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The Effect of Magnitude and Probability on Plea Bargain Decision-Making

Megan L. Small

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THE EFFECT OF MAGNITUDE AND PROBABILITY ON PLEA BARGAIN DECISION-
MAKING

by

MEGAN LYDIANA SMALL

(Under the Direction of Jonathan E. Friedel)

ABSTRACT

Decision-making is studied in various aspects of life and can be especially vital in the context of the criminal justice system, such as plea bargains. Previous research in this area used a less commonly used task (fill-in-the-blank) in addition to a student sample (Falligant & Pence, 2019). The current study uses probability discounting to study the choice between accepting a plea bargain for a shorter incarceration sentence or risking a trial with a longer sentence on a sample of adults with experience in the criminal justice system. Three sentence durations, or magnitudes, were used (1 year, 5 years, and 25 years) across five likelihoods of conviction at trial (99%, 90%, 50%, 10%, and 1%) using an adjusting amount task. Results of the study found that maximum potential sentence length did not impact plea bargain acceptance, but likelihood of being convicted did. These results have the potential to increase empirical validity of the study of discounting in plea bargain related decisions within the criminal justice population and provide defendant perspective.

INDEX WORDS: Psychology, Criminal justice, Plea bargains, Trial, Discounting, Behavioral economics, Probability discounting, Decision making, Criminology

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B.S., University of Central Florida, 2019

A Thesis Submitted to the Graduate Faculty of Georgia Southern University
in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

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DEDICATION

This thesis is dedicated to my loving husband, Craig, who has always supported my academic career. I am eternally grateful for all the personal and professional sacrifices you have made for me to accomplish my dreams.

This thesis is also dedicated to my wonderful family including my parents, Anna and Walter, my brother, Connor, and my grandparents, Dianne and Don. Your endless support and confidence made it possible for me to accomplish my academic journey thus far.

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TABLE OF CONTENTS

ACKNOWLEDGMENTS	3
LIST OF TABLES	5
LIST OF FIGURES	6
CHAPTERS:	
CHAPTER 1: INTRODUCTION	7
Choice Research in Criminal Justice	7
Plea Bargaining	9
Probability Discounting.....	10
How This Study is Original.....	13
Research Questions	15
CHAPTER 2: METHODOLOGY	16
Participants	16
Exclusionary Criteria.....	16
Procedures	17
The Adjusting Amount Task	18
Data Analysis	19
CHAPTER 3: RESULTS	22
Sample Demographics.....	22
Analyses Results.....	24
CHAPTER 4: DISCUSSION.....	28
Limitations and Future Directions.....	30
CHAPTER 5: CONCLUSION	33
REFERENCES	34

LIST OF TABLES

Table 1: Demographics	22
Table 2: Reported Criminal Justice Experience.....	23
Table 3 Mazur Model Fit Statistics.....	25
Table 4 Pearson Correlation Results.....	27

LIST OF FIGURES

Figure 1 Mazur Model Curves	25
Figure 2 Box-and-Whisker Plot	26
Figure 3 Pearson Correlation Scatterplots	26

CHAPTER 1

INTRODUCTION

The study of decision-making is commonly found in various areas of criminal justice research and has included the study of jurors, judges, and prosecutors (e.g., Burke, 2007; Finkelstein, 1975; Ma, 2002). Decision-making research is utilized in many fields to understand factors that lead to individuals making one choice over another, which leads to many different research opportunities in the realm of criminal justice (e.g., Burke, 2007; Ma, 2002). Understanding how and why different individuals in the criminal justice system make various decisions can benefit others, such as a prosecutor being able to understand juror decision-making when preparing their case. As such, the study of decision-making in the criminal justice system can benefit not just researchers, but those who work in it, such as prosecutors and judges, and others affected by it, such as inmates.

Choice Research in Criminal Justice

Choice research performed in the criminal justice system is commonly performed on jurors, judges, and prosecutors. There are many aspects of jury and juror decision-making that interests researchers in this field. Some studies in this area have been performed on the effects of expert or eyewitness testimony in trial on juror decision-making where jurors were found to be more sensitive to eyewitness testimony when coupled with expert testimony (Cutler, Dexter, & Penrod, 1989). Another found that mock jurors were more likely to vote guilty in the presence of an accomplice witness testimony (Neuschatz, Lawson, Swanner, Meissner, & Neuschatz, 2008). Further, the effect of judge-jury interaction on jury decision-making has been studied with findings indicating that jurors and judges evaluate evidence differently or apply different standards of proof (e.g., MacCoun, 1990; Frankel, 1990). Further, there exist many more studies that aim to seek out additional factors that influence jury decision-making such as juror perception of the defendant (e.g., defendant's mental state) or presentation of disposition instructions on decision (Whittemore & Ogloff, 1995),

presentation of judicial instructions (prohibitive versus informative instructions) on decisions (Shaw & Skolnick, 1995), and even the effect of attorney gender on juror decisions (Nelson, 2004) to name a few. Overall, a wide variety of decision-making research related to jurors and juries appears to exist, but similar research on defendants and offenders appears to be lacking in comparison.

In addition to studying jurors, many studies exist examining judges' decision-making. Judicial decision-making based on the judge's gender or race has been the focus of several studies. One such example was Peresie (2004) which cites past empirical findings with conflicting results, with some prior studies finding a direct effect of gender on judging, and some finding no such effect. Many studies appear to exist on judicial decision-making in specified case types such as in divorce cases where rulings are influenced by current social and public opinion trends (Garrison, 1995). A similar study focused on child custody disputes found that counselor recommendations and child preference were the only influencing factors on a judge's final decision (Kunin, Ebbesen, & Konecni, 1992). Additionally, when the death penalty is involved in a court decision, elected judges are more likely to uphold the jury's decision for the death sentence when their elections approach (Bowers, Foglia, Giles, & Antonio, 2006). More recent research has even sought to mimic judges' decision-making within artificial intelligence to reshape or supplement the judicial role (Sourdin, 2018).

