A New Theory of Plea Bargains in Criminal Procedure

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November 15, 2023

Abstract

I present a new model of plea bargaining before criminal trials. Two specific modifications are made from the canonical models (Bebchuk (1984) and Reinganum (1988)) – I assume that the defendant's inherent guilt is immaterial to the trial outcome, instead relying only on the evidence available to be presented, and I assume that the prosecutor knows the true value of the evidence while the defendant knows only the bounds. I find that the decisions in equilibrium rely mainly on the maximum possible evidence the prosecutor *could* have, rather than the evidence they *actually* have. This result implies that plea bargains do not effectively sort innocent and guilty defendants.

JEL Codes: C72, D82, K14, K49

1 Introduction

> Shoot all the bluejays you want, if you can hit 'em
>
> Atticus Finch

The plea bargain is the dominant outcome of the American criminal trial process. Gramlich (2023) found that only 2.3% of criminal cases in 2022 went to trial, with 89.5% of defendants pleading guilty before a trial (the remaining had all charges dropped). Despite this proportion, the majority of the theoretical literature about plea bargains is decades old, and relies on assumptions first made by Bebchuk (1984). I make two main modifications to his procedure, which provide new frontiers to analyze. These assumptions are based on evidence from a large qualitative literature on plea bargains and the criminal trial process as a whole, which have not previously been incorporated into theoretical models.

The first modification I make is related to the broad asymmetric information assumptions others have made. The most common form[1] assumes that the defendant has exogenous 'guilt' or 'innocence.' A typical example is Daughety and Reinganum (2020), who assume that the defendant is of type G or I, where the defendant's type is correlated with the amount of evidence available to the prosecutor at trial. Similar models are presented by Bjerk (2007), Rubinfeld and Sappington (1987), and Baker and Mezzetti (2001). The canonical models are Reinganum (1988) and Grossman and Katz (1983), who first conceptualized the plea bargain process as a sorting mechanism for innocent and guilty defendants.

The fact that some defendants are innocent and others are guilty is undeniable. The salience of that fact in determining the outcome of the trial process, however, is disputed. There

[1]The other form, which I do not detail here, deals with civil cases, and typically assumes that both the plaintiff and the defendant have private information about their respective damages and liability. Daughety and Reinganum (2017) survey the various models, which broadly do not apply here – the civil asymmetries rely on the private information being disparate, often drawn from entirely different distributions. As I enumerate below, that assumption does not make sense in the context of criminal cases.

exists a large and growing qualitative literature, especially in law, which claims that the defendant's guilt or innocence is largely immaterial to the outcome. The main argument related to so-called 'coercive plea bargaining,' enumerated by Caldwell (2011), Newman (2023), and Brunk (1979), along with others. In this case, prosecutors threaten absurd (and unprovable) charges in order to coerce the defendant to pleading guilty to a lighter sentence. This process was legalized in *Bordenkircher v. Hayes* (1978), where the Supreme Court held that a prosecutor threatening to charge Paul Hayes with potential life imprisonment under a Kentucky three-strikes law if he did not plead guilty to a lower charge of felony forgery did not infringe on Hayes' constitutional rights.

The case of the pseudonymous Alfred which Caldwell (2011) describes merits further inspection. Alfred was present when his friend robbed a classmate. Both were arrested, and the prosecutor threatened to charge Alfred with 'street terrorism,' a patently ridiculous gang-related charge, as well as his current felony robbery charge if Alfred did not plead guilty to robbery and take a two year prison sentence. Despite being innocent, Alfred faced the choice of a guaranteed two year sentence, or a potential sixteen year sentence. One can easily imagine how a risk-averse agent would plead guilty, even if they believed their probability of conviction at trial was small. That fact stands in direct opposition to the results presented by Bjerk (2007) and Grossman and Katz (1983), who claim that innocent defendants should always reject plea bargains.

