

## **ABSTRACT**

Title of dissertation:                   EXAMINING GENERAL DETERRENCE USING  
DATA FROM THE NATIONAL FOOTBALL  
LEAGUE

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To date, research studies have found only mild support for classic deterrence theory with the greatest support for increased certainty, little support for increased severity, and scant research on the effect of increased celerity. Much of this prior literature has used scenario-based data, relied heavily on student samples, and explored rule breaking behavior over relatively short time periods. Finally, the slow pace of punishment within the criminal justice system potentially reduces any existing deterrent effect of the certainty and severity of punishment. This dissertation seeks to address these limitations of prior deterrence studies by using 13 years of data (2000-2012) from the National Football League consisting of rule breakers who are punished with penalties and monetary fines almost immediately upon discovery of the infraction.

The main question driving this research is whether there is evidence of general deterrence. Specifically, this dissertation seeks to determine whether prior punishment reduces current rule-breaking behavior. To address this question, this research explores the effect of on-field penalties and post-game fines on behavior within the National Football League at both the league and team levels. The dataset has several rare

characteristics including: large variety and detail in the types of punishment administered, an opportunity to directly observe the effect of punishment, the near immediate imposition of punishment, and the transmission of almost perfect information about punishment.

The primary finding is that there is no evidence of general deterrence in the National Football League, independent of control variables. Specifically, penalties and fines do not appear to prevent future rule breaking behavior. In general, when controlling for particular seasons, opponents, or the record of a team, the effects of penalties and fines lose significance and approach zero. The different controls for seasons, opponents, or record are fairly consistent in their statistical significance for all penalties and violent penalties, although it appears that violent penalties vary less according to these outside factors than all types of penalties. In sum, this dissertation finds no evidence that punishment affects future rule-breaking behavior at either the team or league level and thus, does not provide support for general deterrence.

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FOOTBALL LEAGUE

by

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## CHAPTER 1: INTRODUCTION

Sports, just like societies, have rules that are meant to guide behavior. The National Football League (NFL) is a prime example of this with a 120-page rule book intended to control the actions of 1,696 players and 32 head coaches (Goodell, 2012). These rules encompass a variety of areas from promoting sportsmanship (prohibiting excessive celebration) to ensuring the safety of players (prohibiting unnecessary roughness) all with the intention of producing certain behavior within the league. Each of these rules has sanctions that vary depending on the severity of the act. The punishments include an award of a first down to the opposing team, loss of a down, yardage penalty (5-15 yards), disqualification, suspension, and fines ranging from \$75 to \$500,000. From 2000 to 2012, there were 50,067 penalties committed within the NFL (“Armchair Analysis”). It is the use of these rules, sanctions, and the intentions of the sanctions that make the NFL a particularly powerful comparison to justice systems. Like the NFL, the regulatory and criminal justice systems have rules and laws to guide behavior and these laws are enforced by police officers or regulators (referees in the NFL). While the most severe punishments in the NFL are less severe than the most severe punishments in the criminal justice system (i.e. there is no death penalty or life imprisonment) there is similar variation in severity and type of punishment. The criminal justice system, regulatory justice system, and the NFL rest on the assumption that punishment deters rule breaking behavior and therefore they rely heavily on the tenets of deterrence theory: punishment that is swift, certain, and severe will prevent future crime (Beccaria, 1764; Gibbs, 1975; Nagin, 1998; Zimring and Hawkins, 1973).

This research utilizes the detailed and long term nature of NFL data to explore the effect of punishment on rule infractions. While some research has explored this question within the criminal justice system, sports, and the regulatory justice system, this research will expand on existing research by using longitudinal data with punishments that are enforced more swiftly than punishment within the criminal justice or regulatory justice systems. On-field punishment within the NFL can be compared to both the criminal justice system and the regulatory justice system. The comparison to the regulatory justice system is relevant because it uses group punishment for individual action (i.e., collective accountability) that is often conducted for the benefit of the corporation within a professionalized environment (Braithwaite, 1984). In addition, similar to the on-field behavior of NFL players, white collar rule breaking is often supported by the corporation (Coleman, 2005). Even though the regulatory justice system is an apt comparison, the criminal justice system is being used as a comparison in this dissertation for two primary reasons. First, the decision-making process of football players on the field is likely more similar to that of street criminals. It is typically a fast decision, made under constraints of the game, with strong emotions and visceral states. This process is similar to street criminal decision-making described by Loewenstein and colleagues (1997) and Katz (1988): a criminal decision is likely to involve “the arousal of powerful emotions such as fear, excitement, lust, anger” (Loewenstein et al., 1997, p. 444) and is a “sensual phenomenon” (Katz, 1988, p.4). Regulatory crimes, on the other hand, are hypothesized to be a more deliberative process in part because the culture of a corporation often rewards well thought out, rational decisions (Shover and Hochstetler, 2006).

The second reason this dissertation is using a comparison to the criminal justice system is because the population of NFL players is more similar to the typical street criminal population in terms of age and race. The average age of the NFL player is 25 years old (espn.go.com, 2003) and the groups with the highest rate of arrests within the general population are 18-24 year olds (Snyder and Mulako-Wangota, 2014). White collar criminals, on the other hand, are slightly older: the average age of onset has been reported as 35 and the average age of last arrest, 43 (Weisburd and Waring, 2001). In addition, the average age of a white collar crime offender has been reported to be 40 years old (Benson and Simpson, 2009).

The races of NFL players are also more similar to that of street criminals than white collar criminals. The NFL is made up of primarily non-white players. Only 29% of active players surveyed in 2007 were white, 65% were African-American, 3% Asian, 2% other, and 1% Hispanic (Rhoden, 2008). White collar crime, on the hand, is tied to opportunity to commit white collar crime, which results in an offender that is typically white and male (Benson and Simpson, 2009). In sum, while both the regulatory and criminal justice systems are strong comparisons to the punishment system within the NFL, the criminal justice system will be used in this dissertation due to the similarities in decision-making processes, age, and race.

Both Beccaria (1764) and Bentham (1789) provide the roots of deterrence theory. The theory that stems from their ideas posits that for punishment to prevent future crime it should be swift, certain, and severe. Research on deterrence theory has gone through many stages throughout history starting with a focus on the death penalty (e.g. Sellin, 1959). In the late 1960s and early 1970s, deterrence research focused on objective

deterrence, or the effect of actual punishment on crime (e.g. Chiricos and Waldo, 1970). The next stage of deterrence research focused on offenders' perceptions of punishment both in cross sectional and panel studies (e.g. Gibbs, 1968; Saltzman et al., 1982) and most recently, research has been scenario based and combined deterrence theory as a part of rational choice theory (e.g. Loughran et al., 2011a).

In addition to focusing on objective and perceptual deterrence, deterrence research has focused on the effect of specific policies, laws, or programs. For example there is research on increases in police expenditures, changing numbers of police officers, and changes in police tactics (e.g. Eck and Maguire, 2000; Evans and Owens, 2007; Koper, 1995; Levitt, 1997; Marvell and Moody, 1996; Sherman and Weisburd, 1995), incarceration (e.g. Spelman, 2000), three strikes laws (e.g. Zimring, Hawkins, and Kamin, 2001), gun laws (e.g. Kennedy, 2008), and deterrence within the regulatory justice system (e.g. Simpson and Koper, 1992). In sum, prior deterrence literature has found that the increased certainty of punishment decreases crime while the increased severity of punishment has virtually no effect on crime. The recent criminological research on deterrence theory using scenario based data, and relying heavily on student samples is an improvement over past research by attempting to parse out causality of experiences, perceptions of punishment, and behavior, but it does not explore objective deterrence using longitudinal data comprised of people committing rule violations. This dissertation will do just that, expand on prior deterrence research by exploring objective deterrence using longitudinal data comprised of individuals breaking rules.

This research uses play-by-play and fine data from the NFL over the years 2000-2012 in order to study repeated rule infractions over time within a closely monitored

setting. While the connection between football and the criminal and regulatory justice systems may not be immediately apparent, this dataset provides a particularly unique environment in which to observe rule breaking, sanctions, and subsequent behavior. There are four main reasons football is a particularly useful environment to observe deterrence. First, a football game, season, and football career provide a closed system to observe rule breaking behavior that we would not be able to observe with the same detail for crimes on the street. In any given football game, multiple players break multiple rules with multiple different sanctions. These sanctions differ by the severity of the yardage penalty imposed and whether a post-game fine is imposed. Second, the direct effect of punishment is more easily observed without the complication of the black box of prison (or arrest). This is an improvement over many criminal justice studies that struggle to differentiate between different competing effects, like deterrence and incapacitation (Levitt, 2004). Third, football penalties address one of the criticisms levied by past research; punishment may not have the strong deterrent effect that is expected because it is not imposed quickly enough (Paternoster, 2010). In most cases in football, the punishment is enforced immediately after the infraction. This allows certainty and severity to be observed with celerity held constant. To be clear, celerity is not explored in this dissertation. Instead, because the speed at which penalties are enforced is the same for all on field rule infractions, certainty and severity can be explored without complicating the relationship with the timing of punishment. Finally, football is an environment in which there is almost a perfect transfer of information about the rules and punishments to the players. While this does not remove players' perceptions of celerity, certainty, and severity, it likely gets perceptions of punishment as close as possible to

objective punishment. For example, with the recent crackdown on helmet to helmet hits, newspaper articles were written about the crackdown (e.g. Battista, 2010), a memo was sent to teams from the NFL commissioner, players were shown a video in order to put them “on notice” (Anderson, 2010), and several large fines were levied early on in the crackdown that all players were made aware of. It would be hard to argue that all players did not know about this new increased enforcement. Granted, this particular rule had a unique amount of publicity, but it is likely that all rule changes are told to players at least at a higher rate than new laws are passed on to citizens. In many ways, football is very comparable to that which Beccaria was calling for in 1764: the punishment is swift, certain, proportionately severe, and laws are accessible.

Other researchers have used sports to explore interesting topics like labor migration (Horowitz and McDaniel, 2013) corruption (Duggan and Levitt, 2002), and writing software (Munasinghe et al. 2001). The literature argues that sporting events are controlled economic environments and real world laboratories that result in highly reliable data (McCormick and Tollison, 1984; Moskowitz and Wertheim, 2011; Togler, 2009). Given the precedent of applying sports to non-sports topics, it is not surprising that sports have also been used to research criminological issues. The literature on sports and criminology can be divided into literature on deviance and deterrence. The deviance literature describes deviance and attempts to put deviance within a theoretical framework, but does not specifically explore prevention (e.g. Blackshaw and Crabbe, 2004; Eitzen, 1981; Luschen, 1980). Deviance is split into within-game deviance (e.g. violent behavior or code breaking) and out-of-game deviance including criminal behavior, sex scandals,

gambling, and performance enhancing drugs (Atkinson and Young, 2008; Delany and Madigan, 2009; Duggan and Levitt, 2002).

In addition to the theoretically focused deviance literature, there is sports literature specifically related to deterrence. The deterrence and sports literature focuses on outside of the game and within-game behavior. Research on behavior outside of the game has explored performance enhancing drugs and NCAA rule infractions (Cullen, Latessa, and Jonson, 2012; Strelan and Boeckmann, 2006). The literature that studies within-game behavior explores the effect of policing by questioning the effect of certainty through referees (Allen, 2002; Heckelman and Yates, 2003; Levitt, 2002; McCormick and Tollison, 1984). Finally, most relevant, Witt (2005) researched the effect of an increase in the severity of a rule change within the English Premier League (soccer). This research is particularly informative because it found that, based on a rule change, there is a displacement of fouls from more serious red card penalties to less serious no card or yellow card penalties. This was a macro level study looking at the overall number of fouls across the entire league for two seasons. The data in this dissertation will be able to expand upon this research by providing data over 13 years.

This research, like all deterrence research, is policy relevant. Since football is a closed system with almost complete information, if this research does not find support for deterrence theory, it raises questions about support for deterrence theory within the criminal justice system. On the other hand, if there is support for deterrence theory, it will suggest that the criminal justice system may not be properly exploiting people's rationality (Paternoster, 2010). Therefore, if there is support, this research will suggest that it will be worthwhile to explore more fully, when, why and how the mechanisms for

deterrence work within football with hopes of conveying the lessons learned in football to the criminal justice system.

In sum, football provides an opportunity to study deterrence theory using longitudinal data within a closed, closely observed system. Specifically, this dissertation explores general deterrence. This dissertation will start by describing the history of deterrence theory and research conducted on deterrence theory. Next, this dissertation will review the connection between sports and criminology, and finally, it will conclude with a description of the data, methods, results, and discussion.



## CHAPTER 2: DETERRENCE THEORY

The use of penalties and fines in the NFL assumes that punishment prevents rule breaking and thus invokes deterrence theory. This section will review the deterrence literature. Several reviews have been published that are comprehensive and well-organized, therefore this section covers much of the same ground (Nagin, 1998; Nagin, 2013; Paternoster, 2010). The framework for this review is as follows: deterrence theory will be defined, next the empirical development of deterrence theory will be discussed, and finally empirical research on specific policies and practices will be reviewed.

### HISTORY

The roots of deterrence theory begin with the writings of Cesare Beccaria (1764) and Jeremy Bentham (1789). In the 1700s, punishment within the ancient régimes was harsh and unevenly enforced. Both Beccaria (1764) and Bentham (1789) attempted to describe a system that would be more rational, predictable, and therefore, more efficient than the contemporary systems in which they were writing (Italy and England), but also a system that would prevent people from committing future crimes. Beccaria (1764) established the touch points of a basic framework, while Bentham (1789) presented a more developed theory. Both writings fall within the classical school of thought by positing that people are self-interested and rational, and therefore will seek out pleasure and avoid pain. The classical school asserts that if the pain of punishment is effectively enforced, people will forgo the pleasures of crime in order to avoid the pain of punishment. For Beccaria (1764), effective punishment is swift, certain, and just severe enough to prevent crime. He wrote that punishment should not be excessively harsh (as it

was at the time), but instead should be proportionate to the crime that was committed. In addition to describing effective punishment, Beccaria (1764) suggested other reforms including educating would-be criminals (as a prevention method) and enacting laws that were clearly written and accessible to all. When discussing punishment, Beccaria (1764) focused on state imposed punishment. Bentham (1789), on the other hand, focused on the more abstract costs or pains. Bentham's costs and pains included legal punishments, but also included informal costs. Each writer was the inspiration for different theories: Bentham's (1789) notion of utility and use of informal costs led to rational choice theory and Beccaria's (1764) use of state punishment led to deterrence theory.

After Beccaria (1764) and Bentham (1789), discussion of punishment based theories largely fell out of favor as the field moved toward the positivist school with Lombroso (1876) and Hooton (1939). During this time of decline for deterrence theory there was some research on the death penalty (e.g. Sellin, 1959), but deterrence research did not gain popularity again until the late 1960s with articles from Becker (1968) and Gibbs (1968). These writings coincided with a growth in crime rates, an increase in availability of technology, and improved statistics (Nagin, 2013). Becker (1968), an economist who drew from Bentham (1789) claimed that because people are rational and self-interested, criminal behavior can be understood just like any other economic decision-making: there are costs and benefits that can be manipulated to guide decisions. Becker (1968) hypothesized that certainty was more important than severity to change behavior.

Gibbs (1968), on the other hand, drew more from Beccaria's (1764) work by focusing only on punishment as opposed to the costs and benefits of the expected

utility/rational choice models of Bentham and Becker (1968). Gibbs (1968) specifically looked at certainty and severity and was the first to empirically test deterrence theory (more detail about this research below). Becker (1968) and Gibbs (1968) were the first in a line of research exploring the effect of punishment on crime. Before discussing the development of the research and theory, this section will define deterrence theory.

#### DETERRENCE THEORY DEFINED

As mentioned above, deterrence theory posits that people are self-interested and rational (Becker, 1968; Bentham, 1789; Gibbs, 1968). Therefore, in order for punishment to be effective at preventing crime it should exploit this rationality by increasing the certainty of apprehension and costs of punishment. The simplest stating of the deterrence hypothesis, almost directly from Beccaria (1764) is that when there is greater certainty, severity, or celerity, there should be a lower crime rate (Paternoster, 2010). The effect of punishment within deterrence theory is split into two different types of deterrence: objective and perceptual deterrence. Objective deterrence refers to punishment that is actually enforced, for example, arrests or imprisonment. Research exploring objective punishment assumes that people have knowledge of state punishment and that they internalize that knowledge, i.e., they know how likely it is that they will be arrested or imprisoned (Paternoster, 2010).

Perceptual deterrence, on the other hand, explores people's perceptions of punishment. For example, what a person thinks the likelihood of arrest is for driving drunk. Researchers have been discussing the link between objective and perceptual deterrence for many years. For example, as early as 1975, Gibbs recognized the

importance of determining the relationship between objective deterrence and perceptual deterrence. Despite the early acknowledgement of this connection, there is little literature that has found that the connection is strong. This literature will be reviewed in more detail below. The addition of perceptual deterrence allows for three more nuanced hypotheses of deterrence theory.

H1: Other things being equal, there should be an inverse relationship between the objective properties of punishment (certainty, severity, celerity) and the crime rate.

H2: Other things being equal, there should be a positive relationship between the objective properties of punishment (certainty, severity, celerity) and the perceptual properties.

H3: Other things being equal, there should be an inverse relationship between the perceptual properties of punishment (certainty, severity, celerity) and measures of criminal offending. (Paternoster, 2010, p. 786)

Objective and perceptual deterrence can be further broken down into two categories: general deterrence and specific deterrence. General deterrence is the threat of punishment that all people feel (Nagin, 2013). People generally know that they may be arrested if they drive drunk even if all people rate the risk of being caught slightly differently. Examples of measures of general deterrence include the effect of the number

of police on crime rates, the effect of a three strikes law on crime rates, or the effect of penalties on foul commission in football. Specific deterrence is an individual's own experience with punishment (Nagin, 2013). If a person offends and is caught, the experience of being caught will inform any future decisions to offend. Traditionally general deterrence was only relevant for those who had never committed a crime and specific deterrence was only relevant for those who had experience with punishment (Paternoster and Piquero, 1995). Also, punishment had to occur for both general and specific deterrence (Paternoster and Piquero, 1995).

The traditional view of general and specific deterrence changed with a reconceptualization of deterrence theory by Stafford and Warr in 1993. Stafford and Warr (1993) suggested that people can experience both general and specific deterrence and that in addition to punishment experience, punishment avoidance is also important to the deterrence model. This reconceptualization of deterrence theory fits with the above hypotheses as follows: if a person has a direct or indirect experience with punishment it will decrease the likelihood of future criminal offenses and if a person has a direct or indirect experience with punishment avoidance, then it will increase future rule breaking behavior (Stafford and Warr, 1993).

Research on deterrence theory has gone through many stages including objective deterrence, perceptual deterrence, and finally a stage in which much research is scenario-based and overlaps with behavioral economics and rational choice research. The next section of this chapter will review the research in each of these stages of research and then will review the research on particular policies, like the police and imprisonment.

## OBJECTIVE DETERRENCE

The early objective deterrence studies explored the effect of sanctions on crime rates using official data. Gibbs (1968) was the first researcher to empirically test objective deterrence. To explore objective deterrence, he used the aggregate number of admissions to state prison and the number of homicides known to police. He found support for objective deterrence: the greater the certainty and severity of punishment, the fewer homicides there were. The effect was greater for certainty than severity. As mentioned above, Gibbs' (1968) research was the beginning of a large number of deterrence studies. This section will review briefly some of the other research conducted during this time on objective deterrence.

Tittle (1969), using the same data that Gibbs (1968) used (official data and national prison statistics) found that there is a tipping point for certainty: certainty has an effect on crime, but only when it is above a certain point. He extended prior research by including different types of crime and controls for urbanization, age, race, education, and sex. Next, Chiricos and Waldo (1970) reanalyzed Tittle's (1969) data at three points in time and found that the relationship between police sanctions and imprisonment may have been spurious. They found no evidence for a severity effect and suggested that the certainty effect could be an effect of police reporting. They suggested that aggregate data was not the best way to look at deterrence, instead proposing that researchers use individual-level data.