Decision-making amongst prosecutors is also a well-researched topic. Much of this research is focused on factors related to prosecutorial preferences (e.g., Rainville, 2001) and decision-making in case processing (e.g., Albonetti, 1986; Cole, 1969; Rebovich, 1996) or in the charging function (Gershman, 2010). Further, there exists research examining the effect of different roles in the criminal justice on each other, such as the influence of sentencing demands from a prosecutor on judicial decision-making (e.g., Englich, Mussweiler, & Strack, 2006; White, 1987). There are also several studies focused on the influence of prosecutors on juror decision-making as well (e.g., Greene & Dodge, 1995; White, 1987).

Plea Bargaining

Thus, while there is substantial research in criminal justice on the decision-making of various individuals involved in the system, little is known from the defendants' perspectives. One particular area of the criminal justice system where defendant decision-making research is lacking is in the plea-bargaining process. Plea bargaining is a common form of criminal case resolution in the criminal justice system, and while controversial, it is more cost efficient than sending all criminal cases to trial (U.S. Department of Justice, 2011). In a plea-bargaining scenario, before going to trial a defendant facing a criminal charge will be presented with an opportunity by the prosecuting attorney to plead guilty to a lesser charge or to the original charge with a lesser sentence by prosecutors (U.S. Department of Justice, 2011). The plea bargain process leaves the defendant with the choice between a guaranteed plea bargain or continuing their case to trial where they face the maximum charge and/or sentence if found guilty (U.S. Department of Justice, 2011). Going to trial is often perceived as risky as it is nearly impossible to predict what a jury or judge will decide, and thus, roughly 95% of criminal cases are resolved by accepting a plea bargain and never make it to trial (U.S. Department of Justice, 2011; Bar-Gill & Ben-Shahar, 2009; Bureau of Justice Statistics, 2005). Put simply, defendants are often faced with deciding between a smaller, guaranteed sentence or risking being found guilty in trial and receiving a larger sentence.

Research on the plea bargain system has led to much controversy surrounding the practice. One of the biggest criticisms of the plea-bargaining process is that it allows prosecutors too much discretion in comparison to judges, as judges are held to explicit sentencing guidelines that do not apply to prosecutors in this scenario (Burke, 2007; U.S. Department of Justice, 2011; Finkelstein, 1975). Finkelstein (1975) discovered that prosecutors have been found to use threats, such as more serious charges or longer sentencing, to coerce defendants into accepting pleas to secure a conviction when case evidence is insubstantial and may not be viewed as likely to lead to conviction in trial. Further, other researchers have noted the influences of prosecutorial biases on the plea-bargaining

process due to the wide latitude prosecutors are given when they reduce charges for defendants (Ma, 2002; Burke, 2007).

Despite roughly 95% of criminal cases being resolved in plea bargaining, Bar-Gill and Ben-Shahar (2009) argue that many defendants who settle for a plea bargain would not have been charged or faced such harsh sentencing had they gone to trial. They also suggest that we cannot count on the fact that plea bargains are entered voluntarily and are desirable for all parties involved (Bar-Gill & Ben-Shahar, 2009). This paper cites several other studies that point to the coercive nature of plea bargains and that the defendant's choice of a plea bargain is often a response to threats and powerful constraints from prosecutors, thus making defendants fear the possibility of trial (Alschuler, 1981; Bar-Gill & Ben-Shahar, 2009; Schulhofer, 1992). These threats from prosecutors are referred to as the defendants' collective action problem and it is suggested that if defendants were able to bargain collectively, harsh plea bargains would not be so readily accepted (Bar-Gill & Ben-Shahar, 2009). This information further reflects the need to understand the decision-making process in plea-bargaining from the defendant perspective.

Overall, defendant decision-making appears to be the least researched of all the various roles in the criminal justice system. The analysis of how defendants make decisions, such as plea bargains, can greatly benefit many who work within the criminal justice system, whether it be prosecutors, defense attorneys, or judges. With many studies pointing to flaws in the system via prosecutorial bias and discretion (e.g., Albonetti, 1991; Britt, 2000; Burke, 2007; Ma, 2002; Finkelstein, 1975), there is intellectual merit in having a study that focuses on the defendant perspective in the plea-bargaining process. Thus, this research could benefit the criminal justice system by providing information that could aid in developing new policy and guidelines to ensuring a more just and fair systematic process.

Probability Discounting

Decision-making in the plea-bargaining process can be understood through a variety of tools used in choice and decision-making research, such as behavioral economics. One tool used in

behavioral economics that can be used is probability discounting. Probability discounting is a behavioral economics tool used to quantify an individual's decision making by measuring how the negative value of some event (e.g., prison time) becomes less potent as it becomes less likely to occur (e.g., likelihood of conviction at trial; Falligant & Pence, 2019; McKerchar & Renda, 2012; Myerson, Green, & Morris, 2011; Odum, 2011; Shead & Hodgins, 2009). As the outcome becomes less potent, a person's choice is less likely to be affected by that outcome. The decision-making process in a probability discounting paradigm is measured by presenting participants with the choice between two outcomes. With one outcome, there is a guaranteed outcome that the person will receive. With a second outcome, there is a greater outcome with a varying probability or likelihood of receipt (McKerchar & Renda, 2012; Myerson, Green, & Morris, 2011). Thus, participants are making choices between a guaranteed choice or a risky choice. As seen in existing discounting research, individuals often prefer the immediate or guaranteed choice over the delayed or probabilistic choice (Myerson et al., 2011). In other words, individuals often prefer the smaller certain choice over the larger probabilistic choice, because the value of the probabilistic choice is discounted, whereas the value of the immediate choice is not (Myerson et al., 2011).

Probability discounting has been used to examine a variety of research questions. Most commonly, measures of probability discounting are used to measure impulsive decision-making. One such example includes a study performed by Reynolds and colleagues (2004) where smokers were found to demonstrate greater impulsivity, or greater rates of discounting, than nonsmokers on a monetary amount task. A similar task allowed for Richards and colleagues (2013) to determine that alcohol use did not influence participants' discounting by comparing their rates of discounting when sober and when under the influence of alcohol. Broader studies using this method have also included presenting participants with decision-making tasks with a variety of gains and losses to determine the perceived value of the outcome (Estle, Green, Myerson, & Holt, 2006).

