity, and education have missing rates of 17% to 33%. In my empirical analysis, I code "missing" as a separate category for discrete variables and impute missing values of continuous variables with the sample average.[11] To validate my parsing algorithm, I randomly select 465 verdicts stratified by province from the data set and manually check the parsing results. Table A1 lists accuracy rates for each variable based on the 465 selected verdicts. 17 out of the 18 variables achieve an accuracy rate higher than 90%.

[10] Criminal cases from county-level courts cover 99% of all criminal cases uploaded online. Cases tried in higher-level courts are high-impact cases such as cases related to terrorism and cases that might receive a death penalty.

[11] I also conduct robustness checks dropping cases with missing values variable by variable.

4.2 Rollout of Plea Bargaining

Even though the two pilot programs and the expansion were announced nationally. The actual time when each local court started the policy varies. I investigate the start time by quarter and record the start quarter for each court as the first quarter with cases being resolved by plea bargaining/speedy trial. Figure 1 plots the distribution of the start quarter for pilot and non-pilot regions separately. We can see that some courts in non-pilot regions voluntarily adopted plea bargaining before the formal expansion.[12] Non-pilot courts have incentives to adopt plea bargaining earlier due to the attorney general's career incentives and/or as a measure to handle the increasing caseload. Table A2 shows that voluntary non-pilot courts (non-pilot courts that adopted plea bargaining before the formal expansion) bear a higher caseload than regular non-pilot courts pre-plea bargaining. In Section 5, I explain how my empirical strategy tackles the issue of selection into early adoption.



(a) Non-pilot Courts (b) Pilot Courts

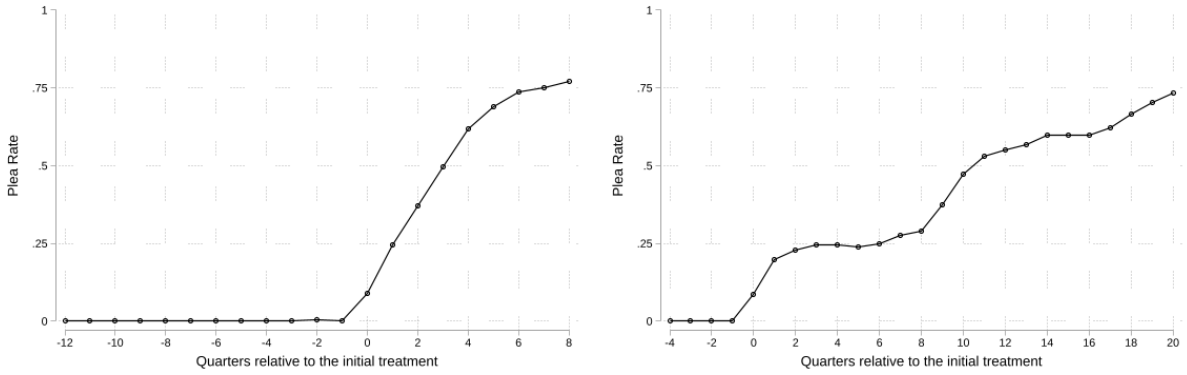
Figure 1: Distribution of the Start Quarter

Notes. These figures plot the distribution of the start quarter of plea bargaining (or speedy trial) for non-pilot and pilot courts separately. The start quarter is defined as the earliest quarter with cases being resolved by guilty pleas and is computed using all criminal cases. Although the decisions about the speedy trial pilot and plea bargaining pilot were made in Q2 2014 and Q3 2016, the guidelines were announced in Q3 2014 and Q4 2016. I consider the latter as the timing of national announcements (red lines).

Figure 2 displays the evolution of rates of guilty pleas by pilot and non-pilot courts. Plea

[12] Voluntary participation is a common phenomenon in Chinese policy experimentations (Wang and Yang, 2021).

bargaining progressed rapidly in non-pilot courts. The rate of guilty pleas reached more than 75% two years after the adoption. For pilot courts, the rate of guilty pleas stayed stably around 25% in the first two years and started to grow again after the transition to the plea bargaining pilot.[13] Given that the policy evolved in different manners for the pilot courts and non-pilot courts, I **focus on non-pilot courts for my main empirical analysis**, as the implementation of plea bargaining is cleaner in this context, and it gives me a much greater number of observations.



(a) Non-pilot Courts (b) Pilot Courts

Figure 2: Evolution of Rates of Guilty Pleas

Notes. These figures plot rates of guilty pleas by quarters relative to the start of plea bargaining or speedy trial for non-pilot and pilot courts separately.

4.3 Case Characteristics

Table 1 presents summary statistics on case characteristics and sentencing outcomes for non-pilot courts before and after the introduction of plea bargaining. For cases with multiple defendants (15%), the summary statistics are done for the first defendant appearing in the verdicts.[14] 8% of defendants are female, and 69% of them at least have a middle school degree. Around 20% of defendants have a criminal history. Most case characteristics are similar before and

[13]The speedy trial pilot only applied to cases whose incarceration lengths might be shorter than one year and the plea bargaining pilot applied to all cases, so the growth may be due to the expansion of the scope of the policy.

[14]The first defendant is the principal offender if applicable.

after the introduction of plea bargaining, except we see some changes in crime compositions, but these differences might simply be driven by time trends. I show the same statistics for pilot courts in Table A3.

The average incarceration length was reduced by about 4% after the introduction of plea bargaining, and incarceration decreased by around 1 percentage points. In Section 5, I investigate if the sentence reduction is (partially) **caused** by plea bargaining.

Table 1: Summary Statistics

	Before		After	
	Mean	S.D.	Mean	S.D.
Panel A: Case Characteristics				
Female	.08	.27	.08	.27
Middle school or Higher	.68	.47	.71	.46
Age	37.92	11.35	39.38	11.5
Minority	.13	.34	.12	.32
Pregenant, disabled, or mental illness	0	.05	0	.04
Single defendant	.85	.36	.86	.35
Multiple crimes	.01	.11	.01	.11
No criminal history	.8	.4	.8	.4
Criminal history (more than 5 years ago)	.09	.29	.1	.3
Criminal history (within five years)	.11	.31	.1	.3
Surrender	.25	.43	.25	.43
Panel B: Crime Types				
DUI	.19	.4	.3	.46
Larceny	.22	.41	.18	.39
Intentional assault	.11	.31	.07	.26
Traffic accident	.09	.29	.07	.26
Drug trafficking	.06	.23	.04	.2
Other crimes	.33	.47	.33	.47
Panel C: Sentencing Outcomes				
Incarceration length (month)	11.19	23.43	10.69	22.83
Incarceration	.58	.49	.57	.49

Notes. This table presents summary statistics for criminal cases in non-pilot regions before and after the introduction of plea bargaining. For cases with multiple defendants, the summary statistics are done for the principal offender. When the defendant commits multiple crimes (1%), the crime type is recorded as the primary crime committed.

4.4 Selection Issue

One limitation of this data is that it only contains cases that are resolved by plea bargaining or trial, but not cases that are dropped (not prosecuted) by prosecutors. This sample selection issue could potentially bias my results because 1) not prosecuting the case is a potential outcome of pleading guilty; 2) the introduction of plea bargaining may alter prosecutors' propensity to prosecute cases as plea bargaining changes prosecutors' and judges' workload (Yang, 2016). They both may lead to unobserved changes in sample compositions but in opposite directions.