Near the end of the objective deterrence stage of research, two different reviews were published on deterrence: 1) The National Academy of Science Report (Blumstein, Cohen, and Nagin, 1978) and 2) Cook (1980). Both reviews found that the criminal

justice system did have a deterrence effect although the National Academy of Science Report was more guarded and tentative about the findings than Cook (1980) was. At this point, researchers recognized that the data were not particularly strong, individual level data would be more effective, and that perceptions may play a part in deterrence. These findings led to shift to a new era of perceptual deterrence research.

#### OBJECTIVE AND PERCEPTUAL DETERRENCE CONNECTION

Research on objective deterrence assumes that there is a relationship between the sanctions that are enforced and what individuals perceive those sanctions to be. There have been several studies that have explored this connection. According to an Assembly Committee on Criminal Procedure in California (California Legislature, 1968), only about ¼ of the sample was able to correctly identify what the maximum punishment was for certain crimes. Not surprisingly, incarcerated people had a greater knowledge of punishment: 62% of the incarcerated sample knew what the punishment was for certain crimes. Williams, Gibbs, and Erickson (1980) explored perceptions more explicitly in a survey of 2,400 adults in Arizona. They found that while people's perceptions do appear to be positively related to the actual punishments, they seem more influenced by what they perceive punishments ought to be as opposed to what punishments actually are (see also Williams and Gibbs, 1981). Johnston, O'Malley, and Bachman (1981) suggested that the particular time period may affect individual's knowledge of laws. In a study using the Monitoring the Future data, they found that about 10-20% of people in states where jail was not legally used as punishment for marijuana use thought it was an option, and in states where jail was an option, about 30-40% believed that it was not an option. As evidence of the importance of the time period, it appeared that people were more

accurate in their estimation of the punishment when it was closer in time to the changing of a marijuana law (decriminalization).

Grube and Kearney (1983) found that about 60% of the 238 respondents in a phone survey knew of a newly imposed mandatory jail sentence for drunk driving. Kleck et al. (2005) directly explored the connection between perceptions of punishment and actual punishment in a telephone survey with 1,500 people in 54 counties. They found that perceptions had no significant relationship with actual punishment. MacCoun et al. (2009), updated Johnston et al.'s (1981) research by using the National Surveys on Drug Use and Health from 2001-2003 and found that the same amount of the sample (1/3) believe that jail is a punishment for marijuana use, regardless of whether it is a punishment in their respective states. Similar to the California Assembly (California Legislature, 1968), they found that experience with punishment improves this estimation: a person who had experience with the marijuana law was 72% more likely to think that jail was not an option when it was not. In sum, the research connecting objective punishment and perceptions is varied. At best, the research finds that over 50% of the population has fairly accurate perceptions of punishment and at worst, there is no connection at all between perceptions and actual punishment. This is a gap in deterrence research that deserves more attention.

## PERCEPTUAL DETERRENCE

Perceptual deterrence research focuses on the perceptions people have of punishment: instead of the actual arrest rate, for example, it explores what people think the likelihood of being arrested is. By the nature of what is being measured, this research



is primarily survey data that started out cross-sectionally, and over time expanded to panel data sets. The surveys generally asked respondents about self-reported criminal behavior or the intent to commit criminal behavior. Both cross-sectional research and longitudinal research had assumptions about perceptions. Cross-sectional surveys assumed that perceptions and criminal behavior were associated, but did not determine whether perceptions affected behavior or behavior affected perceptions. Most longitudinal research did address causality, but still assumed that perceptions were constant over time and did not allow for updating of perceptions.

Waldo and Chiricos (1972) were some of the first researchers to explore perceptual deterrence using individual level data. They interviewed undergraduates about whether the undergraduates themselves would commit a crime and whether someone else would commit the crime. Using survey data, they explored the effect of certainty and severity on crimes they labeled as *mala in se* and *mala prohibita*. *Mala in se* acts are considered inherently bad and in this research are operationalized as theft. *Mala prohibita*, on the other hand, are acts that are only bad because they are prohibited and in this case they are operationalized as drug use. This research found that certainty matters. It matters more for *mala prohibita* than *mala in se* and the deterrent effect is different for different people and different crimes.

Grasmick and Bryjak (1980) explored perceptual deterrence as it relates to severity. They argue that until this point severity had not been measured correctly and therefore they refined the measurement. Their refinement of severity did not assume that each individual had the same perception of severity for a particular punishment and instead allowed the perception of severity to vary by asking how large of a problem the

punishment would create for that person. With this refined measure of severity, Grasmick and Bryjak (1980) found a negative relationship between severity and self-reported behavior: increasing severity decreased self-reported behavior.

Paternoster and colleagues (1982) studied perceptual deterrence using panel research. They explained that the variations in the findings of prior research were due to different measures of perceived risk, different types of punishment, and different analytical techniques. To improve upon prior studies, they conducted a survey of 300 college students over 3 years on involvement in delinquent acts, perceptions of risk, and consequences of punishment in order to explore perceived risk more thoroughly. The panel design of this study improved upon prior research and allowed perceptions to vary over time. In this research, they found evidence of what they called an “experiential” effect, the effect of behavior on perceptions.

The recognition of the experiential effect highlighted the need for panel research designs and most research following Paternoster et al. (1982) used that design. Using the same sample as Paternoster et al. (1982), Saltzman and colleagues (1982) looked specifically at the experiential effect. They explored this effect with minor crime such as petty theft, marijuana use, and bad checks. They found that perceptions do vary over time and as Paternoster et al. (1982) found, that the relationship between perceptions and behavior appears to be reciprocal. In the reciprocal relationship, the effect of behavior on perceptions appears to be greater than the effect of perceptions on behavior.

In a review of the literature from 1972-1986, Paternoster (1987) sums up the deterrence findings to this point. He highlights the experiential effect and the necessity of using panel data, and the need for control variables. Cross-sectional research does

provide support for deterrence theory, but Paternoster (1987) suggests that this is likely a spurious relationship: when employing correct methods to address causality and spuriousness, the inverse relationship between certainty and severity and behavior disappears. This article suggests that deterrence literature up to this point is not promising and proposes that future research should be done with adult samples with high rates of offending. Paternoster (1987) also suggests that even with better samples and better methods, the results of deterrence research may not be promising. He suggests that people may not be as rational as we suspect. It is this concern that leads to the next stage of research that begins to explore how rational people are and what the limitations to this rationality is by merging deterrence theory with rational choice theory and bringing in behavioral economics and cognitive psychology.

## SCENARIO BASED RESEARCH AND ELABORATIONS

In the next stage of deterrence research, theoretical changes were made to deterrence to add benefits and informal sanctions to the model (e.g. Nagin and Pogarsky, 2001). With these additions, the line between deterrence theory and rational choice theory all but disappeared with research conducted in this area addressing both theories. Research has also changed to be primarily scenario-based research, allowing researchers more specificity about situations that they are studying (e.g. would you use marijuana in your house versus someone else's house).

As Paternoster (1987) suggested, much of this research is exploring how rational people are and what some of the limitations to rationality might be. A particular line of research looks at individual differences, specifically focusing on visceral states such as arousal. For example, Loewenstein and colleagues (1997) found that sexual arousal

increased a person's likelihood of perceiving themselves to act in a sexually aggressive way. This suggests that individual differences or visceral states may affect a person's rational decision making.

Other current research has focused on the limitations of rationality. For example, Loughran and several other researchers have explored the effect of ambiguity, anticipated regret, prospect theory, and time discounting (Anwar and Loughran, 2011; Loughran et al., 2011a, Loughran et al., 2011b; Loughran et al., 2012). To briefly summarize these findings, individuals do increase their estimations of the probability of being caught after being arrested (Anwar and Loughran, 2011). The effect of certainty is not linear, there is an approximate tipping point of .3. Below .3 there is no relationship between certainty and offending, but above increased certainty is related to a decrease in offending (Loughran et al., 2011b). People are ambiguity averse for decisions with losses such as arrest (Loughran et al., 2011a). Finally, people do have hyperbolic time preferences: people prefer immediate to delayed reward and this tendency increases as the time period to reward gets shorter (Loughran et al., 2012). This research speaks to when and how people are rational and what might affect their decision-making processes. As deterrence theory suggests, punishment may affect this calculus, but there is more than just punishment in these theoretical models. This recent literature attempts to address past limitations and move deterrence theory in a direction that may determine why, when, and for whom deterrence theory works. This dissertation will not be focusing on individual differences, but will be a useful future direction for this research.

## POLICY EVALUATIONS AND OTHER APPLICATIONS

Deterrence research includes another line of research that explores the effect of certain policies on criminal or rule-breaking behavior. This research could be included in the chronological history of deterrence research, but the studies below are useful when taken as a whole exploring a particular policy or program. Research that is most relevant to deterrence explores the effect of police, imprisonment, certain legislative acts like sentence enhancements, and deterrence within the regulatory justice system. This section will review the literature on each of these areas of policy.

Research on the police can generally be split into two categories: 1) expenditures on police and 2) police strategy. The next sections will discuss each of these areas separately.

### *Expenditures on Police*

The body of literature studying the effect of police expenditures primarily focuses on the impact that increasing the number of police officers has on the certainty portion of the deterrence hypothesis. While this dissertation is not concerned with an increase in the number of “police” on the football field (referees), it is important to understand current knowledge of the effect that increased certainty has on rule breaking behavior because the effectiveness of certainty is applicable to the effectiveness of sanctions. Therefore, this section summarizes the literature addressing expenditures on the police. Much of the literature is plagued by methodological limitations. Specifically, the problem of making a clean causal inference is evident in many studies. For example, literature on police expenditures struggles with determining whether an increase in crime causes an increase

in the number of police or vice versa. Despite these limitations, there is a large body of literature exploring the effect of the police and much of the literature attempts to address these limitations. This section will review the literature and the implications this research has for deterrence theory, and thus implications for sanctioning within the NFL.

Wilson and Boland (1978) were the first to study the effect of the number of police officers on crime. Specifically, they looked at the number of patrol units on the street and the number of moving citations in 35 cities on robbery rates. This research, as with all research exploring the effect of the numbers of police, assumes that police officers deter crime by a threat of greater certainty. Wilson and Boland (1978) found that there was a relationship between resources and activity of the police and the robbery rate, thus finding support for deterrence.

More recently, two studies attempted to address methodological limitations of past research (Levitt, 1997; Marvell and Moody, 1996). Marvell and Moody (1996) used the Granger Causality Test to explore the effect of the number of police officers per capita in 49 states and 56 large cities from 1973-1992 on serious felony crime rates. At the state level, there was a significant negative relationship between the number of police officers and homicide, robbery, and burglary rates. At the city level, the same effect was found for total crimes, homicide, burglary, larceny, and auto theft. Specifically, for each additional officer, at the state level there was a reduction of about four crimes and at the city level, there was a reduction of about 24 crimes. Levitt (1997) also addressed methodological limitations of past studies by using electoral cycles as an instrumental variable. Using this instrumental variable he explored the effect of the number of police officers per capita in 59 US cities from 1970-1992 on serious felony crime rates. Police

reduced crime by 5-8% depending on the type of crime. The effect of the police was greater for violent crime than for property crime (for a critique see McCrary, 2002). These two studies provide support for deterrence theory with methods to address simultaneity.

Eck and Maguire (2000) reviewed the literature on the police up until 2000. Out of 41 studies, Eck and Maguire (2000) found only nine studies methodologically rigorous enough to draw conclusions. Based on these nine studies, Eck and Maguire (2000) concluded that the police had no independent or consistent effect on the crime drop in the 1990s and therefore police research did not support deterrence theory.

Despite the negative findings of Eck and Maguire (2000), researchers continued to study the effect of police while trying to increase the methodological quality of the research on this issue (Corman and Mocan, 2000; Evans and Owens, 2007; Levitt, 2004). Corman and Mocan (2000) researched the effect of the number of police officers and the number of arrests in New York City from 1970 to 1996 on serious felony crime rates including murder, robbery, burglary, and motor vehicle theft. They found support for deterrence theory: robberies and burglaries had a negative relationship with the number of police officers and murder, robbery, burglary, and motor vehicle theft all had a significant negative relationship with the arrest rate for each type of crime.

Levitt, in an empirical analysis (2002) and a review of the literature (2004), found further support that numbers of police officers have an effect on crime. In his 2002 analysis, Levitt used the number of firefighters and civil service workers as an instrumental variable to explore the effect of the number of police on violent and property crimes in 122 cities from 1975 to 1995. He found that the number of police officers

reduced the violent and property crime rate by approximately 5%. In Levitt's (2004) review, he found similar results: an increase in the number of police officers in the 1990s of about 14% resulted in about a 5-6% reduction in crime. Therefore, the police accounted for between 1/5<sup>th</sup> and 1/10<sup>th</sup> of the overall drop in crime in the 1990s.

In 1994, President Clinton passed a crime bill authorizing funding with the goal of putting 100,000 more officers on the streets by 2000 (The Department of Justice, 1994). Evans and Owens (2007) explored the effect of new hires that resulted from this bill in 2,074 cities from 1990-2001. They found that the additional officers had a statistically significant negative relationship with auto thefts, burglaries, robberies, and aggravated assaults rates.

There are two studies that explored the effect of a reduction of the police force or a decrease in police action instead of an increase (DeAngelo and Hansen, 2008; Shi, 2009). These two studies have the reverse hypothesis: as posited by deterrence theory, a decrease in the number of officers will decrease certainty and therefore crime will increase. DeAngelo and Hansen (2008) explored the reduction of police officers with a massive layoff in the Oregon State police department. They found that the reduction of police was related to a 10-20% increase in injuries and fatalities on highways. Shi (2009) exploited a situation in Cincinnati in which officers lowered their use of arrest due to a class action law suit, federal civil rights investigation, and indictment of an officer for shooting and killing an unarmed African-American. Although this did not change the number of police, it had the same effect: decreasing the certainty of arrest. A decrease in arrests during this time was related to an increase in felony crime, providing support for deterrence theory.



Finally, there is some evidence counter to the supportive findings of the empirical articles discussed thus far. Reaves and Hickman (2002) and Zimring (2007) provide descriptive data that is contrary to deterrence theory. In a Bureau of Justice Statistics report, Reaves and Hickman (2002) illustrate that between 1990 and 2000 some cities actually saw an increase police and an increase in crime. Zimring (2007) discussed the effects of crime in Canada during the same time period that the United States had a large crime drop. Canada had a similar crime drop to the United States, but decreased the number of police officers they had during this time, suggesting that the police are not responsible for the crime drop.

In sum, there is evidence in support of police expenditures on crime, and thus support for deterrence theory and specifically, the certainty hypothesis of deterrence theory. Questions remain about how much of an effect there is and how this effect occurs. It is likely that what the officers are doing may determine how large of an effect they have. The next section will explore the effectiveness of police strategies that invoke deterrence theory.

### *Police Strategy*

Police strategy evaluations look at specific programs or strategies the police are involved in instead of only the numbers of police officers. Some policing strategies are more relevant to deterrence theory because they are intended to increase certainty and in some cases celerity and severity. The strategies that will be focused on here are hot spots policing, policing focused on small high crime areas (Sherman and Weisburd, 1995) and pulling-levers policing, a strategy that selects a particular problem and uses all potential

mechanisms to sanction the groups involved in the selected problem (Kennedy, 2006). As Zimring (2007) mentioned, in many cases it is hard to disentangle the effects of particular programs because often many changes in policing are happening at the same time. Nevertheless, there is research on particular programs and this research provides at least some support for deterrence theory.

In order for policing strategies to invoke deterrence theory, changes in strategies must affect the objective certainty, severity or celerity of punishment. Two studies provide evidence that the police are able to affect objective certainty. As mentioned above, Wilson and Boland (1978) explored proactive policing and found that proactive patrol was related to increased certainty. Sampson and Cohen (1988) replicated the Wilson and Boland (1978) research in 171 cities in 1980. They also found that more aggressive policing was associated with more arrest certainty for robbery and burglary suggesting that changes in the police can affect certainty.

One particular policy strategy that exploits the effect of certainty on crime is hot spots policing. This is a policing strategy that identifies the areas that have the most crime and focuses policing on these particular areas. There are different ways that the police can focus on these areas (e.g. problem oriented policing), but the key to hot spots policing is that it focuses on a particular location with a high proportion of crime. There have been many studies conducted on hotspots policing (e.g. Braga, 2005; Kennedy, 2009; Kleiman, 1988; Koper and Mayo-Wilson, 2006; Sherman, 1990; Sherman et al, 2002; Sherman and Weisburd, 1995; Weisburd, 2005; Weisburd and Green, 1995). Several of these studies have been randomized controlled trials. For example, Sherman and Weisburd (1995) conducted a randomized controlled experiment of hot spots

policing in Minneapolis. In the areas of high crime, the experiment doubled the patrol (55 of 110 hotspots). Increases in patrol did cause modest reductions in crime and large reductions in disorder. The decline in total crimes ranged from 6-13%. Weisburd and Green (1995) also used a randomized experiment in Jersey City, NJ to look at hotspots in controlling drug markets. They also found support for hot spots policing. In 2008, Braga conducted a review of the hot spots policing literature and found support for significant reductions in seven of nine studies conducted on hotspots. In sum, there is support for a deterrent effect of hotspots policing, but with only nine quality studies as of 2008.

Kennedy et al. (2001) reviews pulling levers policing, a policing strategy that is a deterrence based strategy attempting to provide targeted enforcement by increasing certainty, severity, and celerity of punishment within the entire criminal justice system for certain individuals in certain circumstances (e.g. gang members committing violent crime in Boston). Pulling levers policing typically involves several steps in order to be conducted thoroughly. These include 1) picking a particular crime or problem to focus on, 2) working with different criminal justice agencies including, but not limited to police, prosecution, and probation, 3) gathering information about particular offenders or groups of offenders who participate in the problem of interest 4) directing enforcement at this group of offenders using all available enforcement methods 5) providing prevention services to the same group of offenders, and finally 6) openly communicating with offenders the nature and purpose of the pulling levers strategy (Kennedy, 2006).

Pulling levers policing has been conducted in many different cities. Operation Ceasefire in Boston, MA was one of the early successful implementations for pulling levers policing. This program addressed a small group of young gang members.

Research conducted suggests that Operation Ceasefire was associated with a fast reduction in youth homicide victimization, shots-fired calls, and gun incidents (Braga et al., 2001). Similar programs were attempted in other areas around the country including Indianapolis and High Point, NC. Indianapolis experienced a homicide reduction similar to Boston while other comparable Midwestern cities did not experience the same drop (McGarrell et al, 2006). In High Point, NC, four of the most serious offenders were arrested and while other offenders were not arrested, but were told of their increased risk of arrest (Cook, 2012). In a follow-up study, Corsaro et al. (2012) found that violence in High Point, N.C. was reduced by 12%. In general, there appears to be support for pulling levers policing, but recent findings have been more modest than the initial strong results (Cook, 2012).

In sum, there is support for the deterrent effect of two different policing strategies: hot spots policing and pulling levers policing. Again, the extent of the effect is unknown and more research should be conducted to determine the mechanisms that make these policies effective.

### Imprisonment

Imprisonment is another policy that attempts to reduce crime. One of the ways that it can reduce crime is by deterrence, thus research on the effect of imprisonment on crime is at least partially research on deterrence theory. Isolating the deterrent effect is difficult because of the incapacitation effect: crime rates may decrease because people refrain from crime because they do not want to be imprisoned (deterrent effect), or crime rates may decrease because offenders are incarcerated and lack the opportunity to commit

crime (incapacitation effect). This section will review the literature exploring these questions and show that there is at least some modest support for a deterrent effect of imprisonment.

As with the policing literature, research on imprisonment struggles with simultaneity. Levitt (1996) attempted to address this issue by using court orders to reduce overcrowding as an instrumental variable to explore the effect of prison on crime in data collected from 1971 to 1993. There was an effect of prison on crime: each year of prison for a person resulted in the reduction of 15 crimes. While the instrumental variable technique can help determine causality, it cannot distinguish between the incapacitation effect and the deterrent effect of prison.