Due to the very nature of plea bargains, a probability discounting task can be easily adapted into a plea bargain scenario. A plea bargain decision can be conceptualized as a choice between the

acceptance of a plea bargain of a lesser, guaranteed punishment or going to trial where there is an unknown likelihood of being convicted and receiving a larger punishment (U.S. Department of Justice, 2011). Therefore, this scenario can be presented to participants as a choice between a specified amount of prison time from a plea bargain versus the choice of going to trial with a varying likelihood of being convicted of a specified maximum sentence.

A recent study sought to examine plea bargain decision-making by using both delay and probability discounting tasks to measure hypothetical plea bargain decision-making in various situations (prison versus sex offender registry) on an undergraduate student sample (Falligant & Pence, 2019). That study primarily sought to use both delay and probability discounting tasks to understand decisions in a criminal justice context. Delay discounting is another form of discounting used as a behavioral economics tool (Odum, 2011). In the study (Falligant & Pence, 2019), the authors analyze the difference in participants' rates of discounting when facing prison time versus having to be on the sex offender registry. The authors used a fill-in-the-blank task to measure discounting, in which participants were told to imagine a scenario where they were being charged with a crime and faced a varying probability of being convicted in trial and having to serve a varying prison sentence or varying time of being a registered sex offender (Falligant & Pence, 2019). They were then asked to type in the number of years in a plea bargain that they would accept instead (Falligant & Pence, 2019). Overall, the study found that participants did not discount differently when facing larger potential sentences (e.g., 1 year versus 25 years in prison). Additionally, rates of discounting between the two consequence types (prison time versus sex offender registry) were found to be similar (Falligant & Pence, 2019). These results indicated that participants' preferences for probabilistic outcomes framed as losses were largely unaffected by both consequence type and magnitude.

As probability discounting is a tool used in a variety of research areas, there are numerous methods of measuring probability discounting. Common measures include multiple choice methods, adjusting amount tasks, and fill-in-the-blank tasks (Chapman, 1996; Reynolds & Schiffbauer, 2004;

Beck & Triplett, 2009). The multiple-choice (MC) method (Beck & Triplett, 2009) allows the participant to select a subjective value from a list of choices provided by the researcher (e.g., Which one of the following amounts would you be willing to accept today rather than have a 50% chance of receiving \$100?). The adjusting amount task instead presents adaptive choices to the participant based on their previously made selections (Reynolds & Schiffbauer, 2004). For example, if a participant was presented with the choice to receive \$10 or a 50% chance of receiving \$100 and chose the guaranteed \$10, the adjusting amount task would adjust the \$10 to a lower number. If the participant chose the probable outcome, the guaranteed amount would adjust to a higher number. Lastly, the fill-in-the-blank task (Chapman, 1996) asks participants to generate the subjective value of an outcome without presenting options (e.g., How much money would you accept today rather than have a 50% of receiving \$100?).

Research surrounding the reliability of one task over another has been conducted several times (e.g., Weatherly & Derenne, 2011; 2013). Data has demonstrated that the fill-in-the-blank method produces steeper rates of discounting than other methods (Weatherly & Derenne, 2011; 2013; Terrell, Derenne, & Weatherly, 2014). Further, the study performed by Weatherly and Derenne (2011) demonstrated that the fill-in-the-blank demonstrated poor reliability relative to other measures. In comparison, a study that utilized the adjusting amount task (Friedel, DeHart, Madden, & Odum, 2014) produced higher R² values, indicating that discounting models fit adjusting amount data better than fill-in-the-blank data. Overall, the adjusting amount test is more commonly used in discounting research.

How This Study is Original

Small and Friedel (in preparation) recently conducted a study with a sample of undergraduate students where they replicated Falligant and Pence's (2019) fill-in-the-blank task. This study also conducted an adjusting amount task to make comparisons between the data of both tasks. The study found that data from the adjusting amount task was best fit by the Mazur (1987) nonlinear curve-

fitting model, but no model fit well to the data from the fill-in-the-blank task. This was supported by lower root-mean-square deviation (RMSE), or standard deviation of residuals, values which measure how far from the regression line data points are. This demonstrated not only that the adjusting amount task produces data with higher quality models, but that discounting could in fact be used as a measure for plea bargain decision-making through use of the adjusting amount task.

While the study performed by Falligant and Pence (2019) serves as an integral starting point for the use of discounting to measure plea bargain decision-making, its use of a student sample is a limitation in terms of generalizing results. Behavioral scientists often utilize student samples in their research and then publish broad claims regarding human behavior and psychology, but these samples may not actually be so generalizable (Henrich, Heine, & Norenzayan, 2010). American student samples have been described as “WEIRD,” as they come from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies, thus making results that come from them unable to be generalized to the world, or potentially even generalizable to the United States (Henrich et al., 2010). Despite these limitations, American undergraduates form the bulk of data in psychology’s experimental fields of psychology, cognitive sciences, and other related fields (Henrich et al., 2010). It is probable that the use of undergraduate samples in criminal justice research may be even less fitting.

Further, undergraduates are likely inappropriate to use in research such as plea bargain decision-making due to an inherent position of potential privilege they are in (e.g., higher education) compared to offenders currently in the criminal justice system. In addition, people that do not work or have direct involvement in the criminal justice system (including students) may simply lack knowledge about these processes due to unfamiliarity with the system. The Bureau of Justice Statistics (2003) notes that about 41% of federal inmates and 31% of probationers have not completed high school or its equivalency, compared to just 18% of the general adult population. Further, passing the GED testing process was the highest level of education attained by roughly 25% of state prison inmates, 20% of Federal inmates, and 10% of probationers, compared to about 4% of the general

population (Bureau of Justice Statistics, 2003). Furthermore, it may not be appropriate to assume that undergraduate students have a complete understanding of the criminal justice system. That incomplete understanding might apply especially to the plea-bargaining process, nor might they have a full grasp on the fact that many offenders are pushed to accepting plea bargains for a variety of reasons (e.g., Albonetti, 1991; Britt, 2000; Burke, 2007; Finkelstein, 1975; Ma, 2002).