In addition, although it became mandatory to upload all judicial decisions online in 2014, judges do not adhere to this practice in reality. The Law Yearbooks of China document 8.15 million criminal trials (excluding appeals) from 2014 to 2020. However, this figure is 5.82 million on China Judgments Online. That is, the uploading rate is around 71%.[15] Table A4 documents the uploading rate by year. Hou and Truex (2019) interview several judges and lawyers who have experience in criminal trials. They conclude that disclosure rates are affected by the local budget, the total number of cases ruled in the court, and the professionalization of the court staff. Sample compositions can also change if plea bargaining affects judges' uploading behaviour. I discuss whether and how these issues bias my results by investigating changes in the number of cases and case severity in Section 5.2.

5 Empirical Analysis

5.1 The Effects of Plea Bargaining

Due to the highly selective nature of plea bargaining, direct comparisons between cases resolved by guilty pleas and proceeding to trial will lead to biased results. The staggered rollout of plea bargaining among non-pilot (or pilot) courts allows me to tackle this issue from a different angle

[15] 0.29 million (5%) uploaded cases have the verdict content hidden and are thus excluded from the empirical analysis. These cases are cases that 1) involve national secrets; 2) involve minors; 3) are resolved by mediation; and 4) other cases that are deemed inappropriate to publicize.

- I estimate the "intent to treat" effect of the introduction of plea bargaining on all sentences in a two-way fixed effect (TWFE) event study framework

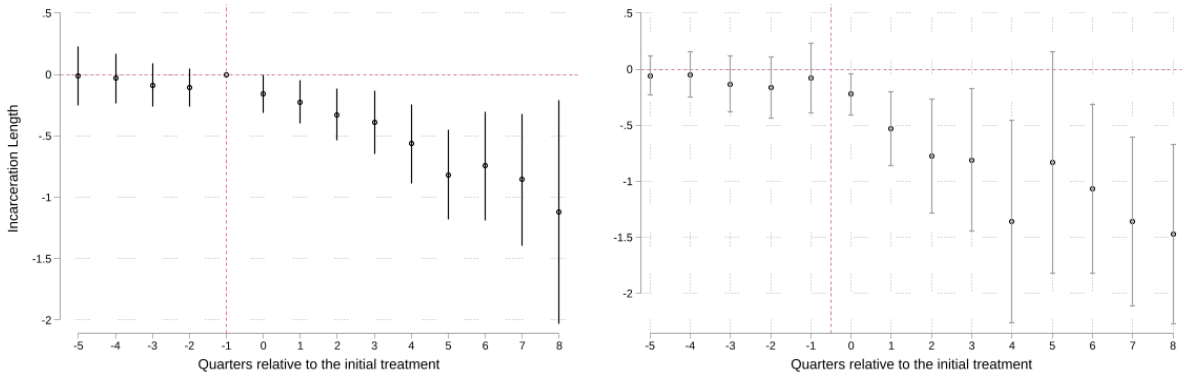
$$y_{ict} = \alpha_c + \gamma_t + \sum_{k=\underline{K},k\neq -1}^{\overline{K}} \beta_k D_{ct}^k + X_{ict}^{'}\eta + \lambda_{crime(i)} + \varepsilon_{ict}, \tag{11}$$

where y_{ict} is the incarceration length for defendant i adjudicated at court c in quarter t. The event dummies are $D_{ct}^k = \mathbf{1}\{t - G_c = k\}$, where G_c indicates the period when court c started to practice plea bargaining. β_k is the effect of plea bargaining k quarters away from the introduction. Note that all defendants are included in my sample, regardless of whether they plead guilty or not, so β_k is the effect of plea bargaining on the average sentence (it corresponds to the ΔS in the theoretical framework), rather than the causal effect of pleading guilty.[16] α_c, γ_t, and $\lambda_{crime(i)}$ are court, quarter and crime type fixed effects. $X_{ict}^{'}$ is a vector of defendant and case characteristics. Standard errors are clustered at the court level. The identification assumption in this framework is that the sentencing patterns in courts that adopted plea bargaining at different times would follow the same trends in the absence of plea bargaining. Voluntary courts may have different characteristics from the rest, but time-unvarying differences in sentencing patterns will be accounted for by the court fixed effects and we can examine the parallel pre-trend assumption through the event study framework.

Figure 3a displays the event study results on incarceration length for non-pilot courts. We can see that the average incarceration length follows a parallel pre-trend and begins to decrease after the adoption, and the effect grows over time as the plea rate increases (Figure 2a). Two years after the adoption, the average sentence is reduced by 1.12 months, which is 10% of the average sentence before the introduction of plea bargaining. Recent work in the TWFE DID

[16] I can estimate the causal effect of pleading guilty through an instrument variable (IV) approach, where $\mathbf{1}\{t \geq G_c\}$ will be used as an instrument for "pleading guilty". However, this approach relies on a stronger identification assumption - the introduction of plea bargaining only affects case outcomes among cases resolved by guilty pleas and does not affect cases that proceed to trial. Given that the introduction of plea bargaining changes the entire criminal procedure dramatically, I do not attempt to defend this assumption and thus mainly investigate the "intent to treat" effect of plea bargaining.

literature shows that the β_k's from the traditional TWFE model cannot be rigorously interpreted as reliable measures of "dynamic treatment effects" if the treatment effects are heterogeneous and the timing of the treatment varies across individuals (De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021; Sun and Abraham, 2021). Figure 3b shows that the results are similar using the estimation and inference procedure developed by Borusyak et al. (2021). I also show that the results are similar in pilot courts and for alternative outcome variables such as incarceration and the inverse hyperbolic sine transformation of incarceration length $log(y_{ict} + (y_{ict}^2 + 1)^{1/2})$ in Figures A2 and A3.



(a) TWFE (b) Borusyak et al. (2021)

Figure 3: Effects on Incarceration Length

Notes. These figures show event study coefficient estimates for plea bargaining's effects on incarceration lengths. Court, quarter, and crime type fixed effects are applied. Controls include dummies for gender, education, minority, single defendant, multiple crimes committed, criminal history, whether surrendered, mitigating factors (pregnant, disabled, or mental illness), and age. The vertical lines represent 95% confidence intervals. Figure 3a uses the conventional two-way fixed effects method. $k \leq -5$ is binned to $k = -5$, and $k \geq 8$ is binned to $k = 8$. Figure 3b applies Borusyak et al. (2021)'s imputation method.

5.2 Changes in Case Severity

As discussed in Section 4.4, plea bargaining may lead to changes in sample compositions by changing prosecutors' propensity to prosecute cases or judges' behaviour in disclosing cases. In a world with 100% disclosure rate, I can directly test plea bargaining's effects on prosecution by analyzing changes in the number of cases. If the number of cases goes up (down), it means

plea bargaining makes prosecutors prosecute more (fewer) cases, which will bias the results in Section 5.1 away from (towards) zero because cases that are on the margin of prosecution are less severe than cases that will be surely prosecuted. However, the imperfect disclosure rates of verdicts by judges diminish the credibility of this approach, as the number of cases is not only affected by the prosecution rate but also the disclosure rate. Therefore, besides investigating changes in the number of cases, I also address this issue by estimating plea bargaining's effect on case severity among prosecuted cases. This serves as a more direct test of changes in sample compositions.