Two different reviews exploring the effect of prison on the crime drop in the 1990s, find that prison does have an effect ranging from 4-33% (Levitt, 2004; Spelman, 2000). Spelman (2000) reviewed the literature on incarceration and found that studies have come up with widely varying results. He describes improved methods, but claims that there are several remaining problems in the literature including simultaneity, omitted variables, and differences between states. Despite these remaining difficulties with the research, the research does find that prison affects crime rates, reducing index crime rates anywhere from 20-40%. When looking specifically at the crime drop, Spelman (2000) claims that between 4 and 21% of the crime drop can be attributed to incarceration. Levitt (2004) also finds an effect, but finds a larger effect: the use of imprisonment from 1990 to 2000 accounted for about 1/3 of the decrease in the crime rate.

Like police research, imprisonment does have descriptive data that provides a counter example to the deterrent effect of prison. As mentioned above, Canada had a

similar decrease in crime as the United States in the 1990s, but instead of the prison population growing during this time period as in the U.S., the rate of incarceration declined by 10% from 1993 to 2001 suggesting that imprisonment may not always have the same effect (Johnson, 2004; Paternoster, 2010).

In sum, empirical research does suggest that imprisonment decreases crime, but there are methodological limitations that need to be addressed. Evidence that imprisonment affects crime may be an incarceration effect or a deterrent effect. Therefore, we can tentatively conclude that imprisonment research provides some support for deterrence theory, although more research should be conducted.

#### *Other Policy Evaluations*

Other policy evaluations that explore deterrence theory often address specific legislation in specific states such as three strikes laws in California or gun enhancement laws. By enacting more severe legislation, states are invoking the severity part of deterrence; more severe punishment should change the perceptions that people have of punishment and thus, cause them to commit less crime.

Several studies have looked at sentence enhancements and the findings appear to be mixed. Loftin and colleagues in the early 1980s conducted a series of studies to explore the effect of sentence enhancements for gun crimes (Loftin and McDowall 1981; Loftin, Heumann, and McDowall 1983; Loftin and McDowall 1984). In general, findings from these studies were not conclusive, but as a whole, it appears that enhancements did not prevent gun use. In accordance with Loftin and colleague's lack of support for the deterrent effect of sentence enhancements, Raphael and Ludwig (2003) found no effect.

A program in Richmond, VA targeted perpetrators of gun crime with more severe Federal prosecution. When compared to juvenile adult homicide arrest rates and other cities without this policy, the threat of the more severe punishment did not have an effect. The studies on sentence enhancements suggest that sentence enhancements have a mixed effect at best.

Kessler and Levitt (1999), on the other hand, do find support for deterrence theory in an attempt to isolate the deterrent effect from the incapacitation effect. In 1982, California passed Proposition 8, a law that increased enhancements for repeat offenders. When Proposition 8 was passed individuals who would not have been incarcerated previous to the enactment of the law were incarcerated and therefore, in the short term, any effect of the law should have only been a deterrent effect of the law itself. In support of deterrence, in the year after the passing of the law, crimes eligible for the enhancement appear to reduce by 4% and after 3 years, by 8%. Interestingly, the effect continues to grow over time (reductions up to 20%), suggesting that there is an incapacitation effect as well. (For a critique see Webster, Doob, and Zimring, 2006).

Several studies have explored the effect of California's three strikes laws. In general, they find that they may affect certain people in certain circumstances. Stolzenberg and D'Alessio (1997) used an interrupted time series design and found that the three strikes law did not have a deterrent effect on serious or petty crime. Zimring, Hawkins, and Kamin (2001) also looked at before and after trends of California's three strikes law but found that the felony crime rate did fall, if only at a maximum of 2%. In addition, the law appeared to affect specific people, those who already had two qualifying offenses.

Finally, similar to Zimring, Hawkins, and Kamin (2001)'s findings, Helland and Taborrok (2007) found that a certain group was deterred by the three strikes law in California. Helland and Taborrok (2007) compared the criminal activity of an individual who was convicted of a qualifying offense to those who committed a qualifying offense, but pled down to a non-qualifying offense. They found support for deterrence among the group that had already committed two strikeable offenses: the threat of a third strike reduced felony arrest by 17-20%.

Another policy evaluation that is related to deterrence theory looks at the effect of a unique community supervision program in Hawaii, Project HOPE (Hawaii Opportunity Probation with Enforcement) (Hawken and Kleiman, 2009). This is a policy that attempts to make punishment more certain. To do this, the program has very clear rules and consequences and follows through on these consequences. There is a greater level of monitoring including regular and random drug testing and when violations occur, short, but certain jail stays are enforced. Hawken and Kleiman (2009) conducted a randomized experiment finding that those who were assigned to Project HOPE had lower rates of positive drug tests, missed appointments, and were less likely to be arrested and imprisoned.

In sum, more severe sentences appear to have little, if any deterrent effect, suggesting, as other deterrence research has, that severity is less important than certainty. The effect that severity does seem to have is for a very specific group who would be well-informed about the punishment (those who have already been punished and know what type of punishment they will receive if punished again).



### Regulatory Justice

Finally, an area in which deterrence theory has been applied and is particularly relevant to this dissertation is within the regulatory justice system. The regulatory justice system typically includes those acts within corporate crime that are outside the bounds of the criminal justice system including “the process of investigation, adjudication, and punishment” (Frank and Lombness, 1988, p. 5). Regulatory justice is administered by regulatory agencies such as the Environmental Protection Agency (Simpson, 2002). As mentioned above, the regulatory justice system is an apt comparison to the NFL in that it uses rules to secure compliance with rules, in this case, regulatory rules (Frank and Lombness, 1988). In addition, similar to the NFL, the rules of the regulatory justice system are used as an attempt to prevent potential harm as opposed to reacting to previously committed rule breaking behavior and breaking the rules does not require intent (Frank and Lombness, 1988). For these reasons it is useful to look to prior research on deterrence within the area of corporate crime to inform this dissertation.

Regulatory justice research is similar to other deterrence research in that it explores perceptions and uses scenario or vignette style research. As with other research on deterrence, the results of research in corporate crime focusing on formal punishment is mixed. In general there is support for formal sanctions, but the effect does not appear to operate independently from informal sanctions.

The support of formal sanctions has been studied using a wide variety of samples. For example, support has been found with longitudinal data from companies from the oil refining, motor vehicles and parts, air crafts and parts, inorganic chemicals, steel, metal containers, and tires and tubes industries (Simpson and Koper, 1992), used car dealers

(Harris and McCrae, 2005), tax defrauders (Murphy and Harris, 2007; Murphy, 2008), MBA students (Paternoster and Simpson, 1996), and U.S. companies within the steel, pulp and paper, and oil refining industries (Simpson et al, 2013). Despite the variety and amount of support, most of the research has found that formal sanctions do not work in isolation and instead has found that formal sanctions work through other informal mechanisms. These mechanisms include morality (Paternoster and Simpson, 1996), outcome expectations (Smith, Simpson and Huang (2007), social harm (Vandenbergh, 2004), and negative social and reputational consequences for the firm (Simpson, 2002; Simpson, Garner, and Gibbs, 2007; Simpson et al. 2013). In sum, the corporate crime literature appears to show slightly more support for deterrence than the criminal justice literature, but points to the more recent rational choice models that include informal sanctions in addition to formal sanctions.

Deterrence research has gone through many stages and can be conducted in many different arenas from student population perceptions to the effect of certain criminal justice system policies. In general, the literature has found at least mild support for deterrence theory, with the greatest support for certainty, little support for severity, and barely any research on celerity. Because this dissertation applies deterrence theory within the context of sports, it is important to review the literature that has made this connection in the past. The next section will review the connection between criminology and sports.

## **CHAPTER 3: THE CONNECTION BETWEEN CRIMINOLOGY AND SPORTS**

The connection between criminology and sports has been discussed from different angles within different disciplines. As evidenced by prior literature, sports provide a unique opportunity to explore many different issues (e.g. Duggan and Levitt, 2002; Horowitz and McDaniel, 2013; Kahn, 2000; Munasinghe et al, 2001; Moskowitz and Wertheim, 2011; Torgler, 2009). There is no exception to these arguments when using sport to study deterrence theory, and specifically how punishment affects rule breaking. The literature connecting criminology and sports can be divided into literature that defines and describes deviance and literature that explores deterrence both for outside of the game behavior and within-game behavior. This proposal will review the literature on within-game and outside of the game behavior to provide background for the focus of this dissertation: player rule violations.

### **DEVIANCE IN SPORTS**

Deviance is generally divided into within-game deviance and out-of-game deviance. Within the game deviance can be further split into three categories: 1) rule violations, 2) norm violations (e.g. stealing signs between pitcher and catcher in baseball), or 3) particularly violent behavior (Atkinson and Young, 2008; Delany and Madigan, 2009; Duggan and Levitt, 2002; Eitzen, 1981). Out-of-game deviance includes a variety of behaviors such as criminal behavior, sex scandals, gambling, and using performance enhancing drugs (Atkinson and Young, 2008; Delany and Madigan, 2009; Duggan and Levitt, 2002).

In addition to defining deviance, there is some discussion about why within-game rule violations occur (“cheating”). Lueschen (1976) provided two situations that will likely lead to more cheating: 1) when there is increased uncertainty in the outcome of the match and 2) when the rewards for winning are greater than the costs of cheating. Hypothesis two invokes rational choice and expected utility theories and implicitly includes punishment. As mentioned in the deterrence section, punishment adds to the costs of cheating and thus may prevent a person from cheating. Lueschen (1976) continues this discussion by highlighting the necessity of referees to act as agents of control, but he stops just short of deterrence by claiming that the purpose of sanctions is to restore equality, not to prevent future behavior. The idea of using punishment to restore equality is discussed further by Brickman (1977), but Brickman focuses even more on defining punishment in sports. Brickman (1977) will be discussed further below. The deviance literature defines and sets up a framework in which punishment and rule infractions fit, but does not discuss in any detail what place, if any, deterrence has in sports. The next section will explore literature related to sports that specifically address parts of deterrence theory.

## DETERRENCE IN SPORTS

Just as the deviance literature is divided into within-game behavior and out-of-game behavior, the deterrence literature explores the effect of punishment or the threat of punishment on each of these behaviors.

### Out-of-game behavior

Deterrence literature that focuses on out-of-game deviance generally includes research on performance enhancing drugs and NCAA infractions. Using a scenario based survey with 116 respondents from Australian football clubs in which drug testing occurs, Strelan and Boeckmann (2006) explore drug testing and perceptual deterrence. Players were given scenarios that described questions including whether the respondent would use performance enhancing drugs if it facilitated a faster recovery from an injury. The variety of deterrence measures that were present in different scenarios included: legal, material loss, important other, public, teammate, moral beliefs, and health concerns. The researchers found that each deterrent was significantly related to lower drug use. By asking, ‘‘Even though you cannot be caught by the authorities, how guilty do you think you would feel if you used HGH in this scenario?’’ (p. 2918), they found that moral beliefs had the strongest effect. In addition, the researchers in this study found that the particular situation influenced a person’s decision to use performance enhancing drugs. Specifically, they were more likely to state they would use drugs if the drugs were for use with recovery from an injury; 50% of the sample responded that they would use banned substances when injured. Strelan and Boeckmann (2006) found that the relationship between legal sanctions and infractions was mediated by moral beliefs and health concerns about the effect of the drugs: when moral beliefs and health concerns were added into the model, legal sanctions became non-significant and the magnitude of the coefficient decreased (-.39 to -.16). To determine whether the effect of legal sanctions was mediated by other deterrents, the researchers conducted a two stage multiple regression: in the first stage legal sanctions were included as an independent variable, and

the second stage added the non-legal sanctions. The researchers used Sobel's (1982) mediation test to determine if this decrease was in fact significant. In sum, Strelan and Boeckmann suggest that legal sanctions affect behavior by influencing the moral beliefs of some people.

Another more recent exploration of the effect of sanctions on out-of-game deviance focused on NCAA rule violations by college football and basketball players. Cullen and his colleagues (2012) conducted a survey of 2,000 male football and basketball players to determine the extent of rule infractions in the NCAA and why these infractions occurred. The authors suggest that while these findings are informative, they should be seen as a resource to build upon because the data was collected almost 20 years ago (1994) and the response rate was only 32.4%. They found that 7 out of 10 respondents committed an infraction with most reporting minor infractions. Cullen et al. (2012) tested several different theories to determine why athletes may be prone to rule infractions including deprivation/strain, differential association/social learning, social bond/control, opportunity, individual difference, organizational, and most importantly for this research, deterrence. When deterrence was in a model on its own, severity of punishment was the only deterrence variable that significantly predicted rule breaking, but when included in the model with other theoretically informed variables, the effect of severity became insignificant while friend's deviance, other's values, parental attachment, and religious fundamentalist were significant. Because of the surprising certainty finding, Cullen et al. (2012) provided discussion of the certainty of punishment in the NCAA. Certainty is measured by asking two questions: (1) "If I broke an NCAA rule, like taking money from a "booster," there is a good chance that I would get

caught.”, and (2) “I think that I could break most NCAA rules and never get caught” (p. 704). Cullen et al. (2012) suggest that because at this time, so little attention and resources were spent on enforcement (1% of the NCAA budget), perhaps certainty could be more effective if more resources were devoted to rule enforcement. In sum, they found no support for deterrence, although with old data, a low response rate, and questions about the certainty measure, this topic is worth exploring more.

### *In-game behavior*

Literature that explores punishment for within-game behavior includes a theoretical discussion by Brickman (1977) and Mark et al. (1983) and empirical research (Allen, 2002; Heckelman and Yates, 2003; Levitt, 2002; McCormick and Tollison, 1984; Witt, 2005). Brickman (1977) and Mark et al. (1983) compare the punishment of sports to the criminal justice system and suggest that the criminal justice system would be well-served by using the punishment system used in sports. Brickman discusses four unique characteristics of sports’ reaction to violence. First, deviance is inevitably a part of sports because conflict is recognized as a central part of the game. Second, the purpose of punishment is to restore fairness, what Brickman (1977) terms “equity punishment.” Third, most players are punished equally. Better players do not get special compensation. The final unique characteristic that Brickman (1977) discusses is that after a punishment, a player is able to start clean and is not hindered by collateral consequences of the punishment. Two of the points in Brickman’s description of sports punishment do not seem to hold true in sports today. Punishment in sports does not appear to be equity punishment or restoring fairness. In fact, punishment in sports has a certain element of pure punishment. For example, in football, if the purpose was to restore fairness then a

team would likely be allowed to replay the play in which a penalty was committed, but instead, a team is often allowed to replay the play and is awarded extra yards or a down. The second point that does not hold true is that players are not always able to start clean after an infraction. In most sports there is some way for punishment to be more severe after multiple infractions. For example, in basketball, after five fouls a player is ejected from the game, in soccer, two yellow cards in the same match result in player ejection, and in football, a second finable offense results in a higher fine. The fact that the punishment systems within sports are more similar to the criminal justice system than Brickman (1977) and Mark et al. (1983) present, allows sports to provide an even better venue to learn about the effects of punishment on behavior and translate those lessons to the criminal justice system.

In addition to these descriptive pieces of within-game punishment, there is empirical literature that explores within-game behavior. There are several studies that explore the certainty of punishment within sports (Allen, 2002; Heckelman and Yates, 2003; Levitt, 2002; McCormick and Tollison, 1984). McCormick and Tollison (1984) researched the effect of an increased number of referees in basketball at the macro level over two seasons. In their study, they equated referees with police and fouls with arrests. In the ACC, the number of referees increased from two to three between two seasons. McCormick and Tollison (1984) found that the number of fouls called decreased with the increase in referees suggesting that as the probability of detection increased, rule infractions decreased.

The National Hockey League (NHL) had a unique situation in the 1998/1999 season that several economists explored (Allen, 2002; Heckelman and Yates, 2003;



Levitt, 2002). In this season, the NHL attempted to determine the effect of an extra referee by using one referee in some games and two referees in other games. Allen (2002), at the individual level, and Heckleman and Yates (2003), using game played by home team as a unit of analysis and an instrumental variable technique, found similar results: increasing the number of referees actually led to an increase in penalties suggesting what Allen (2002) refers to as an “apprehension” effect as opposed to a deterrent effect. They suggest that the extra referee resulted in an increase in the number of penalties actually witnessed and called. Levitt (2002), explored the same season using a macro level analysis and found that there was not a change in the number of penalties from one-referee games to two-referee games. With further analysis, Levitt (2002) determined that an extra referee did not change the probability of punishment, making the analysis of limited use when exploring the effects of more certain punishment within deterrence.

One article that is particularly relevant to this research is Witt (2005). Witt (2005) uses a rule change within soccer to explore the effect of punishment on rule breaking behavior.<sup>1</sup> Similar to the studies in the NHL, the English Premier League had a rule change that provided an opportunity to explore the effect of severity of sanctions on penalties. In soccer, there are three different types of fouls given in response to rule breaking (from least severe to most severe): a no card foul, yellow card foul, and red card foul. In 1998, there was a rule change that made tackles from behind a more serious red card offense. Witt (2005), using Poisson Regression, estimated whether the number of fouls changed with the rule change. Witt (2005) found that the number of red cards did

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<sup>1</sup> Due to the confusion between American football and soccer, this proposal will refer to football as soccer and American football as football regardless of how it is described in the original article.

not increase, but the number of yellow card fouls and no card fouls did increase. Witt (2005) interprets this finding as a displacement of fouls or that players substitute lesser fouls for the red card fouls. A limitation of this study is that the fouls are not delineated by player activity and thus an increase in a type of foul does not tell the researchers what activity the player is committing. For example, a red card could be a tackle from behind or some other flagrant foul. In addition, the changing numbers of fouls could be the result of changing referee behavior. Perhaps, as a result of the rule change, referees called more yellow and no card fouls which deterred players from committing the more serious red card fouls. To summarize the empirical literature, deterrence in sports has an unknown effect: increasing certainty could have an apprehension effect or no effect and increasing severity could cause displacement or change referee behavior. This literature leaves an opportunity for future research to explore the effect of deterrence within sports.

In sum, there is a connection between criminology and sports that has been explored from many different angles including discussions of deviance and cheating and empirical analysis of the effect of various changes in the game on rule breaking behavior. In general, the research conducted includes macro level, short term, or limited information about player activity. This dissertation will add to the literature by providing long term, detailed data.

The review of the literature has illustrated that the deterrence literature, while vast, still leaves room for more research to be conducted. As illustrated by past research, sports provide a unique environment in which to explore deterrence, particularly in the National Football League where this study explores the effect of punishment over 13 years. The next Chapter will describe the research questions, data, and methods.

## CHAPTER 4: DATA AND METHODS

### RESEARCH QUESTIONS

This dissertation attempts to expand upon existing deterrence literature by using a detailed longitudinal dataset. This dissertation addresses the research question and hypotheses at both the league and team level<sup>2</sup>: the league level will explore all penalties throughout the league, specifically looking at whether punishment from the previous week for the entire league affects rule breaking behavior for the entire league in the current week (N=273 weeks). The team level analysis is exploring whether a particular team's punishment from the previous game affects the same team's rule breaking behavior in the current game (N=6,898 games)

General deterrence suggests that the entire league will be deterred by punishment. While this dataset provides a unique opportunity to explore general deterrence at the league level, this is not a completely clean measure of general deterrence. A clean measure of, general deterrence would only include those individuals who did not experience punishment, but this analysis includes both those individuals who experienced punishment and those who did not. This follows the methods conducted by prior macro studies of general deterrence (e.g. Chiricos and Waldo, 1970; Corman and Mocan, 2000; Gibbs, 1968; Levitt, 1997; Shi 2009).