It is worth noting that this process is magnified by racial disparities. Bendejó (2018) finds that Black defendants are significantly less likely to have their charges reduced in plea bargains than white defendants, and when judges themselves sentence defendants who plead guilty (as is the case in some states), Black defendants receive significantly higher sentences. The question of whether Black defendants disproportionately face coercive prosecution merits further research.

To address these criticisms, I present a model where the potential trial outcome, and the

entire plea bargaining process, is based purely on the evidence (both gathered evidence and potential evidence). This suffices to rationalize the decision of innocent defendants to plead guilty, if they know there exists potential evidence which may incriminate them. In Alfred's case, he may believe that the street terrorism charge will be validated by the victim or other witnesses who would say that him and his friend flashed gang signs. Of course, in a full trial there is a discovery process, where each side must turn over evidence gathered to the other, including witness lists. If discovery had happened, Alfred may have chosen to proceed to trial, knowing that the prosecutor did not have enough evidence to convict him of street terrorism.

This leads directly to my second modification of the classical models. Bebchuk (1984), and Silveira (2017) each assume that the evidence to be presented at trial (or the probability of winning at trial)[2] is private information to the defendant, with the prosecutor generally knowing the bounds of such information. This assumption is natural in the case where the defendant's inherent innocence or guilt is salient to the result of a trial, as they will naturally have a better understanding of their probability of winning. Once one does away with that assumption, however, it makes less sense.

The argument in favor of the defendant having an information advantage over the prosecutor typically cites *Brady v. Maryland* (1963), where the Supreme Court held that a prosecutor withholding evidence material to the determination of the defendant's guilt (so-called 'exculpatory' or '*Brady*' evidence) was unconstitutional. Daughety and Reinganum (2018) develop a model of when prosecutors should theoretically violate the *Brady* rule in order to get a conviction. Their prosecutors are motivated by both 'career' concerns (getting convictions) and 'moral' concerns (they face some disutility for convicting an innocent defendant). They characterize the resulting Bayesian Nash Equilibrium between the prosecutor(s) and the judge, when *Brady* violations are later discovered with some positive probability.

[2]The two terms are generally interchangeable – it is entirely reasonable to assume that the probability of winning is an injective function of the amount or level of evidence presented, which the literature as a whole and I also assume.

While prosecutors withholding exculpatory evidence is always a violation of the defendant's rights once discovery happens, states have differing regulations on whether such disclosure is required before a plea bargain is agreed to.[3] As Turner and Redlich (2016) describe, there are typically two regimes – 'open-file,' where a broad discovery process is required before potential plea bargains, and 'closed-file,' where that requirement does not exist. They use as examples North Carolina, which mandates full discovery within ten days of the defendant being charged and before a plea bargain is agreed to, and Virginia, which does not require that any evidence be disclosed before the trial itself begins.

Turner and Redlich also find bounds for the amount of evidence that prosecutors in both regimes generally disclose, regardless of requirements. They find that prosecutors in Virginia voluntarily turn over significantly less evidence than prosecutors in North Carolina, especially lists of witnesses and witness statements, which are typically highly important to the trial outcome.

The model I present here is adaptable to both cases. The prosecutor knows the true level of evidence they have gathered, which here is the variable θ. The defendant knows the levels of evidence which exist, here presented as bounds $\underline{\theta}$ and $\overline{\theta}$ on the value of θ. Section 3 models the complete information case, where there is a full discovery process before plea bargain negotiations begin (*i.e.*, when $\underline{\theta} = \overline{\theta} = \theta$). The main specification, in Section 4, models the case where there exists evidence that is not common knowledge, so $\underline{\theta} < \overline{\theta}$. The difference in knowledge could encompass a complete asymmetry, where the prosecutor has turned over nothing, or it could be a minor asymmetry, such as the prosecutor not turning over expert witness statements but revealing everything else.