First, I estimate a linear equation on incarceration length using only pre-plea bargaining cases

$$y_{ict} = \alpha_c + \gamma_t + X_{ict}^{'}\eta + \lambda_{crime(i)} + \varepsilon_{ict}, \tag{12}$$

where y_{ict} is the incarceration length for defendant i adjudicated at court c in quarter t. α_c, γ_t and $\lambda_{crime(i)}$ are court, quarter and crime type fixed effects. $X_{ict}^{'}$ is a vector of defendant and case characteristics.

Then for all cases, the estimated case severity is measured as

$$severity_{ict} = X_{ict}^{'}\hat{\eta} + \hat{\lambda}_{crime(i)}, \tag{13}$$

where $\hat{\eta}$ and $\hat{\lambda}_{crime(i)}$ are coefficients from equation 12. $severity_{ict}$ can also be interpreted as the predicted sentence in the absence of plea bargaining based on observables.

Finally, plea bargaining's effect on case severity is estimated in an event study framework

$$severity_{ict} = \alpha_c + \gamma_t + \sum_{k=\underline{K},k\neq -1}^{\overline{K}} \beta_k D_{ct}^{k} + \varepsilon_{ict}. \tag{14}$$

This measure cannot detect changes in sample compositions in terms of unobservables. How-

ever, if we see changes in observables, the changes in unobservables probably bias the results in the same direction.

In Figure 4, we can see that plea bargaining does not cause significant changes in case severity among cases in my sample. If anything, the estimated case severity increased slightly after plea bargaining, an indication of a lower prosecution rate. This assures that the reduction in incarceration length post-intervention is not driven by changes in sample compositions.

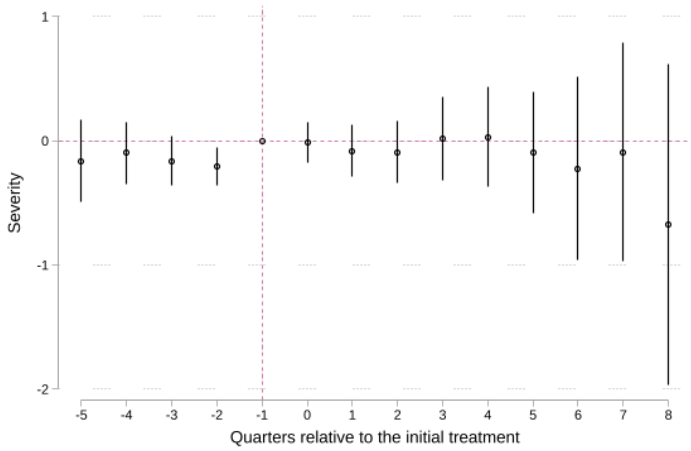


Figure 4: Effects on Case Severity

Notes. This figure shows event study coefficient estimates for plea bargaining's effects on case severity among uploaded cases. Court and quarter fixed effects are applied. The case severity is constructed using Equation 12 and 13. The vertical lines represent 95% confidence intervals. $k \leq -5$ is binned to $k = -5$, and $k \geq 8$ is binned to $k = 8$.

Figure 5 displays results on the number of cases. We see that the number of cases increased by about 5 (8%) per quarter after the introduction of plea bargaining. This could be attributed to a higher prosecution rate or an increasing disclosure rate. Given that a higher prosecution rate contradicts the results on case severity, the more plausible explanation is that judges started to upload a greater number of cases post-plea bargaining. An increasing disclosure rate also aligns with the story that plea bargaining reduces judges' workload and provides them with more time to upload cases thoroughly.

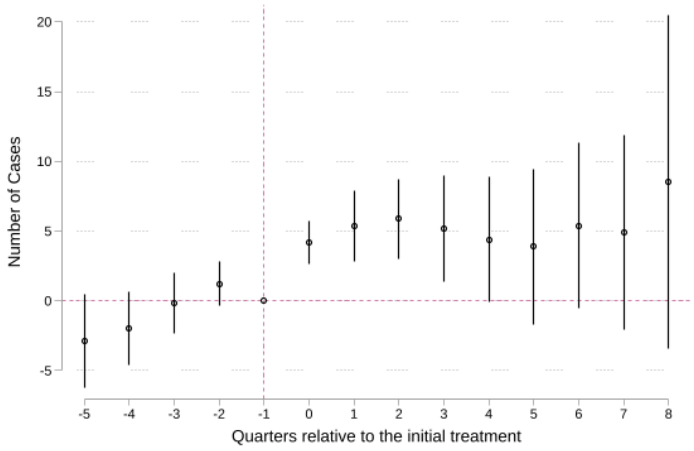


Figure 5: Effects on The Number of Cases

Notes. This figure shows event study coefficient estimates for plea bargaining's effects on the number of uploaded cases. Court and quarter fixed effects are applied. This regression is run at the court-quarter level rather than at the individual level as in other regressions. The vertical lines represent 95% confidence intervals. $k \leq -5$ is binned to $k = -5$, and $k \geq 8$ is binned to $k = 8$.

5.3 Heterogeneity Analysis

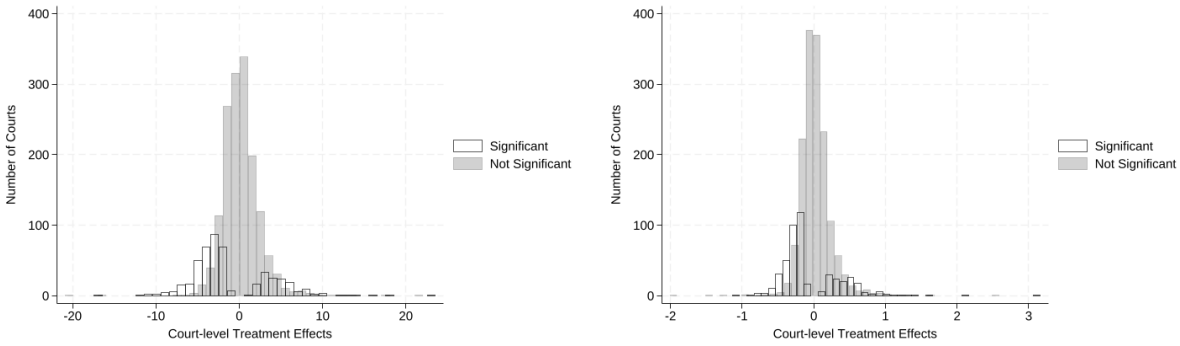
To examine the heterogeneity in treatment effects across courts, I estimate the court-level treatment effects by interacting the court fixed effects with the event indicators in an event study framework

$$y_{ict} = \alpha_c + \gamma_t + \sum_c \sum_{k=1}^{3} \beta_{c,k} post_{ct}^k \times \mathbf{1}\{\alpha_c = 1\} + X_{ict}^{'}\eta + \lambda_{crime(i)} + \varepsilon_{ict}, \tag{15}$$

where $post_{ct}^k = 1$ if $t - G_c \in [4k-4, 4k-1]$, and G_c is the quarter when court c started plea bargaining. $\beta_{c,k}$ is the treatment effect for court c k **years** after the introduction of plea bargaining. Compared with the regression that estimates the overall treatment effect, I group the event dummies from quarters to years in the court-level treatment effect estimation to gain better precision. Besides, I also group all the pre-event indicators into one indicator (and omit it) since we care less about examining the parallel pre-trends in the court-level treatment effect estimation. Other variables are defined in the same manner as in the baseline regression (Equation 11).