More recent deterrence literature claims that groups or gangs are also important (Kennedy, 2009), suggesting that the team may be an important unit of analysis. In the sports context there are two main reasons the team may matter. First, the team receiving

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<sup>2</sup> This analysis could also be done at the individual level, but since the NFL attempts to change groups' behaviors and individuals move in and out of the league, this dissertation is focusing on the league and team level analyses.

the penalty may feel the punishment more acutely. In fact, punishments in football are typically group punishments, so while one player may commit unnecessary roughness, the entire team receives the yardage and down as punishment. Second, a team may continue to receive informal costs and benefits throughout the week based on their own penalties. For example, they may be punished in practice with sprints or rewarded by something as overt as money, as illustrated by the bounty scandal<sup>3</sup>. It is for these reasons that this dissertation explores the effect of punishment at both the league and team level. Below is the research question and hypotheses for this dissertation. These questions are applicable to both the league and team analyses.

*RQ: Is there evidence of general deterrence?*

*H1: Past punishments will reduce the number of current rule infractions.*

*H2: Past fines will reduce the number of current rule infractions.*

*H3: Past punishments for violent behavior will reduce the number of current violent rule infractions.*

*H4: Past fines will reduce the number of current violent rule infractions.*

## DATA

The data for this dissertation were downloaded from two different sources: 1) play-by-play NFL data from armchairanalysis.com (2013) and 2) individual-level fine data from justfines.com (2013). This section will briefly describe each data source and

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<sup>3</sup>The bounty scandal was a bounty system initiated by a coach of the New Orleans Saints during seasons 2009-2011, was supported by players and ignored by management. The bounty system paid players money for deliberately hitting and injuring opposing players. The sum of the money given and received totaled in the thousands (Maske, 2012; "Saints Bounty," 2013).

then describe the combined dataset used in this dissertation. The play-by-play data includes information for each player from 2000-2012. There is information about every play and every player that was involved in each play. Details about penalties include information about each penalty committed and the resulting punishment that was enforced. This dataset includes 6,541 individuals, 562,580 plays, and 50,070 penalties. The fine data was collected from 2000-2012 and includes the date the fine was imposed, the team, player, amount, and description of the fine. The fines included in this analysis are imposed for within-game, play-related behavior. For example, coaches' fines and fines for technical violations such as uniform violations are not included. There are 426 fines. To answer the research question at both the team and the league level, two different datasets were created. The league level has the full sample as described above. The team level dataset also includes all the data described above, but they are disaggregated amongst the 32 teams in the NFL.

### *Strengths and Limitations*

There are many strengths of this dataset. As mentioned in the introduction there are four unique characteristics that make this dataset particularly useful for studying deterrence: 1) there is greater detail offered in this dataset than other rule breaking datasets, 2) the direct effect of the penalty is observed 3) punishment is enforced immediately, and 4) there is almost perfect knowledge of punishment received. Other strengths are the longitudinal nature of the data and the potential implications for deterrence theory. Although using football to study deterrence theory may not seem intuitive, rational choice theory posits that criminal offending is a decision that is made

like any other decision by fully rational people (Becker, 1968; Cornish and Clarke, 1986; Matsueda et al., 2006) and as such, the decision to break rules within football is a unique opportunity to explore the effect of punishment on behavior. Some scholars argue that sports are different because violence is normative (Brickman, 1977), but the culture of sports does not change the intention of the punishment. The intent of the punishment is to change behavior (R. Anderson, personal communication, September 18, 2013) and in fact, the NFL claims that the punishment is changing behavior by making the game safer (R. Goodell, October 3, 2013). This dataset allows this research to explore the claim that punishment changes behavior and specifically whether penalties and fines change within-game, rule-breaking behavior.

There are also some limitations with this dataset. The first limitation has to do with the theoretical application of the dataset. This dissertation attempts to explore general deterrence at the league and team level, but the nature of the data makes this a little less clean than it would ideally be. General deterrence is typically defined as deterrence of people in the general population who are not punished (Nagin, 2013). This is in contrast to specific deterrence which deals with the effect of punishment on someone who has been punished (Nagin, 2013). As mentioned above, the league level general deterrence measure includes those individuals who are punished for rule-breaking behavior so it is not a completely clean measure of general deterrence. In addition, because the team gets punished as a team, it could be argued that this is actually a measure of specific deterrence. I argue that this is not the case because the entire team does not experience the official punishment in the same way (specific deterrence would not have any variation in the way an individual experiences punishment). For example,

the individual who committed the infraction experiences the most direct punishment: they know the behavior that occurred, their number is called out and they experience all the costs and benefits of that particular punishment. The rest of the team on the field experiences the next level of punishment: some of the players on the field likely observed the behavior, and they all experience the punishment first hand (they have to fight to get the yardage back, or prevent a first down from occurring). The final level of punishment is for the rest of the team that is not on the field. They experience the punishment by watching and perhaps having to adjust their behavior when they do get on the field (if they get on the field). The entire team experiences the punishment throughout the week if the penalty had an effect on the outcome of the game and they all experience informal costs and benefits throughout the week that may vary slightly based on their position or role on the team. Therefore, there are people on the team who are deterred by a formal punishment that they do not experience firsthand (as specific deterrence would require) and the team analysis is a general deterrence analysis albeit a slightly less clean measure than a perfect measure of those who do not experience the punishment at all.

Another limitation due to the observational nature of the data of the NFL, is that the dataset does not include all the informal sanctions and incentives that are present within football. For example, the discovered bounty system for the New Orleans Saints where players were being paid for committing penalties, or a potential high five from a team mate for committing a particularly hard tackle. In addition, similar to the limitations in Witt (2005)'s exploration of soccer, the data do not distinguish between the particular actions that resulted in the penalty. While there is much more detail in football than in soccer (57 different types of penalties), there is not access to the different types of

behavior that constitute the categories of penalties. For example, the controversial helmet-to-helmet hits are included in many different categories like ‘personal foul,’ ‘unnecessary roughness’, and ‘roughing the passer.’ One other limitation is the flip side of the strength above. While this dataset provides a unique opportunity to explore deterrence it is not criminal justice data. Blumstein and Benedict (1999) find that NFL players appear to have the same number of arrests as the general population, but that the NFL population is hard to find a comparison group for. The NFL generally consists of people from disadvantaged backgrounds who are making large sums of money (Blumstein and Benedict, 1999). Due to the fact that a comparable general population may be difficult to determine, the policy implications, while important, may not be directly applicable to the criminal justice system. Instead, the intent of this research is to guide discussion about deterrence based policies and to provoke more research to replicate these findings within the criminal justice system. Finally, due to the nature of the data, there is no clear measure of informal costs and benefits. This dissertation attempts to control for some of the potential costs and benefits, but to address them more completely, it would be necessary to have player interviews.

To address the research questions this dissertation used two different sets of variables: aggregate-league wide per week measures and aggregate per team per game measures. Descriptions of both types of variables are included below.

### *Dependent Variables*

*Penalties per week* is a count measure of the number of penalties committed league-wide for each week in the dataset. The NFL defines a week as Thursday through



Monday. For the purpose of the league-level analysis, a week is defined as Thursday through Wednesday. This is different from the way the NFL defines a week in order to account for fines that are given as a result of actions in the Monday night game. While it is arguable that Sunday games are more likely to be influenced by Thursday night games than games the previous week, this dissertation argues that because there are so few games on Monday or Thursday, most teams will be affected by the entire week's games as opposed to just one game on Monday or Thursday. An alternative league-wide measure of current rule-breaking behaviors is *average penalties per game*, an average of the number of penalties in each game league-wide (See Appendices C and D for sensitivity analysis). For the team analyses, *penalties per game* is included as a count of the number of penalties each team committed in a particular game. Each of these measures are also created for "violent" penalties (*violent penalties per week and violent penalties per game*). See Table 1 for categories of penalties with violent penalties indicated. See Figures 1 2, 3 and 4 below for the distribution of these variables illustrating that all the variables are normally distributed except for violent penalties at the team level. For the league level, the small grouping of penalties to the left of the normally distributed variable can be accounted for by the post season weeks with fewer games (See Appendices A and B for the distribution without post season). These distributions can be explained as the percentage of the sample that had the referenced number of penalties per week. For example, within the league violent penalties distribution (Figure 2), a little over 3% of the sample had about 30 violent penalties per week.

Table 1. Categories of Penalties

Penalty	Freq.	Percent	Cum.	Violent
12 On-field	64	0.19	0.19	
Chop Block	109	0.32	0.5	X
Clipping	25	0.07	0.58	
Defensive Holding	2,321	6.76	7.34	
Defensive Offside	3,755	10.94	18.29	
Defensive Pass Interference	2,997	8.74	27.02	
Delay of Game	1,464	4.27	31.29	
Disqualification	39	0.11	31.4	
Encroachment	1,030	3	34.4	
Face Mask	1,435	4.18	38.59	X
Fair Catch Interference	84	0.24	38.83	
False Start	3,252	9.48	48.31	
Horse Collar	91	0.27	48.58	X
Illegal Bat	23	0.07	48.64	
Illegal Blindside Block	15	0.04	48.69	X
Illegal Block Above the Waist	1,565	4.56	53.25	
Illegal Contact	1,405	4.1	57.34	
Illegal Crackback	73	0.21	57.56	X
Illegal Cut	1	0	57.56	
Illegal Formation	341	0.99	58.55	
Illegal Forward Pass	131	0.38	58.93	
Illegal Kick	12	0.03	58.97	
Illegal Motion	354	1.03	60	
Illegal Procedure	18	0.05	60.05	
Illegal Receiver Pass	2	0.01	60.06	
Illegal Scrimmage Kick	2	0.01	60.07	
Illegal Shift	210	0.61	60.68	
Illegal Substitution	49	0.14	60.82	
Illegal Touch Kick	137	0.4	61.22	
Illegal Touch Pass	110	0.32	61.54	
Illegal Use of Hands	697	2.03	63.57	X
Illegal Wedge	3	0.01	63.58	
Ineligible Downfield Kick	289	0.84	64.42	
Ineligible Downfield Pass	19	0.06	64.48	
Intentional Grounding	529	1.54	66.02	
Interference with Opportunity to Catch	63	0.18	66.2	
Invalid Fair Catch Signal	22	0.06	66.27	
Kickoff Out of Bounds	17	0.05	66.32	
Leaping	7	0.02	66.34	

Leverage	23	0.07	66.41	
Low Block	85	0.25	66.65	X
Neutral Zone	681	1.98	68.64	
Offensive Holding	4,255	12.4	81.04	
Offensive Offside	76	0.22	81.26	
Offensive Pass Interference	1,093	3.19	84.45	
Offside on Free Kick	334	0.97	85.42	
Personal Foul	884	2.58	88	X
Player Out of Bounds on Punt	80	0.23	88.23	
Roughing the Kicker	72	0.21	88.44	X
Roughing the Passer	1,232	3.59	92.03	X
Running Into the Kicker	176	0.51	92.54	
Short Free Kick	4	0.01	92.56	
Taunting	221	0.64	93.2	
Tripping	122	0.36	93.56	X
Unnecessary Roughness	1,712	4.99	98.55	X
Unsportsmanlike Conduct	499	1.45	100	

Figure 1. Distribution of League Penalties per Week

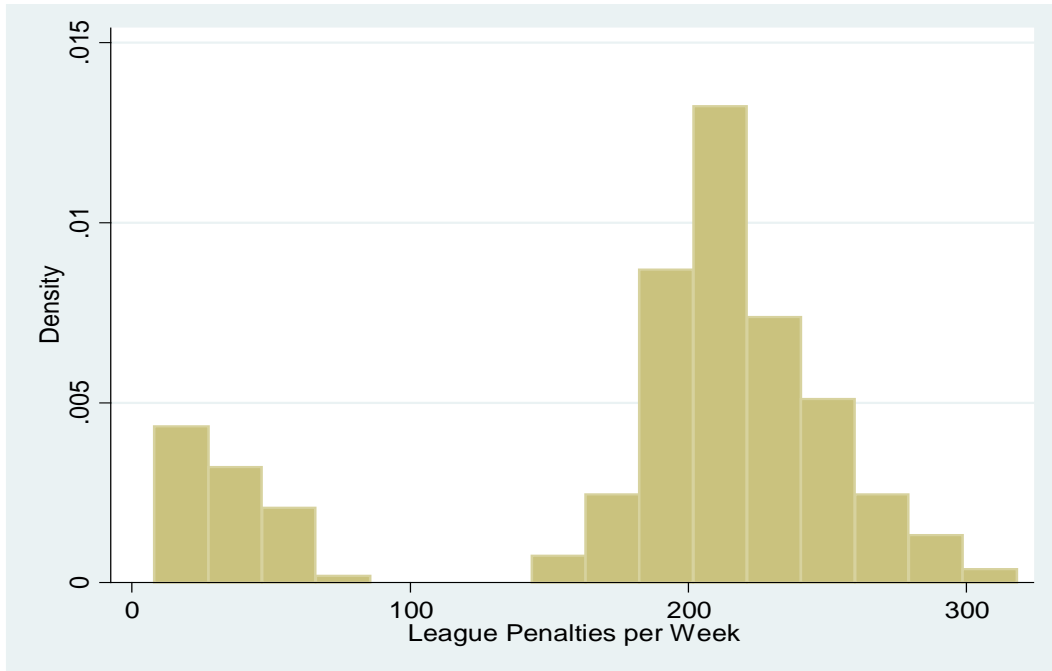


Figure 2. Distribution of Violent League Penalties per Week

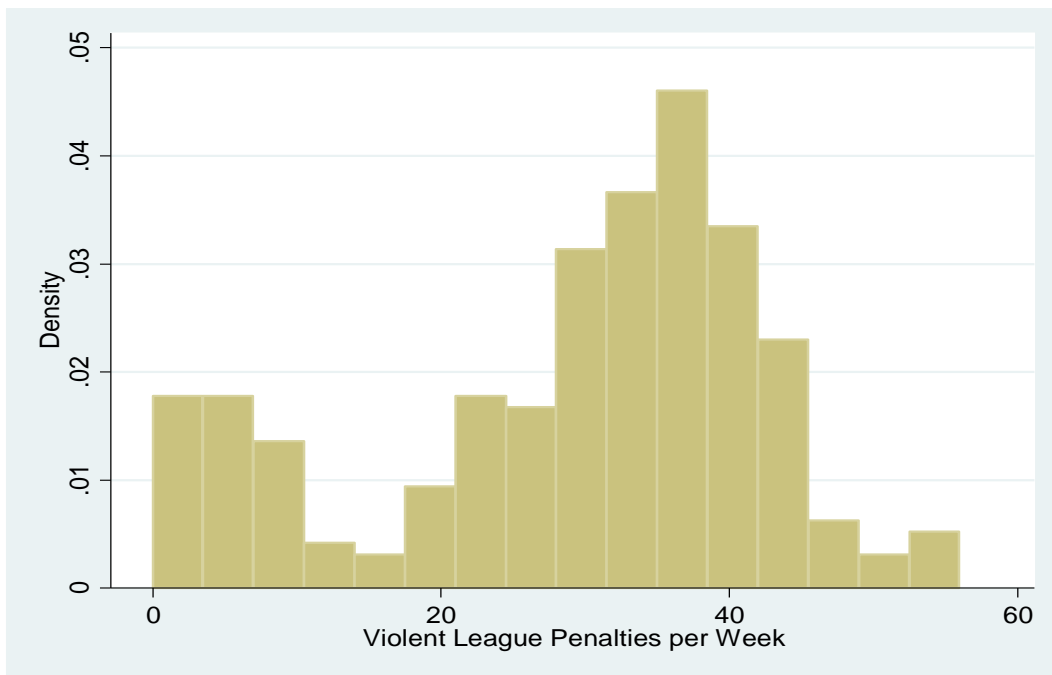


Figure 3. Distribution of Penalties per Game per Team

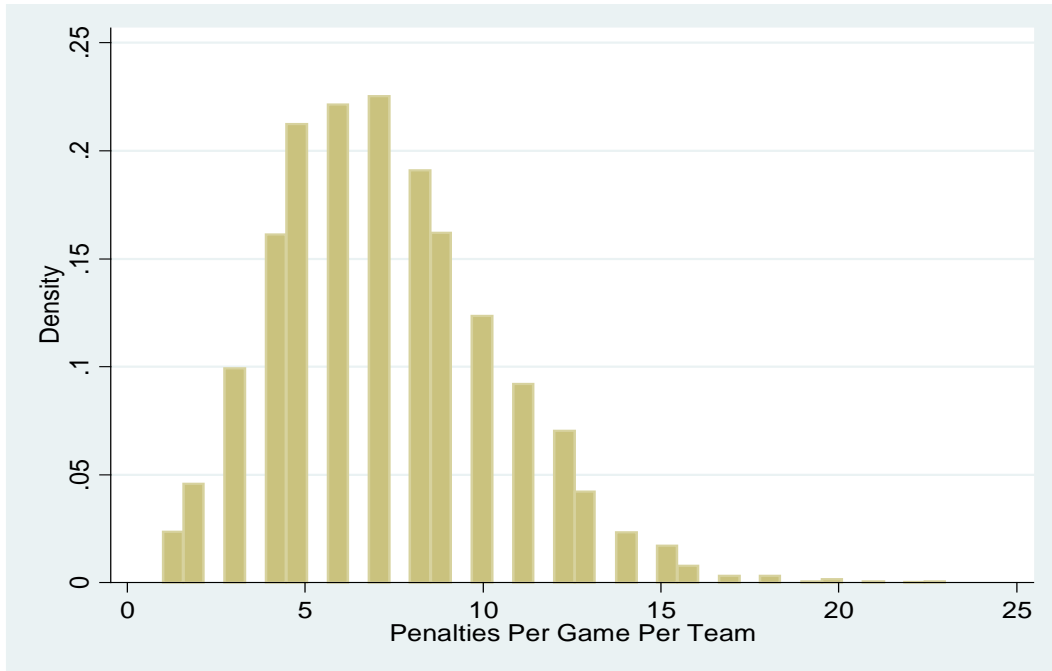
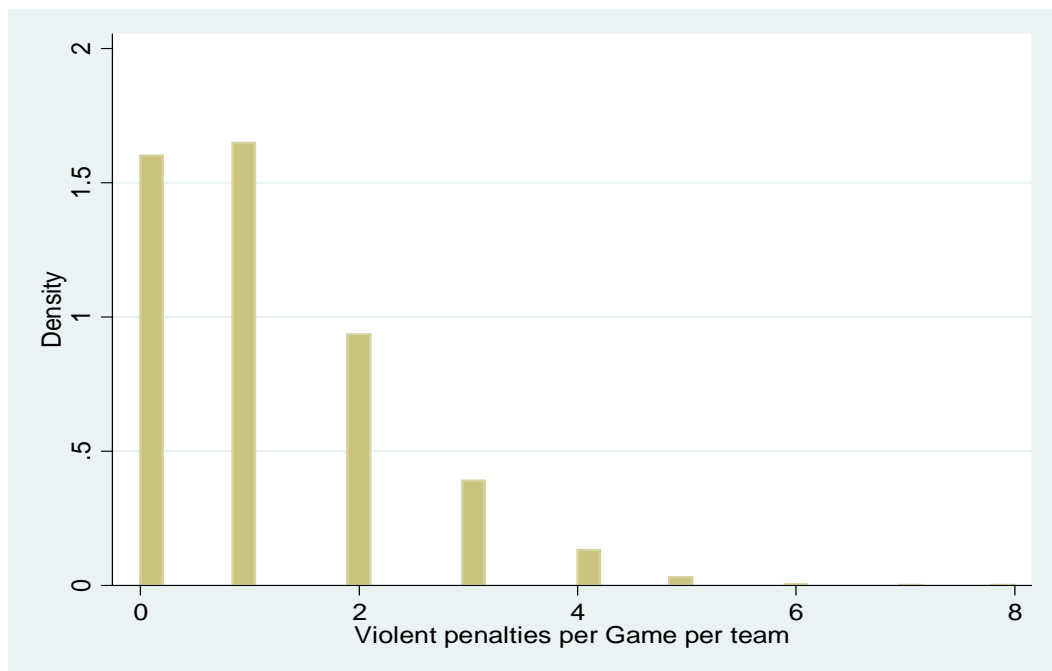


Figure 4. Distribution of Violent Penalties per Game per Team



### Independent Variables

All of the independent variables will be used at both the league and team level. The primary independent variables to explore general deterrence will be measures of previous punishment: *previous penalties*, *previous fines*, and *previous amount of fines*. Each one of these variables will be a sum from the either the previous week or the previous game: the number of penalties per week league wide or the number of penalties per game per team the previous game, the number of fines league-wide the previous week, and the monetary amount of the fines imposed league-wide the previous week. For the analyses using violent fines as the dependent variable, previous penalties is replaced with previous violent penalties. The decision to use previous violent penalties in the violent penalty analysis is based both in previous rational choice models that assume crime-specific analyses (Nagin, 1998) and in empirical research that has found limited support that deterrence is crime specific, i.e., crime prevention efforts focused on one type of crime are likely only to effect that particular type of crime (Anwar and Loughran, 2011). While the previous penalty measure is the same measure that is used for the dependent variable, because of the temporal lag, this research can use one measure to predict the other. This technique has been used in prior research, specifically within policing literature. For example, arrests have been used to predict police contact (Corman and Mocan, 2000), increased number of police have been used to predict UCR (police) reports of crime (Levitt, 1997), and increased enforcement has been used to predict calls for service (Sherman and Weisburd, 1995). Each study that has used similar measures for independent and dependent variables has tried to correct for this in some

manner. This dissertation uses the temporal lag to correct for the use of the same measure as independent and dependent variable.