Research Questions

This study sought to build on Falligant and Pence's (2019) prior work by extending the sample beyond undergraduate students and using a sample of adults with experience with the criminal justice system. By using adults with experience in the system, this study provides greater generalizability to criminal justice populations in comparison to students. Additionally, this study allowed for other factors, such as race and socioeconomic status, to be explored. Furthermore, this study utilized an adjusting amount task to administer the probability discounting tasks rather than the fill-in-the-blank task used by Falligant and Pence (2019). As described above, adjusting amount tasks are a more common measure of probability discounting than the fill-in-the-blank task and allow for greater accuracy and reliability in this study (e.g., Friedel et al., 2014; Weatherly et al., 2011). In addition to the adjusting amount task being more common and reliable, the null results in Falligant and Pence's (2019) probability discounting task may have been a result of their use of the fill-in-the-blank task.

The first research question of this study was: Do people with experience in the criminal justice system discount plea bargain decision-making differently when faced with different lengths of maximum prison sentences? The second research question of the study was: Is the degree of discounting correlated across prison sentences?

CHAPTER 2

METHODOLOGY

Participants

To determine an appropriate sample size, a power analysis was conducted. The analysis was conducted with G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) using the reported effect size ($\eta_p^2 = 0.72$) from Falligant and Pence (2019). For the analysis, repeated measures, within factors ANOVA was specified and an estimated non-sphericity correction of .88 was used. Due to Falligant and Pence (2019) not reporting a correlation statistic, a conservative estimate of $r = 0.3$ was used. Finally, alpha was set at 0.05 and power of 0.95. The power analysis determined that a sample size of 4 was needed for the study. Study participants were recruited through Qualtrics and followed specified exclusionary criteria.

Exclusionary Criteria

The study had three criteria that participants had to meet to be included in the study. Following the informed consent, participants were asked to respond to 5 questions assessing their personal experience in the criminal justice system. Response options were yes, no, or not sure. The questions asked the participants if they themselves 1) have ever been arrested, 2) have ever been to jail or prison, or 3) have ever been convicted of a crime. Questions also asked participants if a friend or family member of theirs 1) has ever been arrested, 2) has ever been to jail or prison, or 3) has ever been convicted of a crime. Participants had to respond “yes” to at least one of the six questions to be included.

The second criterion was that participants had to be 18 years of age or older. Participants were asked to input their age in years as part of the demographic questions section following the informed consent and criminal justice experience questions. Any participants who inputted an age younger than 18, or left the question blank, were excluded.

Lastly, the third criterion was that participants who failed an attention check were excluded. There were 6 total attention check questions; one appeared in the beginning of the survey following the demographic questions section, and the remaining 5 appeared at the end of the survey following the adjusting amount tasks. This was done to assess attention both before and after the adjusting amount tasks. All attention check questions gave participants the choice to respond “yes” or “no.” The attention check at the beginning was: “Have you ever completed a JMSS measure/questionnaire?” The JMSS measure is fictitious and does not exist. The set of 5 attention checks at the end of the survey asked participants if 1) they had ever been to Canada, 2) had ever been bitten by an insect, 3) are human, 4) have ever suffered a fatal heart attack, and 5) have ever been bitten by a great white shark. This set of attention check questions were designed so that participants could not reply only yes or only no to all 5 questions. Thus, any participants who did respond yes to all 5 questions or responded no to all 5 questions was excluded.

Procedures

In this study, we analyzed plea bargain decision-making using a probability discounting task via an online survey of a sample of adults with experience in the criminal justice system. Survey participants were recruited through Qualtrics recruitment service, who ensured that participants met inclusionary criteria described below. Participants were reimbursed for their time at a value of the federal minimum wage for 30 minutes of their time if they met inclusion criteria and completed the survey in its entirety. All survey materials were presented to participants using Qualtrics. The online survey first presented the participant with an informed consent, and if they selected the option indicating giving their consent to the study, they were taken to the first section of the survey which contained demographics questions. These questions asked participants about their age, sex assigned at birth, gender identity, sexual orientation, education level, income level, and zip code. This section also asked participants if they themselves or someone they know has previously been arrested, charged, or convicted of a crime, and ever spent time in jail or prison. Participants that answered “no”

to all criminal justice experience questions were immediately excluded from the study and did not continue forward to the remainder of the survey.

Following the demographics section, participants were then taken to a screen with the first adjusting amount task. There were three total tasks, one for each of the three magnitudes [1, 5, 25 year(s)], with an instruction block appearing first to explain the hypothetical situation to the participants. The instruction block told participants to imagine that they have been accused of a crime and if they go to trial, their lawyer has given them a certain likelihood of being convicted, and they can choose to accept a plea bargain of a reduced sentence instead of prison. This block further clarified that the plea bargain is always a guaranteed prison sentence, with only the likelihood of a prison sentence after a trial. After the participant selected the “next” button on the instruction page, they were brought to the adjusting amount task. After completion of the three adjusting amount tasks, participants were brought to the last part of the survey which contained 7 attention check questions.

The Adjusting Amount Task

The adjusting-amount task is an algorithm-based task that adjusts the questions a participant sees based on the participant’s prior choices and produces the main measure of probability discounting. First, participants were told to imagine that they are faced with a choice between accepting a guaranteed duration of incarceration or a jury trial with some probability of being convicted of a longer duration of incarceration. For the first trial, the task presented a choice (e.g., select the option you would prefer: a plea bargain of serving 12.5 years in prison or a 99% chance of being convicted and serving 25 years in prison). The participant then selected the option they prefer. As this task is algorithm-based, the choice made by the participant on trial 1 affected the choices presented to them on trial 2. Thus, on subsequent trials, the algorithm adjusted the plea bargain duration based on the participant’s past choices to find the maximum acceptable plea bargain for each combination of incarceration lengths and likelihoods of conviction. For example, if the participant selected the 12.5 years plea bargain, the next trial presented a larger, less desirable plea bargain (e.g.,

18.25 years). If they chose the 99% chance of 25 years in prison, the next trial presented a shorter, more desirable plea bargain (e.g., 6.25 years).