Figure 6a plots the distribution of court-level treatment effect estimates for the second year

after the intervention.[17] Courts with significant treatment effects at the 95% confidence intervals (CI) are plotted with the white bars.[18] Breaking down the treatment effects by courts makes the estimates less precise. Nevertheless, 8% and 17% of courts exhibit treatment effects significantly higher and lower than 0 at the 95% CI, suggesting substantial heterogeneity. To interpret the magnitudes of the court-level treatment effects in percentage terms and compare courts with different average sentences, I divide the court-level treatment effect by the average sentence in 2014 and 2015 (before the rollout of plea bargaining in non-pilot regions) and plot the distribution in Figure 6b. The standard deviation of the court-level treatment effect / average sentence is 30%.



(a) (b)

Figure 6: Distribution of Court-level Treatment Effects

Notes. These figures plot the distribution of court-level treatment effects for the second year post-adoption. The white bars are for courts with significant treatment effects at the 95% CI and the grey bars are for courts with insignificant treatment effects. The 95% CIs are obtained by block bootstrapping by court 1,000 times. Figure 6a plots the raw treatment effects in months and Figure 6b plots the treatment effects divided by the average sentences in 2014 and 2015.

To understand the sources of the high dispersion in the court-level treatment effects, I go back to the comparative statics derived from the theoretical model in Section 2 and examine whether the key parameters in the theoretical model can explain the empirical dispersion. Specifically, I check heterogeneities in the following dimensions at the court level - sentence uncertainty at trial, the prosecutor's trial cost, and the defendant's bargaining power. I first

[17] The treatment effects correlate strongly across the years. See Figure A4 for the bin scatter plots of the treatment effects across different years.

[18] The 95% confidence intervals are obtained by block bootstrapping by court 1,000 times.

construct measures for these parameters and then demonstrate the empirical tests. All these parameters are measured using cases tried in 2014 and 2015, before the introduction of plea bargaining in non-pilot regions.

Sentencing uncertainty at trial

Theory predicts that a higher sentencing uncertainty at trial leads to a lower sentence discount (or a larger sentence penalty) post-plea bargaining due to the defendant's risk aversion. Sentencing uncertainty is estimated as the standard deviation of residuals from Equation 12, where I regress incarceration length on case and individual characteristics using only pre-plea bargaining cases.

$$uncertainty_c = sd_c(\hat{\varepsilon_{ict}}), \tag{16}$$

where $\hat{\varepsilon_{ict}}$ is the residual from Equation 12. The standard deviation of the residuals is composed of 1) the variation of unobservables and 2) the true sentencing uncertainty. As a result, this measure (Equation 16) relies on the assumption that the variation of unobservables explains the same portion of $uncertainty_c$ for each court.

Prosecutor's Trial Cost

The prosecutor's trial cost is expected to be associated with more generous plea deals. I use the caseload per prosecutor as a proxy for the prosecutor's trial cost.[19] When prosecutors have more cases to deal with, the marginal cost of prosecuting one case gets higher.

$$caseload_c = \frac{\#\text{ of cases}_c}{\#\text{ of judges}_c}. \tag{17}$$

Defendant's Bargaining Power

The defendant's higher bargaining power is expected to make the plea deal more favourable towards defendants. I use the prevalence of privately retained lawyers as a proxy for defendants'

[19] Currently, I only have data on the number of judges per court, not on the number of prosecutors. Therefore, in this version, I use caseload per judge.

bargaining power since defendants are supposed to have greater bargaining power when they have a legal representative to negotiate on their behalf. Specifically, I use the percentage of cases with a privately retained attorney in 2014 and 2015 as a measure of the local prevalence of hiring legal representation. The average percentage in my data set is 22%, with a standard deviation of 0.09.[20]

$$lawyer_c = \frac{\#\text{ of cases with private attorneys}_c}{\#\text{ of cases}_c}. \tag{18}$$

It is worth noting that China also rolled out a "Lawyers for All" (LFA) program between 2017 and 2023, which requires the court to assign a defence attorney for defendants who are tried through the ordinary procedure.[21] For other cases, defendants will be put in contact with an on-duty lawyer who provides legal advice. However, these on-duty lawyers do not act as defence attorneys and they do not appear in court on behalf of the defendant. I argue that the LFA program does not confound my analysis on plea bargaining or invalidate my measure of the defendant's bargaining power for the following reasons: 1) Wu (2020) finds that the LFA program does not affect sentencing outcomes because of a lack of qualified court-appointed lawyers and funding; 2) the roll-out of LFA does not coincide with the roll-out of plea bargaining, so we would not see a parallel pre-trend if LFA had a significant impact on sentencing outcomes; 3) LFA does not change the relative degree of legal representation across courts as long as the quality of court-appointed lawyers is below the privately retained ones. If so, the pre-LFA percentage of privately retained attorneys will be a valid proxy of the defendant's bargaining power throughout the entire sample period.

Empirical Tests

[20] The defense rate among all criminal cases was around 30% during that period (Wang et al., 2022). It is expected that cases not uploaded online have a higher defence rate because these cases are normally more severe and sensitive.

[21] 42% and 35% of cases in my data were tried through the ordinary procedure pre and post plea bargaining expansion.

To examine the heterogeneity, I interact the year-level event indicators $post_{ct}^{k}$ with court-level characteristics measured pre-policy intervention

$$y_{ict} = \alpha_c + \gamma_t + \sum_{k=1}^{3} \delta_k post_{c,t}^{k} + \sum_{k=1}^{3} X_c^{'} post_{c,t}^{k} \beta_k + X_{ict}^{'} \eta + \lambda_{crime(i)} + \varepsilon_{ict}, \tag{19}$$

where X_c is a vector of court-level characteristics which includes the sentencing uncertainty at trial ($uncertainty_c$), provincial-level caseload ($caseload_c$), the prevalence of privately retained attorneys ($lawyer_c$), and court strictness ($strictness_c$, measured by the estimated court fixed effect $\widehat{\alpha_c}$ from Equation 12). Besides the three characteristics of interests ($uncertainty_c$, $caseload_{p(c)}$, and $lawyer_c$), court strictness is also included because the standard deviation of the residualized sentence ($uncertainty_c$) correlates with the mean sentence mechanically. All the interaction terms are included in the regression simultaneously to account for correlations between the pre-existing court-level characteristics.

Table 2: Heterogeneity on Court-level Characteristics

	Post^k	Post^k × Uncertainty	Post^k × Caseload	Post^k × Lawyer
k = 1	-0.11	0.16***	-0.09*	-0.15***
	(0.09)	(0.06)	(0.05)	(0.05)
k = 2	-0.39***	0.32***	-0.13**	-0.11**
	(0.12)	(0.07)	(0.06)	(0.05)
k = 3+	-0.44***	0.56***	-0.21**	-0.42***
	(0.17)	(0.12)	(0.08)	(0.10)

Notes. This table displays the coefficient estimates for the event indicators and the interactions between the event indicators and the sentencing uncertainty at trial, caseload and prevalence of privately retained attorneys. All the coefficients are from a single regression with incarceration length as the defendant variable. All court-level characteristics are standardized.

Table 2 presents the heterogeneity analysis on incarceration length. Consistent with model predictions, a higher caseload and a greater prevalence of privately retained attorneys lead to more favourable deals for defendants, while higher sentencing uncertainty at trial has the oppo-

site effect.