### Controls

Several control variables will be included in each model. Several of the control variables are included as proxy measures for rational choice (attempting to address some of the informal costs and benefits) or decision-making variables (attempting to address the situation in which the decision to commit a penalty is being made). These proxy variables will be noted and discussed below. The league level analysis will include *games per week*, *post season*, *season*, and *week*. *Games per week* is a count of the number of games in a particular week. This is an important measure to include to control for the post-season when there are a fewer number of games each week. *Post-season* is a dummy variable that will be '1' if the game is a post-season game. This control is included as a measure of rational choice. It may be that because there is more at stake in the post-season a different number of penalties will be committed. This is an example of a time in which a player's cost benefit calculus might change based on the particular game, but the direction of the effect is unknown. It may also be that referees change what penalties they enforce during the postseason. *Season* will be included as a dummy variable for each season in the dataset because certain events may affect the number of penalties during a particular year. For example, there was a well-publicized crackdown of helmet-helmet hits beginning in October, 2010 and the bounty scandal from 2009-2011. Both of these events may have affected the number of penalties league wide and for particular teams (See Figure 5 and 6). The reference category for this variable is

season 2000 because that season has an average number of penalties. *Week* will also be included as a dummy variable for each week in the season. It is possible that as the season progresses players may feel there is more or less to lose depending on their standings and referees may change their style of refereeing as it gets close to the playoffs. Week 5 is included as a reference category for the all penalty analysis and Week 14 is the reference for the violent penalty analysis. Each of these weeks are used as the reference category because they have an average number of relevant penalties (all or violent). Figures 5-10 below illustrate the changes across season and week. These figures illustrate that there does appear to be variation across seasons and weeks, although not surprisingly, the variation across weeks appears to be less varied than that which occurs across seasons. Surprisingly, there does not appear to be a large increase in penalties or fines in the some of the seasons that would be expected: 2010 with the helmet to helmet crackdown, or 2009-2011 with the bounty scandal.



Figure 5. Penalties per Season

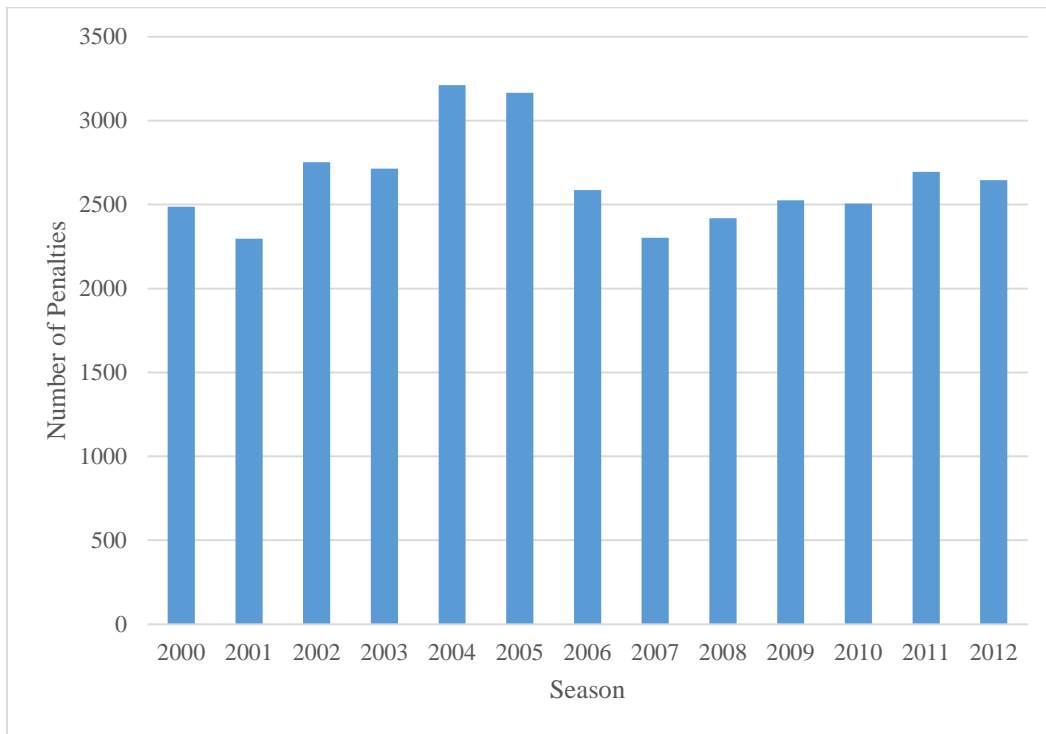


Figure 6. Violent Penalties per Season

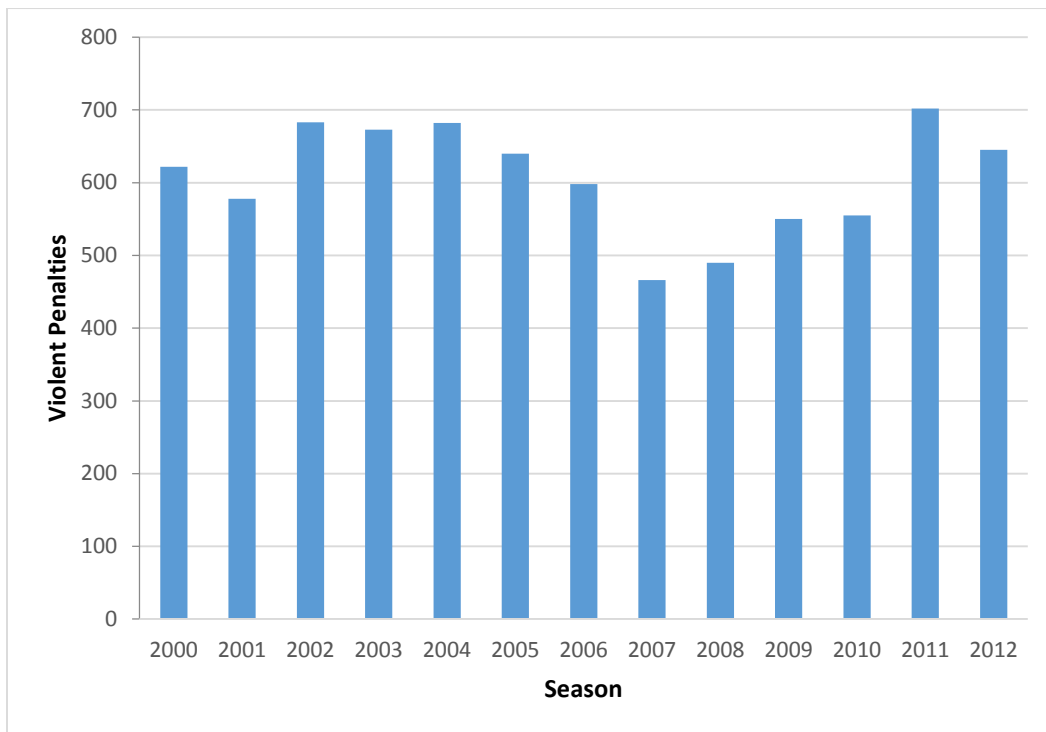


Figure 7. Fines per Season

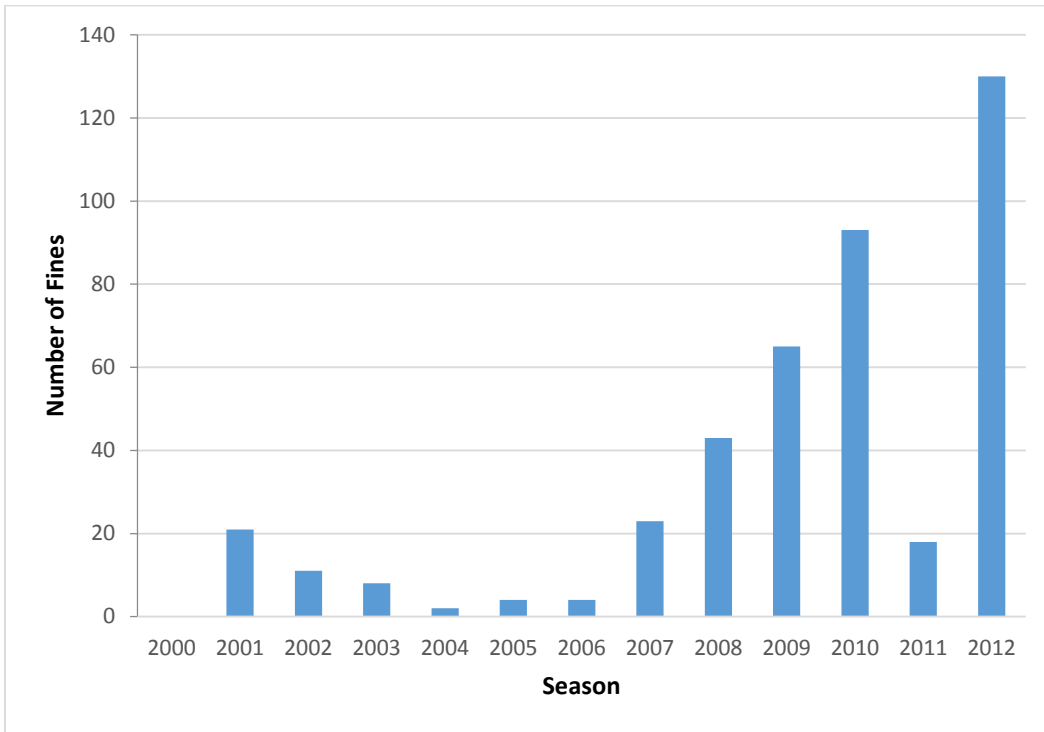


Figure 8. Penalties per Week

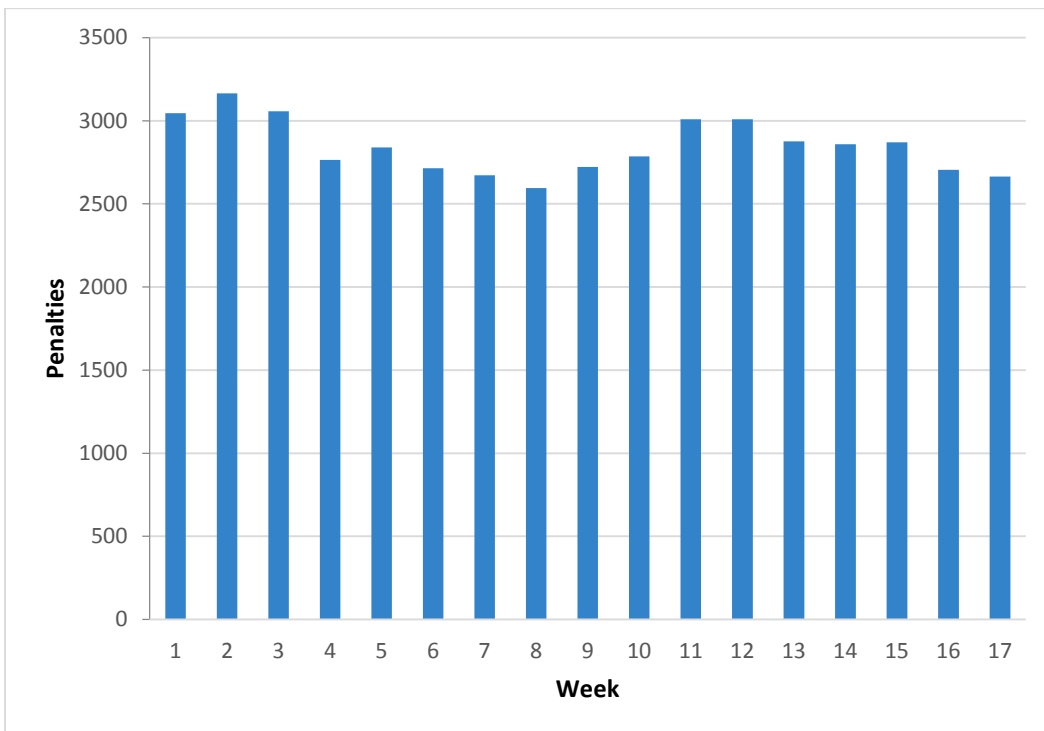


Figure 9. Violent Penalties per Week

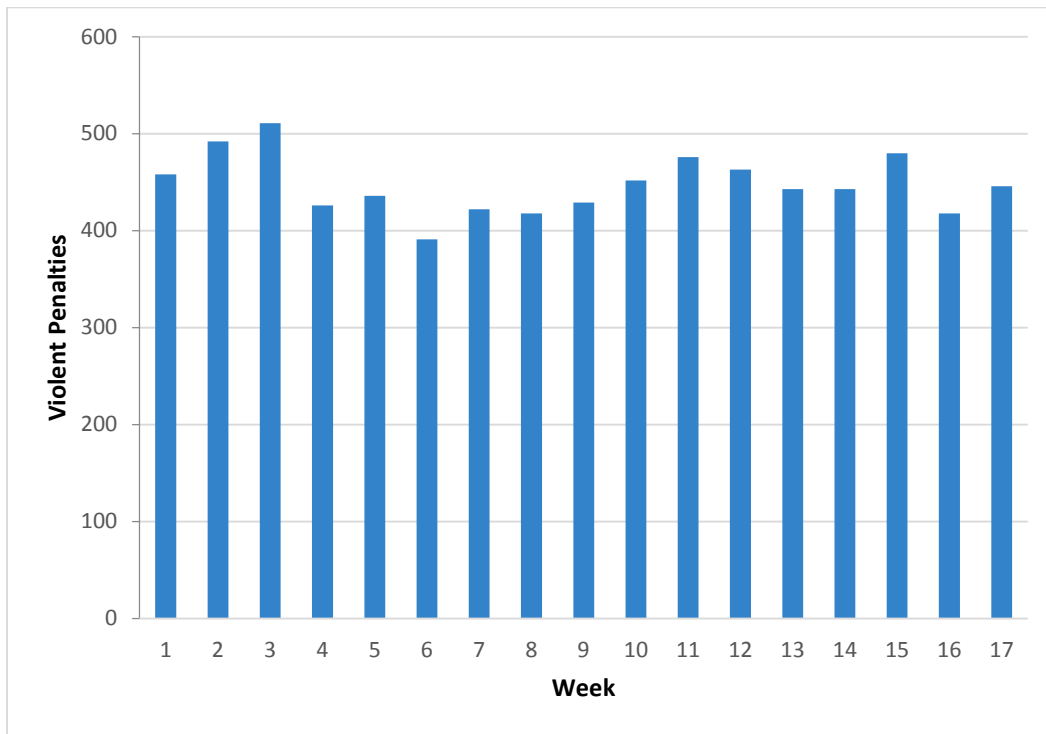
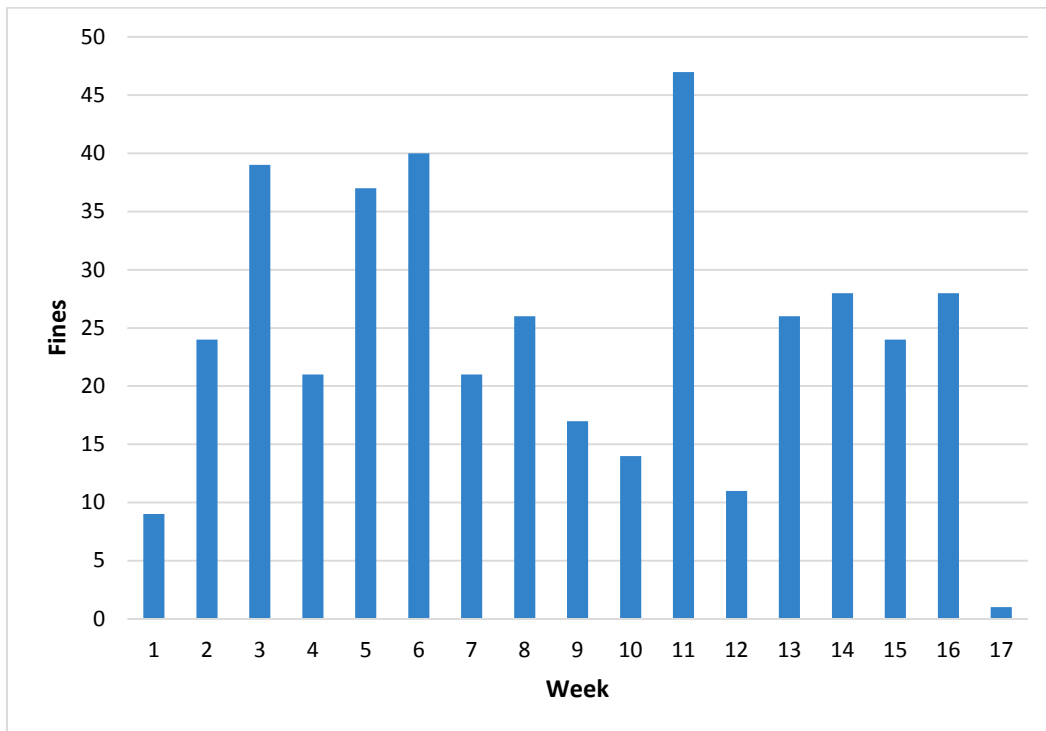


Figure 10. Fines per Week



The team level analysis will include several other control variables. *Lagbye* is included as a binary measure of whether a team had a bye week the preceding week. It may be that a bye week reduces the effect of the penalties from the week before the bye or that players' behavior changes after a week off. *Home game* is a binary variable with '1' designating home games. The direction of this control variable is unknown: a home team player may feel they have more to lose therefore they may commit fewer penalties, or a home team player may respond to the crowd in their own stadium and commit more penalties. Again, this control attempts to address some of the informal costs and benefits that are not measured by the dependent variables. For example, the crowd may be an informal benefit when they cheer or an informal sanction when they boo. Rational choice literature discusses the importance of informal sanctions in addition to formal sanctions (e.g. Cornish and Clarke, 1986). In addition, the referees may change the level of penalty calling depending on whether the team is home or away (Moskowitz and Wertheim, 2011). *Conference game* is a binary variable with '1' designating a conference game. This is another variable attempting to address the informal costs and benefits of rational choice theory. In a conference game, injuring another player may have greater benefits for a team within the same conference, the crowd may be more involved in the game, and emotions may run higher bringing players into a visceral state discussed by Loewenstein and colleagues (1997). *Lagwin* will be included as a dummy variable for whether the team won the game the previous week. It is possible that a team coming off a win may behave differently than a team coming off a loss. This differential behavior is supported by the decision-making literature on gains and losses. Specifically, research has found that when people face a loss, they are more likely to be risk seeking and when facing a

gain, they are more likely to be risk averse (e.g., Kahneman and Tversky, 1979; Pogarsky, 2009; Tversky and Kahneman, 1981). Therefore, if a team won the game before, they may feel as though they are facing a loss and may be more likely to be aggressive in their penalty commission. If they lost the game before, they may feel as though they are facing a win and may be more conservative in their penalty commission. *Year* will also be included in the team level analysis for the reasons mentioned above and *week* will again be included as a series of dummy variables. Again, penalty commission may vary each week based on different competing pressures throughout the season. Finally, *team* will be included as a dummy variable for each team. It is possible that different teams account for the differences in the number of penalties as certain teams have more penalties than other teams. San Diego is the reference category for team in the all penalty analysis and Jacksonville is the reference category for the violent penalty analysis because these teams had an average number of relevant penalties across the 13 years of data. See Figures 11 and 12 below for examples of team variation in penalty commission. These figures illustrate that there is variation in penalty commission: The New York Jets have the fewest penalties with 1,299 penalties, Oakland has the greatest number of penalties with 1,932 penalties. For violent penalties, Tennessee has the greatest number of violent penalties (314) and Indiana has the fewest (192). It is also interesting to note that while there is overlap between the two figures, the top and bottom five teams for the greatest number of penalties is not the same for all penalties and violent penalties (e.g. Detroit has the second highest number of violent penalties and is not in the top five for all penalties and Seattle has the 2<sup>nd</sup> lowest number of violent penalties but is not in the bottom five of all penalties).