[3]The First, Second, Fourth, and Fifth Circuit Courts have held that prosecutors are not required to turn over any evidence before a guilty plea is made, while the other courts generally hold that *Brady* evidence must be turned over. The two groups of courts cite entirely different precedents – the First, Second, Fourth, and Fifth cite *Brady v. United States* (1970), where the Supreme Court held that a defendant who agreed to a guilty plea had signed away their constitutional rights relating to a jury trial, including their rights under *Brady v. Maryland* (1963). The others cite *United States v. Ruiz* (2002), where the court held that a prosecutor withholding exculpatory evidence from a defendant who pleads guilty may be violating her constitutional rights. Westerfield (2019) effectively discusses the nuances with this issue.

Importantly, *Brady* evidence is captured here. Say that a defendant is innocent, but there exists enough circumstantial evidence that they are charged. If the prosecutor has found exculpatory evidence, then θ will be low, possibly equal to $\underline{\theta}$, meaning that the defendant will most likely be found innocent at trial. The prosecutor can turn over that evidence, and both parties will know that the defendant is likely to be found innocent. However, they could also keep the evidence to themselves, and bluff in the plea bargaining negotiations, hoping that the defendant will agree to plead guilty to a larger sentence than is warranted. This process is entirely legal in Virginia, and McMunigal (2007) provides some qualitative evidence that it may be common.[4]

It's worth returning to Turner and Redlich (2016) for a point about the assumption made by Daughety and Reinganum (2018) and others that prosecutors have moral concerns about the possibility of convicting an innocent defendant. This assumption is somewhat upheld by empirical evidence. Glaeser, Kessler, and Piehl (2000) finds that federal prosecutors are motivated by both moral and career concerns, though Boylan (2005) and Boylan and Long (2005) find that career concerns lead to prosecutors seeking higher sentences. Here, I make the assumptions that the prosecutor's utility is increasing in sentence, decreasing in trial costs, and continuous, and no others, such that prosecutors here are motivated only by so-called 'career' concerns.

These assumptions are justified by the assumption that no underlying guilt or innocence exists, as the prosecutor can see only the evidence they have gathered. A specific form of their utility function (one that is near-zero for small sentences and concave for large sentences, for example) could capture the dynamic of them seeing little value in generating a plea sentence commensurate with a defendant likely to be found innocent. In that case, they would prefer to drop the charges entirely than offer a small plea. Alternatively, a purely risk-neutral prosecutor would look to maximize sentence regardless of innocence, and would

[4]There seems to exist no solid evidence that it does, which makes some sense – the laws around *Brady* remain murky these days, so a prosecutor admitting to knowingly suppressing *Brady* evidence (even if they believe it's legal, according to McMunigal) may be admitting to a crime.

always offer a plea bargain, even to potentially innocent defendants.

This model has its advantages, especially the fact that it matches the qualitative research on the subject. Another advantage is that I make only the functional form assumptions required to produce solutions and no more. This means that the model can be adapted to any continuous utility functions. It seems natural to assume a risk-averse defendant, though some (particularly older defendants, for whom the difference between a 10 year plea bargain and a 30 year trial sentence is insignificant but the difference between the plea bargain and being found innocent is large) may always prefer the risk of trial to a certain plea bargain commensurate with the evidence. By making few functional form assumptions, the results I present are also testable empirically. Regardless of what evidence emerges about the shape of prosecutors' and defendants' utility functions, this model will able to be tested using them.

The main disadvantage of presenting work in general form is the interpretation of results. The results I present here do not describe behavior the way Silveira (2017) does, and thus are much less intuitive. This model cannot itself describe what prosecutors and defendants do under different conditions or regimes. What it can do is provide a framework for future empirical analysis of prosecutorial decision making.