These results indicate that plea bargaining has an unintended consequence on inequality, as places with different sentencing norms and institutional features experience divergent impacts. The fact that both the defendant's and prosecutor's bargaining considerations matter also suggests that there is at least some degree of judicial independence in the criminal justice system in China.

6 Conclusion

Guilt pleas impact the well-being of millions of defendants worldwide. Yet, due to its highly selective nature, a credible investigation of its causal impact on sentencing outcomes is limited. I address this issue by examining a policy experiment conducted in China that rolled out plea bargaining across courts between 2014 and 2020. I find that, on average, sentences decrease by 7% after the introduction of plea bargaining. However, the treatment effects vary substantially across courts, with some courts even experiencing a significant sentence surge.

To understand the sources of the high dispersion in the effects across courts. I derive a theoretical model that emphasizes the two parties' bargaining considerations and bargaining power. Consistent with the theoretical model, I find that the sentencing uncertainty at trial, the prosecutor's caseload, and the local prevalence of privately retained attorneys are important drivers of the high dispersion. The heterogeneity analysis demonstrates that the bargaining outcome is largely affected by the sentencing norms and the institutional features of the criminal justice system. Thus, caution is warranted when extrapolating empirical results from one context to another.

References

Abrams, David S, "Is pleading really a bargain?," *Journal of Empirical Legal Studies*, 2011, *8*, 200–221.

Baker, Scott and Claudio Mezzetti, "Prosecutorial resources, plea bargaining, and the decision to go to trial," *Journal of Law, Economics, and Organization*, 2001, *17* (1), 149–167.

Bebchuk, Lucian Arye, "Litigation and settlement under imperfect information," *The RAND Journal of Economics*, 1984, pp. 404–415.

Borusyak, Kirill, Xavier Jaravel, and Jann Spiess, "Revisiting event study designs: Robust and efficient estimation," *arXiv preprint arXiv:2108.12419*, 2021.

Brereton, David and Jonathan D Casper, "Does It Pay to Plead Guilty-Differential Sentencing and the Functioning of Criminal Courts," *Law & Soc'y Rev.*, 1981, *16*, 45.

Callaway, Brantly and Pedro HC Sant'Anna, "Difference-in-differences with multiple time periods," *Journal of Econometrics*, 2021, *225* (2), 200–230.

Chaisemartin, Clément De and Xavier d'Haultfoeuille, "Two-way fixed effects estimators with heterogeneous treatment effects," *American Economic Review*, 2020, *110* (9), 2964–96.

Chen, Heng, Yuyu Chen, and Qingxu Yang, "Women in the Courtroom," *Available at SSRN 4039566*, 2022.

Goodman-Bacon, Andrew, "Difference-in-differences with variation in treatment timing," *Journal of Econometrics*, 2021, *225* (2), 254–277.

Grossman, Gene M and Michael L Katz, "Plea bargaining and social welfare," *The American Economic Review*, 1983, *73* (4), 749–757.

Hou, Yue and Rory Truex, "Ethnic Discrimination in Criminal Sentencing in China," 2019.

_ **and** _ , "Ethnic Discrimination in Criminal Sentencing in China," *The Journal of Politics*, 2022, *84* (4), 2294–2299.

Hu, Jiayin, Wenwei Peng, and Yang Su, "Empowering through Courts: Judicial Centralization and Municipal Financing in China," 2024.

Jordan, Andrew William, "What Can Plea Bargaining Teach Us About Racial Bias in Criminal Justice?" PhD dissertation, The University of Chicago 2020.

Kim, Jeong-Yoo, "Credible plea bargaining," *European journal of law and economics*, 2010, *29* (3), 279–293.

Kutateladze, Besiki L and Victoria Z Lawson, "Is a plea really a bargain? An analysis of plea and trial dispositions in New York City," *Crime & Delinquency*, 2018, *64* (7), 856–887.

Landes, William M, "An economic analysis of the courts," *The Journal of Law and Economics*, 1971, *14* (1), 61–107.

Lee, SangMok, "Plea bargaining: on the selection of jury trials," *Economic Theory*, 2014, *57* (1), 59–88.

Li, Enshen, "Haste makes waste: Why China's new plea leniency system is doomed to fail," *Asian journal of comparative law*, 2022, *17* (1), 76–105.

Liebman, Benjamin L, Margaret E Roberts, Rachel E Stern, and Alice Z Wang, "Mass digitization of Chinese court decisions: How to use text as data in the field of Chinese law," *Journal of Law and Courts*, 2020, *8* (2), 177–201.

Liu, Ernest, Yi Lu, Wenwei Peng, and Shaoda Wang, "Judicial independence, local protectionism, and economic integration: Evidence from China," Technical Report, National Bureau of Economic Research 2022.

Liu, Zhuang, TJ Wong, Yang Yi, and Tianyu Zhang, "Authoritarian transparency: China's missing cases in court disclosure," *Journal of Comparative Economics*, 2022, *50* (1), 221–239.

Metcalfe, Christi and Ted Chiricos, "Race, plea, and charge reduction: An assessment of racial disparities in the plea process," *Justice Quarterly*, 2018, *35* (2), 223–253.

Motivans, Mark, "Federal Justice Statistics, 2021," *US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics*, 2022.

Priest, George L and Benjamin Klein, "The selection of disputes for litigation," *The journal of legal studies*, 1984, *13* (1), 1–55.

Reinganum, Jennifer F, "Plea bargaining and prosecutorial discretion," *The American Economic Review*, 1988, pp. 713–728.

Rhodes, William M, "Plea bargaining: Its effect on sentencing and convictions in the District of Columbia," *J. Crim. L. & Criminology*, 1979, *70*, 360.

Russell, Jago and Nancy Hollander, "The Disappearing Trial: The global spread of incentives to encourage suspects to waive their right to a trial and plead guilty," *New Journal of European Criminal Law*, 2017, *8* (3), 309–322.

Silveira, Bernardo S, "Bargaining with asymmetric information: An empirical study of plea negotiations," *Econometrica*, 2017, *85* (2), 419–452.

Smith, Douglas A, "Plea Bargaining Controversy, The," *J. Crim. L. & Criminology*, 1986, *77*, 949.

Sun, Liyang and Sarah Abraham, "Estimating dynamic treatment effects in event studies with heterogeneous treatment effects," *Journal of Econometrics*, 2021, *225* (2), 175–199.

Uhlman, Thomas M and N Darlene Walker, "A plea is no bargain: The impact of case disposition on sentencing," *Social Science Quarterly*, 1979, *60* (2), 218–234.

Wang, Minyuan, Ming Hu, and Jiapei Tao, "Implementation Report of the Criminal Defense System in China in Recent Years," *Legal Application*, 2022.

Wang, Shaoda and David Y Yang, "Policy Experimentation in China: The Political Economy of Policy Learning," Technical Report, National Bureau of Economic Research 2021.

Wu, Yuhao, "Empirical Studies of the Effects of Legal Reforms on the Criminal Justice System in China." PhD dissertation, University of Pennsylvania 2020.

Yan, Shi, "What exactly is the bargain? The sensitivity of plea discount estimates," *Justice Quarterly*, 2022, *39* (1), 152–173.

Yang, Crystal S, "Resource constraints and the criminal justice system: Evidence from judicial vacancies," *American Economic Journal: Economic Policy*, 2016, *8* (4), 289–332.