Figure 11. Penalties per Team for 13 Years

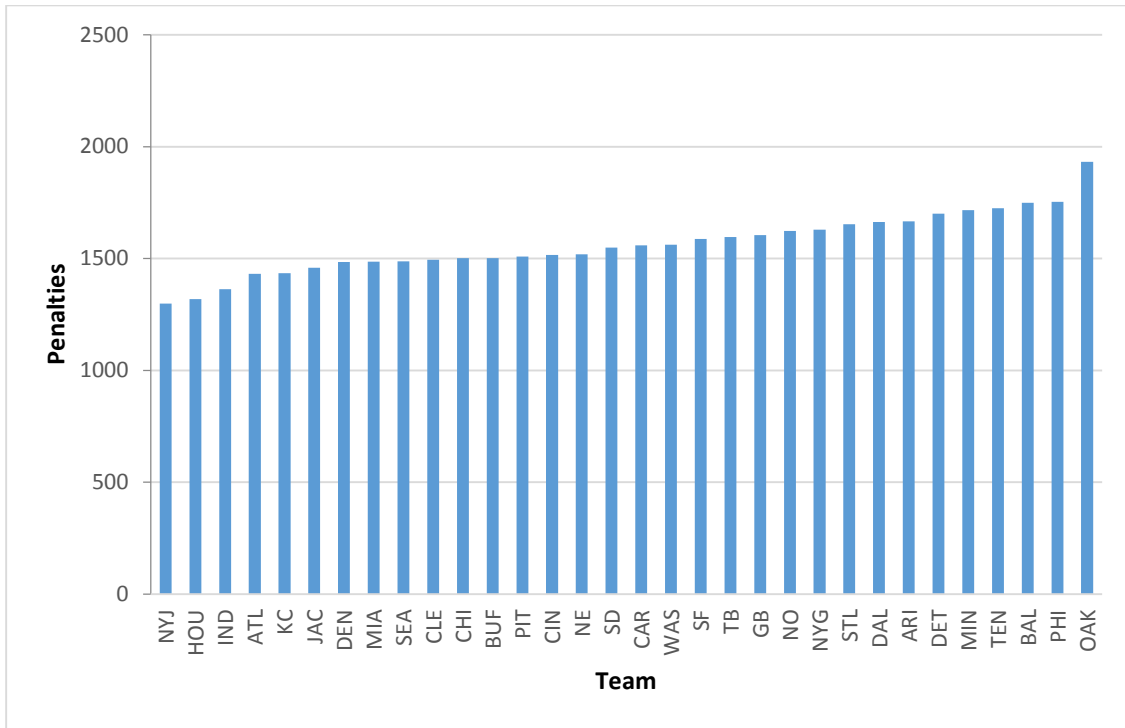
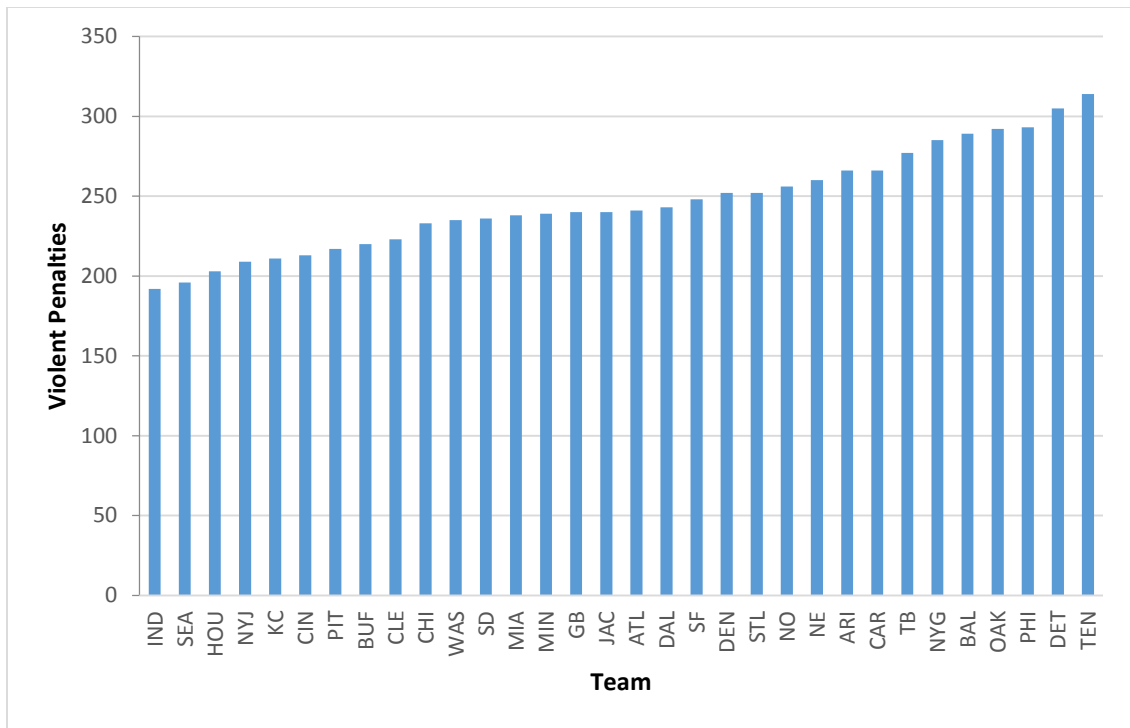


Figure 12. Violent Penalties per Team for 13 Years



## ANALYSES

The analysis for this dissertation consists of four main analyses: 1) Ordinary Least Squares Regression (OLS) for all penalties at the league level, 2) OLS for violent penalties at the league level, 3) OLS for all penalties at the team level, and 4) Poisson Regression for violent penalties at the team level. All of the dependent variables except the violent penalties per team are normally distributed. In addition, the relationship between previous penalties and current penalties is expected to be approximately linear. Therefore, an Ordinary Least Squares Regression is an appropriate model to use. Violent penalties at the team level, on the other hand, is a count variable that is not normally distributed, therefore a Poisson Regression is an appropriate model to use. It is possible to collapse this variable into a binary or categorical variable (violent penalty or not or 2+ penalties), but doing so results in loss of important variation in the dependent variable for this analysis (See Figures 1-4 for distributions of dependent variables).<sup>4</sup> Poisson regression models have frequently been used for count variables within criminology (e.g. Osgood, 2000). While there is not an overdispersion problem, this model was run with robust standard errors as suggested by Cameron and Trivedi (2009) to control for any mild violations of the assumptions. These four analyses will allow the dissertation to determine if lagged punishment affects current rule infractions at the league and team levels.

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<sup>4</sup> This dissertation ran the team level violent analyses as poisson, negative binomial, logistic, ordinal, and multinomial regressions and found that the results were all substantively the same.

## CHAPTER 5: RESULTS

### LEAGUE ANALYSES

This section will briefly explain what led to the final model and then describe the results for the final model. The models that were not used are included in Appendices C-F. First, a decision was made whether to include a penalties per week measure with a control for games per week or an average penalty per game measure as the dependent variable. Comparing the models for the two dependent variable options confirms that the results were substantively the same (See Appendices C and D and Tables 2 and 3). There were some slight differences in p-values, but this is likely due to a greater variance in the penalties per week measure (See descriptives in Appendix G). This dissertation choose to use the penalties per week measure because it is a more intuitive measure to interpret and uses an actual count of the number of penalties as opposed to an average for the entire week. Second, lagged fines could be included as a number of fines or a monetary amount of fines. These two measures resulted in models that were very similar. Therefore, number of fines was used based on ease of interpretation (See Appendices E and F). These decisions were consistent for the all penalty analyses and the violent penalty analyses.



### All Penalties

The results for the analyses with all penalties are included below in Table 2<sup>5</sup>. First, focusing on the independent variables of interest across all models, it appears that they have a fairly consistent effect. In the model without any controls and the model with post season as a control, previous penalties is significantly related to a small increase in current rule infractions (B= 0.07, p= 0.006 and B= 0.06 P= 0.012), although when including season dummy variables, this effect approaches zero and loses significance (0.001, p= 0.953). The effect of previous fines on current penalties appears to support the deterrence hypothesis in the model with no controls. With each additional fine in the previous week, all penalties decrease by 1.34 penalties per week (p= 0.006). Since the average number of penalties per week is 2,844, 1.34 is only a 0.047% decrease in penalties. When season controls are added to the model, this effect is still negative, although it is no longer significant (B= -0.62, p= 0.217), suggesting that it is season changes in penalties that is driving the relationship between past punishment and current rule infractions at the league level.

Focusing now on the control variables, when post season is added in as a control, the relationships between the independent variable and dependent variable remain the same and post season has the expected relationship with current penalties. A post-season game has 61.14 fewer penalties each week than a regular season game (p=0.000). In model 3 with season controls, moving from regular season to a post season game decreases the number of penalties per week by 66.95 (p=0.000). Even with the control

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<sup>5</sup> Each of the models at the league and team level have several hypothesis tests in the model that presume independence and could result in alpha inflation, but due to the lack of significant findings, this does not appear to be an issue.

for games per week, these coefficients take into account a decrease in penalties due to a decrease in the number of games. For that reason, it is useful to interpret the average penalties per game measure in order to determine the true effect of the post season. As shown by Model 2 in Appendix C, a post season game results in a decrease of 2.32 average penalties per game ( $p= 0.000$ ). This suggests that either players are committing fewer penalties during the post-season or that the referees are calling fewer penalties.

Season and week dummy variables are where there are more statistically significant results. For the season dummy variables, the results illustrate that there are statistically significant differences in penalties from season to season, specifically in seasons 2001, 2004, 2005, 2006, 2007, and 2008. The largest differences above and below the average season appear during season 2005 with 27.51 penalties a week above the average season ( $p=0.000$ ) and in 2007 with 21.34 penalties a week below the average season ( $p=0.001$ ). Surprisingly, these changes are not happening during expected times. For example, there is not effect of the New Orleans Bounty scandal in the years 2009-2011, and there is not a significant change in the number of penalties during the helmet to helmet crackdown in 2010.

The week results also show an interesting trend: the end of the season appears to have a lower number of penalties when compared to the average week. Specifically, in the last two weeks before the post season, there are the least number of penalties with a decrease of over 40 penalties compared to the average week of penalties ( $p=0.000$ ).

In sum, while the initial analyses show evidence that fines have a small deterrent effect, upon including season effects as a control, there is no evidence of a deterrent

effect of penalties or fines at the league level independent of season effects. The next section will present the results for violent penalties at the league level.

Table 2. League Analyses: Dependent Variable Penalties per Week (OLS, Betas Reported, N=273)

	<b>Model 1: No Controls</b>	<b>Model 2: Post Control</b>	<b>Model 3: Season Controls</b>	<b>Model 4: Week Controls</b>	<b>Model 5: Season and Week Controls</b>
<b>Previous Penalties</b>	.07**	.06*	.001	0.39***	0.04
<b>Previous Fines</b>	-1.34**	-1.43*	-0.62	-1.08*	-0.56
<b>Games Per Week</b>	14.41***	9.75***	9.78***	15.36***	15.57***
<b>Post Season</b>		-61.14***	-66.95***	0	2.86
<b>2000</b>					
<b>2001</b>			-18.25**		-17.59**
<b>2002</b>			7.03		4.40
<b>2003</b>			5.85		3.28
<b>2004</b>			23.27***		20.03**
<b>2005</b>			27.51***		24.11***
<b>2006</b>			-14.72*		-16.51**
<b>2007</b>			21.34**		-22.92***
<b>2008</b>			-19.65**		-21.30**
<b>2009</b>			-10.90		-12.94*
<b>2010</b>			-7.99		-10.18
<b>2011</b>			-0.14		-2.51
<b>2012</b>			-0.93		-3.44
<b>Week 1</b>				69.14***	-6.37
<b>Week 2</b>				-11.75	-3.99
<b>Week 3</b>				-10.46	0.13
<b>Week 4</b>				-17.90*	-10.67
<b>Week 5</b>					
<b>Week 6</b>				-7.08	-5.63
<b>Week 7</b>				-6.18	-8.28
<b>Week 8</b>				-12.51	-14.98*
<b>Week 9</b>				-3.42	-8.27
<b>Week 10</b>				-12.74	-13.86
<b>Week 11</b>				-13.00	-12.51
<b>Week 12</b>				-21.79*	-16.55
<b>Week 13</b>				-35.00**	-28.34**
<b>Week 14</b>				-31.10**	-28.67**
<b>Week 15</b>				-29.47**	-27.61**
<b>Week 16</b>				-42.93***	-40.59***
<b>Week 17</b>				-40.64***	-42.99***
<b>Week 18 (post)</b>				-18.13	-20.87
<b>Week 19 (post)</b>				46.51	-12.67
<b>Week 20 (post)</b>				51.63	-6.36
<b>Week 21 (post)</b>				66.64	0.00

\*p<.05; \*\*p<.01; \*\*\*p<.001

### Violent Penalties

See Table 3 below for the violent penalty results. The relationships in the violent penalties analyses follow largely the same trends as the all penalty analyses with some slight variations. The similarity is that there are small statistically significant relationships between prior penalties and current rule infractions and prior fines and current rule infractions in the models with no controls, post season control, and week controls, but adding seasons to the model removes the significance and reduces the effect. The main differences are with the effect of post season and the number of significant seasons.

Like the all penalty analyses, the initial model shows support for deterrence theory with fines: each additional fine in the previous week leads to a reduction in 0.36 penalties each week ( $p=0.008$ ). On average there are 447 violent penalties a week, resulting in a 0.08% reduction in violent penalties. Again, as with the all-penalty model, the effect of previous penalties has a slightly positive effect across all models, but this effect approaches zero and loses statistical significance in the final model ( $p=0.662$ )

Exploring the control variables in this model adds additional interesting findings to the model. Like the all penalty analysis, post season is a negative relationship with current rule infractions, but it is not a significant relationship. The magnitude of the effect is also much smaller: moving from a regular season game to a post season game is related to a decline in 6.19 violent penalties per week as opposed to decrease in 61 of all penalties (or as shown by Appendices C and D, accounting for the decrease in games during the post season, a decrease of 0.02 average violent penalties per game as opposed to 2.32 average penalties per game of all types). The season dummy variables again

imply that there are variations over time in commission of penalties, although for violent penalties this is only the case in two seasons: 2007 and 2008. In both of these seasons there was a decrease in violent penalties compared to the average season: in 2007, a decrease of 7.86 penalties per week ( $p=0.000$ ) and in 2008, a decrease in 6.42 penalties per week ( $p=0.002$ ). Again this suggests that either players are more consistent in their commission of violent penalties or that referees are more consistent in their calling of violent penalties, or perhaps, both. In addition, this indicates that there is some change in season 2007 and 2008 that resulted in a change in the number of penalties.

The week results for violent fines show the greatest differences from the all fine analyses. While there does appear to be variation by week in penalties, it is slightly different. Instead of a significant decrease at the end of the season, there is a significant increase in the middle of the season and the end of the season does not significantly differ from the average. In the model with only week control variables, the post season consistently has a higher number of penalties than the average. In the regular season there are significant differences in weeks 1, 3, 5, 7, 8, and 9.

In sum, the results for the violent penalties at the league level appear to be fairly consistent with the results for all penalties: there does not appear to be evidence of a deterrent effect of penalties or fines independent of season effects. There may be deterrence occurring as a result of season changes, but future research will need to be conducted to determine what this effect may be.

Table 3. League Analyses: Dependent Variable Violent Penalties per Week (OLS, Betas Reported, N=273)

	Model 1- No Controls	Model 2-Post Control	Model 3- Season Control	Model 4- Week Control	Model 5- Season and Week Control
<b>Previous Violent Penalties</b>	.09*	.09*	0.00	0.21***	-0.03
<b>Previous Fines</b>	-0.36**	-0.37**	-0.27	-0.38**	-0.31
<b>Games Per Week</b>	2.26***	1.78***	1.86***	3.81***	3.93***
<b>Post Season</b>		-6.19	-6.76	0	25.15*
<b>2000</b>					
<b>2001</b>			-1.84		-1.86
<b>2002</b>			2.33		1.63
<b>2003</b>			1.81		1.10
<b>2004</b>			2.16		1.45
<b>2005</b>			0.19		-0.57
<b>2006</b>			-1.81		-2.63
<b>2007</b>			-7.86***		-8.81***
<b>2008</b>			-6.42**		-7.32***
<b>2009</b>			-3.29		-4.08*
<b>2010</b>			-2.65		-3.38
<b>2011</b>			3.33		2.66
<b>2012</b>			2.08		1.50
<b>Week 1</b>				7.84*	-0.20
<b>Week 2</b>				3.62	4.01
<b>Week 3</b>				7.89**	8.92**
<b>Week 4</b>				4.12	5.49
<b>Week 5</b>				6.92*	6.87*
<b>Week 6</b>				4.64	4.72
<b>Week 7</b>				7.84*	7.08*
<b>Week 8</b>				6.48*	6.39*
<b>Week 9</b>				6.66*	6.44*
<b>Week 10</b>				5.64	5.60*
<b>Week 11</b>				3.22	3.49
<b>Week 12</b>				1.61	2.10
<b>Week 13</b>				-0.76	-0.31
<b>Week 14</b>					
<b>Week 15</b>				2.90	2.89
<b>Week 16</b>				-2.58	-1.89
<b>Week 17</b>				0.70	0.23
<b>Week 18 (post)</b>				17.15	-6.37
<b>Week 19 (post)</b>				24.27*	-5.81
<b>Week 20 (post)</b>				27.93*	-1.60
<b>Week 21 (post)</b>				30.29*	0.00

\*p<.05; \*\*p<.01; \*\*\*p<.00

## TEAM ANALYSES

### All Penalties

See Table 4 below for results for the all penalty team analyses. Focusing on the independent variables of interest across all models suggests that there is no deterrent effect of penalties and fines independent of season or week effect. The team analyses look similar to the league analyses. The effect of previous punishment is significant across all models and is positive, suggesting that an increase in previous penalties at the team level the previous week leads to very small increases in penalties in the current week. This effect diminishes when season control variables are included in the model or when team control variables are included in the model. Given that the model with season, week, and team dummies reduces the effect of prior penalties to almost zero ( $B=0.03$ ,  $p=0.019$ ), the results suggest that there is little to no effect of previous penalties on current penalties and variations in penalties can likely be explained by other factors.

Fines, on the other hand, as with the league analyses, have an effect in the expected direction, but the effect is not significant when season dummy variables are included in the model ( $B=-0.01$ ,  $p=0.522$ ). Similar to the league analyses, it appears that any decrease in penalties due to fines is actually a season variation in penalties.