The rest of the paper is organized as follows. Section 2 introduces the model and its assumptions. Section 3 solves the model in the complete information case (analogous to full discovery before a plea bargain is decided), and Section 4 solves the model in the incomplete information case, where there is some information disparity for both parties. Section 5 discusses the effect of increasing prosecutorial discretion with regard to the charges filed, and Section 6 concludes. There are two main extensions in the appendix, Appendix A.1, which generalizes the model to a multistage bargaining game, and Appendix A.2, which generalizes to each side having incomplete information about the other's utility.

2 Model

I present a modification to the general theoretical structure developed by Bebchuk (1984) and Reinganum (1988), as it is implemented by Silveira (2017). A prosecutor (p) and a defendant (d) are bargaining over a sentence (s). The plea bargaining process is a single-stage game where the prosecutor proposes a sentence s, which the defendant may accept or reject.[5] If accepted, the defendant is given that sentence. If rejected, the case goes to trial, where there is an uncertain outcome and costs for each party.

If the case goes to trial, the defendant is found guilty with probability Θ, drawn from a distribution F with support $(\underline{\theta}, \overline{\theta}) \subseteq [0,1]$,[6] where the realization θ of Θ denotes what evidence the prosecutor has access to and $\underline{\theta}$ and $\overline{\theta}$ are the bounds on what evidence actually exists. My main departure from earlier research is with what information each party has about the realization of Θ, denoted θ. The prosecutor knows the exact realization of θ, but not the bounds $\underline{\theta}$ and $\overline{\theta}$. The defendant knows the bounds $\underline{\theta}$ and $\overline{\theta}$ but not the exact realization of θ. Neither side has any information on F.

The largest portion of previous research on this topic focuses on asymmetric information from a single side (see Bebchuk (1984); Daughety and Reinganum (2020); Baker and Mezzetti (2001), among many others), and those papers which do have two-sided incomplete information (such as Friedman and Wittman (2007) and those surveyed by Daughety and Reinganum (2017)) have each side drawing signals from different distributions. This model of incomplete information does not require one or both sides to draw from an 'incorrect' distribution, and allows for a more intuitive understanding of what information each side has access to. The prosecutor knows the exact amount of evidence they are able to present at trial, since they have already gathered it, but do not know what evidence could possibly be gathered. The

[5] The decision to reduce what is often a longer bargaining process to a single offer is not without loss of generality, and a multi-stage game is explored in Appendix A.1.

[6] I make the same technical assumptions as Silveira (2017): the density function f is strictly positive on $(\underline{\theta}, \overline{\theta})$, and is non-increasing in a neighborhood of $\overline{\theta}$. Also, the hazard rate $f/[1-F]$ is strictly increasing in θ.

defendant does not know exactly what evidence the prosecutor has access to,[7] but does know what evidence the prosecutor *could* have access to.

As an example, a privately innocent defendant knows that the prosecutor does not have access to the highest quality evidence because they did not commit the crime, whereas a privately guilty defendant knows that the prosecutor could find high-quality evidence. A guilty defendant will have a higher $\overline{\theta}$ than an innocent defendant, but the prosecutor does not know if θ itself is close to $\overline{\theta}$ or $\underline{\theta}$. This dynamic allows the prosecutor to bluff (by offering a bargain commensurate with a higher level of evidence than exists) and allows the defendant to call that bluff (if the offered bargain denotes evidence greater than $\overline{\theta}$).

The prosecutor and defendant both have preferences over the length of sentence and the (exogeneous) total costs associated with a trial $c_i \in \mathbb{R}_{++}$ for $i \in \{p, d\}$, which are public knowledge.[8] The range of possible plea sentences comes from S, the outcome if convicted at trial of the charges. I assume initially that the charges and associated S are exogeneous, an assumption which will be relaxed in Section 5. The defendant has $u_d : [0, S] \times \{0, c_d\} \to \mathbb{R}_-$, where u_d is strictly decreasing in both arguments, continuous, twice-differentiable, and that $u_d(0, 0) = 0$. The prosecutor has $u_p : [0, S] \times \{0, c_p\} \to \mathbb{R}_+$, where u_p is strictly increasing in the first argument and strictly decreasing in the second, continuous, twice-differentiable, and $u_p(0, c_p) = 0$. I make the minor technical assumption that the trial costs are not greater than the associated benefits for each side. Formally, $u_d(S, 0) < u_d(0, c_d)$ and $u_p(0, 0) < u_p(S, c_p)$.