Appendix

A1 Tables and Figures

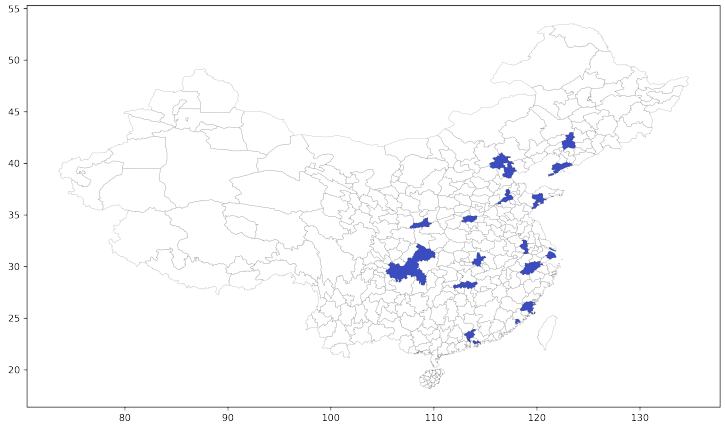
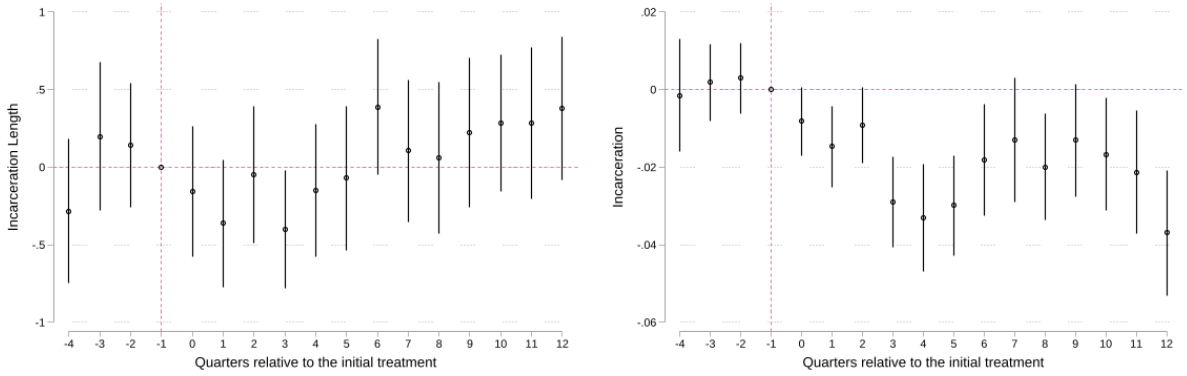


Figure A1: Pilot Cities

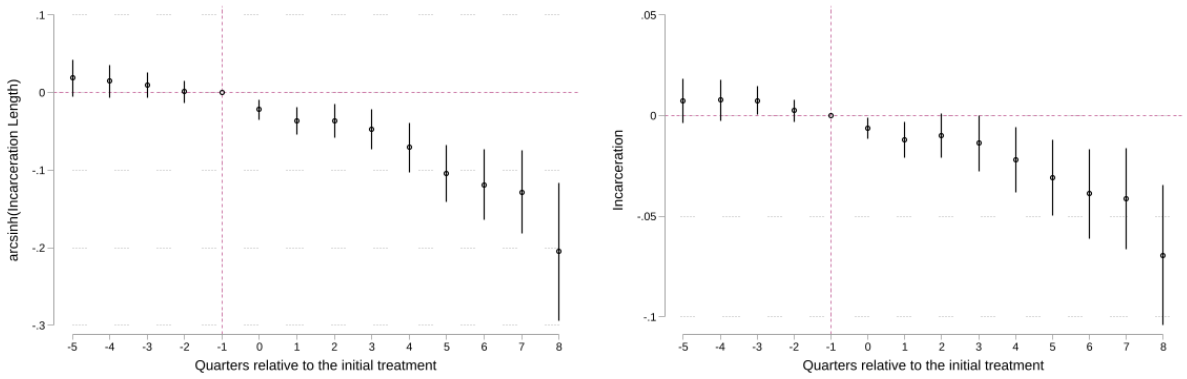


(a) Effects on Incarceration Length

(b) Effects on Incarceration

Figure A2: Effects on Incarceration and Incarceration Length for Pilot Courts

Notes. These figures show event study coefficient estimates for plea bargaining's effects on incarceration length and incarceration for pilot courts. Court, quarter, and crime type fixed effects are applied. Controls include dummies for gender, education, minority, single defendant, multiple crimes committed, criminal history, whether surrendered, mitigating factors (pregnant, disabled, or mental illness), and age. The vertical lines represent 95% confidence intervals. $k \leq -4$ is binned to $k = -4$, and $k \geq 12$ is binned to $k = 12$.

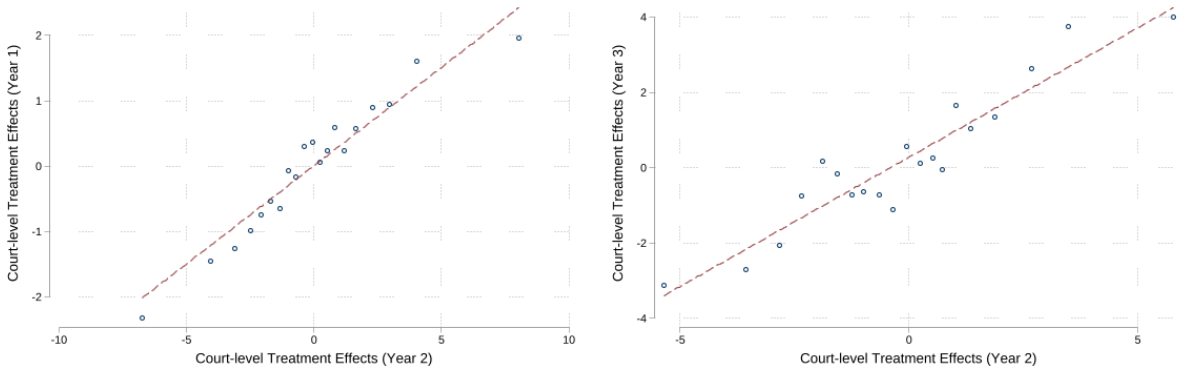


(a) Effects on IHS Tran. of Incar. Length

(b) Effects on Incarceration

Figure A3: Effects on Incarceration and Incarceration Length for Non-pilot Courts

Notes. These figures show event study coefficient estimates for plea bargaining's effects on the inverse hyperbolic sine transformation of incarceration length and incarceration for pilot courts. Court, quarter, and crime type fixed effects are applied. Controls include dummies for gender, education, minority, single defendant, multiple crimes committed, criminal history, whether surrendered, mitigating factors (pregnant, disabled, or mental illness), and age. The vertical lines represent 95% confidence intervals. $k \leq -5$ is binned to $k = -5$, and $k \geq 8$ is binned to $k = 8$.



(a) Year 2 VS. Year 1

(b) Year 2 VS. Year 3

Figure A4: Correlation between Different Years' of Court-level Treatment Effects

Notes. These figures show the bin scatter plots of the court-level treatment effects across the years. Figure A4a plots the treatment effects in the first year against the second year. Figure A4b plots the treatment effects from the third year onwards against the second year.