The adjustment became smaller with each trial to narrow down the maximum accepted plea bargain (e.g., adjusting from 12.5 to 6.25, then 6.25 to 3.13, etc.). This adjustment happened for a total of 7 trials (6 adjustments) for each magnitude and likelihood of conviction combination and was performed 5 different times (7 trials for each likelihood of conviction for each magnitude) for each magnitude. The final plea bargain amount at the end of the 7 trials is the indifference point for the specified magnitude and probability. There were three different durations of incarceration associated with the trial choice alternative: 1, 5, and 25 year(s). Additionally, there were five different likelihoods of conviction via trial: 99%, 90%, 50%, 10%, and 1%.

Overall, the purpose of this task was to gather the aforementioned indifference points from each participant. The indifference points served as the dependent variable of this study, and discounting studies in general (Odum, 2011). In the case of this study, the indifference points are the plea bargain incarceration durations that are subjectively equivalent to the probabilistic incarceration durations. For example, an indifference point of “20” on the task with the 25-year magnitude and a 99% probability of being convicted would indicate that the participant views accepting a plea bargain of 20 years as equal to the maximum sentence (e.g., 25 years) with those odds of conviction (e.g., 99% chance of conviction). Thus, this measure assessed the participant’s degree of discounting probabilistic incarceration (Odum, 2011).

Data Analysis

Before analyses were conducted, datum was filtered using criteria discussed by Johnson and Bickel (2008) to identify nonsystematic indifference points. These criteria were used to filter data to eliminate potentially low-quality data ensure given the limited use of tasks of this nature on this population. The Johnson and Bickel (2008) criteria examines individual data points to identify indifference points that were not monotonically decreasing with probability. In other words, this

approach flags participant data that does not appear to follow a trajectory in decision-making that discounting models, such as the Mazur model (1987), state. Thus, the current study flagged instances of non-systematic discounting data using the two criteria of Johnson and Bickel (2008): 1) if any indifference point (starting with the second probability) was greater than the preceding indifference point by a magnitude greater than 20% of the larger later sentence and 2) if the last indifference point (obtained at probability of conviction) was not less than the first indifference point by at least a magnitude equal to 10% of the larger later outcome (Johnson & Bickel, 2008). The first criterion flags participant data where at least one indifference point (starting with the second probability) is greater than the preceding indifference point by a magnitude 20% of the larger, potential conviction (Johnson & Bickel, 2008). Violation of criterion 1 in this study would indicate that larger plea bargains become more desirable as likelihood of conviction decreases, rather than becoming less desirable. The second criterion flags data to ensure that the last indifference point (e.g., 99%) is not less than the first indifference (e.g., 1%) by a magnitude of at least 10% of the maximum prison sentence (Johnson & Bickel, 2008). Violation of criterion 2 in the data indicate that probability of conviction has minimal or no impact on willingness to accept a plea bargain (Johnson and Bickel, 2008). The indifference points were assessed with both criteria for each of the three tasks (one task for each magnitude) so that participants were excluded for violating one or both criterion on at least one task. Use of these criterion flagged 57 participants and reduced the sample from 101 participants to 44 participants.

First, to equate the degree of discounting across prison sentence duration (e.g., magnitude) the indifference points were standardized. The indifference points were divided by the maximum potential sentence to represent a proportion of the maximum amount presented in the questions [1, 5, 25 year(s)]. For example, all the indifference points for the task with a maximum potential sentence of 25 years were divided by 25. Thus, all indifference points were transformed into proportions of the long duration sentence. Then, the Mazur (1987) discounting model was fit to the standardized indifference points. The Mazur (1987) model was used instead of others (e.g., Rachlin, 2006;

Myerson & Green, 1995) because a previous study conducted (Small and Friedel, in preparation) with a student sample found the Mazur (1987) model to be the highest quality model based on AICc values. That Mazur model is

$$V = \frac{A}{1 + b\theta}$$

in which the parameter V is the indifference point, θ is the odds against being convicted, A is the magnitude of standardized prison time (all set to the standardized value of 1), and b is the degree of discounting. The model was fitted to group-level median indifference points.

The first goal of the study was to determine if there were differences in the degree of discounting across prison sentence durations. To answer this first question, a repeated measures ANOVA approach was used. Area under the curve (AUC) values were used for these analyses as they are a commonly used measure of discounting due to being theoretically neutral and typically circumvent statistical problems created by skewed distributions resulting from curve fitting (Myerson, Green, & Warusawitharana, 2001). The AUC values represent the area between the indifference points and the x-axis if those data points were plotted on a graph. Area-under-the-curve was calculated by using a formula to calculate the area of adjacent trapezoids (as if they were plotted on a graph). The formula for the trapezoids is $(Y_1 + Y_2)/2 * (X_2 - X_1)$ where Y are successive indifference points and X are successive odds against conviction. The trapezoids are summed to obtain the final AUC (Myerson et al., 2001). For the repeated-measures ANOVA, the Greenhouse-Geisser correction was used to account for sphericity.

The second goal of the study was to determine if the degree of discounting is correlated across prison sentence durations. To answer this question, a Pearson's correlation analysis was used. Correlation analyses were conducted to compare discounting at 25 years to 5 years, 25 years to 1 year, and 5 years to 1 year.

CHAPTER 3

RESULTS

Sample Demographics

The sample consisted of 42 participants. The sample had a median age of 43 years old. Most of the sample reported both their sex assigned at birth and gender identity as female (see Table 1). The majority of the sample identified as heterosexual. Further, much of the sample identified as white and not Hispanic or Latino/Latina/Latinx. Reported household income had some variability, with about a quarter of the sample having reported an annual household income of less than \$10,000. While the demographic section of the survey did contain a question requesting that the participant input their zip code, most participants left this question blank.