Both the prosecutor and defendant's utility functions are public knowledge. This is a strong assumption, and not a realistic one. In Appendix A.2 I relax it to a framework developed in the style of Chatterjee and Samuelson (1983), where each party views the other's utility

[7] Recall that we are assuming that this occurs before any potential discovery process. Section 3 deals with the complete information case, which models the situation where discovery happens before a potential plea bargain.

[8] The assumption that these costs are public is not trivial, but reasonable. The implicit assumption here is that the costs are largely determined by the charges themselves – a murder trial takes longer to prosecute, and is thus more costly, than a simple traffic ticket. In Section 5, where I discuss the effects of greater prosecutorial discretion, this assumption will be revisited.

as a draw from a certain privately-known distribution. The results are qualitatively similar, but less interpretable.

3 Complete Information

We first explore the complete information case, where $\overline{\theta} = \underline{\theta}$, and the realization of Θ is common knowledge. This could be interpreted as a regime under which full discovery is required before any discussion of plea bargains. The prosecutor's expected utility from a trial is $\theta u_p(S, c_p) + (1-\theta)u_p(0, c_p) = \theta u_p(S, c_p)$, and the defendant's expected utility from trial is $\theta u_d(S, c_d) + (1-\theta)u_d(0, c_d)$. Since the utility functions are non-decreasing (non-increasing) and continuous, we have the following pair of lemmas.

Lemma 1.A. *Whenever $\theta \geq \theta_0$, there exists $s^\star \in [0, S]$ such that*

$$u_p(s^\star, 0) = \theta u_p(S, c_p) + (1-\theta)u_p(0, c_p)$$

where θ_0 is such that $\theta_0 u_p(S, c_p) = u_p(0, 0)$.

Proof. Note that $\theta u_p(S, c_p) + (1-\theta)u_p(0, c_p) = \theta u_p(S, c_p)$. Also note that $u_p(s, 0)$ is defined for $s \in [0, S]$. If $\theta = 0$, $\theta u_p(S, c_p) < u_p(0, 0)$, from the definitions above. Since $u_p(S, c_p) > u_p(0, 0)$ from the technical assumption above, there exists some $\theta_0 \in (0, 1)$ where $\theta_0 u_p(S, c_p) = u_p(0, 0)$, from the Intermediate Value Theorem. Since u_p is increasing in the first element and decreasing in the second, and is continuous, there exists $s' \in [0, S)$ such that $u_p(S, c_p) = u_p(s', 0)$. The rest follows directly from the Intermediate Value Theorem. □

Lemma 1.B. *Whenever the realization of Θ is known to the defendant, and $\theta \leq \theta_C$, there exists $s^\dagger \in [0, S]$ such that*

$$u_d(s^\dagger, 0) = \theta u_d(S, c_d) + (1-\theta)u_d(0, c_d)$$

where θ_C is such that $u_d(S, 0) = \theta_C u_d(S, c_d) + (1-\theta_C)u_d(0, c_d)$.