Table A1: Accuracy Rates of Variable Extraction

Variable Name	Accuracy Rate (%)
Panel A: Defendant Characteristics	
Gender	100.0
Education	96.0
Age	97.0
Ethnicity	97.0
Pregenant, disabled, or mental illness	100.0
Number of defendants	97.0
Criminal history	94.0
Surrender	92.0
Panel B: Case Characteristics	
Settled by plea	96.0
Crime type	97.0
Multiple crimes	98.0
Date caught	87.0
Date of trial	97.0
Court name	98.0
Judge name	99.0
Lawyer information	91.0
Panel C: Sentencing Outcomes	
Probation	99.0
Sentence length	93.0

Notes. The accuracy rates are calculated by comparing the values extracted by the algorithm with those obtained through manual extraction from a test set of 465 randomly selected verdicts, stratified by province.

Table A2: Caseload of Voluntary And Regular Non-pilot Courts

	Non-eager Courts		Eager Courts		Difference	
	Mean	S.D.	Mean	S.D.	Coef.	S.E.
Number of cases	439.05	420.62	699.09	1034.62	260.03^{***}	(62.45)
Number of judges	8.16	3.83	9.37	6.16	1.21^{***}	(0.38)
Number of cases per judge	52.38	34.89	64.82	46.79	12.44^{***}	(2.91)

Notes. The caseloads and number of judges are calculated based on cases tried in 2014 and 2015, before the introduction of plea bargaining in non-pilot courts.

Table A3: Summary Statistics for Pilot Courts

	Before		After	
	Mean	S.D.	Mean	S.D.
Panel A: Case Characteristics				
Female	.1	.3	.1	.29
Middle school or Higher	.76	.43	.78	.41
Age	35.09	10.48	37.38	10.81
Minority	.08	.27	.07	.25
Pregenant, disabled, or mental illness	0	.06	0	.05
Single defendant	.86	.35	.87	.33
Multiple crimes	.01	.09	.01	.08
No criminal history	.78	.41	.77	.42
Criminal history (more than 5 years ago)	.09	.28	.11	.32
Criminal history (within five years)	.13	.34	.11	.32
Surrender	.2	.4	.18	.38
Panel B: Crime Types				
DUI	.16	.36	.24	.42
Larceny	.27	.45	.25	.43
Intentional assault	.09	.29	.08	.28
Traffic accident	.05	.21	.04	.2
Drug trafficking	.11	.31	.07	.26
Other crimes	.32	.47	.31	.46
Panel C: Sentencing Outcomes				
Incarceration length (month)	11.87	22.72	11.15	22.7
Incarceration	.7	.46	.65	.48

Notes. This table presents summary statistics for criminal cases in pilot regions before and after the introduction of plea bargaining. For cases with multiple defendants, the summary statistics are done for the principal offender. When the defendant commits multiple crimes (1%), the crime type is recorded as the primary crime committed.

Table A4: Uploading Rates of First-Instance Criminal Cases by Year

Year	Yearbook	Online	Uploading rate
2014	1,023,017	748,086	73%
2015	1,099,205	800,614	73%
2016	1,115,873	832,034	75%
2017	1,296,650	899,917	69%
2018	1,198,383	895,192	75%
2019	1,297,191	958,922	74%
2020	1,115,890	681,340	61%
Total	8,146,209	5,816,105	71%

Data source: Law Yearbooks of China and China Judgment Online. For the "Online" column, I also count 292,822 (5%) cases that were uploaded but had their contents hidden. These cases are excluded from the empirical analysis.

A2 Proof of Comparative Statics

Plug Equations (1), (2), (4) and (5) back to the Nash bargaining problem (8) and take the first order condition, which solves the optimal plea deal S^*

$$\Phi = \alpha U^{'}(S^*)\left(S^* - \overline{S} + C_p\right) + (1-\alpha)\left[U(S^*) - \int U(S)dF(S)\right] = 0, \tag{20}$$

where $\left(S^* - \overline{S} + C_p\right) \geq 0$ and $[U(S^*) - \int U(S)dF(S)] \geq 0$ because of Conditions (3) and (6).

We have

$$\frac{\partial \Phi}{\partial S^*} = \alpha U^{''}(S^*)\left(S^* - \overline{S} + C_p\right) + \alpha U^{'}(S^*) + (1-\alpha)U^{'}(S^*) < 0. \tag{21}$$

Assuming the variance (var = $\int (S-\overline{S})^2 dF(S)$) of the trial outcome changes through a mean-preserving spread, we have

$$\frac{\partial \Phi}{\partial var} = -(1-\alpha)\frac{\partial \int U(S)dF(S)}{\partial var} \geq 0. \tag{22}$$

Also,

$$\frac{\partial \Phi}{\partial C_p} = \alpha U^{'}(S^*) \leq 0, \tag{23}$$

$$\frac{\partial \Phi}{\partial \alpha} = U^{'}(S^*)\left(S^* - \overline{S} + C_p\right) - \left[U(S^*) - \int U(S)dF(S)\right] \leq 0. \tag{24}$$

Then by Equation (10) and the implicit function theorem,

$$\frac{d\Delta S}{dvar} = \rho \frac{dS^*}{dvar} = -\rho \frac{\frac{\partial \Phi}{\partial var}}{\frac{\partial \Phi}{\partial S^*}} \geq 0, \tag{25}$$

$$\frac{d\Delta S}{dC_p} = \rho \frac{dS^*}{dC_p} = -\rho \frac{\frac{\partial \Phi}{\partial C_p}}{\frac{\partial \Phi}{\partial S^*}} \leq 0, \tag{26}$$

$$\frac{d\Delta S}{d\alpha} = \rho \frac{dS^*}{d\alpha} = -\rho \frac{\frac{\partial \Phi}{\partial \alpha}}{\frac{\partial \Phi}{\partial S^*}} \leq 0. \tag{27}$$

A3 The Alternative Model

Priest and Klein (1984) have a theoretical framework to explain the selection of disputes for litigation in civil cases. In their model, the plaintiff and the defendant have imperfect information on the trial outcome and the settlement fails if one of them (or both of them) is too optimistic.[22]

[22]The other way to explain why settlements fail is to assume asymmetric information and model plea bargaining as a screening or signalling game (Bebchuk, 1984; Reinganum, 1988). Based on the information available in my data set, my primary focus lies in understanding the impact of two parties' bargaining considerations and bargaining

I adapt their framework to model plea bargaining in criminal cases. The model differs from the original one mainly in three aspects: 1) since prosecutors and defendants bargain on sentence length, I use sentence length as the trial outcome, which is a continuous variable instead of a binary one (win or lose) as in the original framework; 2) I allow for risk aversion in defendant's preference to account for their aversion to sentencing uncertainties; 3) besides deriving conditions of a settlement, I also solve the value of the plea deal through a Nash bargaining problem with asymmetry bargaining power.

A3.1 Actors' Choice

The case can be resolved by either plea bargaining or a formal trial. Prior to the trial, the defendant (he) has the opportunity to plead guilty and agree to the plea sentence $\widehat{S}$ offered by the prosecutor (she). I assume the plea offer is determined through a Nash bargaining process with asymmetric bargaining power. If a plea agreement is not reached, the case will proceed to trial, where the sentence is drawn from a distribution function $F(S)$. The average sentence at trial is denoted as $\overline{S}$ ($\int SdF(s) = \overline{S}$).