Table 1: Demographics

Demographic	Participants (N = 42)
Sex assigned at birth	
Female	61.9% (<i>n</i> = 26)
Male	38.1% (<i>n</i> = 16)
Gender Identity	
Female	61.9% (<i>n</i> = 26)
Male	38.1% (<i>n</i> = 16)
Sexual Orientation	
Heterosexual	81% (<i>n</i> = 34)
Bisexual	16.7% (<i>n</i> = 7)
Homosexual	-
Asexual	-
Pansexual	-
Prefer not to say	2.4% (<i>n</i> = 1)
Racial Identity	
White/Caucasian	81% (<i>n</i> = 34)
Black/African American	11.9% (<i>n</i> = 5)
Native American or Native Alaskan	-
Asian	2.4% (<i>n</i> = 1)
Native Hawaiian or Pacific Islander	-
Other	4.8% (<i>n</i> = 2)
Ethnic Identity	

Not Hispanic and/or Latino/Latina/Latinx	83.3% (<i>n</i> = 35)
Hispanic and/or Latino/Latino/Latinx	9.5% (<i>n</i> = 4)
Prefer not to answer	7.1% (<i>n</i> = 3)
Reported Household Income Range	
Less than \$10,000	7.1% (<i>n</i> = 3)
\$10,000-\$19,999	11.9% (<i>n</i> = 5)
\$20,000-\$29,999	16.7% (<i>n</i> = 7)
\$30,000-\$39,999	14.3% (<i>n</i> = 6)
\$40,000-\$49,999	14.3% (<i>n</i> = 6)
\$50,000-\$59,999	7.1% (<i>n</i> = 3)
\$60,000-\$69,999	2.4% (<i>n</i> = 1)
\$70,000-\$79,999	9.5% (<i>n</i> = 4)
\$80,000-\$89,999	4.8% (<i>n</i> = 2)
\$90,000-\$99,999	2.4% (<i>n</i> = 1)
\$100,000-\$149,999	7.1% (<i>n</i> = 3)
More than \$150,000	2.4% (<i>n</i> = 1)

About half of the sample reported having been arrested (see Table 2). Next, a little under half reported having ever been to jail or prison, and a little under half reported ever being convicted of a crime. Almost all the participants reported having a friend or family member who had been arrested. Further, most of the sample had a friend or family member who had been to jail or prison and convicted of a crime.

Table 2: Reported Criminal Justice Experience

Criminal Justice Experience	Participants (N = 42)
Have you ever been arrested?	
Yes	45.2% (<i>n</i> = 19)
No	54.8% (<i>n</i> = 23)
Not sure	-
Have you ever been to jail or prison?	
Yes	35.7% (<i>n</i> = 15)
No	64.3% (<i>n</i> = 27)
Not sure	-
Have you ever been convicted of a crime?	
Yes	40.5% (<i>n</i> = 17)
No	59.5% (<i>n</i> = 25)
Not sure	-
Has a friend or family member of yours ever been arrested?	

Yes	90.5% ($n = 38$)
No	4.8% ($n = 2$)
Not sure	4.8% ($n = 2$)
Has a friend or family member of yours ever been to jail or prison?	
Yes	90.5% ($n = 38$)
No	7.1% ($n = 3$)
Not sure	2.4% ($n = 1$)
Has a friend or family member of yours ever been convicted of a crime?	
Yes	73.8% ($n = 31$)
No	19% ($n = 8$)
Not sure	7.1% ($n = 3$)

Analyses Results

Figure 1 displays the Mazur model curves for each of the three magnitudes used. This figure demonstrates participants' willingness to accept a plea bargain decreasing as the odds that they will not be convicted increases. Table 3 displays parameter estimates, including the R^2 and $RMSE$ values. The R^2 and $RMSE$ values produced by the Mazur model formula indicate a good fit to the group-level data. The table also displays the best-fit b values which are similar across the three magnitudes, indicating that choices made at each magnitude were not more or less impulsive compared to each other.

Figure 1 Mazur Model Curves

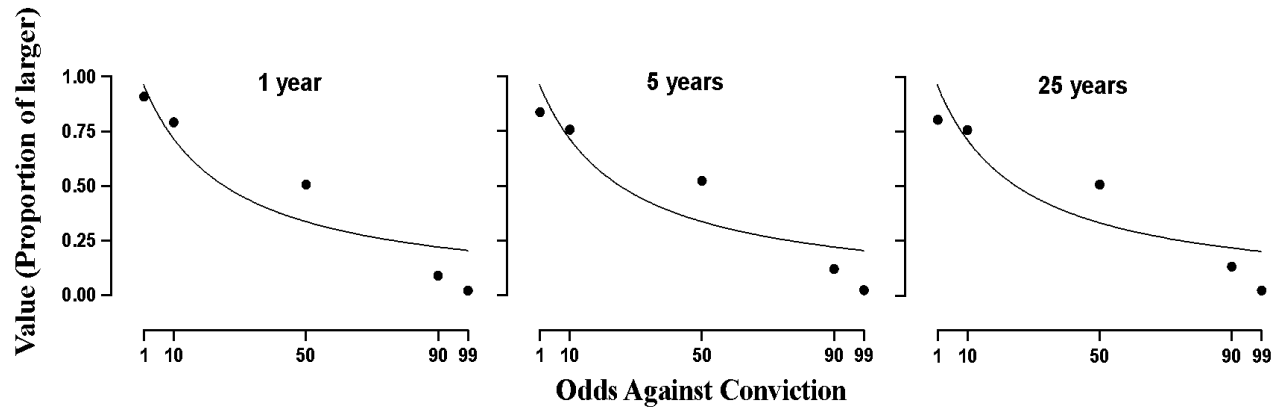


Table 3 Mazur Model Fit Statistics

Magnitude	Best-fit b value	R^2	RMSE
1 year	0.03955	0.8643	0.1477
5 years	0.03961	0.8253	0.1537
25 years	0.04026	0.8113	0.1546

Figure 2 displays a box-and-whisker plot (Tukey whiskers) based on the distribution of individual-level AUC values for each magnitude. The “whiskers,” or lines extending from the boxes, represent the outlier AUC values for each magnitude. The boxes themselves represent interquartile range, where most of the AUC values fall and the lines within the boxes denote the median AUC value. The repeated-measures one-way ANOVA of the area under the curve (AUC) values indicate no statistically significant differences in AUC values across the three magnitudes [$F(1.886, 77.33) = 1.57, p = 0.2157$]. In terms of discounting, this means that participants did not differ in how they discounted a plea bargain when facing different maximum potential prison sentences.