The direction of the effect for the control variables is consistent across models with the magnitude only changing slightly. All relationships except one are statistically significant. A bye game the week before significantly leads to an increase in penalties, a home game leads to a decrease in penalties, a conference game leads to an increase in penalties, and a win the week before leads to a decrease in penalties. These findings suggest that other informal costs and benefits and decision-making factors are likely



influencing penalty commission. In addition, referee behavior may be influencing some of these variables like home game (Moskowitz and Wertheim, 2011).

The season, week, and team dummy variables tell a slightly more complicated story. The results for the season dummy variables follow the league-level results in that it appears that there is variation in the number of penalties in each season with significant differences in 2001 and 2004-2010. The largest difference is in 2005 with an increase of 0.98 penalty penalties per team per game ( $p=0.000$ ). The average number of penalties per team per game is 7.23 therefore this is a 13.39% increase. These findings again suggest that it is important to determine what happened in these seasons to cause these changes. The week dummy variables also show the same effects as the league analyses: penalties decrease at the end of the season. Weeks with below average penalties begin in week 12 and continue into the post season. It will be useful for future research to determine if player or referee behavior is changing. The team dummy variables also suggest that there are team differences in penalties. For example, Oakland commits 1.7 ( $p=0.000$ ) more penalties per game than the average team. This is especially surprising because of the 13 year time span of the data. In sum, as with the league analyses, there is no evidence of deterrent effects of penalties and fines independent of season and team effects.

Table 4. Team Analyses: Dependent Variable Penalties per Game per Team  
(OLS, Betas Reported, N=6,898)

	<b>Model 1: No Controls</b>	<b>Model 2: Controls</b>	<b>Model 3: Season Controls</b>	<b>Model 4: Week Controls</b>	<b>Model 5: Team Controls</b>	<b>Model 6: Season and Week Controls</b>	<b>Model 5: Season, Week, and Team Controls</b>
<b>Previous Penalties</b>	0.09***	0.09***	0.06***	0.1***	0.06***	0.06***	0.03*
<b>Previous Fines</b>	-0.04***	-0.04***	-0.01	-0.05***	-0.04***	-0.01	-0.01
<b>Lag Bye Game</b>		0.42**	0.44**	0.40*	0.44**	0.41**	0.41**
<b>Home Game</b>		-0.50***	-0.50***	-0.50***	-0.50***	-0.49***	-0.49***
<b>Conference Game</b>		0.16*	0.17*	0.18*	0.15*	0.19*	0.19*
<b>Lag Win</b>		-0.28***	-0.28***	-0.14	-0.20**	-0.17*	-0.11
<b>2000</b>							
<b>2001</b>			-0.67***			-0.66**	-0.68***
<b>2002</b>			0.21			0.22	0.24
<b>2003</b>			0.17			0.18	0.20
<b>2004</b>			0.81***			0.82***	0.87***
<b>2005</b>			0.98***			0.98***	1.04***
<b>2006</b>			-0.58**			-0.57**	-0.56**
<b>2007</b>			-0.84***			-0.82***	-0.83***
<b>2008</b>			-0.79***			-0.77***	-0.79***
<b>2009</b>			-0.50*			-0.47*	-0.47*
<b>2010</b>			-0.40*			-0.38	-0.35
<b>2011</b>			-0.03			-0.02	0.00

<b>2012</b>			-0.16			-0.12	-0.10
<b>Week 1</b>				0.18		-0.02	-0.29
<b>Week 2</b>				-0.07		-0.06	-0.08
<b>Week 3</b>				0.06		0.07	0.07
<b>Week 4</b>				-0.34		-0.38	-0.39
<b>Week 5</b>							
<b>Week 6</b>				-0.19		-0.23	-0.24
<b>Week 7</b>				-0.31		-0.36	-0.38
<b>Week 8</b>				-0.57*		-0.58*	-0.61**
<b>Week 9</b>				-0.30		-0.32	-0.35
<b>Week 10</b>				-0.50*		-0.49*	-0.51*
<b>Week 11</b>				-0.42		-0.41	-0.43*
<b>Week 12</b>				-0.40		-0.47*	-0.49*
<b>Week 13</b>				-0.87***		-0.85***	-0.88***
<b>Week 14</b>				-0.82***		-0.86***	-0.89***
<b>Week 15</b>				-0.75**		-0.79***	-0.83***
<b>Week 16</b>				-1.17***		-1.20***	-1.24***
<b>Week 17</b>				-1.24***		-1.29***	-1.34***
<b>Week 18 (post)</b>				-1.91***		-1.89***	-1.84***
<b>Week 19 (post)</b>				-1.70***		-1.71***	-1.74***
<b>Week 20 (post)</b>				-1.63***		-1.63***	-1.66***
<b>Week 21 (post)</b>				-0.85		-0.84	-0.83
<b>ARI</b>					0.56		0.58*
<b>ATL</b>					-0.55		-0.59*
<b>BAL</b>					0.47		0.54
<b>BUF</b>					0.01		-0.03

<b>CAR</b>					0.02		0.00
<b>CHI</b>					-0.19		-0.20
<b>CIN</b>					-0.04		-0.07
<b>CLE</b>					-0.06		-0.10
<b>DAL</b>					0.59*		0.59*
<b>DEN</b>					-0.25		-0.29
<b>DET</b>					0.85**		0.86**
<b>GB</b>					0.00		0.03
<b>HOU</b>					0.13		0.07
<b>IND</b>					-1.09***		-1.09***
<b>JAC</b>					-0.27		-0.30
<b>KC</b>					-0.39		-0.42
<b>MIA</b>					-0.17		-0.19
<b>MIN</b>					0.71		0.72*
<b>NE</b>					-0.56		-0.54
<b>NO</b>					0.25		0.27
<b>NYG</b>					0.12		0.14
<b>NYJ</b>					-1.10***		-1.12***
<b>OAK</b>					1.69***		1.74***
<b>PHI</b>					0.56		0.62*
<b>PIT</b>					-0.47		-0.46
<b>SD</b>							
<b>SEA</b>					-0.40		-0.41
<b>SF</b>					0.18		0.17
<b>STL</b>					0.46		0.46
<b>TB</b>					0.22		0.21
<b>TEN</b>					0.83**		0.83**
<b>WAS</b>					0.16		0.13

\*p<.05; \*\*p<.01; \*\*\*p<.001

### Violent Penalties

See Table 5 below for the results for the violent penalty team analyses. The results of the primary independent variables for the violent penalty team analyses are largely the same as the all penalties team analyses and the league level analyses. Previous violent penalties are related to a slight increase in current violent penalties, although once all the controls are included in the model, the effect is no longer significant and the effect drops to close to zero. Of particular note in these analyses are the differences between the violent penalty analyses and the all penalty analyses. The first difference is that none of the controls are statistically significant in any of the models. This suggests that violent penalties are less influenced by outside forces such as opponents and schedules. Again, the question remains whether this is player behavior or referee behavior.

The season dummy variables again show variation in the number of violent penalties between seasons, but like the league analyses, shows that there much less variation. The two main seasons that show a decrease in violent penalties are consistent with the league analyses: 2007 (IRR=0.74, p=0.000) and 2008 (IRR= 0.79, p= 0.000). The week dummy variables do not show the same decreasing trend as the all penalty analysis suggesting again that violent penalties are more consistent week to week. There is some team variation in penalty commission, but there is less variation. Tennessee and Detroit have the greatest increase in the rate of penalties per game over the average team with an increase of 27% (Detroit p=0.008, Tennessee p=0.006). All of these results point to their being less variation in violent penalties than with all penalties. The next chapter will discuss in detail the implications of these findings.

Table 5. Team Analyses: Dependent Variable Violent Penalties per Game per Team  
(Poisson, IRR Reported, N=6,898)

	<b>Model 1- No Controls</b>	<b>Model 2- Controls</b>	<b>Model 3- Season Control</b>	<b>Model 4- Week Control</b>	<b>Model 5- Team Control</b>	<b>Model 6- Season and Week Controls</b>	<b>Model 5 Season, Week, and Team Controls</b>
<b>Previous Violent Penalties</b>	1.04**	1.04***	1.03*	1.04**	1.02*	1.02*	1.01
<b>Previous Fines</b>	0.99**	0.99**	0.99	0.99**	0.99**	0.99	0.99*
<b>Lag Bye Game</b>		1.08	1.08	1.07	1.08	1.08	1.07
<b>Home Game</b>		0.96	0.96	0.96	0.96	0.96	0.96
<b>Conference Game</b>		1.03	1.03	1.03	1.03	1.03	1.03
<b>Lag Win</b>		0.99	0.99	0.99	1.00	0.99	1.00
<b>2000</b>							
<b>2001</b>			0.95			0.95	0.95
<b>2002</b>			1.07			1.08	1.08
<b>2003</b>			1.06			1.06	1.06
<b>2004</b>			1.07			1.07	1.07
<b>2005</b>			1.00			1.01	1.01
<b>2006</b>			0.94			0.94	0.95
<b>2007</b>			0.74***			0.74***	0.74***
<b>2008</b>			0.79***			0.79***	0.79***
<b>2009</b>			0.89*			0.89	0.90
<b>2010</b>			0.90			0.91	0.92
<b>2011</b>			1.11			1.11	1.12*

<b>2012</b>			1.07			1.08	1.09
<b>Week 1</b>				1.05		1.04	1.03
<b>Week 2</b>				1.11		1.11	1.11
<b>Week 3</b>				1.22**		1.23**	1.23**
<b>Week 4</b>				1.07		1.06	1.07
<b>Week 5</b>				1.10		1.10	1.11
<b>Week 6</b>				1.02		1.02	1.01
<b>Week 7</b>				1.10		1.10	1.10
<b>Week 8</b>				1.07		1.07	1.07
<b>Week 9</b>				1.09		1.09	1.09
<b>Week 10</b>				1.09		1.09	1.09
<b>Week 11</b>				1.07		1.08	1.08
<b>Week 12</b>				1.06		1.06	1.06
<b>Week 13</b>				0.98		0.98	0.98
<b>Week 14</b>							
<b>Week 15</b>				1.09		1.09	1.09
<b>Week 16</b>				0.94		0.94	0.94
<b>Week 17</b>				1.01		1.01	1.01
<b>Week 18 (post)</b>				0.78*		0.78*	0.80
<b>Week 19 (post)</b>				0.92		0.92	0.92
<b>Week 20 (post)</b>				1.03		1.04	1.03
<b>Week 21 (post)</b>				0.99		1.00	0.99
<b>ARI</b>					1.09		1.09
<b>ATL</b>					0.97		0.97
<b>BAL</b>					1.11		1.12
<b>BUF</b>					0.93		0.92
<b>CAR</b>					1.08		1.08
<b>CHI</b>					0.95		0.95
<b>CIN</b>					0.88		0.88
<b>CLE</b>					0.94		0.93

<b>DAL</b>					1.00		1.00
<b>DEN</b>					1.02		1.02
<b>DET</b>					1.27**		1.27**
<b>GB</b>					0.94		0.94
<b>HOU</b>					0.99		0.99
<b>IND</b>					0.74**		0.75**
<b>JAC</b>							
<b>KC</b>					0.88		0.87
<b>MIA</b>					0.98		0.98
<b>MIN</b>					0.97		0.97
<b>NE</b>					0.98		0.98
<b>NO</b>					1.03		1.03
<b>NYG</b>					1.11		1.12
<b>NYJ</b>					0.85		0.85
<b>OAK</b>					1.18		1.18
<b>PHI</b>					1.13		1.14
<b>PIT</b>					0.84		0.84
<b>SD</b>					0.96		0.96
<b>SEA</b>					0.78*		0.78*
<b>SF</b>					1.01		1.00
<b>STL</b>					1.02		1.02
<b>TB</b>					1.12		1.12
<b>TEN</b>					1.27**		1.28**
<b>WAS</b>					0.97		0.97

\*p<.05; \*\*p<.01; \*\*\*p<.001



## CHAPTER 6: DISCUSSION AND CONCLUSION

In this dissertation, I have attempted to add to the deterrence literature by providing an empirical analysis of rule breaking behavior over 13 years within a unique environment, the National Football League. Deterrence literature until this point has been either cross sectional or relied mostly on student samples and scenario based data. Prior research has found limited support for deterrence theory with the greatest support for certainty, little support for severity, and very little research on celerity. This dissertation sought to address limitations in previous literature by exploring general deterrence in a 13 year dataset at both the team and league levels. In addition, by utilizing a dataset that enforces punishment almost immediately for all on field behavior and very swiftly for all fines, this research addresses criticism raised by other researchers that the evidence for deterrence theory is not strong because punishment does not happen swiftly enough (Paternoster, 2010). This research addresses the following four hypotheses:

*H1: Past punishments will reduce the number of current rule infractions.*

*H2: Past fines will reduce the number of current rule infractions.*

*H3: Past punishments for violent behavior will reduce the number of current violent rule infractions.*

*H4: Past fines will reduce the number of current violent rule infractions.*

To explore these hypotheses I utilized data created from existing data sources online: a play-by-play dataset and a fine dataset. This section will review the relevant results and discuss the implications of these findings.

## SUMMARY OF RESEARCH FINDINGS

The results are fairly consistent through all the team, league, all penalty, and violent penalty analyses. This section will review the results and focus on some important differences between the different models. In general, this research did not support the hypotheses and therefore deterrence theory is not supported by the imposition of penalties and fines. Despite the general findings, the nuances of the results tell a slightly complicated story.

In all models except for one (Table 3, Model 5) previous punishments is related to an increase in current rule infractions. For both the team and league analysis, this effect approaches zero and loses statistical significance when controls are included in the model. This suggests that the variation in current penalties is not explained by past penalties, but instead may be explained by variation in season, week, or team and as mentioned does not provide support for deterrence theory.

The effects of fines are also consistent across all models, although for fines it is a negative relationship: each additional fine the week before leads a decrease in penalties. Again, the effect reduces in magnitude and loses significance with the addition of control variables, suggesting that while the direction supports deterrence theory, the effect is likely driven by opponent, schedule, season or team.

Focusing on the control variable results illuminates some of the nuances of the results. The control variables are not consistent across all models and deserve further

discussion. In the all penalty models, some of the controls that deserve discussion are post season, lag bye, home game and conference game. Each of these controls are significant in the models with seasons or weeks as controls, suggesting that these have an effect independent of seasons or weeks. Post season leads to a decrease in the number of penalties. It is possible that this is due to an increased cost of committing penalties. Perhaps players are more careful about their behavior in the post season due to concern about the cost of committing penalties. It is also possible that referees are calling fewer penalties in the post season in order to keep the game flowing. Similarly, at the team level, all of the controls except lag win are significant in the all penalty model (lag bye, home game, and conference game). The increase in penalties the week following a bye week possibly suggests that players are out of practice at refraining from committing penalties or they feel that the benefits of coming out strong with many penalties outweigh the costs of committing penalties. There is a decrease in the number of penalties in a home game. This could be that the informal costs and benefits are greater with a home crowd or that the referees call fewer penalties for the home team (Moskowitz and Wertheim, 2011). Finally, there are more penalties for a conference game. This finding provides support for the hypothesis provided by Loewenstein and colleagues (1997), suggesting that when emotions are high in a conference game, players may be less deterrable and be more likely to commit a greater number of penalties.

Another findings for the control variables that is interesting to discuss is that the controls have statistically significant relationships with current penalties in the all penalty models, but not the violent penalty models. This suggests that violent penalties are not as influenced by outside factors as all penalties are. This dissertation suggests that there are four main reasons that violent penalties may not be affected by these control variables.

Two of the explanations are based on changing player behavior and two are based on referee behavior. First, player decision-making may be different for violent penalties. For example, it could be that these penalties are expressive or impulsive as opposed to instrumental and therefore are subject to different decision-making processes (as suggested by Loughran et al. (2011a) with face-to-face crimes and Chambliss (1967) and Zimring and Hawkins (1973)). Second, it could be that for violent penalties, the cost and benefit calculus is different. A player who tackles a quarterback after the whistle (resulting in injury to the quarterback) faces very different consequences (good and bad) than a player who steps offside during the snap. Third, it could be that referees are more vigilant in their consistency of calling violent penalties. They may see violent penalties as more important to keeping the game under control or they may be receiving outside pressure to control violent penalties. Finally, it may only be that violent penalties are easier for a referee to see.

The week, season, and team controls also do not have a consistent effect across all models. One consistent finding is that there is an effect for each of these controls suggesting that current penalties vary based on something that is happening during a particular season, week, or for a specific team. One finding that is consistent across all models is that in seasons 2007 and 2008, there was a decrease in penalties. The magnitude and significance level varies slightly depending on the model, but these seasons will be important to look at in future research. It is likely that something league wide occurred that affected the number of penalties. Future research will have to determine if this was a deterrent effect (for example as the result of a crackdown) or if it was some enforcement change (for example, the removal of a particular category of penalty).

The week control variables tell a less consistent story. The effect of the week depends on the model, therefore the main summary that can be taken from these findings is that weeks matter, further exploration needs to be done about what the effect is and why that effect occurs. It is possible that weeks vary so much from season to season that they are not a useful avenue to explore over 13 years.

Team, on the other hand has a more consistent effect. It does appear that certain teams affect the number of penalties that occur in a given week. For example, Oakland has 1.74 more penalties than average each game, the New York Jets have 1.12 fewer penalties per game, Tennessee has 0.32 more violent penalties each game than average, and Indiana has .29 fewer violent penalties per game than the average team. This is especially surprising given the length of time that this dataset encompasses. The fact that a particular team has more or less penalties over a 13 year period suggests some mechanism is present other than deterrence. There are two main explanations for the team variation. First, these differences are based on a culture within the team over 13 years similar to a subculture of violence where different rules or norms are expected for a certain group in certain situations (Wolfgang and Ferracuti, 1982). Recent evidence of a team employing certain rule-breaking behavior is the Seattle Seahawks' use of pass interference at a much higher level than any other team during the 2013 season (Clark and Clegg, 2014). This strategy may have been so successful that it helped them win the Super Bowl. The second explanation is that the referees or the league determine that these teams are more penalty prone and therefore call more penalties against them, similar to a labeling perspective where the punishers define the person being punished as bad (Tannenbaum, 1938). In sum, while there is no evidence of a deterrent effect of

penalties or fines independent of the control variables, these results do provide interesting policy and theoretical implications in addition to avenues for future research.

## IMPLICATIONS FOR THEORY AND POLICY

The implications of this dissertation for deterrence theory are in line with prior deterrence research. There is no evidence of a deterrent effect suggesting that punishment that is swift and certain does not prevent future rule-breaking for the time period studied within the NFL. This lack of finding could be for several different reasons suggested by prior research. For example, it could be that because NFL players are playing in a state of high emotion and high testosterone, they are in a visceral state. Therefore, prior literature would suggest that NFL players are more likely to commit penalties while in a “hot state” (Lowenstein et al., 1997). Although Lowenstein and colleagues (1997) do not suggest a mediating effect of arousal, they do suggest that arousal may affect how a person weighs costs and benefits. This would translate to the NFL by reducing the expected effect of penalties and fines due to the hot state of football players.

In addition, it is possible that the type of punishment is not “proportionately severe” and therefore, is not a successful deterrent. Given this population is well-informed about the punishment and they are continuously experiencing the punishment, it is possible that a more severe punishment would result in a deterrent effect. This is in concordance with the research on three strikes laws. Specifically, Helland and Taborrok (2007) found a 17-20% decrease of arrests for those individuals who already had two strikes. Likewise, it is possible that in the NFL, a threat of ejection after a certain number

of penalties (like in soccer) would be a more effective deterrent than the penalty system as it is currently enforced.

As with most research on theory, instead of completely refuting deterrence theory, this dissertation suggests changes or further modifications of the theory (Wallace, 1971). Recent research has subsumed deterrence theory within rational choice theory and this dissertation suggests more work within that direction. While prior punishment did not affect rule-breaking behavior, the control variables did.