A3.2 Prosecutor's Problem

A risk-neutral prosecutor's expected utility at trial is given by

$$EU_p^{trial} = \int SdF(S) - C_p = \overline{S} - C_p. \tag{28}$$

It increases with the average trial sentence and decreases with the trial cost C_p ($C_p \geq 0$). C_p reflects the resources and time needed for the prosecutor to take a case to trial.

The prosecutor's utility with plea deal $\widehat{S}$ is

$$U_p^{plea}(\widehat{S}) = \widehat{S}. \tag{29}$$

Thus, the prosecutor will accept the deal $\widehat{S}$ if and only if

$$U_p^{plea}(\widehat{S}) \geq EU_p^{trial} \Longrightarrow \widehat{S} \geq \overline{S} - C_p = \widehat{S_p}, \tag{30}$$

where $\widehat{S_p}$ is the plea deal that makes the prosecutor indifferent between a trial and a plea settlement (henceforth, prosecutor's trial equivalent offer). Note that since the prosecutor has a non-negative trial cost, her trial equivalent offer $\widehat{S_p}$ is smaller than the average trial sentence $\overline{S}$. This shows that the prosecutor is willing to make some concessions in the plea negotiation.

power, with less emphasis on the information structure. Consequently, I opt for a model that places greater weight on the former dimensions.

A3.3 Defendant's Problem

The defendant is risk-averse and has imperfect information about the incarceration length at trial. His (perceived) expected utility at trial is

$$EU_d^{trial}(\varepsilon_d) = \int -\frac{S^\gamma}{\gamma} dF(S+\varepsilon_d). \tag{31}$$

The defendant has a constant relative risk aversion with coefficient $\gamma - 1$, where $\gamma > 1$. The defendant believes the trial sentence is drawn from the distribution $F(S+\varepsilon_d)$, a mean shift from the true distribution $F(S)$. This mimics the reality that defendants are less informed of the trial outcome and thus may overestimate ($\varepsilon_d < 0$) or underestimate ($\varepsilon_d > 0$) the average trial sentence. The ε_d is defendant-specific and follows a distribution function $G(\varepsilon_d)$.

The defendant's utility with plea deal $\widehat{S}$ is

$$U_d^{plea}(\widehat{S}) = -\frac{\widehat{S}^\gamma}{\gamma}, \tag{32}$$

and the defendant accepts the deal $\widehat{S}$ if and only if

$$U_d^{plea}(\widehat{S}) \geq EU_d^{trial}(\varepsilon_d) \Longrightarrow \widehat{S} \leq \widehat{S_d}(\varepsilon_d), \tag{33}$$

where $\widehat{S_d}(\varepsilon_d)$ is the offer that makes the defendant indifferent (henceforth, the defendant's trial equivalent offer). $\widehat{S_d}(\varepsilon_d)$ depends on ε_d because the level of optimism affects the defendant's expectation of the plea deal. Because of risk aversion, a defendant with a correct belief ($\varepsilon_d = 0$) will have his trial equivalent offer $\widehat{S_d}(0)$ higher than the average trial sentence $\overline{S}$. However, when ε_d is high enough, we have $\widehat{S_d}(\varepsilon_d) < \overline{S}$.

A3.4 Nash Bargaining Solution

If the defendant's trial equivalent offer ($\widehat{S_d}(\varepsilon_d)$) is greater than the prosecutor's trial equivalent offer ($\widehat{S_p}$), they both can gain a positive surplus from a plea settlement. Thus, a case will be resolved by plea bargaining if and only if $\widehat{S_p} \leq \widehat{S_d}(\varepsilon_d)$. The divide of the total surplus is determined by the Nash bargaining problem

$$\max_{S^*} [U_d^{plea}(S^*) - EU_d^{trial}(\varepsilon_d)]^\alpha \times [U_p^{plea}(S^*) - EU_p^{trial}]^{1-\alpha},$$

where $\alpha \in [0,1]$ represents the defendant's bargaining power. Note that the solution $S^*(\varepsilon_d)$ is a function of ε_d because ε_d affects the bargaining solution through affecting the defendant's trial equivalent offer $\widehat{S_d}(\varepsilon_d)$.

Plea Rate

The plea rate in the judicial system will be

$$\text{Plea rate} = P(\widehat{S_p} \leq \widehat{S_d}(\varepsilon_d)) = \int \mathbf{1}\{\widehat{S_p} \leq \widehat{S_d}(\varepsilon_d)\} dG(\varepsilon_d). \tag{34}$$

In a world where defendants have perfect information, the plea rate will always be 100%, because $\widehat{S_p} \leq \overline{S} \leq \widehat{S_d}(0)$. The assumption of imperfect information from the defendant's side generates friction in the bargaining and leads to a non-perfect plea rate. For defendants who are overly optimistic (ε_d is on the right tail of the distribution G()), they may have a trial equivalent offer $\widehat{S_d}(\varepsilon_d)$ being lower than the prosecutor's trial equivalent offer $\widehat{S_p}$, in which case a plea deal cannot be reached.

Effects on Sentencing

Plea bargaining's effect on the average sentence (the post - pre change in the average incarceration length) is

$$\Delta S = \{E[S^*(\varepsilon_d)|\widehat{S_p} \leq \widehat{S_d}(\varepsilon_d)] - \overline{S}\} \times \text{Plea rate} + 0 \times (1 - \text{Plea rate}), \tag{35}$$

where $E[S^*(\varepsilon_d)|\widehat{S_p} \leq \widehat{S_d}(\varepsilon_d)]$ is the average accepted plea deal and $\overline{S}$ is the average trial sentence. ΔS is driven by two forces: 1) the plea rate and 2) the generosity of the plea deal. I focus on plea bargaining's effect on the average sentence instead of its effect on those who plead guilty to circumvent the selection issue in the empirical analysis. The measurement of ΔS only requires capturing the post-pre difference in the average sentence, without the need to explicitly pin down the types of defendants taking plea deals. The sign of ΔS is ambiguous because it is unclear whether the average accepted plea deal is higher or lower than the average trial sentence, and it depends on multiple parameters such as the defendant's risk aversion ($\gamma - 1$), the sentence distribution at trial ($F(S)$), the prosecutor's trial cost (C_p), the defendant's bargaining power (α), etc.

A3.5 Comparative Statics

I derive three comparative statics on plea rate and ΔS, focusing on variations that can be empirically measured in my data.

Sentencing Uncertainty at trial ($\int (S - \overline{S})^2 dF(S)$)

A higher sentencing uncertainty at trial leads to a higher plea rate and a higher ΔS. Risk-averse defendants have a higher certainty equivalent when the uncertainty goes up, leading to a right shift in the distribution of the defendant's trial equivalent offer $\widehat{S_d}(\varepsilon_d)$, which subsequently causes a higher plea rate and a higher ΔS. Intuitively, when the trial becomes more uncertain, risk-aversed defendants will be more eager to settle on a plea and agree to less generous plea deals.

Prosecutor's Trial Cost (C_p)

When the prosecutor's trial cost increases, the plea rate increases and ΔS decreases. When C_p goes up, the prosecutor has a higher incentive to avoid the trial and thus will be willing to make more concessions in plea bargaining.

Defendant's Bargaining Power (α)

A higher bargaining power for defendants does not change the plea rate but will make the plea deal more favourable towards defendants (decrease ΔS). The plea rate depends only on the values of $\widehat{S_p}$ and the distribution of $\widehat{S_d}(\varepsilon_d)$, both of which are irrelevant to α. α only affects how the surplus is divided conditional on a settlement.