Figure 2 Box-and-Whisker Plot

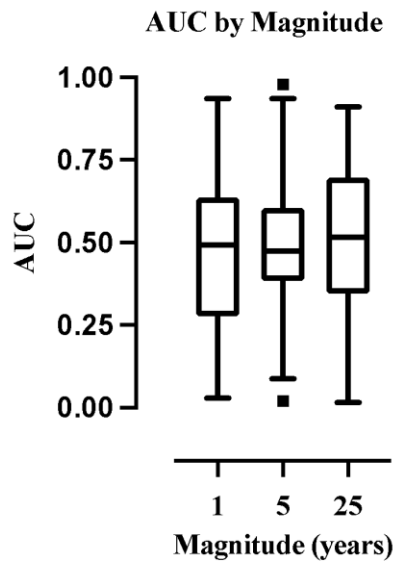


Figure 3 displays the scatterplots demonstrating the correlations across the three magnitudes. Pearson's correlations were calculated to compare degree of discounting between the different magnitudes of prison sentences. Table 4 contains the Pearson's r between AUC at each pairing of magnitudes. Pearson's correlation analyses across all three magnitudes all produced statistically significant r values, which can be visualized by the scatterplots' demonstrations of strong, positive correlations. In other words, as the choice to forgo a plea bargain in exchange for the choice to go to trial increases at one magnitude, it also increases at other magnitudes.

Figure 3 Pearson Correlation Scatterplots

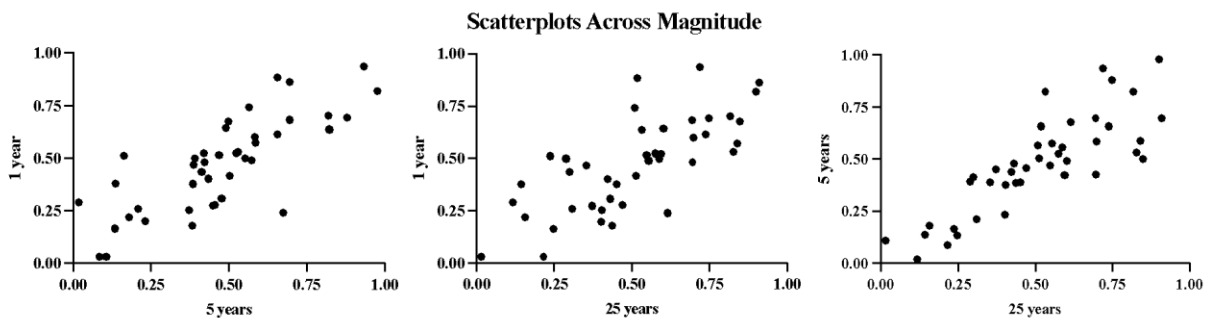


Table 4 Pearson Correlation Results

	1 year	5 years	25 years
1 year	1	0.78***	0.73***
5 years	-	1	0.83***
25 years	-	-	1

*** represents $p < 0.001$

CHAPTER 4

DISCUSSION

This study utilized a probability discounting task to measure decision-making in hypothetical plea bargain scenarios when faced with varying lengths of maximum prison sentences. This sample of individuals with direct or indirect criminal justice experience responded to scenarios with varying probabilities of being convicted of a crime via a jury trial and having to serve a stated maximum potential prison sentence (e.g., prison time). The Mazur model formula produced model parameters determining good fit with group-level data, indicating that participants discounted according to the Mazur model by displaying steeper discounting as odds of not being convicted increased. The repeated-measures ANOVA used to test the first research question found that different maximum prison sentence lengths, or sentences of different severities, did not affect participants' decision-making. This indicates that while severity or length of maximum sentence did not affect participants' willingness to accept a plea bargain, their decision was impacted by the likelihood of being convicted at trial. Thus, certainty affected participants' willingness to accept a plea bargain in that they were less likely to accept a plea bargain as the likelihood of conviction decreased.

The second research question sought to determine if participants' discounting when faced with different probabilities were similar at the different magnitudes. Even though participants' willingness to accept a plea bargain did not differ when facing different sentence lengths, correlation analyses demonstrated that participants' rate of discounting was consistent across magnitudes. In other words, if an individual demonstrated steep discounting when facing a maximum sentence of 1 year, then they were going to demonstrate steep discounting when facing a maximum sentence of 25 years. Thus, while decision-making did not differ significantly between magnitudes, decision-making followed a similar pattern at the various probabilities of conviction across magnitudes.

This study's findings are similar to those published by Schneider and Zottoli (2019) wherein participants assigned to guilty and innocent conditions were offered discounted sentences

(20%, 50%, or 70%) in exchange for a guilty plea in place of a potential trial sentence of 5 or 25 years. However, in the current study, potential trial sentence had a minimal effect on plea acceptance, despite previous research supporting the notion that plea acceptance increases with increasing potential trial sentences (Dervan & Edkins, 2013; Zimmerman & Hunter, 2018). Specifically, discount played a larger role in participant willingness to accept a plea than potential trial sentence magnitude (Schneider & Zottoli, 2019). These differences could be due to the fact that the current study presented participants with choices where much of the focus was placed on the probability of being convicted at trial, whereas the study by Schneider and Zottoli (2019) simply focused on discounting the value of the actual plea bargain, regardless of the probability of being convicted. Simply put, the current study's independent variable was the probability of being convicted at trial and the independent variable in the study by Schneider and Zottoli (2019) was the value of the plea bargain itself.