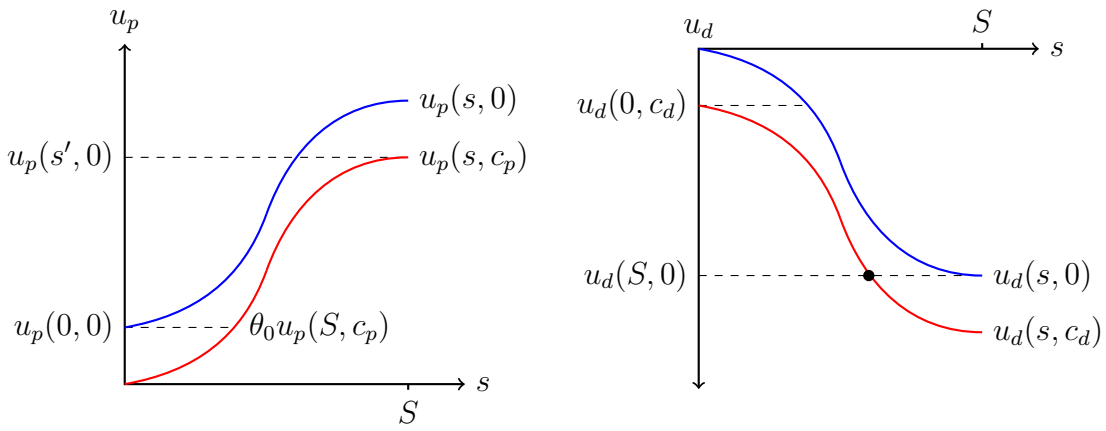

Figure 1: Utility as a function of sentence and trial costs for the prosecutor (left) and the defendant (right). Utility without trial costs is in blue, utility with trial costs is in red. Marked are relevant points from the proofs of Lemma 1.A and Lemma 1.B. The point marked in the right plot is the defendant's trial utility at θ_C, $\theta_C u_d(S,c_d) + (1-\theta_C)u_d(0,c_d)$, which is equal to $u_d(S,0)$.

Proof. From the technical assumption above $u_d(S,0) < u_d(0,c_d)$. Since $u_d(S,0) > u_d(S,c_d)$, there exists some θ_C such that $u_d(S,0) = \theta_C u_d(S,c_d) + (1-\theta_C)u_d(0,c_d)$. Since $u_d(s,0)$ ranges over $[u_d(S,0),0]$ and is continuous, and the trial utility ranges over $[u_d(S,0),u_d(0,c_d)]$ for $\theta \leq \theta_C$, proof follows directly from the Intermediate Value Theorem. □

These lemmas allow translation between proposed plea bargains and the trial utility, which acts as each agent's disagreement payoff. Figure 1 shows the relevant conversion points from the lemmas with arbitrary utility functions. Note that the utility functions with trial costs are direct translations downward of the functions without trial costs, as the costs either exist or don't.

The defendant has a simple rule: they will accept an offer s if $u_d(s,0) \geq \theta u_d(S,c_d) + (1-\theta)u_d(0,c_d) = u_d(s^\dagger,0)$ $\left(\Rightarrow s \leq s^\dagger\right)$, and reject it otherwise. If $\theta > \theta_C$, the defendant will accept any sentence offered, including the maximum implied. Recall the earlier assumption that any offered sentence s must be in the set $[0,S]$. If $\theta < \theta_0$, the prosecutor can do no better than offering a sentence of 0, which the defendant will accept. This could be interpreted as the prosecutor dropping all charges to avoid a costly trial when there isn't enough

evidence. Otherwise, the prosecutor will offer the maximum sentence which is preferred by the defendant to a trial. For simplicity, we assume that when the defendant is indifferent between a plea bargain sentence and going to trial, they will accept the plea sentence.

Proposition 1. *If $\overline{\theta} = \underline{\theta}$, and this information is common knowledge, the prosecutor will offer*

$$s = \begin{cases} 0 & \theta < \theta_0 \\ \max\{s^\star, s^\dagger\} & \theta_0 \leq \theta < \theta_C \\ S & \theta \geq \theta_C \end{cases}$$

The defendant will accept an offer of 0, $s^\dagger$ or S, and will reject an offer of $s^\star$.