The controls variables included in the models served as a limited proxy for other rational choice and decision-making variables and suggest that further work should be done in this area. The control variables all assume that a different deterrence process may be occurring based on the circumstances of a particular game. For example, all the controls may provide information about player's decision making process and whether they are loss averse or loss seeking (i.e. in a game after a win, a player may be more conservative in their penalty commission). This is in support of current rational choice literature that finds that whether a person is facing a loss or a gain affects decision making (e.g. Loughran et al, 2011a). In addition, a particular opponent (conference game) or location (home game) may be measuring rational choice by including different informal costs and benefits that are present like prestige within the conference or loud fan participation at a home game. Because these variables are only crude measures of decision-making and rational choice variables and do not directly measure informal costs and benefits, this research cannot draw any conclusions about decision-making or rational choice, but the consistency of the significance in the all penalty models does suggest that it would be worthwhile to explore these theoretical models more explicitly. In sum, this research does not support traditional deterrence theory, but does suggest that current and

future lines of research exploring rational choice and decision-making processes other than formal sanctions is a useful line of inquiry.

Policy implications stemming from this research can be divided into two categories: 1) those directly relevant to football and 2) those that are relevant for the criminal justice system. Within football, given that the stated goal of penalties is to change behavior and particularly to make the game safer and that this research does not show support for this goal, it may be necessary to change the goal of punishment. Perhaps a better goal would be to maintain player or fan satisfaction with the equity of the game as opposed to attempting to change behavior (similar to police foot patrol increasing satisfaction with the police rather than crime reduction (Pate et al., 1986)). Penalties do not appear to change behavior for violent or all penalties and in fact, may actually increase the undesirable behavior.

In regards to fines, the policy implications are a little less clear. It appears that fines may have a slight deterrent effect, but because the effect is so weak and the statistical significance is not consistent, it is important not to make any policy changes based on these results, but instead to conduct further research. For example, the NFL would be wise to explore in more detail when and why fines work to fully optimize the use of fines as a deterrent mechanism. Specifically, it may be useful for the NFL to take taking into account player income (like day fines within the criminal justice system (Hillsman and Green, 1991)). This would allow the NFL to address the criticism that the NFL players make so much money, that fines, as they are currently enforced, may not be effective or that players set aside money for fines as the cost of doing business (NFL.com, 2009).



Finally, and most important for this dissertation, there are several policy implications for the criminal justice system. As previously mentioned, any criminal justice system implications from this research must be taken with a healthy amount of skepticism. While the comparison to the criminal justice system is an apt comparison and the data are an especially useful way to explore deterrence theory, this is not the criminal justice system and therefore results should be applied with caution. That being said, given that prior research on deterrence concludes that at best there is mild support for deterrence theory, this research adds to that body of research while addressing some of the limitations of prior research. Specifically, Paternoster (2010) suggested that the expected deterrent effect may not be evident because punishment in the criminal justice system does not happen fast enough. Since this research explored punishment that is almost always enforced immediately, combining this research with prior deterrence research raises questions about the use of punishment within the criminal justice system as a method of deterrence. Even with these findings, it is worth exploring the results of the fines in this research in combination with fine research in the criminal justice system. Some research has supported the use of a day fines system where offenders are fined based on their salary (Hillsman and Green, 1991) while others caution against the use of the fine and fee system used in the criminal justice system in many jurisdictions in the United States (Becket and Harris, 2011). Again, the fine results are not strong enough to make changes, but with further research exploring a fine system may be a worthwhile approach.

In sum, this research, with a lack of support for deterrence theory combined with prior literature to question the veracity of a strict deterrence model within the criminal justice system. Instead, the consistency of significant control variables that take into

account other factors such as informal costs and benefits (e.g. the benefit of a loud crowd at a home game, or the risky behavior of penalty commission in the game after a win) suggests future research should continue to take into account these informal costs and benefits with rational choice and decision-making models. Due to these findings, this dissertation suggests that the NFL reevaluate the goals of their punishment and that the criminal justice system explore different options for punishment other than formal punishment as a strict deterrence model.

## FUTURE RESEARCH

There are several areas of future research that will be useful to explore. First, and perhaps the most natural extension, is to explore more combinations of the measures included in this dissertation. It is possible that the fines and penalties are working completely independently and should be tested by including them in separate models. Or, it is possible that they are working together more and should be run as interactions. Likewise, it may be that seasons are working in interaction with the independent variables or other controls. This dissertation did not test every possible combination of the variables and therefore a good next step would be to explore some of these other options.

Second, and also directly relevant, is to determine what changes occurred during the seasons when there were consistent changes in penalties. This is particularly important to the theoretical implications because if there is a particular rule change or some sort of enforcement change, the results may be applicable to the criminal justice system. For example, if the season effect had occurred in 2010, as expected with the helmet to helmet crackdown, these results would have suggested that the crackdown had

a deterrent effect (which would be most obviously applicable to police crackdowns). Because the changes occurred in season with no known major changes more research needs to be conducted. The changes could have been a result of changes in 2006: new commissioner, horse-collar rule expanded, low hits against the passer prohibited or changes in 2007 and 2008: high definition replay and incidental face mask penalty removed. Each one of these changes could have had an effect on penalties and the effect may determine whether deterrence is at work or some other mechanism.

Another extension of this research will be to attempt to disentangle player behavior from referee behavior. This is a similar challenge faced in the criminal justice system when trying to determine whether police behavior or actual crime levels change. One helpful step to address this issue would be to include referee information in the dataset. For example, knowing who the referees were and when they were in the league may help address some of the changes. In addition, exploring the first weeks of 2012 in which substitute referees were utilized may help shed some light on this issue. Finally, a statistical technique may be used to address this issue, similar to the way instrumental variables have been used in some policing research (Levitt, 1997).

Fourth, an important step in this research is to access player perceptions. As noted in prior deterrence research, there is a gap between perceptions of punishment and actual punishment (Gibbs, 1975). Although the NFL allows perceptions to be as close as possible to objective deterrence it is likely not a perfect match. Therefore, interviews with players will help address this connection. In addition, interviews with players will provide measures of the informal costs and benefits that are not measured in this dissertation allowing the model to be expanded to the more recent rational choice model.

Next, exploring the fine results with more nuance would be an important step. The fine result, while not strong is an interesting result to explore from a deterrence perspective. For example, it may be possible to explore severity of fine by looking at variation in monetary amount. Also, with the addition of more fines over time, it may be possible to split fines by offense type to determine if fines are more effective for certain offenses. Fines could also be explored in other sports. For example, the use of the fine has increased in the NBA, with league officials claiming that it is effective (Keh, 2013). Given that the leveling of fines is a method of punishment that is used in the criminal justice system, this is a particularly useful line of research.

Sixth, an individual-level analysis of this data will be a fruitful future direction for this research to take. To my knowledge, no individual level longitudinal deterrence research has been conducted generally or within sports and thus, this would be an addition to the field. In addition, this would allow for the possible identification of particular deterrables or incorrigibles as suggested by Pogarsky (2002); perhaps certain players moving in and out of the league are driving certain relationships. An individual level analysis would add to the deterrence literature information about particular individuals and whether there are individual differences that lead a person to be more likely to be deterred.

Finally, while this data is a useful comparison to the criminal justice system and has many strengths as discussed, it remains that it is not criminal justice data. It would be useful to replicate this study within the criminal justice system. A longitudinal dataset with arrests would be a good place to start to determine the effect of prior arrest on the future likelihood of arrest. If the results from this dissertation are supported within the

criminal justice system, this would increase the strength of any policy or theoretical implications.

## CONCLUSION

Deterrence theory has been explored in many ways throughout the history of the theory, but was traditionally done by cross-sectional official data or more recently with scenario based studies using primarily student samples. This dissertation sought to address the gap in the literature by using data from the National Football League over 13 years. There are several advantages of these data including a variation and detail in punishment, the direct effect of punishment is more easily observed, punishment happens immediately in almost all circumstances on the field, and perceptions are as close to actual punishment as possible. Within football, players are made aware of all punishment within the game that they play in, they are made aware of many other penalties in other games through game tape, news media, or through coaches, teammates, or friends, and finally, if there are any changes in enforcement, they are notified by multiple sources. The best example of this is the recent helmet-to-helmet crackdown where players were notified of the change in newspaper articles that were written about the crackdown (e.g. Battista, 2010), a memo sent to teams from the NFL commissioner, a video in order to put them “on notice” (Anderson, 2010), and several large fines. While, not all punishment is as well publicized, football is a situation in which actors at the very least have perceptions that are more aligned to actual punishment than the average citizen’s perceptions about laws and law enforcement.

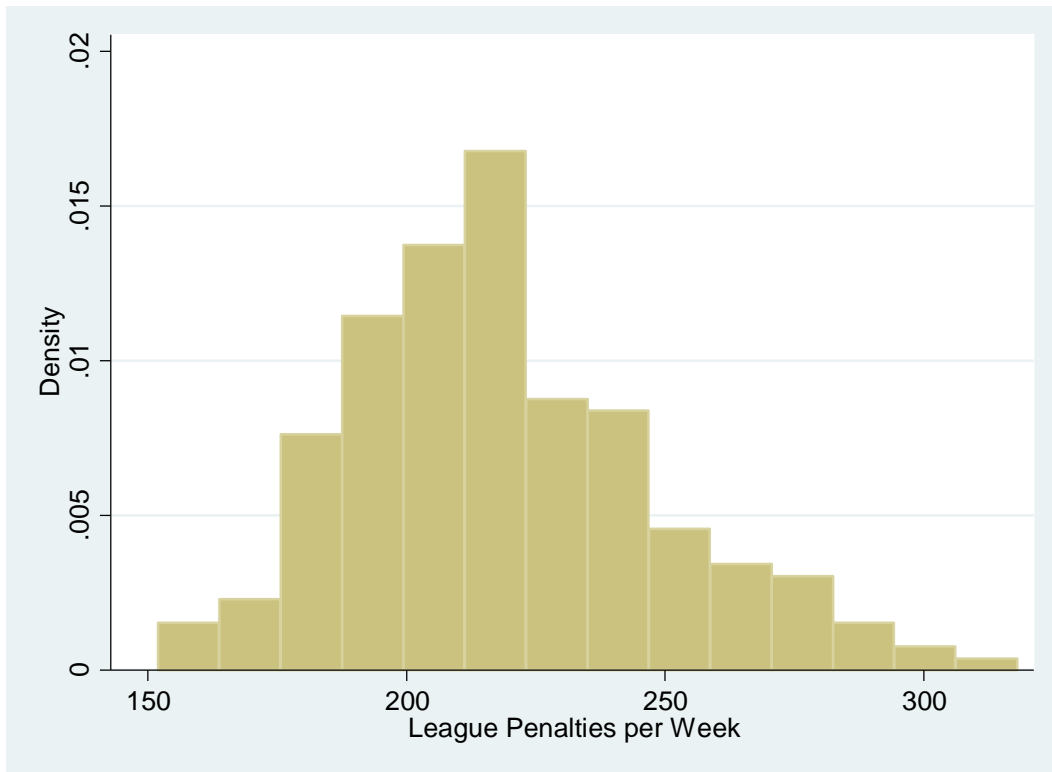
In addition to the inherent strengths of these data, prior research has applied sports to topics outside of sports taking advantage of the controlled real world laboratories that

sports typically are (McCormick and Tollison, 1984; Moskowitz and Wertheim, 2011; Togler, 2009). With this dataset and improvements over past research, this dissertation sought to find support for general deterrence and specifically explored whether prior punishment affected current rule infractions. In sum, this dissertation did not find support for the hypotheses and thus, did not find support for punishment as a deterrent independent of control variables.

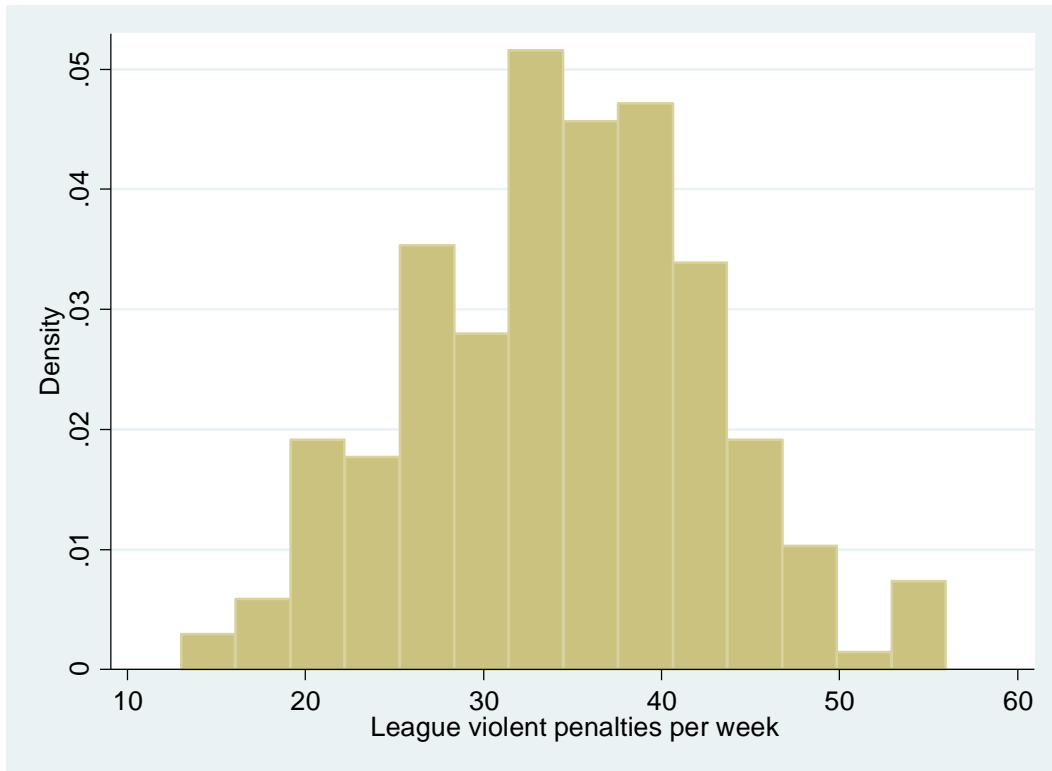
Even though there was limited to no support for deterrence theory, there was evidence of some other factors affecting the current rule breaking behavior like season, record, opponent, teams, and week. These findings suggest that future research should explore further the different factors that may be affecting penalty commission in an attempt to better understand whether institutional or personal factors may be affecting rule breaking behavior. These results also suggest that the criminal justice system should continue to be wary of increasing punishment to change behavior and instead should focus more on other alternative sanctioning and crime prevention methods.

## APPENDICES

Appendix A. Distribution of League Penalties per Week without Post Season



Appendix B. Distribution of Violent League Penalties per Week without Post Season





Appendix C: League Analysis. Dependent Variable Average Penalties per Game (OLS, Betas Reported, N=273)

	<b>Model 1: No Controls</b>	<b>Model 2: Post Control</b>	<b>Model 3: Season Controls</b>	<b>Model 4: Week Controls</b>	<b>Model 5: Season and Week Controls</b>
<b>Previous Penalties</b>	0.16***	0.12**	0.05	0.41***	0.15
<b>Previous Fines</b>	-0.04	-0.10*	-0.03	-0.07	-0.03
<b>Post Season</b>		-2.32***	-2.33***	-2.32**	-3.79***
<b>2000</b>					
<b>2001</b>			-1.56*		-1.41
<b>2002</b>			0.23		0.20
<b>2003</b>			0.28		0.29
<b>2004</b>			0.88		0.77
<b>2005</b>			1.34*		1.17
<b>2006</b>			-1.40*		-1.26
<b>2007</b>			-2.06**		-1.88
<b>2008</b>			-1.12		-0.99
<b>2009</b>			-1.18		-1.11
<b>2010</b>			-0.89		-0.82
<b>2011</b>			-0.78		-0.73
<b>2012</b>			-0.86		-0.81
<b>Week 1</b>				5.14***	1.25
<b>Week 2</b>				-0.18	-0.18
<b>Week 3</b>				-0.07	0.06
<b>Week 4</b>				-0.99	-0.82
<b>Week 5</b>					
<b>Week 6</b>				-0.67	-0.54
<b>Week 7</b>				-0.68	-0.68
<b>Week 8</b>				-1.15	-1.13
<b>Week 9</b>				-0.43	-0.55
<b>Week 10</b>				-1.03	-0.98
<b>Week 11</b>				-0.73	-0.76
<b>Week 12</b>				-0.91	-1.01
<b>Week 13</b>				-1.63*	-1.69*
<b>Week 14</b>				-1.38	-1.66*
<b>Week 15</b>				-1.28	-1.59*
<b>Week 16</b>				-2.11**	-2.40**
<b>Week 17</b>				-1.98*	-2.49**
<b>Week 18 (post)</b>				-1.00	0.00
<b>Week 19 (post)</b>				0.00	0.66
<b>Week 20 (post)</b>				-0.42	0.37
<b>Week 21 (post)</b>				1.26	1.98**

\*p<.05; \*\*p<.01; \*\*\*p<.001

Appendix D. League Analysis. Dependent Variable Average Violent Penalties per Game (OLS, Betas Reported, N=273)

	<b>Model 1- No Controls</b>	<b>Model 2- Post Control</b>	<b>Model 3- Season Control</b>	<b>Model 4-Week Control</b>	<b>Model 5- Season and Week Controls</b>
<b>Previous Violent Penalties</b>	0.13*	0.12*	0.06	0.17*	0.05
<b>Previous Fines</b>	-0.02	-0.03	-0.03	-0.02	-0.03
<b>Post Season</b>		-0.30**	-0.31**	-0.10	-0.06
<b>2000</b>					
<b>2001</b>			-0.13		-0.13
<b>2002</b>			0.27		0.27
<b>2003</b>			0.05		0.05
<b>2004</b>			0.07		0.07
<b>2005</b>			-0.06		-0.06
<b>2006</b>			-0.07		-0.08
<b>2007</b>			-0.50*		-0.50*
<b>2008</b>			-0.10		-0.10
<b>2009</b>			-0.13		-0.13
<b>2010</b>			-0.11		-0.11
<b>2011</b>			0.14		0.14
<b>2012</b>			0.30		0.31
<b>Week 1</b>				0.40	0.13
<b>Week 2</b>				0.22	0.22
<b>Week 3</b>				0.44	0.47
<b>Week 4</b>				0.09	0.16
<b>Week 5</b>				0.23	0.24
<b>Week 6</b>				0.02	0.06
<b>Week 7</b>				0.24	0.25
<b>Week 8</b>				0.14	0.16
<b>Week 9</b>				0.19	0.21
<b>Week 10</b>				0.17	0.19
<b>Week 11</b>				0.14	0.16
<b>Week 12</b>				0.10	0.14
<b>Week 13</b>				-0.05	-0.04
<b>Week 14</b>					
<b>Week 15</b>				0.18	0.18
<b>Week 16</b>				-0.15	-0.13
<b>Week 17</b>				0.03	0.02
<b>Week 18 (post)</b>				-0.39	-0.45
<b>Week 19 (post)</b>				0.00	-0.11
<b>Week 20 (post)</b>				0.15	0.08
<b>Week 21 (post)</b>				0.05	0.00

\*p<.05; \*\*p<.01; \*\*\*p<.001

Appendix E. Penalties per Week as Dependent Variable and Number of Fines  
(OLS, Betas Reported)

Previous Penalties	0.07***
Previous Fines	-1.34***
Games Per Week	14.41***
F Statistic	766.76
Prob >F	0.00
R-Squared	0.90

\*p<.05; \*\*p<.01; \*\*\*p<.001

Appendix F. Penalties per Week as Dependent Variable and Monetary Amount of Fines  
(OLS, Betas Reported)

Previous Penalties	0.07***
Previous Monetary Amount of Fines	-0.00009***
Games Per Week	14.38***
F Statistic	766.7
Prob >F	0.00
R-Squared	0.90

\*p<.05; \*\*p<.01; \*\*\*p<.001

Appendix G. Dependent Variable Descriptives

Variable	N	Mean	Std. Dev.	Min	Max
Average Penalties per Game	273	14.18	2.36	6.25	24.00
Average Violent Penalties per Game	273	2.25	0.71	0.00	7.00
Penalties per Week	273	183.41	78.17	8.00	318.00
Violent Penalties per Week	273	28.88	13.59	0.00	56.00

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