The current study's findings that participants' willingness to accept a plea bargain was unaffected by severity of potential sentence but was affected by probability of conviction is also consistent with literature on deterrence theory. Mendes and McDonald (2001) performed a meta-analysis on 33 published studies regarding the effect of severity on deterrence. That meta-analysis cites research dating to the 1970s wherein researchers consistently find null findings regarding severity of punishment (e.g., length of sentence) influencing deterrence (Mendes & McDonald, 2001). Rather, it is certainty (e.g., the likelihood that punishment will actually occur) and celerity (e.g., the time between the occurrence of the crime and receiving punishment) of punishment that often affects defendants. The concept that certainty and celerity play a larger role in deterrence than severity has come to be generally accepted in the field (Tonry, 2017; O'Connell et al., 2011; Pogarsky, 2009). This is also evident in practice by harsher punishments failing to deter violent and drug crimes any more than lesser ones do, the fact that mandatory minimum sentences and lengthy prison terms in practice have failed to deter crime, and the death penalty's inability to deter homicide compared to other available punishments (Tonry, 2017).

Thus, while the current study found that magnitude (e.g., severity of maximum potential punishment) had no significant effect on participant decision-making, this study did establish support for certainty of punishment playing a role. Evidence that certainty impacted participants' decision-making was seen in the Mazur curve-fitting models for the three magnitudes used in this study that showed a decline in willingness to accept a plea bargain when the probability of conviction decreased. In other words, as the occurrence of punishment became less certain, participants were less willing to accept a plea bargain.

Limitations and Future Directions

A limitation of the study was sample size and demographic make-up of the sample. The sample consisted mostly of heterosexual, cisgender, white, non-Hispanic/Latinx individuals. This is not reflective of the diverse demographic make-up of individuals in the criminal justice system. According to the Federal Bureau of Prisons (2022), the current incarcerated population in the United States is over 90% male with a median age of 36 years old. Further, the current inmate population is roughly 57% White, 40% Black, and 70% report not identifying as Hispanic/Latinx (Bureau of Prisons, 2022).

As a future direction, further studies should focus on recruiting not only a larger sample, but also focus on recruiting a more diverse sample representing all major racial and ethnic backgrounds in the United States and expanding beyond non-minoritized individuals. In addition to increasing sample size and expanding to a more diverse sample, future studies should consider limiting the sample to individuals with direct criminal justice experience (e.g., having been arrested, convicted, and/or spent time in jail/prison), opposed to the current study that employed individuals with both direct and indirect (e.g., knowing someone who has been arrested, convicted, and/or been to jail/prison) experience. Use of participants with direct criminal justice experience can also be used to expand upon the differences in discounting plea bargain decisions when assigned to a guilty or innocent

condition, as similar studies have not focused on samples of individuals from this population (e.g., Schneider & Zottoli, 2019; Wilford et al., 2021; Dervan & Edkins, 2013; Edkins & Dervan, 2013).

Another limitation of this study is the fact that real plea-bargain decisions have a variety of variables and are more complex than the two-option choice presented in the study. In practice, a defendant would spend substantially more time deliberating on the decision to accept a plea bargain or not than participants spent deliberating in this study. Wilford et al (2021) examined some of these additional variables that go into plea bargain decisions by assigning participants as “guilty” or “innocent” to determine how that classification effected participants’ willingness to accept a plea bargain. That study found that “guilty” participants were more likely to accept a plea bargain than “innocent” participants were (Wilford et al., 2021). This recent study supports other existing research that brings light to the “innocence problem” often found in the plea-bargaining process wherein study participants assigned to an “innocent” condition are less likely to accept a plea bargain than participants assigned “guilty,” but ultimately end up still being more likely to accept a plea bargain than seeking trial (Edkins & Dervan, 2013). Thus, the current study was limited in that probability and severity were the only variables related to this complex decision used. As such, future studies should aim to incorporate some of these variables into their surveys.

Lastly, this study was unable to collect complete data on participants’ geographic location as more than half of the participants left the question asking for their zip code blank. Ensuring diversity in location is important as Britt (2000) discussed the importance of considering jurisdictional differences across counties. As such, it is also of importance for future research to ensure sample participants have diversity in location, as participant attitudes towards plea bargains can be affected by their locale’s unique racial and economic disparities. It is noted that there are differences between counties regarding how harsh judges punish offenders of various racial, ethnic, and socioeconomic backgrounds dependent on the county’s existing political climate (Britt, 2000). Thus, this variable should be further explored by expanding the study sample to individuals from a variety of counties and states. Qualitative measures

assessing participants' rationale for accepting or not accepting a plea could also aid in exploring this variable.

CHAPTER 5

CONCLUSION

Ultimately, this study serves as the first to examine plea bargain decision-making with probability discounting with a sample containing individuals with direct and indirect experience in the criminal justice sample. Based on model-fit statistics from the Mazur model, this study found evidence that discounting tasks regarding plea bargain decisions do work. While there are many other variables in the plea-bargaining decision to be examined, this study's use of a sample containing individuals with direct and indirect experience in the criminal justice system provides new perspective to contribute to the existing body of literature that primarily uses student samples and samples of random adults (regardless of criminal justice experience). The lack of magnitude effect in this study is ultimately supported by similar research (Schneider & Zottoli, 2019; Tonry, 2017; O'Connell et al., 2011; Pogarsky, 2009). With social context, such as the innocence problem, becoming a more widely researched area of plea-bargain related decisions (Schneider & Zottoli, 2019; Wilford et al., 2021; Edkins & Dervan, 2013; Dervan & Edkins, 2013), future research should ideally aim to examine effects of magnitude and varying probabilities of conviction on participants with direct criminal justice experience assigned to different conditions where they are to assume guilt or innocence. There are still many unanswered questions in regard to the plea-bargaining process, and with an estimated 12 million people arrested annually in the United States, the number of individuals affected are too large to ignore.

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