Proof follows directly from Lemma 1.A, Lemma 1.B, and the assumptions. If θ is small enough, the prosecutor will 'drop all charges,' knowing that the trial costs are not worth the chance of conviction. If θ is large enough, the defendant knows that the trial costs are not worth the minuscule chance of being acquitted, so will accept any sentence. Otherwise, the sentence offered and the acceptance is dependent on each of their reservation utilities.

If $s^\star < s^\dagger$, then the defendant is more risk-averse than the prosecutor. Since both parties know this, the prosecutor will offer the maximum sentence the defendant would accept rather than proceed to trial, and the defendant will accept. The prosecutor will gain from this, making $u_p(s^\dagger, 0) - u_p(s^\star, 0)$ more than their reservation utility. If $s^\dagger > s^\star$, then the prosecutor is more risk-averse than the defendant, meaning that they would never offer a sentence acceptable to the defendant. They will offer the minimum of $s^\star$, which the defendant will reject, and they will proceed to trial.

This iteration of the model has flavors of a 'gains from trade' scenario, which makes intuitive sense. The existence of plea bargaining as an institution is based on its efficiency – if the prosecutor and the defendant generally agree on the value of a trial, they are better served by making a deal and avoiding the resulting costs of the trial procedure. Note that these results

do not rely on the assumption that bargaining is a single-stage game. If it were multi-stage or continuous, the prosecutor would begin by offering higher sentences and, if rejected, offer lower ones until the defendant accepts (or they reach an impasse). The final sentence offered would be precisely the sentence offered in the single-stage game.

4 Incomplete Information

Now consider the case when $\overline{\theta} > \underline{\theta}$. The defendant has knowledge of the bounds of Θ, $\underline{\theta}$ and $\overline{\theta}$, the prosecutor has knowledge of the true realization of Θ, θ. Neither knows the other's information. Lemma 1.A still holds, but Lemma 1.B does not. Instead, we have the following lemma.

Lemma 2. *As long as $\overline{\theta} \leq \theta_C$, there exist $s_d^L, s_d^H \in [0, S]$ such that*

$$u_d(s_d^L, 0) = \underline{\theta} u_d(S, c_d) + (1 - \underline{\theta}) u_d(0, c_d)$$

$$u_d(s_d^H, 0) = \overline{\theta} u_d(S, c_d) + (1 - \overline{\theta}) u_d(0, c_d)$$

Proof. Follows directly from Lemma 1.B. □

The resulting bargaining game is solved recursively. Assume that the prosecutor has proposed some sentence $\tilde{s} \in [0, S]$. If $\tilde{s} \leq s_d^L$, the defendant will accept always, and if $\tilde{s} > s_d^H$, the defendant will reject always. Otherwise, they must solve an expected utility maximization problem. Since the defendant knows the prosecutor's utility function, they know that $\tilde{s}$ implies some $\tilde{\theta}$ such that $u_p(\tilde{s}, 0) = \tilde{\theta} u_p(S, c_p) + (1 - \tilde{\theta}) u_p(0, c_p)$. If $\tilde{\theta} \geq \overline{\theta}$, the defendant maintains the same prior.[9] Otherwise, they will update their prior on the maximum evidence

[9] Note that it is possible, even likely, that the defendant is risk-averse and would accept some sentence that implies a greater level of evidence than is possible.

known to the prosecutor, knowing that the prosecutor will never propose a sentence lower than $s^\star$. They set $\overline{\theta} = \tilde{\theta}$.

Define $D : [\underline{\theta}, \overline{\theta}] \to [0, 1]$ such that $D(\underline{\theta}) = 0$, $D(\overline{\theta}) = 1$, is non-decreasing and continuous, is non-increasing in a neighborhood of $\overline{\theta}$, and that $D(x) = \mathbf{Prob}(\theta \leq x)$. D represents the defendant's beliefs about the evidence the prosecutor *actually* has access to.

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5 Prosecutorial Discretion

6 Conclusion

Appendices

A Extensions and Variants

A.1 Multistage Bargaining

A.2 Imperfect Utility Information